Municipality/Organization:	City of Malden
EPA NPDES Permit Number:	MA041046
MADEP Transmittal Number:	**041088**
Annual Report Number & Reporting Period:	**No. 14: April 1, 2016-March 31, 2017**

NPDES PII Small MS4 General Permit Annual Report

Part I. General Information

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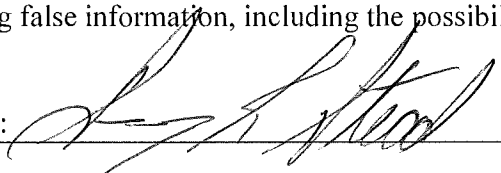
Certification:

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: 

Printed Name: Gary Stead

Title: Interim City Engineer

Date: 4/26/2017

Part II. Self-Assessment

After several years of review, the Annual NPDES MS4 Permit has been revised with the provisions of the new permit becoming effective on July 1, 2017. The City of Malden, through its comprehensive stormwater compliance program has already met the majority of the new permit requirements and through the implementation of its comprehensive Illicit Discharge Detection and Elimination (IDDE) program, ongoing drainage system inventory, mapping, and maintenance efforts, together with community outreach, the City has demonstrated its ability to greatly improve the quality of stormwater discharges to tributary surface waters. The systematic cleaning of catch basins, mapping of infrastructure system components, logging of component attributes, identification of infrastructure needs, and removal of illicit discharges serves to demonstrate the scope and effectiveness of the City's stormwater management program. The City of Malden currently maintains a dedicated team of in-house staff and technical support services to meet the challenges of stormwater management within a highly urbanized study area. Beyond the prior years of community outreach and public education, the City has developed and adopted zoning controls, enforcement mechanisms and inspection requirements to support the daily work practices by the Malden Department of Public Works (DPW) and Engineering Department. The City has also developed a comprehensive geographic information system (GIS) system that has included the mapping of the drainage and sewer infrastructure and scanning of historic plans and documentation to increase the effectiveness of this management tool.

City representatives have been meeting with stewardship organizations such as the Mystic River Watershed Association (MyRWA), the Friends of the Malden River, Greenways Regional Planning Group, the Mystic Valley Development Commission (MVDC) throughout the last year to promote partnerships and the dissemination of water quality information. The City continues to meet with representatives of the Department of Conservation and Recreation (DCR) in an attempt to address long needed repairs to flow conveyance channels along Town Line Brook and at Oak Grove. Funding constraints continue to be an issue, with conditions continuing to degrade in these major flow conveyance networks, particularly Town Line Brook. As such, outside assistance from political and regulatory representatives is needed to reverse ongoing surface water quality trends and the improvement of overall channel integrity. The City of Malden continues to work with regional watershed groups, neighboring communities and athletic organizations, to develop a protocol, or guidance, for recreational uses upon the Malden River, building upon the outfall and surface water sampling programs discussed in this submittal. MyRWA is also in the process of developing a predictive model to further this effort through funding assistance provided by Massachusetts Department of Environmental Protection (MDEP). The City continues to work with the U.S. Amy Corps of Engineers (ACOE) on the National Ecosystem Restoration (NER) Plan that will enhance both habitat and surface water quality within the Malden River corridor.

As described within this report, the City of Malden continues to perform dry weather flow isolation studies to identify and remove illicit discharges through the implementation its IDDE Plan. Dry weather sampling events have also identified deficiencies in the over a century old infrastructure that have been repaired and/or replaced. During the 2016-2017 permit year, the City, through its IDDE Plan implementation, isolated and identified the responsible party for an illicit connection to the municipal drainage system that is believed to have conveyed millions of gallons of sewerage prior to its mitigation. More comprehensive efforts have included targeted inflow/infiltration studies, video camera surveys, together with in-situ lining and sealing. Working with representatives of the USEPA, and regional stewardship organizations, it has been demonstrated that substantial dry weather flows from neighboring communities, particularly from Ell Pond in Melrose flow through the City of Malden's drainage system. In addition to improved stormwater quality, a notable reduction in local flooding has been achieved through improvements to the drainage system.

The City continues to make significant progress towards meeting the requirements of the recently revised small MS4 General Permit, which becomes effective on July 1, 2017.

Part III. Summary of Best Management Practices (BMPs) and Compliance Team Goals

1. Public Education, Outreach and Community Involvement

BMP 1-1 Place Educational Information on City's Web Site and Malden Access Television (MATV). Meetings, presentations, distribution of education materials

Responsible Department/Person:
Engineering Dept, Mayor's Office & MATV

Measurable Goal(s):
Continued maintenance of the City informational web site and participation with MATV.

Progress on Goals- Year 14:
Community outreach is maintained by the City through the maintenance of an informational website and works with representatives of MATV to update the community on current stormwater management issues. The City has made a clear commitment, through its Mayor and related support staff to promote community awareness and involvement.

During this permit year there has been extensive involvement by groups such as the Friends of the Malden River, MyRWA, the Army Corps of Engineers (ACOE), the MVDC and local planning agencies to promote a greater awareness of water quality issues within the Malden River Corridor. Members of the Stormwater Compliance Team have made presentations, as well as attended meetings held by this advocacy group. Members of the SCT have also met with graduate students and faculty from MIT and Tufts Universities to share stormwater and surface water quality information.

Goal Status:
Achieved original goals. Community outreach is an integral part of the City's efforts to mitigate stormwater quality concern.

BMP 1-2 Conduct Recycling Opportunities & Paint Waste Collection Days

Responsible Department/Person:
DPW & Mayor's Office

Measurable Goal(s):
Continuation and possible expansion of recycling collection days, and distribution of related educational information.

Progress on Goals- Year 14
MDPW sponsors two (2) paint waste collection and recycling days annually. As summarized in Part V, Section 2.5, these collection efforts typically days result in incur disposal costs of approximately $11,000. The City also continues to maintain its recycling programs at the MDPW yard.

Goal Status:
Annual Program - Activity Ongoing

BMP 1-3 Enforce Pet Waste Management Programs

Responsible Department/Person:
Animal Control Dept & City Clerk

Measurable Goal(s):
Posting of signage, installation of waste collection containers, park maintenance, ordinance enforcement, Community involvement.

Progress on Goals- Year 14:
The Board of Health (BOH) actively monitors public recreation areas to discourage the feeding of waterfowl populations that contribute to the degradation of surface water quality. In addition, pet waste, education and control programs (stations) are in-place. The continued replacement of earthen/grassy playing field surfaces with synthetic cover is also a key factor in the reduction of animal waste contributions to stormwater runoff. Fellsmere Pond is a key recreational/surface water body surrounded by protected open space that is monitored by City personnel. In addition, pet waste management is strictly enforced at public open spaces and recreational areas. Public understanding and conformance to the BOH recommendations remains as an area for improvement.

Goal Status:
Achieved

BMP 1-4 Establish a partnership with local schools to educate Malden's students about stormwater

Responsible Department/Person:
Stormwater Compliance Team

Measurable Goal(s):
Workshops, demonstration projects, student involvement

Progress on Goals- Year 14:
During this permit year, the Stormwater Compliance Team spoke to Malden school students on Earth Day about the water cycle and the relationship with the City drainage system. Stormwater management goals and ongoing practices are educational tools that are included in community outreach efforts.

Goal Status:
Through the use of website postings and connection to the classroom, the City hopes to continue the advancement of student involvement in meeting this goal.

BMP 1-5 Development of student involvement/internship for High School Seniors and expand Cooperative Education programs for college level interns

Responsible Department/Person:
Engineering Dept & MDPW

Measurable Goal(s):
Number of participants

Progress on Goals- Year 14:
During this reporting period the City Engineering Department and MDPW did not employ any interns.

Goal Status:
The City is currently exploring ways to partner high school and college interns.

BMP 1-7 Host or participate in Stormwater Management brainstorming sessions with citizen advisory groups and Mystic River Watershed representatives (MyRWA)

Responsible Department/Person:
Eng. Dept. & Mayor's Office

Measurable Goal(s):
Annual Participation. Dissemination of information to the general public

Progress on Goals- Year 14:
The City of Malden continues to work with regional watershed stewardship groups, neighborhood communities and civic organizations to develop protocols, or guidance for recreational uses upon the Malden River, by building upon the results of ongoing outfall and surface water sampling programs. Further, MyRWA is in the process of developing a predictive model for water quality trends through funding assistance provided by MDEP. The City continues to share sampling results with MyRWA and has performed targeted sampling events to investigate discharges to outfalls that have been sampled by MyRWA. The outfall and surface water sampling programs will assist in developing an increased knowledge base to educate and improve community involvement and awareness of the relationship between stormwater discharges and surface water quality.

In addition, the City is working to enhance the quality of the river corridor through the Malden River Greenways, which is a comprehensive planning group comprised of the City of Malden, the Friends of the Malden River, MyRWA, the ACOE, the MVDC and local planning agencies. Proposed projects include the construction of an emergent wetland, eradication of invasive plants, the creation of open spaces and recreational land uses. Each of these projects will improve stormwater discharges and surface water quality on the Malden River.

Consistent with this goal, protocols and guidance have also been developed for recreational uses on the Malden River, which is subject to both animal and human related bacteria discharges during wet weather conditions. A detailed summary of the protocols in place may be referenced from BMP 3-3. Additional outreach activities for the community included the Mystic River Stormwater Education Collaborative, which Malden joined during this reporting period. This initiative, led by MyRWA, will work to develop a multimedia education program to increase awareness of stormwater pollution for a regional coalition of municipalities.

Goal Status:
Ongoing community activity

2. Local Planning Processes and Community Involvement

BMP 2-1	Development of incentives for redevelopment initiatives that address existing stormwater management concerns

Responsible Department/Person:
Local Planning Agencies and Compliance Team
Measurable Goal(s):
Mitigation of existing stormwater concerns, implementation of Best Management Practices.

Progress on Goals- Year 14:

The cities of Malden and Melrose, together with The Pine Banks Park Foundation, Inc., recently completed a comprehensive capping and site closure program to address an area of ashen municipal solid waste (MSW) deposition, as fill, within northerly portions of Pine Banks Park located in Melrose, Massachusetts. Site improvements in this area included a multipurpose synthetic playing area, a Reclaimed Asphalt Pavement (RAP) parking area and a new softball field, which has included significant stormwater quality enhancement measures for the Oak Grove/Malden River watershed.

The recently completed South Broadway Park restoration project is another example of stormwater quality enhancements. The greatest opportunities for the advancement of this goal continues to come from the identified infrastructure and watershed needs that are identified through the ongoing CB inventory, mapping inventory program. Through the integration of the stormwater management program into daily work practices by the Malden DPW, infrastructure deficiencies are more quickly identified and placed into the local permitting process.

As awareness and understanding of infrastructure needs has increased though the stormwater compliance program, targeted water quality improvements and repairs have been incorporated into ongoing development practices. This has included the requirement of onsite retention and a comprehensive evaluation of the aged sewer and drainage infrastructure in the downtown area.

Goal Status:
Through the changes in staffing and engineering support, increased planning and incentives to promote improved stormwater management practices will be a priority during the next permit year.

BMP 2-2 Development of a "Clean Malden" Program

Responsible Department/Person:
Stormwater Compliance Team
Measurable Goal(s):
Promote neighborhood stewardship programs designed to remove trash from sensitive watershed areas, catch basin inlets and report conditions of concern.

Progress on Goals- Year 14:
The Friends of Malden River is a group of Malden citizens established to promote community awareness and opportunities associated with this resource area. This group meets regularly with MyRWA and has also established lines of communication with the City of Malden, including the Mayor's office, the Engineering office and the Environmental Justice Coordinator. The Friends of Malden River have worked on funding sources, a Public Improvement Plan (PIP) for 378 Commercial Street and a Malden River festival to support community awareness for the Malden River. In addition to the above, the trash boom located at the head of the Malden River routinely serviced by Malden DPW personnel.

Goal Status:
Achieved and ongoing

BMP 2-3 Inter-departmental review and communication to address stormwater quality concerns

Responsible Department/Person:
Local Planning and Inspectional Agencies

Measurable Goal(s):
Coordination of Planning and Inspectional services to further identify and address stormwater management issues.

Progress on Goals- Year 14:
Through the adoption of a City ordinance pertaining to the stormwater management requirements, the objectives of this BMP have been integrated into the formal Department Head meeting agenda. Representatives of the BOH continue to be instrumental in successful enforcement actions when necessary. This program has led to the isolation and mitigation of illicit flow contributions as well as infrastructure deficiencies to be corrected which are discussed in further detail within the Illicit Discharge Detection and Elimination Program (IDDE) Semi-Annual Status Reports, which have been filed with USEPA and may be referenced from Appendix A. (See also BMP 2-1)

Goal Status:
Ongoing

BMP 2-4 Development of an electronic database file management system

Responsible Department/Person:
Engineering Department and Compliance Team

Measurable Goal(s):
Compilation of all stormwater infrastructure information, integration of all ongoing inspection, inventory and repair activities.

Progress on Goals- Year 14:
Through the assistance of CDM-Smith, the City has completed the conversion of its current mapping system to GIS/electronic format using field GPS receivers. Future goals to advance the operational integration of the electronic file and data management program currently utilized by the City include the use of "tablets" in the field to more readily access information and update existing files. Changes in staffing and more direct daily involvement by engineering personnel will further advance this goal.

Goal Status:
Activity Ongoing

BMP 2-5 Development and implementation of local ordinances

Responsible Department/Person:
Local Planning Agencies and Compliance Team

Measurable Goal(s):
Adopt and enforce state and federal regulatory guidance. Perform community infrastructure needs analysis and conveyance of information to local permitting processes. Assign BMP guidance and requirements to private land use activities that are connected to the urban stormwater network.

Progress on Goals- Year 14:
The City continues to enforce existing stormwater ordinances and is reviewing Green Infrastructure and LID guidance and proposed Permit revisions to provide further enforcement guidance. The Engineering Department and where needed BOH has actively pursued violators of the local ordinances, as they pertain to stormwater quality.

Goal Status:
Achieved

BMP 2-6 Completion of an infrastructure needs analysis

Responsible Department/Person:
Eng. Dept, DPW, Compliance Team

Measurable Goal(s):
Development of a long term plan for infrastructure upgrade

Progress on Goals- Year 14:
The reorganization of Engineering and MDPW support staff has advanced the focus and prioritization of infrastructure needs, as well as more direct daily involvement by City staff. This evaluation is an ongoing and iterative process that serves not only to enable timely repairs responses but provide a foundation for major capital improvement projects.

Goal Status:
Annual Ongoing Activity

3. Stormwater Monitoring and Inspection Program

BMP 3-1	Conduct a minimum of one annual inspection of all known outfalls during dry weather sampling events.

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Documentation of inspection results. Identification of issues of concern and corresponding confirmation resolution/ implementation of mitigation measures.

Progress on Goals- Year 14:
During this permit year, one (1) dry weather sampling event was performed by the Stormwater Compliance team. Details pertaining to the dry weather sampling events may be referenced within BMP 3-3 and Appendix A.

Goal Status:
Achieved and Ongoing Activity

BMP 3-2	Perform targeted sampling and analyses during dry weather and wet weather sampling events to document seasonal and annual trends.

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Collection of water quality data

Progress on Goals- Year 14:
A summary table (Table 1.0) with historic dry weather sampling results, together with figures depicting approximate sample locations may be referenced as Appendix B. As discussed further in BMP 3-3, the results of the dry weather sampling program have led to the removal of a significant, long term discharge of raw sewage into the municipal drainage system by representatives of the Gateway Apartments in December of 2016. Dry weather sampling will continue during the next permit year. In addition, a wet weather sampling event was performed during in November of 2016. Details pertaining to the wet weather sampling event may be referenced within BMP 3-3.

Goal Status:
Achieved and Ongoing Activity

BMP 3-3	**Perform mass balance modeling within primary watersheds to isolate sub basin bacteria loading sources.**

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Identification of source area contributions

Progress on Goals- Year 14:
Representatives of NCA and MDPW personnel continue to conduct dry weather inspections of the City's infrastructure and flow isolation studies. During this permit year the central section of Malden, which contributes flows to the Malden River has been iteratively inspected and monitored. This is a systematic program that has resulted in the identification and correction of infrastructure deficiencies, the timely repair of flow conveyance networks and removal of illicit discharges all of which have contributed to improvements in the quality of stormwater discharges. Historically, areas selected for inspection were generally based upon the results of the outfall sampling program and/or the identification of dry weather flows by MDPW staff during their routine maintenance and infrastructure locating program. As this program has continued, a more uniformed and systematic inspection program has been developed.

As a part of this inspection program, an evaluation of the drainage system in Pleasant/Commercial/Exchange Street portion of the Malden River watershed was conducted in response to the detection of high E. coli levels during a dry weather sampling event at manhole E28BY-MH1, which is located between Route 60 and Exchange Street. An inspection of the drainage manhole revealed an approximate 48-inch RCP line with flow containing a strong sewage odor that was observed to be approximately 10 – 12 gallons per minute. Based upon a review of historic plan information, as well as field observations, this flow moves in a southerly direction into the Spot Pond Brook culvert, which ultimately discharges into the Malden River. Due to the high levels of E. coli encountered, a mass balance flow isolation of the drainage network within to the Exchange and Commercial Street area was conducted.

Supplemental dry weather sampling by the Stormwater Compliance Team at E28BY-MH1 and several upstream drain manholes located on Exchange Street, Commercial Street and Pleasant Street revealed an E. coli concentration of 9,800 MPN/100ml at E28BY-MH1, with elevated E. coli concentrations also detected at four (4) of the five (5) upstream manholes (Figure 1). The highest of these levels was encountered at E28-MH1 (19,000 MPN/100ml), which is approximately 400 feet northwest of E28BY-MH1.

Upstream sampling of manholes S39-MH1 and P27-MH10, in Pleasant Street, revealed a significant decrease of E. coli concentrations. Specifically, it is seen that E. coli levels of 30 and 34 MPN/100 mL were detected at S39-MH1 when elevated levels of E. coli were detected at E28-MH1 and F26-MH3. Continued monitoring of the drainage system in this area revealed the highest E. coli levels at manhole F26-MH3 (>483,920 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets. A concentration of 140,000 MPN/100ml was also detected at downstream manhole E28-MH1, where high E. coli levels were previously recorded. A significant decrease in E. coli levels was identified at manhole P27-MH12 (27 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets. This sampling point is approximately 90 linear feet upstream of F26-MH3, where the highest E. coli levels were historically detected. A sample was also collected from the closest accessible manhole upstream of the Malden River outfall. This manhole, (C15-MH8.1) is located south of Charles Street and approximately 330 feet north of the

Malden River and an E. coli level of 1,200 MPN/100ml was detected. It should be noted that the water in manhole C15-MH8.1 was stagnant at the time of sampling.

During the inspection of Exchange Street drainage manhole E28BY-MH1, a strong sewage odor was identified and the evaluation of both the sewage and drainage infrastructure indicated that the invert elevations for the piping systems were very close, suggesting that possible exfiltration from the municipal sewage system was impacting the nearby drainage network. In response to the observations recorded within the Exchange Street area, representatives of CDM Smith Inc. (CDM) were requested to review the results of their inflow/ infiltration investigation in the area and according to CDM, no significant or obvious signs of infiltration or exfiltration were noted. To further investigate the drainage system in the area, the City contracted National Water Main Cleaning Company (National) to camera the area of concern. On 2 June 2016, National, under the direction of the City, CDM and NCA initiated the CCTV inspection.

Video inspection of the infrastructure was initiated at the intersection of Pleasant and Florence Streets, at drain manhole P27-MH13. A detail sketch plan of the area may be referenced from Figure 2. A visual inspection of this manhole revealed flow from the west (Pleasant Street) which then flowed in a southern direction down Commercial Street. While placing the video inspection equipment into the manhole, an intermittent flow was observed emanating from an 18-inch reinforced concrete pipe (RCP) drain line located in Florence Street (north). The video inspection of the drain line in Florence Street revealed no illicit connections, or indications of compromise to the pipe, which terminated approximately 115 feet to the north, at manhole F26-MH4. In addition, a colorimetric field test for ammonia was performed by CDM, with only low levels encountered, indicating this flow was most likely not the source of the elevated E. coli levels in the area. The camera was then sent approximately 100 feet west, along a 36-inch RCP to manhole P27-MH10, with no illicit connections or indications of compromise to the pipe noted.

A visual inspection of manhole P27-MH11 revealed that in addition to the 36-inch RCP line that flows from P27-MH10 there was a second 36-inch RCP line that was not identified on plans reviewed during this study. Field observations noted at manhole P27-MH11 included a strong sewage odor and visual indications of sewage contributions from the second 36-inch RCP line. A video inspection of this line revealed that it runs west along the center of Pleasant Street and then turns north to Summer Street, to manhole S39-MH3. It is to be noted that indications of sewage were observed along the entire length of pipe. The video inspection equipment was then moved to manhole S39-MH3 and visual observations of the manhole showed water entering the structure from a 12-inch RCP located of the western side of the manhole. Of particular importance to this mass balance flow isolation program was the absence of flow within the pipe from Summer Street (north). Video inspection of the 12-inch RCP revealed addition indications of sewage discharge and that the drainage line connected to manhole S39-MH3.1, approximately 50 feet to the west. A visual inspection of manhole S39-MH3.1 revealed two (2) 8-inch ductile iron pipe inverts within the structure. The video inspection of the ductile iron pipe that connects to manhole S39-MH3.2, located approximately 100 feet south-southwest of manhole S39-MH3.1, revealed no illicit connections or indications of compromise. However, indications of sewage discharge were identified during the video inspection of the 8-inch ductile iron pipe that connects to the Gateway at Malden Center Apartments (10 – 20 Summer Street), approximately 35 feet to the northwest of manhole S39-MH3.1. Video observations noted included the presence of a stub and two (2) 8-inch ductile iron pipes which connect to 10 – 20 Summer Street building. Indications of sewage were noted within each of the pipes and flow from building was emanating from the northern pipe, which appears to run parallel with Summer Street.

Representatives of the City, CDM and NCA spoke with the facility manager for the building and were allowed access to several common area bathrooms and locker rooms, as well as the building basement. A visual inspection of the sewerage and drain lines within the basement and several dye tests were performed to determine the origin of the sewage from within the building, however they were inconclusive. The City contacted the property owner and they engaged a plumbing contractor to determine the best course of action to resolve the illicit connection. After several camera inspections of the building utility lines, it was determined that a sewer riser was connected to a roof drain, which in turn discharged to the City storm drain system.

According to representatives of Gateway Apartments, 11 one (1) bedroom apartments were connected to this roof drain. More specifically, it was determined that sewer connections for each of the "07" apartments (i.e. 107, 207, etc.) for the entire building were connected to a roof drain riser pipe that discharged to the municipal drainage system. The City remained in constant contact with representatives of the Gateway Apartments, who were cooperative and attempted to remove the illicit connection as quickly as possible. However, due to the complexity of the illicit connection and the multiple apartments connected to the roof drain, the work was not completed until 21 December 2016. A subsequent inspection by the City of Malden Plumbing Inspector was conducted and it was confirmed that the sewer riser was disconnected from the City storm drain system. During the next reporting period, a dry weather sampling event will be conducted in the area to characterize E. coli concentrations post illicit connection removal. The removal of this illicit connection represents a major reduction in potential surface water discharge and the most significant benefit derived from IDDE Plan implementation to date.

In addition to the above, the most recent dry weather water quality evaluation conducted along the Malden River included the sampling of outfalls on 28 April 2016. During the 28 April sampling event, four (4) outfalls were identified as flowing and were sampled, with the other 22 outfalls either having no flow or were submerged. Reference to Table 1.0 and Figure 3 shows that E. coli levels ranged from 1.0 MPN/100ml (MR-6) to 8.6 MPN/100ml (MR-4).

The focus of IDDE response actions during this permit year has also been directed towards the illicit connections identified within the Malden River watershed, as well as the targeted wet weather sampling conducted along the Malden River and the Linden Brook Culvert in November of 2016. As outlined within the City's IDDE Plan, wet weather is defined as an event in which at least 0.25-inches of rain falls within 24 hours prior to the sampling event. A representative rainfall event of 0.42-inches occurred on 29 November 2016 and wet weather sampling was conducted on 30 November 2016.

As shown in Table 2.0, six (6) Malden River outfalls were found to be flowing, with high E. coli concentrations encountered at MR-4.1 (870 MPN/100ml) and MR-8 (7,000 MPN/100ml). A comparison of the wet weather concentrations with dry weather levels (Appendix B) at these two locations reveals that no flow has been observed at MR-4.1 during dry weather conditions, while flow was observed at MR-8 during the latest dry weather event, the bacteria level was only 5.2 MPN/100ml. In addition to the outfalls, base flow wet weather samples were collected from Little Creek and the Saugus Branch Culvert headwall. Elevated E. coli levels were detected at all three (3) locations, with the highest concentration (4,900 MPN/100ml) detected at the southern Saugus Branch Culvert headwall (MR-2S). It should be noted that little to no flow was observed at these locations during the sampling event.

To supplement the results obtained from the laboratory analysis of E. coli, a colorimetric field test for ammonia utilizing Hach Ammonia (Nitrogen) Test Strips was performed at selected wet weather Malden River sample locations. As shown on Table 3.0, in general, the field test results were

consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

Targeted wet weather sampling was also conducted along the Linden Brook Culvert on 30 November 2016 (Figure 4). The scope of work performed at that time involved the sampling of two (2) manhole structures that discharge to the Linden Brook Culvert, one (1) manhole along the culvert and one (1) outfall/discharge area on the Malden/Revere line (LBR-1). As shown on Table 2.0, a bacteria sample was collected from an upstream drain manhole on Winship Street and one downstream location on Cherry Street, with elevated E. coli levels detected at both locations (3,500 & 2,400 MPN/100ml, respectively) The stormwater conveyance network in the Winship and Cherry Street area discharges into the Linden Brook Culvert to the east. To assess potential impact to flow within the Linden Brook Culvert, a sample was collected from a downstream location at Home and Mingo Streets (H43-MH1), with a concentration of 260 col/100 ml identified. Although the level encountered is above the action level, it is well below the concentrations detected at Winship and Cherry Streets.

During the 30 November 2016 wet weather sampling event, a water sample was collected from LBR-1. Elevated bacterial levels, (480,000 MPN/100ml) indicative of sewerage infiltration, were encountered. Based upon information obtained from the Malden DPW, since the initial identification of the grease build-up resulting in a sewer line blockage in the area of LBR-1, the City of Malden has performed weekly preventative maintenance, which includes the evaluation of flow within the sewer line and the placement of degreasing chemicals if necessary. These weekly evaluations have indicated that the municipal sewer system in this area has been flowing as expected. Based upon the reported maintenance intervals, it did not appear that a sewer line blockage in the area of LBR-1 was the source of the high E. coli levels. Accordingly, an additional E. coli sample was collected by NCA on 3 January 2017, with a result of 2,000 MPN/100ml detected. Although this level is considered high, the concentration is orders of magnitude lower than the level detected in November of 2016. The City will continue to evaluate this area next reporting period.

As a part of their Massachusetts Environmental Trust funded Mystic Recreation Flagging Project, MyRWA has collected hundreds of samples from six (6) locations, including the Malden River within the Mystic River watershed. The goal of their effort includes the interim development of a "flagging" system in the watershed to alert recreational users to safe or unsafe conditions, which will be followed by the development of "logistic models" that will allow for predictive guidance pertaining to water safety. Based upon the review of historic water quality information complied by the City and MyRWA, it was postulated that for rainfall events of less than half an inch, a 48 hour period of rebound would allow for the flushing of the River and reduction of bacteria levels to below safe boating standards. To test this hypothesis, sampling events were performed approximately 48 hours following half inch rainfall events at the floating crew dock, located at 356 Commercial Street in Malden.

As a general protocol, it has been recommended that river activities be suspended immediately following significant rainfall events, however the duration of this restriction has lacked sufficient foundation to be adequately determined. Specifically, it is known that there is a period of rebound following wet weather events that directly corresponds to the duration and/or amount of rainfall following which dry weather sampling has revealed consistent bacteria levels below applicable boating (1,260 MPN/100ml) and often swimming (235 MPN/100ml) EPA standards. To further evaluate this rebound condition, the City has worked with representatives of MyRWA to develop a post wet weather protocol for on river activity.

During the last reporting period, the 48 hour rebounding protocol led to the documentation of bacteria levels below the USEPA safe boating standard for each applicable rainfall event. In

addition, the corresponding safe swimming standard was met on 19 April and 7 July, with only a slight exceedences observed on 28 April 2016. The sampling program was continued during this reporting period to provide further background support for the 48 hour protocol that is enforced by the Malden Athletic Director. As shown on Table 4.0, two (2) sampling events were conducted this reporting period (4 October & 30 November 2016). A bacteria level of 140 MPN/100ml was identified during the October sampling event, well below the USEPA safe swimming standard. In contrast, an E. coli concentration of 2,900 MPN/100ml was detected during the most recent sampling event performed in November of 2016. The October sample was collected 53 hours from the last rainfall, while the November sample, which contained elevated E. coli levels, was collected only 10.8 hours from the last rainfall. This pattern is consistent with rebound condition described above. The City will continue this sampling program next reporting period and share the data and work with MyRWA to develop a predictive model that will include the use of electronic signboards and development of a public advisory website.

Additional details pertaining to the wet and dry weather inspections performed during this permit year may be referenced from the Illicit Discharge Detection and Elimination Program (IDDE) Semi-Annual Status Reports, which have been filed with USEPA and may be referenced as Appendix A.

Goal Status:
Initial city wide objectives for this goal have been met. IDDE program and dry weather flow isolation studies are ongoing.

BMP 3-4	**Target the evaluation of stormwater discharges from "green space" parklands, cemeteries and open space to assist in the segregation of human, animal and waterfowl bacteria contributions.**

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Separation of non-human bacterial loading and implementation of mitigation measures.

Progress on Goals- Year 14:
The City has implemented several measures to reduce discharge of non-human bacterial loading at park lands, cemeteries and open space. These have included the use of dogs, postings to prevent the feeding of waterfowl, pet waste stations and enforcement of posted signage. In addition, several recreational facilities such as MacDonald Stadium, Maplewood Park, and portions of the Pine Banks Park have been converted to synthetic playing fields under the direction of City of Malden personnel. During the last permit year the City converted South Broadway Park from grass playing fields to synthetic surfaces and integrated stormwater BMPs into the design of this large athletic park.

Goal Status:
Ongoing Activity

BMP 3-5	Development of mitigation strategy based upon sampling and inspection progress for consideration in annual capital planning.

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Preparation of annual report.

Progress on Goals- Year 14:
Dry weather sampling continues to focus upon primary surface water bodies that received base-flow or dry weather contributions from upstream surface waters. The surface water bodies principally include the Malden River, Lower Spot Pond Brook, West End (Edgeworth Brook) Culvert, Little Creek, Linden Brook and the Town Line Brook. As a "flow through" community, significant base flow discharges from the City of Melrose and in particular Ell Pond continue to occur. Beyond the removal of illicit discharges, flow conveyance capacity requirements and necessary infrastructure repairs have been identified. Included amongst long term planning efforts was the completion of a Phase 3 of the comprehensive Infiltration and In-flow (I&I) study for the municipal sewer system that was performed by CDM Smith. This report includes a summary of findings and proposed recommendations to mitigate infiltration and inflow into the City's sewer system and was presented for approval to Massachusetts Water Resources Authority (MWRA) during this permit year. Approval has been received, together with necessary funding.

The City has converted and updated a majority of its current storm drain system mapping to GIS format using field GPS receivers. This includes the scanning of existing record plans as well as the conversion of field data, specifically drainage infrastructure components are located and inventoried as a part of ongoing system wide maintenance, service and inspection program being implemented by the MDPW. This planning tool is essential to the identification of capital planning projects. The results obtained from the outfall sampling program, together with the development of an electronic file management system, continue to assist in the prioritization of infrastructure needs.

Goal Status:
Both in-house and contracted services are in place to oversee mitigation maintenance and planning efforts.

BMP 3-6	Development and Implementation of an Illicit Discharge Detection and Elimination (IDDE) Plan

Responsible Department/Person:
Eng Dept & Compliance Team

Measurable Goal(s):
Development and implementation of an IDDE Plan.

Progress on Goals- Year 14:
The City continues to implement its U.S. Environmental Protection Agency (US EPA) approved IDDE program through its daily CB inspection and maintenance program through the use of a dedicated MDPW Stormwater Team and outside services. The drainage infrastructure is inspected by DPW during catch basin cleaning, and upon the identification of previously unknown dry weather flows, the Engineering Department and NCA are immediately notified by MDPW personnel and targeted mass balance sampling efforts are performed. During dry weather inspections completed under the IDDE program, various dry weather flows have been identified. The Semi-Annual Status Reports pertaining to this effort, which have been filed with USEPA, may be referenced as Appendix A.

Goal Status:
Achieved

4. Pre- and Post-Construction Stormwater Runoff Control Measures

BMP 4-1	Development of inspection protocol/checklist local permitting agencies to monitor ongoing construction activities

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Development of checklist

Progress on Goals- Year 14:
The City's permitting process now incorporates the criteria contained within adopted stormwater ordinances to guide its review process. These ordinances provided the mechanism for enforcement and work is ongoing to integrate the results from daily inspection and monitoring into these processes. (See also BMP 2-1)

Goal Status:
Achieved and Ongoing

BMP 4-2	Integration of Applicant Certification requirement for the monitoring and inspection of development activities into local planning processes.

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Applicant Certification and submission of inspection and monitoring reports. (See BMP 4-1)

Progress on Goals- Year 14:
No progress has been made to these certification requirements, beyond conditions of approval and City oversight.

Goal Status:
Ongoing

BMP 4-3 Promote the use of new and innovative products/designs in new development initiatives. Condition of approval, monitoring

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Conditions of Approval, monitoring of construction activities.

Progress on Goals- Year 14:
Municipal projects within the City during this permit year have included the construction of a new Malden Police Headquarters on Eastern Avenue. Recreational improvements during the last permit year have also included the conversion of South Broadway Park to synthetic playing field surfaces, along with the completion of surface cover and drainage improvements at Callahan Park. The City continues to enforce the use of low impact stormwater control measures, such as onsite retention and infiltration, as well as the upgrade of its aging infrastructure during ongoing developmental practices in the downtown area. New development projects are being required to undertake detailed investigations of the municipal infrastructure and implementation of BMPs to improve the nature of urban runoff.

Goal Status:
Ongoing

BMP 4-4 Enforcement of existing state and federal guidance.

Responsible Department/Person:
Planning Board and Inspectional Services, Eng. Dept.

Measurable Goal(s):
Documentation of violations, implementation of corrective actions.

Progress on Goals- Year 14:
See BMP 3-6 and 5-8. Following the adoption of local control measures in April 2009, the City has enforced the removal of illicit discharges and required that investigations be undertaken to mitigate improper stormwater discharges. These efforts have led to the repair of sewer laterals within Eldrich Drive in the area of Oak Grove. In addition, the City, through IDDE Plan implementation isolated and identified the responsible party for an illicit connection believed to have conveyed millions of gallons of sewerage to the municipal drainage system prior to its mitigation.

Goal Status:
Ongoing

BMP 4-5 Develop partnerships in planning with local Conservation Commission

Responsible Department/Person:
Planning Board and Inspectional Services, Eng. Dept.

Measurable Goal(s):
Stormwater quality management practices as conditions of approval.

Progress on Goals- Year 14:
The goals of this general permit and the corresponding IDDE program are directly communicated to the local Conservation Commission. In addition, infrastructure needs and deficiencies are communicated to the Commission for review and consideration during the local permitting process.

Goal Status:
Achieved and ongoing

BMP 4-6 Site design measures to improve stormwater quality

Responsible Department/Person:
Planning Board

Measurable Goal(s):
Improved design features for new development.

Progress on Goals- Year 14:
The adoption of local ordinances (See BMP 4-3) have provided planning review processes with guidance for appropriate design practices, in addition to BMP 2-5. Further, compliance with stormwater guidance for new development (310 CMR 10.00) is required.

Goal Status:
Ongoing

5.0 Pollution Prevention and Stormwater Management Strategies.

BMP 5-1 Develop a Formal Training Program for DPW Staff

Responsible Department/Person:
DPW, Human Resources Dept.

Measurable Goal(s):
Staff Training

Progress on Goals- Year 14:
Day to day responsibilities for implementation of the stormwater compliance program fall under the direction of the Malden Water Department subject to the oversight of the Engineering Department. A trained crew has been assigned to work with NCA and the Malden Engineering Department in meeting the objectives of the IDDE Plan, as well as General Permit Program compliance. This team has been responsible for the identification of numerous water main leaks, resolution of illicit connections and repair of infrastructure components, all of which is directed towards the improvement in the quality of the City's stormwater discharges. Beyond the identification of illicit discharges, the committed focus upon surface water quality and the contributing drainage infrastructure has led to more timely repairs and improved system maintenance.

Goal Status:
Achieved and ongoing

BMP 5-2 Maintain Lawn Care Policy

Responsible Department/Person:
DPW, School Dept., Cemetery Dept

Measurable Goal(s):
Proper utilization of pesticides, herbicides, fertilizers and appropriate disposal of lawn trimmings, yard waste

Progress on Goals- Year 14:
The application of pesticides, herbicides and fertilizers is provided by a licensed outside contractor, supervised by the MDPW. All other lawn care for recreational areas is maintained by the MDPW.

Goal Status:
Ongoing activity

BMP 5-3	Development of a maintenance and monitoring plan for open channel component of Town Line Brook

Responsible Department/Person:
Eng. Dept., DCR & Compliance Team

Measurable Goal(s):
Removal of excess sediment deposits, restoration of flow capacity, structural repair.

Progress on Goals- Year 14:
The City, through its elected and appointed staff has reached out to the DCR for several years concerning the structural and water quality deficiencies associated with Town Line Brook. However, due to funding constraints, there are no plans for future work. The extent of damage to the concrete walls of this trapezoidal channel remains a significant concern, and has been reviewed with representatives of USEPA. Sediment deposition with the channel, together with compromises in its structural integrity represent long term and ongoing sources for degradation of surface water quality.

Goal Status:
Ongoing

BMP 5-4	Implementation of recommended maintenance and monitoring plan developed for Spot Pond Brook at Oak Grove.

Responsible Department/Person:
Eng. Dept., DPW & DCR

Measurable Goal(s):
Implementation of those recommendations contained within engineering study completed by Meridian Associates, Inc.

Progress on Goals- Year 14:
As referenced in BMP 5-3, several meetings and two (2) site walks were held with DCR last reporting period concerning Spot Pond Brook. However, due to funding constraints, there are no plans for future work. No planned maintenance activities occurred during this reporting period.

Goal Status:
Funding for necessary improvements and attention by DCR remains the goal of this BMP.

BMP 5-5 Expansion of programs such as the Fellsmere Pond restoration initiative

Responsible Department/Person:
Mayor's Office, Compliance Team DPW

Measurable Goal(s):
Water quality improvement

Progress on Goals- Year 14:
The current Administration has made significant commitment to public outreach and community involvement. At the core of this effort is education and input from concerned residents, as well as the business community. With the development of the Friends of the Malden River Organization, a focus of community involvement has been directed to water quality issues associated with the River, which includes litter debris and bank clean up. Potential public opportunities as well as enhancement alternatives for the Malden River Corridor are being actively pursued by local agencies and stewardships groups. In addition to the Malden River, bank stabilization measures and mitigation of significant compromises to the drainage infrastructure that conveys both groundwater outbreak and drainage flow in the area of Fellsmere Pond were identified and addressed. During this permit year, aeration fountains were installed in Fellsmere Pond and a bacteria treatment is scheduled for May of 2017.

Goal Status:
Achieved and ongoing

BMP 5-6 Comprehensive catch basin inspection, inventory, maintenance program

Responsible Department/Person:
Eng. Dept., DPW & Compliance Team

Measurable Goal(s):
Electronic logging of CB locations, documentation of CB construction and functional characteristics, recommendations for improved performance standard compliance at individual locations or tributary segments of the drainage system.

Progress on Goals- Year 14:
The ongoing maintenance program includes repairs to catch basins and laterals, which reduces the potential for sediment entrainment and reduces flooding issues. During the 2016-2017 permit year, the Engineering Department and the MDPW utilized the information obtained from the CB inventory and cleaning program to perform the following maintenance activities:

- Replacement/restoration of 21 catch basin structures
- Replacement/restoration of 4 drain manhole structures
- Clearing of 1,100 linear feet of drain laterals
- Cleaning of 105 catch basins

Goal Status:
Achieved and Ongoing

Goal Status:
Achieved and Ongoing

BMP 5-7 Continue sewer re-lining and connection upgrade program

Responsible Department/Person:
Eng. Dept. & DPW

Measurable Goal(s):
Reduction in I/I, identification of potential illicit connections, assist in infrastructure needs analysis

Progress on Goals- Year 14:
During the last reporting period, a $3 million dollar contract (2014 S-1) was completed by the City for extensive sewer relining/cleaning services. No sewer re-lining or connection upgrade programs were completed during this permit year.

Goal Status:
Ongoing activity

BMP 5-8 Development and implementation of communication/notification plan for SSOs

Responsible Department/Person:
Eng. Dept. & DPW

Measurable Goal(s):
Notification of U.S. EPA and MDEP within 24 hours of event occurrence

Progress on Goals- Year 14:
No SSOs were identified during Year 14. Additional details may be referenced from the Illicit Discharge Detection and Elimination Program (IDDE) Semi-Annual Status Reports, which have been filed with USEPA and may be referenced as Appendix A.

Goal Status:
Achieved and Ongoing

6. Pollution Prevention and Good Housekeeping in Municipal Operations

BMP 6-1 Regular meetings of Compliance Team to review plan implementation results

Responsible Department/Person:
Compliance Team

Measurable Goal(s):
Data evaluation and review, implementation of corrective actions, and prioritization of mitigation measures.

Progress on Goals- Year 14:
Stormwater management requirements, compliance enforcement and ongoing work practices have been integrated into daily work procedures, with an emphasis placed upon improved communication.

Goal Status:
Achieved and Ongoing

BMP 6-2 Annual Compliance review

Responsible Department/Person:
Compliance Team & Mayor's Office

Measurable Goal(s):
Identification of capital plan improvements, modification of plan and objectives, documentation of plan activity for Annual Report.

Progress on Goals- Year 14:
This document, together with the development of a working GIS system represents major milestones that serve to demonstrate the extent of efforts that have been undertaken by the City of Malden to achieve the goals and objectives of the MS4 program. Building upon the foundation that has been developed over the past few years, the City is well positioned to meet the goals and requirements of soon to be in-place revisions of the MS4 General Permit, which becomes effected on July 1, 2017. The ongoing IDDE program, including outfall sampling and mass balance isolation studies are key components of ongoing planning efforts designed to prioritize and timely implement necessary infrastructure improvements.

Goal Status:
Ongoing

Part IV. Summary of Information Collected and Analyzed

Part V. Program Outputs & Accomplishments (Optional)

1. Programmatic (See BMPs 1-4 and 5-1)

1.1	Stormwater management position created/staffed	Compliance Team Established
1.2	Annual program budget/expenditures	$ 620,000 – 720,000

2. Education Community Involvement and Training (See BMPs 1-1, 1.2, 1-4, and 1-5)

2.1	Estimated number of residents reached by education program(s)	55%
2.2	Stormwater management committee established	Yes
2.3	Stream teams established or supported	Yes
2.4	Shoreline clean-up participation or quantity of shoreline miles cleaned	0.5 miles
2.5	Household Paint Waste Collection Days	
	Days sponsored	2 Days
	Community participation	20%
	Material collected	$11,000
2.6	School curricula implemented	Yes

3. Legal/Regulatory (See BMPs 2-5 and 3-6)

3.1	Regulatory Mechanism Status	
	Illicit Discharge Detection & Elimination	Adopted
	Erosion & Sediment Control	Adopted
	Post-Development Stormwater Management	Adopted

4. Mapping and Illicit Discharges (See BMPs 2-4)

4.1	Outfall mapping complete	All Known-100%
4.2	Estimated or actual number of outfalls	65
4.3	System-Wide mapping complete	
	Sewer-Paper/Mylar	100%
	Sewer-GIS	100%
	Drain-Paper/Mylar	100%
	Drain-GIS	90%
4.4	Outfalls inspected/screened	100%
4.5	Illicit discharges identified	8
4.6	Illicit connections removed	1,470 GPD (est.)
4.7	% of population on sewer	99.6%
4.8	% of population on septic systems	0.4%

5. Construction

5.1	Number of construction starts (>1-acre)	2
5.2	Estimated percentage of construction starts adequately regulated for erosion and sediment control	2
5.3	Site inspections completed	2
5.4	Tickets/Stop work orders issued	None
5.5	Fines collected	None
5.6	Complaints/concerns received from public	None

6. Post-Development Stormwater Management

6.1	Estimated percentage of development/redevelopment projects adequately regulated for post-construction stormwater control	100%
6.2	Site inspections completed	0
6.3	Estimated volume of stormwater recharged	None

7. Operations and Maintenance – current reporting period (See BMPs 5-1)

7.1	Average frequency of catch basin cleaning (seasonal) (non-commercial/non-arterial streets)	3 days a week
7.2	Average frequency of catch basin cleaning (commercial/arterial or other critical streets)	3 days a week
7.3	Total number of structures cleaned	105
7.4	Storm drain cleaned	1,100 LF
7.5	Qty. of screening/debris removed from storm sewer infrastructure	100 yards
7.6	Disposal or use of debris (landfill, POTW, compost, recycle for sand, beneficial use, etc.)	NA
7.7	Cost of screening disposal	NA
7.8	Average frequency of street sweeping (non-commercial/non-arterial streets)	6 days a week
7.9	Average frequency of street sweeping (commercial/arterial or other critical streets)	6 days a week
7.10	Qty. of sand/debris collected by sweeping	750 tons
7.11	Disposal or use of sweepings (landfill, POTW, compost, recycle for sand, beneficial use, etc.)	NA
7.12	Cost of sweeping disposal	NA
7.13	Street sweepers purchased/leased	0
7.14	Reduction in application on public land of: (“N/A” = never used; “100%” = elimination)	
	Fertilizers (State regulations require applicators (license which City does not currently have)	100%
	Herbicides	None
	Pesticides	None
7.15	Anti/De-Icing precuts and rations	Salt 100% CaCl2 100 gals/30 tons
	5000 gallon tank	CaCl2-100%
7.16	Pre-wetting techniques utilized	Yes
7.17	Manual control spreaders used	No
7.18	Automatic or Zero-velocity spreaders used	Yes
7.19	Estimated net reduction in typical year salt application	15%
7.20	Salt pile covered	Yes

NANGLE CONSULTING ASSOCIATES, INC

APPENDIX A

Environmental Engineering and Land Use Planning

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CITY OF MALDEN

Illicit Discharge Detection and Elimination Program
Semi-Annual Status Report

July 1, 2016 – December 31, 2016

Prepared by:

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and

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Malden, Massachusetts

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1.0 INTRODUCTION

The City of Malden, through the implementation of zoning ordinances and local enforcement has developed an Illicit Discharge Detection and Elimination (IDDE) Program. In accordance with the reporting schedule for this program, this status report pertains to the period of 1 July through 31 December 2016. The City of Malden's IDDE plan was developed to facilitate the implementation of a systematic and iterative procedure for the evaluation of dry weather flows, identification of potential illicit discharges and timely repairs to the storm drainage infrastructure, with the overall goal of improving surface water quality discharge within the City of Malden. This semi-annual status report has been prepared through the cooperative efforts of the City of Malden Engineering Department, the City of Malden Department of Public Works (MDPW) and Nangle Consulting Associates, Inc. (NCA) to document key program tasks completed during this reporting period.

Since its inception, the City's IDDE program has identified and removed illicit discharges/connections to the municipal drainage system, reduced significant potable water losses due to the detection of leakages, enforced Best Management Practices (BMPs)/stormwater ordinances and completed significant repairs to components of the drainage infrastructure. To support this effort, a comprehensive GIS mapping and catch basin cleaning/repair program was developed several years ago, which is implemented and maintained by the MDPW and Engineering Department. The goals and objectives of this IDDE plan are directed towards the reduction in the historic bacteria levels that have been detected at selected outfalls to surface waters within the City. In addition, as a "flow though" community, bacteria loadings entering into the City of Malden's infrastructure from upstream neighboring communities have also been quantified.

In general, the results of dry weather inspections, together with both dry and wet weather sampling, support the opinion that increased wet weather loadings are tied to the age and condition of the municipal infrastructure, major portions of which were installed during the late 1800's and early 1900's. It is to be noted that this early drainage infrastructure was installed, by design, to reduce flooding and assist in the conveyance of surface waters from the City to downstream outfalls that discharge coastal waters. Further, the relationship between age of the infrastructure and increased bacterial loadings are particularly evident during wet weather sampling events within older neighborhoods that grew from the extensive industrial operations along the Malden River. To address the constraints associated with this infrastructure, the City Engineering and Public Works Departments, supplemented by outside technical assistance, have developed a program that integrates the implementation of the IDDE Plan into the routine daily work practices. This has led to the identification of infrastructure deficiencies and enabled the timely repair of potential flow and related water quality concerns.

The above described direct response mitigation/repair measures have also led to the removal of illicit connections/discharges and substantial reduction of historic flooding concerns. During this reporting period, a significant illicit discharge connection was removed within the area of Pleasant and Exchange Streets, in response to the results of dry weather sampling and mass balance flow isolation studies. As discussed in Section 3.1.1 of this submittal, the illicit connection of eleven (11) residential apartments to a roof drain riser that discharged to the municipal drainage system was identified in June of 2016. This connection was made at the time of original building

construction and its identification and removal speaks to the importance and effectiveness of the City of Malden IDDE program.

This report has been prepared to document and summarize IDDE activities that have been undertaken by the City during the June 2016 through December 2016 reporting period. Included with the scope of work is the performance of a wet weather sampling event in November of 2016 and the continued development of a recreational guidance document based upon the results of the ongoing outfall sampling program performed by the City and surface water quality sampling of the Malden River by the Mystic River Watershed Association (MyRWA). With respect to the latter, the City of Malden, through its redevelopment agency (The Malden Redevelopment Authority) has worked closely with representatives of the Athletic Department, the Malden Board of Health and MyRWA to develop protocols for crew activities upon the Malden River following significant wet weather events. Specific details pertaining to this guidance, as well as other activities conducted this reporting period is presented in Section 3.0 of this report. The data and information obtained during this reporting period also serves as the basis for tasks to be completed during the next 6 month period.

2.0 DOCUMENTED ILLICIT DISCHARGES AND CONNECTIONS

During this reporting period, no illicit connections were identified, however, the illicit connection identified in June of 2016 at 10 – 20 Summer Street (Gateway at Malden Center Apartments) has been removed. A detailed description of the assessment and isolation of this significant discharge to the City drainage system is presented in Section 3.1.1 of this submittal. A summary of the illicit discharges/connections identified to date is presented on Figure 1 and Table 1.0.

3.0 OVERVIEW OF IDDE ACTIVITIES (JULY 2016 – DECEMBER 2016)

In addition to outfall sampling, the City of Malden's IDDE Program incorporates the use of three (3) primary measures to identify and mitigate illicit discharges to its municipal drainage system, which may be described as follows:

(1) Targeted dry weather inspections and sampling by representatives of the Stormwater Compliance Team.

(2) Detailed inspection of the municipal infrastructure during the daily implementation of the catch basin clean-out and drainage system mapping program.

(3) Response to public, private or governmental agencies reports of possible sudden and/or identified discharge to the municipal storm system.

To provide a basis for the iterative dry weather inspection program and the observations recorded during this reporting period, the following excerpt from the City's IDDE work plan describes the methods and prioritization procedure maintained for this ongoing mitigation measure;

- Based upon the initial outfall monitoring data obtained, the City is currently implementing a Rapid-Assessment Prioritization approach through the targeted assessment of dry-weather flows in several areas within the City. Specifically the major tributaries to the most significant volume dry weather discharges to the Town Line Brook and the Malden River have been identified and sampled at key junction locations to initially determine the dry weather contributions from adjacent communities through major flood control infrastructure that is routed through the City of Malden.

During this reporting period, the results of the dry weather sampling program have led to the removal of a significant, long term discharge of raw sewage into the municipal drainage system by representatives of the Gateway Apartments in December of 2016. As stated above, details pertaining to the identification and removal of this illicit connection are presented in Section 3.1.1. The information obtained through the City's outfall sampling program, together with surface water quality data obtained by others, continues to be shared between the City, public and private educational officials, the local community and MyRWA to develop safety/guidance protocols for recreational uses on the Malden River.

By design, observations recorded during the dry weather inspections, together with the results of infrastructure sampling, serve as the basis for ongoing work plan tasks and updates to the original IDDE plan. Accordingly, the IDDE program maintained by the City is regarded as an ongoing and iterative effort that has successfully demonstrated the capability to quickly respond

to water quality issues as needs and concerns are identified. The City of Malden has invested significant time and capital funding to develop a Stormwater Compliance Team (SCT) comprised of members of the Department of Public Works, Engineering and outside technical support. Activities performed by this group include the performance of wet and dry weather inspections, together with targeted sampling efforts. Preventative measures include the systematic cleaning of catch basins, and related infrastructure components.

Since the initial implementation of the IDDE Plan, public outreach, postings of signage, daily work practices, interdepartmental meetings and local permitting processes have served to promote and understand the need for appropriate responses to illicit discharges. Increased involvement by engineering technical staff in the daily work practices of MDPW stormwater personnel is also intended to further this goal. Contact information is readily available through a variety of media, including mailings and web site postings to ensure implementation of appropriate response measures by members of the Stormwater Compliance Team. The current municipal leadership has made a significant effort to increase public awareness and participation through increased integration of digital and electronic media into daily practices. Public outreach has also included active participation by the Compliance Team through community workshops, educational presentations and regional watershed meetings.

3.1 Targeted Dry Weather Inspection/Sampling Program (NCA)

During this reporting period, representatives of NCA have conducted dry weather sampling events and inspection of the City's infrastructure, conveying surface water flows to central portions of Malden that discharge to Lower Spot Pond Brook and ultimately the Malden River. In addition, Linden Brook has also been the focus of field activities performed during this reporting period. Historically, areas selected for inspection were generally based upon the results of the outfall sampling program and/or the identification of dry weather flows by MDPW staff during their routine maintenance and infrastructure locating program. As described in further detail in Section 3.1.1, the City continues to share sampling results with MyRWA and has performed targeted sampling events to investigate discharges to outfalls that have been sampled by MyRWA. One particular area of interest is the Saugus Branch drainage system that discharges to the outfalls referred to as MR-2S and MR-2N.

A map depicting the approximate locations where targeted dry weather inspections have been conducted by NCA to date is presented as Figure 2. In addition, the drainage infrastructure is also inspected by the MDPW during the catch basin cleaning program. Upon the identification of previously unknown dry weather flows, the Engineering Department and NCA are immediately notified by MDPW personnel and targeted mass balance sampling efforts are performed. During dry weather inspections completed under the IDDE program, various dry weather flows have been identified. A summary of these flows within the municipal system that have been identified to date are shown on Table 2.0 and Figure 3. In addition to illicit discharges and connections (Table 1.0), waterline breaks have been identified and addressed. As stated previously, during this reporting period, dry weather investigations were performed within the Malden River watershed and details pertaining to these sampling results are provided below.

3.1.1 Malden River Watershed

As described in earlier submittals, the City of Malden's stormwater compliance team initially targeted potential illicit discharges to the Malden River as its highest priority. Utilizing the outfall monitoring data and information obtained during dry weather sampling events, the City has identified significant base flow as surface waters, to the Malden River. Consistent with the original design of the MDC/DCR conveyance network; this occurs primarily thorough culverted channels/brooks located in northwestern portions of the City. This flow includes contributions that originate from the Fells Reservation and Lower Spot Pond Brook. As shown on Figure 4, a total of 26 outfalls to the Malden River have been identified. Periodic dry weather sampling has been performed by NCA, MyRWA and the USEPA. The most recent dry weather water quality evaluation conducted along the Malden River included the sampling of outfalls on 28 April 2016. During the 28 April sampling event, four (4) outfalls were identified as flowing and were sampled, with the other 22 outfalls either having no flow or were submerged. Reference to Table 3.0, shows that E. coli levels ranged from 1.0 MPN/100ml (MR-6) to 8.6 MPN/100ml (MR-4).

An evaluation of the drainage system in Pleasant/Commercial/Exchange Street portion of the Malden River watershed was conducted in response to the detection of high E. coli levels during a dry weather sampling event at manhole E28BY-MH1, which is located between Route 60 and Exchange Street, as shown on Figure 5. An inspection of the drainage manhole revealed an approximate 48-inch RCP line with flow containing a strong sewage odor that was observed to be approximately 10 – 12 gallons per minute. Based upon a review of historic plan information, as well as field observations, this flow moves in a southerly direction into the Spot Pond Brook culvert, which ultimately discharges into the Malden River. Due to the high levels of E. coli encountered, a mass balance flow isolation of the drainage network within to the Exchange and Commercial Street area was conducted.

Supplemental dry weather sampling by the Stormwater Compliance Team at E28BY-MH1 and several upstream drain manholes located on Exchange Street, Commercial Street and Pleasant Street revealed an E. coli concentration of 9,800 MPN/100ml at E28BY-MH1, with elevated E. coli concentrations also detected at four (4) of the five (5) upstream manholes. The highest of these levels was encountered at E28-MH1 (19,000 MPN/100ml), which is approximately 400 feet northwest of E28BY-MH1 (Table 3.0).

Upstream sampling of manholes S39-MH1 and P27-MH10, in Pleasant Street, revealed a significant decrease of E. coli concentrations. Specifically, it is seen that E. coli levels of 30 and 34 MPN/100 mL were detected at S39-MH1 when elevated levels of E. coli were detected at E28-MH1 and F26-MH3. Continued monitoring of the drainage system in this area revealed the highest E. coli levels at manhole F26-MH3 (>483,920 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets. A concentration of 140,000 MPN/100ml was also detected at downstream manhole E28-MH1, where high E. coli levels were previously recorded. A significant decrease in E. coli levels was identified at manhole P27-MH12 (27 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets. This sampling point is approximately 90 linear feet upstream of F26-MH3, where the highest E. coli levels were historically detected. A sample was also collected from the closest accessible manhole upstream of the Malden River outfall. This manhole, (C15-MH8.1) is located south of Charles Street and

approximately 330 feet north of the Malden River and an E. coli level of 1,200 MPN/100ml was detected. It should be noted that the water in manhole C15-MH8.1 was stagnant at the time of sampling.

As summarized previously, during the inspection of Exchange Street drainage manhole E28BY-MH1, a strong sewage odor was identified and the evaluation of both the sewage and drainage infrastructure indicated that the invert elevations for the piping systems were very close, suggesting that possible exfiltration from the municipal sewage system was impacting the nearby drainage network. In response to the observations recorded within the Exchange Street area, representatives of CDM Smith Inc. (CDM) were requested to review the results of their inflow/ infiltration investigation in the area and according to CDM, no significant or obvious signs of infiltration or exfiltration were noted. To further investigate the drainage system in the area, the City contracted National Water Main Cleaning Company (National) to camera the area of concern. On 2 June 2016, National, under the direction of the City, CDM and NCA initiated the CCTV inspection. To assist in the review of the following information, (referenced as Figure 6), which depicts the approximate location of drain manhole locations associated within this scope of work.

The video inspection was initiated at the intersection of Pleasant and Florence Streets, at drain manhole P27-MH13. A visual inspection of this manhole revealed flow from the west (Pleasant Street) which then flowed in a southern direction down Commercial Street. While placing the video inspection equipment into the manhole, an intermittent flow was observed emanating from an 18-inch reinforced concrete pipe (RCP) drain line located in Florence Street (north). The video inspection of the drain line in Florence Street revealed no illicit connections, or indications of compromise to the pipe, which terminated approximately 115 feet to the north, at manhole F26-MH4. In addition, a colorimetric field test for ammonia was performed by CDM Smith, with only low levels encountered, indicating this flow was most likely not the source of the elevated E. coli levels in the area. The camera was then sent approximately 100 feet west, along a 36-inch RCP to manhole P27-MH10, with no illicit connections or indications of compromise to the pipe noted.

A visual inspection of manhole P27-MH11 revealed that in addition to the 36-inch RCP line that flows from P27-MH10 there was a second 36-inch RCP line that was not identified on plans reviewed during this study. Field observations noted at manhole P27-MH11 included a strong sewage odor and visual indications of sewage contributions from the second 36-inch RCP line. A video inspection of this line revealed that it runs west along the center of Pleasant Street and then turns north to Summer Street (Figure 6), to manhole S39-MH3. It is to be noted that indications of sewage were observed along the entire length of pipe. The video inspection equipment was then moved to manhole S39-MH3 and visual observations of the manhole showed water entering the structure from a 12-inch RCP located of the western side of the manhole. Of particular importance to this mass balance flow isolation program was the absence of flow within the pipe from Summer Street (north). Video inspection of the 12-inch RCP revealed addition indications of sewage discharge and that the drainage line connected to manhole S39-MH3.1, approximately 50 feet to the west (Figure 6). A visual inspection of manhole S39-MH3.1 revealed two (2) 8-inch ductile iron pipe inverts within the structure. The video inspection of the ductile iron pipe that connects to manhole S39-MH3.2, located approximately 100 feet south-southwest of manhole S39-MH3.1, revealed no illicit connections or indications of compromise. However, indications of sewage discharge were identified during the video inspection of the 8-inch ductile iron pipe that connects to the Gateway at Malden Center Apartments

(10 – 20 Summer Street), approximately 35 feet to the northwest of manhole S39-MH3.1. Video observations noted included the presence of a stub and two (2) 8-inch ductile iron pipes which connect to 10 – 20 Summer Street building. Indications of sewage were noted within each of the pipes and flow from building was emanating from the northern pipe, which appears to run parallel with Summer Street.

Representatives of the City, CDM and NCA spoke with the facility manager for the building and were allowed access to several common area bathrooms and locker rooms, as well as the building basement. A visual inspection of the sewerage and drain lines within the basement and several dye tests were performed to determine the origin of the sewage from within the building, however they were inconclusive. The City contacted the property owner and they engaged a plumbing contractor to determine the best course of action to resolve the illicit connection. After several camera inspections of the building utility lines, it was determined that a sewer riser was connected to a roof drain, which in turn discharged to the City storm drain system.

According to representatives of Gateway Apartments, 11 one (1) bedroom apartments were connected to this roof drain. More specifically, it was determined that sewer connections for each of the "07" apartments (i.e. 107, 207, etc.) for the entire building were connected to a roof drain riser pipe that discharged to the municipal drainage system. The City remained in constant contact with representatives of the Gateway Apartments, who were cooperative and attempted to remove the illicit connection as quickly as possible. However, due to the complexity of the illicit connection and the multiple apartments connected to the roof drain, the work was not completed until 21 December 2016. A subsequent inspection by the City of Malden Plumbing Inspector was conducted and it was confirmed that the sewer riser was disconnected from the City storm drain system. During the next reporting period, a dry weather sampling event will be conducted in the area to characterize E. coli concentrations post illicit connection removal. The removal of this illicit connection represents a major reduction in potential surface water discharge and the most significant benefit derived from IDDE Plan implementation to date.

A second, though much smaller illicit discharge has been the focus of dry weather sampling events to investigate elevated E. coli levels encountered previously at LSP-4 which is an outfall for the drainage system located within Eldrich Drive (Figure 7). Base flow, as groundwater, is consistently observed within this drainage network and to isolate potential sewage contributions to this base flow, a comprehensive evaluation of the flow conveyance network associated with LSP-4 was completed in February 2012. Given the proximity of the sewer and drain lines to LSP-4, as well as the settlement of the drain line in the area of Buildings 1054 and 1056 Elrich Drive, attention was directed towards the sewer laterals and nearby drainage line servicing the two apartment buildings. Following dye testing by the Compliance Team, camera surveys performed by representatives of the property owner confirmed that compromises to the laterals servicing two (2) residential building had occurred.

Working with representatives of the Malden Engineering Department, repairs to the sewer laterals in the area of Building 1054 and 1056 were completed by the property owner in March 2012. Since that time, and as summarized on Table 3.0, dry weather flow sampling at LSP-4 has revealed a significant decrease in bacteria levels relative to concentrations detected in 2012. However, E. coli concentrations of 110,000 and 3,200 MPN/100 ml were detected at LSP-4 in July and November of 2014, respectively. The drainage system in Eldrich Drive receives base flow, as groundwater infiltration and it is likely that the levels of groundwater relative to the exfiltration

zone for the former broken laterals is a contributing factor. Specifically, while the sewer laterals were replaced/repaired, long impacted contact soils and underlying groundwater likely contain bacteria residuals that enter the drainage system during periods of high groundwater. To correct this condition, it has been recommended that relining and restoring the structural integrity of the main drainage line and manholes be performed.

3.1.2 Town Line Brook Watershed

Town Line Brook in Malden begins at the Malden and Everett city boundary and is culverted until it daylights into an open concrete lined trapezoidal channel at Broadway. Significant tidal influences exist in the form of an approximate 2-3 foot change in surface water elevation between Broadway and the remaining length of the culvert to the Revere City line. As shown on Figure 8, a total of 29 outfalls to Town Line Brook in Malden have been identified. The historic monitoring data of Town Line Brook has revealed relatively uniform bacteria levels during dry weather sampling events. Several outfall locations have consistently exhibited bacteria loadings during dry weather sampling events, including S3-MH12, TL-0, TL-9 and Trifone Brook (TL-24). Manhole sample point S3-MH12 is the upstream sampling point for this section of the Brook as it enters the Malden system from Everett, while TL-0 is located at Broadway, where Town Line Brook daylights. TL-9 is located proximate to the terminus of Hadley Street in Malden and receives dry weather flows from the City of Everett, with Trifone Brook (TL-24), also flowing from Everett prior to discharging into Town Line Brook. Based upon the historic monitoring of these outfalls, it is apparent that contributions continue to enter the Malden system from upstream areas and the focus of dry weather sampling has been directed towards the area described within this current submittal. Targeted sampling within the Town Line Brook Watershed will be performed during the next reporting period.

3.1.3 Linden Brook Watershed

Linden Brook Culvert is the major stormwater conveyance network located in northeasterly portions of the City. Dry weather inspections have revealed base flow throughout the culvert at all times, with E. coli levels detected historically within the mid-portion of the culvert, at manhole H43-MH1, located on Home Street (Figure 9). Flow isolation studies performed to date within this portion of the City had not revealed any specific source conditions for the results of prior sampling. In an effort to identify source conditions, flow isolation studies have been conducted on upstream drainage connections to the Linden Brook Culvert. A dry weather flow (Flow # 18), was identified in the areas of Cherry and Gilbert Streets, which contributes flows from the northern and central portions of Malden to the Linden Brook Culvert (Figure 9). An initial dry weather flow sample collected from drainage manhole (C18-MH5) located on Cherry Street contained elevated E. coli levels and to further assess this condition, dry weather flows were sampled several times from this drainage manhole. In addition, several upstream dry weather flow samples relative to C18-MH5 were also collected from a manhole located on Winship Street (W47-MH1). Reference to Table 3.0 and Figure 9, indicates that the E. coli levels encountered at both drainage manholes contained high bacterial levels during each of the sampling events. Although it does not appear that the E. coli levels encountered at Cherry and Winship Streets are source conditions that impact flows within central portions of the Linden Brook Culvert at Home Street, additional

characterization of the Cherry/Winship Street flow and Linden Brook Culvert base flow will be continued next reporting period.

During a September 2012 sampling event, conducted with representatives of the USEPA, a water sample was collected from outfall LBR-1 (Figure 9), located in Revere, at which time distinct indications of sewage odors were noted. Consistent with identification of strong sewage odors and immediately apparent from a review of Table 3.0 is the significantly elevated level of E. coli (>241,920 MPN/100 ml) detected in sample LBR-1. To assess this condition and as described in prior status reports, the City of Malden contracted with National Water Main Cleaning Company, under the supervision of CDM Smith. As summarized in the following excerpt from an email to the City of Malden from CDM Smith, it is believed that line blockage due to grease build up may have been a crucial factor for the conditions identified at LBR-1, in addition to a "minor" defect in the form of a leaky joint.

> As you know, National Water Main Cleaning Company along with CDM Smith staff were out on site on Tuesday November 6, 2012 to investigate the potential illicit connection into the Linden Brook Culvert at Salem Street near the Route 1 underpass. The following in a summary of the day's events. The following figure graphically represents the results of the work.
>
> National Water Main was onsite to clean and CCTV the siphon under the Old Linden Brook culvert. Upon arrival the condition of the sewers had not changed from the previous visit held 2 weeks prior: The downstream manhole (MH 3 in the attached figure) and a manhole upstream of the siphon (MH 1 in the figure) were completely plugged with heavy grease. A limited amount of liquid was passing through MH 3. Heavy cleaning of MH 3 and the sewer under the culvert took longer than expected. From MH 3 upstream to MH 1 an enormous amount of grease and sediment was removed. The pipe was 100% clogged with slugs of grease in several spots.
>
> The sewer between MH 1 and MH 2 was successfully CCTV'd with the aid of the jetter (upstream of the siphon). This pipe was found to be in good condition. The most notable defect was a leaking joint (runner) at 9pm 54-ft from MH 1 (while traveling downstream). This was a rather minor defect. Active I/I was observed, however, it is possible that when the siphon builds some head, a small amount of sewage could exfiltrate from this same joint.
>
> We discovered what appears to be an external drop connection just downstream of MH 2. This prevented us from CCTV'ing any further as the camera could not pass the vertical 90 degree bend. CCTV from the upstream direction would require two jetters or bypass pumping, (one to keep MH 3 drained and one to intercept flow from upstream in MH 2). This vertical drop was heavily blocked with grease. Approximately 80% of the grease in this pipe was removed with a root cutter and the pipe is in much better condition.
>
> Last we lowered the camera into the 12-in connection to the culvert that once housed a gate valve (in MH 3). It no longer houses any gate, instead there is a masonry plug that seems to be in good condition. As the intent of finding the definitive source of sewage into the culvert was inconclusive, we recommend that we resample the outfall and test for parameters consistent with sewage. If the results are consistent with the previous results we should develop a new approach to finding the source.

As shown on Table 3.0, following the above described maintenance work, four (4) dry weather sampling events were conducted at LBR-1, with E. coli concentrations ranging from 1 MPN/100 ml to 520 MPN/100 ml, well below the levels encountered prior to the cleaning of the syphon. As described within Section 3.2.2, elevated E. coli levels were again encountered within LBR-1 during a recent wet weather sampling event.

3.2 Targeted Wet Weather Inspection/Sampling Program (NCA)

As described within this submittal, the focus of IDDE response actions during this reporting period has been directed towards the illicit connections identified within the Malden River watershed, as well as the targeted wet weather sampling conducted along the Malden River and the Linden Brook Culvert in November of 2016. As outlined within the City's IDDE Plan, wet weather is defined as an event in which at least 0.25-inches of rain falls within 24 hours prior to the sampling event. A representative rainfall event of 0.42-inches occurred on 29 November 2016 and wet weather sampling was conducted on 30 November 2016. A summary of the results obtained from Malden River and Linden Brook Culvert sample locations may be referenced from the following sections.

3.2.1 Malden River

As shown on Table 4.0, six (6) Malden River outfalls were found to be flowing, with high E. coli concentrations encountered at MR-4.1 (870 MPN/100ml) and MR-8 (7,000 MPN/100ml). A comparison of the wet weather concentrations with dry weather levels (Table 3.0) at these two locations reveals that no flow has been observed at MR-4.1 during dry weather conditions, while flow was observed at MR-8 during the latest dry weather event, the bacteria level was only 5.2 MPN/100ml. In addition to the outfalls, base flow wet weather samples were collected from Little Creek and the Saugus Branch Culvert headwall. Elevated E. coli levels were detected at all three (3) locations, with the highest concentration (4,900 MPN/100ml) detected at the southern Saugus Branch Culvert headwall (MR-2S). It should be noted that little to no flow was observed at these locations during the sampling event.

To supplement the results obtained from the laboratory analysis of E. coli, a colorimetric field test for ammonia utilizing Hach Ammonia (Nitrogen) Test Strips was performed at selected wet weather Malden River sample locations. As shown on Table 5.0, in general, the field test results were consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

3.2.2 Linden Brook Culvert

Targeted wet weather sampling was also conducted along the Linden Brook Culvert on 29 November 2016. The scope of work performed at that time involved the sampling of two (2) manhole structures that discharge to the Linden Brook Culvert, one (1) manhole along the culvert and one (1) outfall/discharge area on the Malden/Revere line (LBR-1). As shown on Table 4.0 and Figure 9, a bacteria sample was collected from an upstream drain manhole on Winship Street and one downstream location on Cherry Street, with elevated E. coli levels detected at both locations (3,500 & 2,400 MPN/100ml, respectively) The stormwater conveyance network in the Winship and Cherry Street area discharges into the Linden Brook Culvert to the east (Figure 9). To assess potential impact to flow within the Linden Brook Culvert, a sample was collected from a downstream location at Home and Mingo Streets (H43-MH1), with a concentration of 260 col/100 ml identified. Although the level encountered is above the action level, it is well below the concentrations detected at Winship and Cherry Streets.

As referenced within Section 3.1.3, during the 30 November 2016 wet weather sampling event, a water sample was collected from LBR-1. As shown on Table 4.0, elevated bacterial levels, (480,000 MPN/100ml) indicative of sewerage infiltration, were encountered. Based upon information obtained from the Malden DPW, since the initial identification of the grease build-up resulting in a sewer line blockage in the area of LBR-1, the City of Malden has performed weekly preventative maintenance, which includes the evaluation of flow within the sewer line and the placement of degreasing chemicals if necessary. These weekly evaluations have indicated that the municipal sewer system in this area has been flowing as expected. Based upon the reported maintenance intervals, it did not appear that a sewer line blockage in the area of LBR-1 was the source of the high E. coli levels. Accordingly, an additional E. coli sample was collected by NCA on 3 January 2017, with a result of 2,000 MPN/100ml detected. Although this level is considered high, the concentration is orders of magnitude lower than the level detected in November of 2016. The City will continue to evaluate this area next reporting period.

Similar to the Malden River wet weather samples, to supplement the results obtained from the laboratory analysis of E. coli, ammonia field tests were performed at selected wet weather Linden Brook Culvert sample locations. As shown on Table 5.0, in general, the field test results were consistent with the laboratory results obtained. The City will continue to utilize the field ammonia test to supplement the ongoing laboratory analysis program.

3.2.3 Malden River Floating Dock

As outlined in previous submittals, the City of Malden is a flow through community that receives significant flows containing elevated bacteria levels during wet weather events. The primary outfall locations for these flows are Town Line Brook (Everett) and Spot Pond Brook (Melrose), which flow into the Malden River. As depicted on Figure 10, for crew activities, flow from Melrose and in particular Ell Pond (a.k.a. Crystal Pond) are of concern, as evidenced by the summary of sampling data collected on June 1, 2015 at this location by MyRWA. As shown, E coli levels of 86,640 MPN/100ml were detected at Ell Pond, which exhibited a consistent decline throughout downstream sampling locations in Malden, followed by a large increase at Route 16 in Everett (81,640 MPN/100ml). It is to be noted that elevated bacteria levels have been recorded at the Malden/Melrose town line through the period of IDDE plan implementation.

As a part of their Massachusetts Environmental Trust funded Mystic Recreation Flagging Project, MyRWA has collected hundreds of samples from six (6) locations, including the Malden River within the Mystic River watershed. The goal of their effort includes the interim development of a “flagging” system in the watershed to alert recreational users to safe or unsafe conditions, which will be followed by the development of “logistic models” that will allow for predictive guidance pertaining to water safety. Based upon the review of historic water quality information complied by the City and MyRWA, it was postulated that for rainfall events of less than half an inch, a 48 hour period of rebound would allow for the flushing of the River and reduction of bacteria levels to below safe boating standards. To test this hypothesis, sampling events were performed approximately 48 hours following half inch rainfall events at the floating crew dock, located at 356 Commercial Street in Malden.

Users of the floating dock have included primarily private clubs who were subject to special conditions and agreements pertaining to the use of the property. Recently, this recreational activity has fallen under the jurisdiction of the Malden Athletic Department who has been working with representatives of the MRA, the City and outside technical assistance to develop safety protocols for both student requirements and issues associated with the water quality of the Malden River. With respect to the latter, dry and wet weather sampling performed by the City has clearly demonstrated that elevated bacteria levels occur within the river during and immediately after significant rainfall events due to the urban nature of the tributary watersheds within the cities of Malden, Medford, Melrose and Everett at a minimum.

As a general protocol, it has been recommended that crew activities be suspended immediately following significant rainfall events, however the duration of this restriction has lacked sufficient foundation to be adequately determined. Specifically, it is known that there is a period of rebound following wet weather events that directly corresponds to the duration and/or amount of rainfall following which dry weather sampling has revealed consistent bacteria levels below applicable boating (1,260 MPN/100ml) and often swimming (235 MPN/100ml) EPA standards. To further evaluate this rebound condition, the City has worked with representatives of MyRWA to develop a post wet weather protocol for on river activity.

As summarized on Table 6.0, during the last reporting period, the 48 hour rebounding protocol led to the documentation of bacteria levels below the USEPA safe boating standard for each applicable rainfall event. In addition, the corresponding safe swimming standard was met on 19 April and 7 July, with only a slight exceedences observed on 28 April 2016. The sampling program was continued during this reporting period to provide further background support for the 48 hour protocol that is enforced by the Malden Athletic Director. Two (2) sampling events were conducted this reporting period (4 October & 30 November 2016). As shown on Table 6.0, a bacteria level of 140 MPN/100ml was identified during the October sampling event, well below the USEPA safe swimming standard. In contrast, an E. coli concentration of 2,900 MPN/100ml was detected during the most recent sampling event performed in November of 2016. Reference to Table 6.0, shows that the October sample was collected 53 hours from the last rainfall, while the November sample, which contained elevated E. coli levels, was collected only 10.8 hours from the last rainfall. This pattern is consistent with rebound condition described above. The City will continue this sampling program next reporting period and share the data and work with MyRWA to develop a predictive model that will include the use of electronic signboards and development of a public advisory website.

3.3 Inflow Infiltration Sewer System Evaluation & Capacity Analysis

The City of Malden has also completed a comprehensive Infiltration and Inflow (I&I) study for its municipal sewer system. CDM Smith, on behalf of the City, has prepared a Phase 3 Sanitary Sewer Evaluation Survey (SSES) report that includes a summary of findings and proposed recommendations to mitigate excessive infiltration and inflow into the City's sewer system. This report was approved by MWRA last year. As described in Section 3.1.1, the City also has a contract in place for emergency repairs to the sewage infrastructure. This contract allowed for the video camera surveys performed in the Pleasant and Exchange Street area and the I&I investigations performed by CDM Smith.

4.0 SANITARY SEWER OVERFLOWS (SSO'S)

No SSOs were identified during this reporting period.

5.0 EVALUATION OF IDDE PROGRAM GOALS AND OBJECTIVES

The City of Malden has implemented a comprehensive illicit discharge elimination program that has resulted in the isolation and mitigation of numerous illicit discharges/connections and reduced significant potable water losses due to the detection of water line breaks. During this reporting period, the removal of a significant, long term discharge of raw sewage into the municipal drainage system that was finalized, which demonstrated both the effectiveness and importance of the IDDE program. The City continues to advance its commitment to the objectives of the IDDE Program through the hiring of additional staff, purchase of equipment, and the description of the Compliance Team leader who is responsible for the daily administration of this program. At the recommendation of USEPA, the use of ammonia test strips was incorporated into flow isolation and mass balance evaluations of dry and wet weather conditions.

Through the assistance of the USEPA, through their prior multiple lines of evidence testing program, a greater understanding of the distinction between human and animal bacteria loadings has been further defined. The Compliance Team is continuing to work with Alpha Analytical to develop cost efficient sampling parameters, such as caffeine analysis and hopes to work with USEPA in implementing multiple lines of evidence testing within the Malden River Watershed. Further understanding of surface water quality characteristics and bacteria loadings has been obtained through the development of crew safety protocols, particularly as it pertains to wet weather rebound within the River. During the next reporting period, wet weather sampling of the Malden River outfalls will be performed to further this understanding.

Table 1.0 Summary of Illicit Connections/Discharges identifed as of 12/31/2016

Illicit Connections

Illicit Connection Identification	Date Identified	Discharge Type	Estimated Volume	Date Removed	Location
ID-1	1/15/2009	Sewage	40 gpd	2/16/2009	33 Lodgen Ct., Unit 1F
ID-2	1/15/2009	Grey Water	100 gpd	3/2/2009	34 Hanover Street
ID-4	8/28/2009	Sewage	60 gpd	9/4/2009	2-4 Hancock Street
ID-9	5/18/2010	Sewage	60 gpd	5/19/2010	36 Charles Street
ID-12	Apr-12	Confirmed Roof Drain	NA	NA	100-110 Pleasant Street
ID-13	Sep-12	Sewage	Unknown	January-13	Exchange Street
ID-15	Oct-13	Process Water	Unknown	N/A	Sharon Street
ID-16	6/2/2016	Sewage	1,210 gpd	12/21/2016	Summer Street (11 units)

Total Illicit Flow Removed to Date: ***1,470 gallons/day*** ***536,550 gallons/year***

Illicit Discharges

Illicit Discharge Identification	Date Identified	Discharge Type	Estimated Volume	Date Removed	Location
ID-3	8/11/2009	Oil Sheen	Unknown	n/a	Near 1081 Fellsway
ID-5	9/10/2009	#2 oil spill	<5 gallons	9/10/2009	269 Pearl Street
ID-6	9/21/2009	Poss. Washwater	Unknown	9/21/2009	120 Main Street
ID-7	12/9/2009	Trans. Dielectric fluid	<27 Gallons	12/10/2009	Near 6 Grove Street
ID-8	4/29/2010	Hydraulic Fluid	<10 Gallons	4/29/2010	496 Main Street
ID-10	2/10/2012	Sewage	Note 1	Pending	1056 Erlich Drive
ID-11*	9/11/2012	Sewage	Unknown	11/6/2012	Linden Brook @ Lynn St.
ID-14	8/15/2013	Grey Water	Unknown	13-Dec	Forestdale School

1 - approximately 1 gallon per minute observed discharging at LSP-4 during dry weather

* Possible discharge due to grease blockage-Syphon still under investigation

Table 2.0 Summary of Dry Weather Flows Identifed as of 12/31/2016

Flow Identification	Location	Flow Type	Status
Flow 1	Medford City Line	Water Line Leak	Removed
Flow 2	Saint Mary's Street	Groundwater	No Further Action
Flow 3	Fellsmere Reservation	Groundwater	No Further Action
Flow 4	Malden River	Surcharge-Submerged Invert	Evaluation Ongoing
Flow 5	DCR Spot Pond Brook	Base Flow	Evaluation Ongoing
Flow 6	Forestdale-Pine Banks Park	Base Flow	No Further Action
Flow 7	Wigglesworth Street	Groundwater-Illicit Discharge	Removed
Flow 8	Main Street	Water Line Leak	Removed
Flow 9	Pierce Street	Groundwater Breakout	No Further Action
Flow 10	Linden Brook	Base Flow	Evaluation Ongoing
Flow 11	LSP-4	Dry Weather Flow	Evaluation Ongoing
Flow 12	Kennedy Dr-Granada Highlands Apts.	Base Flow	No Further Action
Flow 13	Orchard Street	Dry Weather Flow	Evaluation Ongoing
Flow 14	Exchange Street	Intermittent Dry Weather Flow	Evaluation Ongoing
Flow 15	Lower Commercial Street	Dry Weather Flow	Evaluation Ongoing
Flow 16	Huntley Street	Dry Weather Flow	No Further Action
Flow 17	Goldcliff Road	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 18	Cherry & Gilbert Streets	Dry Weather Flow	Evaluation Ongoing
Flow 19	Sylvan Street	Dry Weather Flow	Evaluation Ongoing
Flow 20	First Street & Elwell Ave	Base Flow	No Further Action
Flow 21	Bowman Street	Base Flow	No Further Action
Flow 22	Springdale Street	Dry Weather Flow	No Further Action
Flow 23	Grant Street	Dry Weather Flow	Evaluation Ongoing
Flow 24	Wheeler Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 25	Revere Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 26	Kennedy Dr & Fairfield Avenue	Base Flow	No Further Action
Flow 27	Sharon Street	Process Water	No Further Action
Flow 28	Pleasant/Commercial/Exchange Sts.	Dry Weather Flow - Sewage	Removed
Flow 29	Summer Street	Base Flow	No Further Action

Table 3.0 Dry Weather Conditions - E. coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml								
	9/12/2013	9/24/2013	7/2/2014	11/5/2014	6/25/2015	7/14/2015	8/25/2015	9/29/2015	4/28/2016
Malden River									
MR-0	980	-	-	-	-	-	-	-	NS-stagnent
MR-1	-	-	-	-	-	-	-	-	NS-stagnent
MR-3	-	-	-	-	-	-	-	-	NF
MR-4	-	-	-	-	-	-	-	-	8.6
MR-4.1	-	-	-	-	-	-	-	-	NF
MR-5	-	-	-	-	-	-	-	-	NF
MR-6	-	-	-	-	-	-	-	580	1.0
MR-6.1	-	-	-	-	-	-	-	-	NF
MR-7	-	-	-	-	-	-	-	-	NF
MR-8	292	-	-	-	-	-	-	-	5.2
MR-8.1	-	-	-	-	-	-	-	-	NF
MR-9	-	-	-	-	-	-	-	-	NF
MR-10	-	-	-	-	-	-	-	-	NF
MR-11	-	-	-	-	-	-	-	-	ND (2.0)
MR-11.1	-	-	-	-	-	-	-	-	NF
MR-12	-	-	-	-	-	-	-	-	-
MR-12.1	-	-	-	-	-	-	-	-	NF
MR-12.2	-	-	-	-	-	-	-	-	-
MR-13	-	-	-	-	-	-	-	-	-
LSP-0-Channel[2]	-	-	-	-	-	-	-	-	-
LSP-3	-	-	-	-	-	-	-	-	-
LSP-4	-	2,000	110,000	3,200	-	-	-	-	-
LSP-9	-	-	-	-	-	-	-	-	-
LSP-10-Channel[2]	-	-	-	-	-	-	-	-	-
CH-1	-	-	-	-	-	<1	-	-	-
C15-MH8.1	-	-	-	-	-	-	-	1,200	-
C46-MH19	-	-	-	-	500	-	-	-	-
E13-MH4 (Elrich)	-	2,000	-	-	-	-	-	-	-
E28-MH8	-	-	-	-	-	-	-	-	-
E28-SP1	-	-	-	-	-	-	-	-	-
E28-SP2	-	-	-	-	-	-	-	-	-
E28-MH1	-	-	-	-	-	19,000	140,000	>483,920	-
E28-MH2W	-	-	-	-	-	9,000	-	-	-
E28-MH2N	-	-	-	-	-	3.1	-	-	-
E28-MH4	-	-	-	-	-	4,500	-	-	-
E28-MH4A	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	82,000	9,800	10,000	5,800	-
F26-MH3	-	-	-	-	-	6,700	>483,920	>483,920	-
NG-C1	-	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	39	-	-	-
P27-MH12	-	-	-	-	-	-	27	-	-
S29-MH1	-	-	-	-	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	-	-	-
S39-MH1	-	-	-	-	-	34	30	-	-
Little Creek									
LC-0	-	-	-	-	3,700	460	-	-	NS-stagnent
LC-N	-	-	-	-	2,400	-	-	-	NS-submerged
LC-S	-	-	-	-	-	-	-	-	NS-submerged
Saugus Branch									
MR-2	550	-	-	-	-	-	-	-	NS-stagnent
MR-2N	-	-	150	490	390	35	310	3,100	NS-stagnent
MR-2S	-	-	130	440	440	75	290	440	NS-stagnent
Town Line Brook									
TL-0[3]	-	-	-	-	-	-	-	-	-
TL-3	-	-	-	-	-	-	-	-	-
TL-9	-	-	-	-	-	-	-	-	-
TL-13	-	-	-	-	-	-	-	-	-
B53-MH7	-	-	-	-	-	-	-	-	-
BP-MH3	-	-	-	-	-	-	-	-	-
S3-MH12[3]	-	-	-	-	-	-	-	-	-
S14-MH4	-	-	ND (1.0)	4.1	-	-	-	-	-
Linden Brook									
B46-MH2	-	<1	-	-	-	-	-	-	-
C18-MH5	-	23,000	11,000	1,300	-	-	-	-	-
C36-MH1	-	-	-	-	-	-	-	-	-
D17-MH1	-	-	-	-	-	-	-	-	-
F1-MH4	-	-	-	-	-	-	-	-	-
F23-MH2	-	13	-	-	-	-	-	-	-
G36-MH2	-	-	1,700	290	-	-	-	-	-
H43-MH1	-	12	-	1,000	-	-	-	-	-
K6-MH1	-	-	-	-	-	-	-	-	-
L5-MH1	-	-	-	-	-	-	-	-	-
LBR-1	-	-	520	88	-	-	-	-	-
M31-MH1	-	12	-	-	-	-	-	-	-
O10-MH1	-	-	-	-	-	-	-	-	-
P24-MH1	-	-	-	-	-	-	-	-	-
S27-MH2	-	-	-	17	-	-	-	-	-
S45-MH4	-	-	-	8.5	-	-	-	-	-
V1-MH1	-	-	-	-	-	-	-	-	-
W26-MH1	-	-	-	-	-	-	-	-	-
W47-MH1	-	-	3,500	1,700	-	-	-	-	-

NS-not sampled
NF-no flow
- not evaluated
ND - None Detected above Reported Detection Limit
(results in parentheses represent the detection limit)
Laboratory certificates contained within attachments

File No. 465.09

Table 4.0 Wet Weather Conditions - E. coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml	
	11/30/2016	1/3/2017
Malden River		
BH-1	2,900	-
MR-0	NS-stagnent	-
MR-1	NS-stagnent	-
MR-3	NF	-
MR-4	180	-
MR-4.1	870	-
MR-5	190	-
MR-6	43	-
MR-6.1	NF	-
MR-7	NF	-
MR-8	7,000	-
MR-8.1	NF	-
MR-9	NF	-
MR-10	NF	-
MR-11	3.1	-
MR-11.1	NF	-
MR-12	-	-
MR-12.1	NF	-
MR-12.2	-	-
MR-13	-	-
Saint Mary St.	-	-
Fellsmere Pond	-	-
LSP-4	15,000	-
LSP-5.1-Channel	-	-
LSP-9	-	-
LSP-10-Channel	-	-
Little Creek		
LC-0	3,200	-
LC-N	NS-submerged	-
LC-S	NS-submerged	-
P12-MH10	-	-
Saugus Branch		
MR-2	-	-
MR-2N	4,600	-
MR-2S	4,900	-
Broadway/Eastern	-	-
Town Line Brook		
TL-0	-	-
TL-9	-	-
TL-13	-	-
TL-16	-	-
TL-24	-	-
TL-BL-EV	-	-
S3-MH12	-	-
Linden Brook		
C18-MH5	2,400	-
H43-MH1	260	-
LBR-1	480,000	2,000
W47-MH1	3,500	-

NS-not sampled
NF-no flow
- not evaluated

ND - None Detected above Reported Detection Limit
(results in parentheses represent the detection limit)
Laboratory certificates contained within attachments.

File No. 465.09

Table 5.0 Wet Weather Conditions - Ammonia Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	Ammonia (ppm)
	11/30/2016
Malden River	
BH-1	-
MR-0	NS-stagnent
MR-1	NS-stagnent
MR-3	NF
MR-4	2
MR-4.1	0
MR-5	0
MR-6	4
MR-6.1	NF
MR-7	NF
MR-8	0
MR-8.1	NF
MR-9	NF
MR-10	NF
MR-11	6
MR-11.1	NF
MR-12	-
MR-12.1	NF
MR-12.2	-
MR-13	-
LSP-4	-
LSP-9	-
Little Creek	
LC-0	0
LC-N	NS-submerged
LC-S	NS-submerged
P12-MH10	-
Saugus Branch	
MR-2	-
MR-2N	0.5
MR-2S	0.5
Linden Brook	
C18-MH5	1
H43-MH1	0
LBR-1	6
W47-MH1	1

Samples field analyzed using
Hach Ammonia (Nitrogen) Test Strips (0-6.0 ppm).
NS-not sampled
NF-no flow
- not evaluated

Table 6.0 Malden River Boat House - E. Coli Concentrations

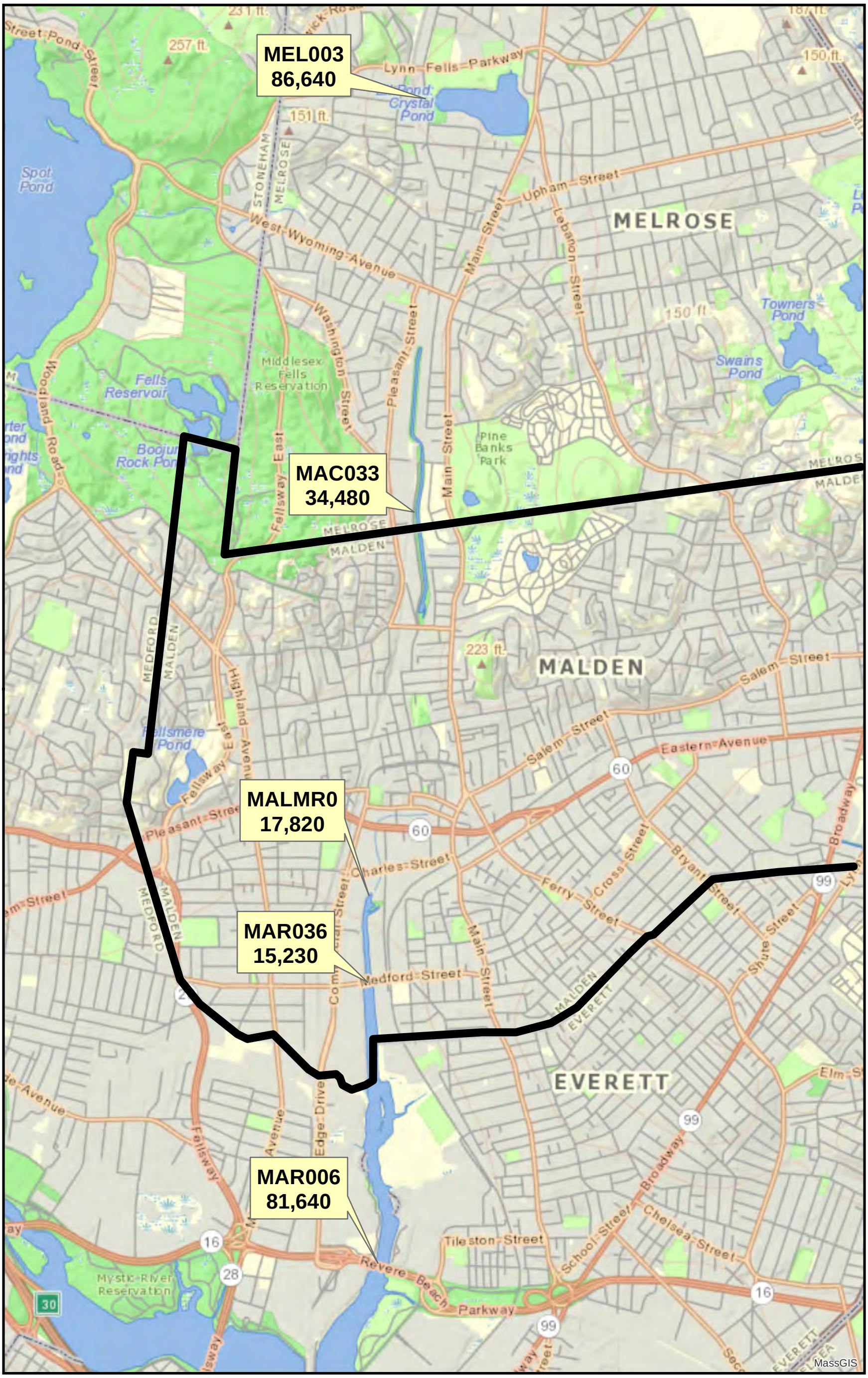
Site Location, Malden River - Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 9223B ACTION LEVEL- 235 MPN/100ml				
	4/19/2016	4/28/2016	7/7/2016	10/4/2016	11/30/2016
Sample Collection Time	**12:45**	**11:45**	**13:00**	**13:15**	**7:25**
Time Elasped from Rain Event	**6.45 hrs**	**46.5 hrs**	**51.5 hrs**	**53 hrs**	**10.8 hrs**
Rainfall Amount	**0.02"**	**0.27"**	**0.34"**	**0.03"**	**0.42"**
BH-1	210	290	47	140	2,900

File No. 465.09

Laboratory certificates contained within attachments.



June 1, 2015 Wet Weather Sampling E. Coli Results (MPN/100 ML)

Data collected by MyRWA and presented in July 10, 2015 Bacterial Assessment Report

NORTH

Figure 10

ANALYTICAL REPORT

Lab Number:	L1700045
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	01/07/17

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1700045
Report Date: 01/07/17

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1700045-01	LBR-1	WATER	MALDEN, MA	01/03/17 13:30	01/03/17

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1700045
Report Date: 01/07/17

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

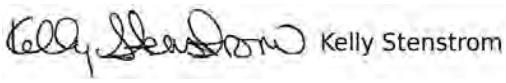
In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Kelly Stenstrom

Title: Technical Director/Representative Date: 01/07/17

INORGANICS
&
MISCELLANEOUS

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1700045
Report Date: 01/07/17

SAMPLE RESULTS

Lab ID: L1700045-01
Client ID: LBR-1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 01/03/17 13:30
Date Received: 01/03/17
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	2000		MPN/100ml	10	NA	10	-	01/03/17 15:10	121,9223B	TP

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1700045
Report Date: 01/07/17

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG966578-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	01/03/17 15:10	121,9223B	TP

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1700045
Report Date: 01/07/17

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1700045-01A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.8	Y	Absent	E-COLI-QT(.33)
L1700045-01B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.8	Y	Absent	E-COLI-QT(.33)

*Values in parentheses indicate holding time in days

Project Name:	CITY OF MALDEN	**Lab Number:**	L1700045
Project Number:	465.09	**Report Date:**	01/07/17

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1700045
Project Number:	465.09	**Report Date:**	01/07/17

Data Qualifiers

reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1700045
Project Number:	465.09	**Report Date:**	01/07/17

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: ***EPA 3050B***

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

L1700045

Date Rec'd in Lab: 1/3/17

ALPHA Job #: L1700045 1/3/17

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: NCA

Address: 45 Dan Road Suite 115
Canton Ma

Phone: 781-821-0521

Email:

Additional Project Information:

Project Information

Project Name: City of Malden

Project Location: Malden Ma

Project #: 465.09

Project Manager:

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☒ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
E. Coli Enumeration

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

Sample Comments

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	E. Coli Enumeration	TOTAL # BOTTLES
00045 01	LBR-1	1/3/17	13:30	W	CA	X	2

Container Type		P
Preservative		H

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	1/3/17 1350		1/3/17 1350

All samples submitted are subject to Alpha's Terms and Conditions.
See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1638682
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	12/06/16

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1638682-01	LC-0	WATER	MALDEN, MA	11/30/16 07:00	11/30/16
L1638682-02	BH-1	WATER	MALDEN, MA	11/30/16 07:25	11/30/16
L1638682-03	MR-11	WATER	MALDEN, MA	11/30/16 07:35	11/30/16
L1638682-04	MR-8	WATER	MALDEN, MA	11/30/16 07:55	11/30/16
L1638682-05	MR-6	WATER	MALDEN, MA	11/30/16 08:15	11/30/16
L1638682-06	MR-4	WATER	MALDEN, MA	11/30/16 08:30	11/30/16
L1638682-07	MR-5	WATER	MALDEN, MA	11/30/16 08:45	11/30/16
L1638682-08	MR-2S	WATER	MALDEN, MA	11/30/16 09:30	11/30/16
L1638682-09	MR-2N	WATER	MALDEN, MA	11/30/16 09:40	11/30/16
L1638682-10	MR-4.1	WATER	MALDEN, MA	11/30/16 10:05	11/30/16
L1638682-11	LBR-1	WATER	MALDEN, MA	11/30/16 10:40	11/30/16
L1638682-12	H43-MH1	WATER	MALDEN, MA	11/30/16 11:00	11/30/16
L1638682-13	C18-MH5	WATER	MALDEN, MA	11/30/16 11:20	11/30/16
L1638682-14	W47-MH1	WATER	MALDEN, MA	11/30/16 11:45	11/30/16
L1638682-15	LSP-4	WATER	MALDEN, MA	11/30/16 12:30	11/30/16

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1638682
Report Date: 12/06/16

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature:  Melissa Cripps

Title: Technical Director/Representative Date: 12/06/16

INORGANICS
&
MISCELLANEOUS

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-01
Client ID: LC-0
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 07:00
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	3200		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-02
Client ID: BH-1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 07:25
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	2900		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-03
Client ID: MR-11
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 07:35
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	3.1		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-04
Client ID: MR-8
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 07:55
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	7000		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-05
Client ID: MR-6
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 08:15
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	43		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-06
Client ID: MR-4
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 08:30
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	180		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-07
Client ID: MR-5
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 08:45
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	190		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-08
Client ID: MR-2S
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 09:30
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	4900		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-09
Client ID: MR-2N
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 09:40
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	4600		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-10
Client ID: MR-4.1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 10:05
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	870		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	DW

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-11
Client ID: LBR-1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 10:40
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	480000		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	JT

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-12
Client ID: H43-MH1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 11:00
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	260		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	JT

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-13
Client ID: C18-MH5
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 11:20
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	2400		MPN/100ml	1.0	NA	1	-	11/30/16 14:50	121,9223B	JT

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-14
Client ID: W47-MH1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 11:45
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	3500		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	JT

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

SAMPLE RESULTS

Lab ID: L1638682-15
Client ID: LSP-4
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 11/30/16 12:30
Date Received: 11/30/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	15000		MPN/100ml	200	NA	200	-	11/30/16 14:50	121,9223B	JT

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1638682
Report Date: 12/06/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01-10 Batch: WG956823-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	11/30/16 14:50	121,9223B	DW
Microbiological Analysis - Westborough Lab for sample(s): 11-15 Batch: WG956824-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	11/30/16 14:50	121,9223B	JT

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1638682-01A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-01B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-02A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-02B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-03A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-03B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-04A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-04B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-05A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-05B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-06A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-06B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-07A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-07B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-08A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-08B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-09A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-09B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-10A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-10B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-11A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-11B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-12A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-12B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-13A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-13B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-14A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-14B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)
L1638682-15A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)

*Values in parentheses indicate holding time in days

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1638682
Report Date: 12/06/16

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1638682-15B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.3	Y	Absent	E-COLI-QT(.33)

*Values in parentheses indicate holding time in days

Project Name:	CITY OF MALDEN	**Lab Number:**	L1638682
Project Number:	465.09	**Report Date:**	12/06/16

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1638682
Project Number:	465.09	**Report Date:**	12/06/16

Data Qualifiers

reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1638682
Project Number:	465.09	**Report Date:**	12/06/16

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: ***EPA 3050B***

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 2

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Date Rec'd in Lab: 11/30/16

ALPHA Job #: L1638682

Client Information

Client: NCA
Address: 45 Dan Road Suite115
Canton Ma
Phone: 781-821-0521
Email:

Project Information

Project Name: City of Malden
Project Location: Malden Ma
Project #: 465.09
Project Manager:
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Additional Project Information:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☒ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ANALYSIS

VOC: ☐ 8260 ☐ 624 ☐ 524.2
SVOC: ☐ ABN ☐ PAH
METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15
METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13
EPH: ☐ Ranges & Targets ☐ Ranges Only
VPH: ☐ Ranges & Targets ☐ Ranges Only
☐ PCB ☐ PEST
TPH: ☐ Quant Only ☐ Fingerprint
E. Coli - Enumeration

SAMPLE INFO
Filtration
☐ Field
☐ Lab to do
Preservation
☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	E. Coli	Sample Comments	TOTAL # BOTTLES
38682-01	LC-0	11/30/16	7:00	W	CA	X		2
-02	BH-1		7:25			X		2
-03	MR-11		7:35			X		2
-04	MR-8		7:55			X		2
-05	MR-6		8:15			X		2
-06	MR-4		8:30			X		2
-07	MR-5		8:45			X		2
-08	MR-2S		9:30			X		2
-09	MR-2N		9:40			X		2
-10	MR-4.1		10:05			X		2
	Container Type					P		
	Preservative					H		

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
CA	11/30/16 13:05		11/30/16 1305

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

Serial_No:12061618:44

CHAIN OF CUSTODY

PAGE 2 OF 2

ALPHA ANALYTICAL

WESTBORO, MA TEL: 508-898-9220 FAX: 508-898-9193

MANSFIELD, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 11/30/16

ALPHA Job #: L1638682

Client Information

Client: NCA

Address: 45 Dan Rd Suite 115
Canton Ma

Phone:

Fax:

Email:

☐ These samples have been previously analyzed by Alpha

Project Information

Project Name: City of Malden

Project Location: Malden Ma

Project #: 465.09

Project Manager:

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due: Time:

Report Information - Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program | Criteria

MA MCP PRESUMPTIVE CERTAINTY --- CT REASONABLE CONFIDENCE PROTO

☐ Yes ☒ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Is Matrix Spike (MS) Required on this SDG? (If yes see note in Comments)

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

If MS is required , indicate in Sample Specific Comments which samples and what tests MS to be performed.
(Note: All ***CAM*** methods for inorganic analyses require MS every 20 soil samples)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	ANALYSIS: E. Coli Enumeration	Sample Specific Comments	TOTAL # BOTTLES
38682-11	LBR-1	11/30/16	10:40	W	CA	X		2
-12	H43-MH1		11:00			X		2
-13	C18-MH5		11:20			X		2
-14	W47-MH1		11:45			X		2
-15	LSP-4		12:30			X		2

SAMPLE HANDLING

Filtration
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

Container Type	P																				
Preservative	H																				

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

Relinquished By:	Date/Time	Received By:	Date/Time
	11/30/16 13:45		11/30/16 13:05

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 18-Jan-2010)

ANALYTICAL REPORT

Lab Number:	L1631438
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	10/07/16

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1631438
Report Date: 10/07/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1631438-01	BH-1	WATER	MALDEN, MA	10/04/16 13:15	10/04/16

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1631438
Report Date: 10/07/16

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name:	CITY OF MALDEN	**Lab Number:**	L1631438
Project Number:	465.09	**Report Date:**	10/07/16

Case Narrative (continued)

Sample Receipt

The sample was received at the laboratory above the required temperature range. The sample was transported to the laboratory in a cooler with ice and delivered directly from the sampling site.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Kelly Stenstrom

Title: Technical Director/Representative Date: 10/07/16

INORGANICS
&
MISCELLANEOUS

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1631438
Report Date: 10/07/16

SAMPLE RESULTS

Lab ID: L1631438-01
Client ID: BH-1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 10/04/16 13:15
Date Received: 10/04/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	140		MPN/100ml	1.0	NA	1	-	10/04/16 17:10	121,9223B	WR

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1631438
Report Date: 10/07/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG939996-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	10/04/16 17:10	121,9223B	WR

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1631438
Report Date: 10/07/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1631438-01A	Bacteria Cup Na2S2O3 preserved	A	N/A	13.2	Y	Absent	E-COLI-QT(.33)
L1631438-01B	Bacteria Cup Na2S2O3 preserved	A	N/A	13.2	Y	Absent	E-COLI-QT(.33)

*Values in parentheses indicate holding time in days

Project Name:	CITY OF MALDEN	**Lab Number:**	L1631438
Project Number:	465.09	**Report Date:**	10/07/16

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1631438
Project Number:	465.09	**Report Date:**	10/07/16

Data Qualifiers

reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1631438
Project Number:	465.09	**Report Date:**	10/07/16

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
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EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: ***EPA 3050B***

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 10/4/16

ALPHA Job #: L1631438

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: NCA

Address: 45 Dan Road - Suite 115
Canton Ma 02021

Phone: 781-821-0521

Email:

Additional Project Information:

Project Information

Project Name: City of Malden

Project Location: Malden Ma

Project #: 463.09

Project Manager:

ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☒ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13	METALS: ☐ MCP 14 ☐ RCP 15 ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	☐ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	E. Coli - Enumeration	SAMPLE INFO: Filtration ☐ Field ☐ Lab to do; Preservation ☐ Lab to do	Sample Comments	TOTAL # BOTTLES
31438-01	BH-1	10/4/16	13:15	SW	CA									X			2

Container Type														P			
Preservative														H			

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	10/4/16 14:00	AM	10/4/16 14:00

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

CITY OF MALDEN

Illicit Discharge Detection and Elimination Program
Semi-Annual Status Report

January 1, 2016 – June 30, 2016

Prepared by:

Nangle Consulting Associates, Inc.
45 Dan Road – Suite 115
Canton, MA 02021

and

City of Malden Engineering Department
200 Pleasant Street
Malden, Massachusetts

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1.0 INTRODUCTION

This status report pertains to the period of 1 January through 30 June 2016 for the City of Malden's Illicit Discharge Detection and Elimination (IDDE) Program. The City of Malden's IDDE plan was developed to facilitate the implementation of a systematic and iterative procedure for the evaluation of dry weather flows, identification of potential illicit discharges and timely repairs to the storm drainage infrastructure, with the overall goal of improving surface water quality discharge within the City of Malden. This semi-annual status report has been prepared through the cooperative efforts of the City of Malden Engineering Department, the City of Malden Department of Public Works (MDPW) and Nangle Consulting Associates, Inc. (NCA) to document key program tasks completed during this reporting period.

Since its inception, the City's IDDE program has identified and removed illicit discharges/connections to the municipal drainage system, reduced significant potable water losses due to the detection of leakages, enforced Best Management Practices (BMPs)/stormwater ordinances and completed significant repairs to components of the drainage infrastructure. To support this effort, a comprehensive GIS mapping and catch basin cleaning/repair program was developed several years ago, which is implemented and maintained by the MDPW and Engineering Department. The goals and objectives of this IDDE plan are directed towards the reduction in the historic bacteria levels that have been detected at selected outfalls to surface waters within the City. In addition, as a "flow though" community, bacteria loadings entering into the City of Malden's infrastructure from upstream neighboring communities have also been quantified.

In general, the results of dry weather inspections, together with both dry and wet weather sampling, support the opinion that wet weather loadings are tied to the age and condition of the municipal infrastructure, major portions of which were installed during the late 1800's and early 1900's. This is particularly evident during wet weather sampling events within older neighborhoods that grew from the extensive industrial operations along the Malden River. To address the constraints associated with this infrastructure, the City Engineering and Public Works Departments, supplemented by outside technical assistance, have developed a program that integrates the implementation of the IDDE Plan into the routine daily work practices. This has led to the identification of infrastructure deficiencies and enabled the timely repair of potential flow and related water quality concerns. These direct response mitigation/repair measures have also led to the removal of illicit connections/discharges and substantial reduction of historic flooding concerns. During this reporting period, a significant illicit discharge connection has been identified within the area of Pleasant and Exchange Streets, in response to the results of dry weather sampling and mass balance flow isolation studies. As discussed in Section 3.1.1 of this submittal, the illicit connection of eleven (11) residential apartments to a roof drain riser that discharges to the municipal drainage system has been identified. This connection was made at the time of original building construction and its identification and removal speaks to the importance and effectiveness of the City of Malden IDDE program.

This report has been prepared to document and summarize IDDE activities that have been undertaken by the City during the January 2016 through June 2016 reporting period. Included with the scope of work that has been performed is the development of recreational guidance document based upon the results of the ongoing outfall sampling program performed by the City and surface water quality sampling of the Malden River by the Mystic River Watershed Association (MyRWA). Specific details pertaining to this comprehensive evaluation are presented in Section 3.1.1 of this report. The data and information obtained during this reporting period also serves as the basis for tasks to be completed during the next 6 month period.

2.0 DOCUMENTED ILLICIT DISCHARGES AND CONNECTIONS

During this reporting period, one (1) illicit connection was identified at 10 – 20 Summer Street (Gateway at Malden Center Apartments). A summary of the illicit discharges/connections identified to date is presented on Figure 1 and Table 1.0.

3.0 OVERVIEW OF IDDE ACTIVITIES (JANUARY 2016 – JUNE 2016)

In addition to outfall sampling, the City of Malden's IDDE Program incorporates the use of three (3) primary measures to identify and mitigate illicit discharges to its municipal drainage system, which may be described as follows:

(1) Targeted dry weather inspections and sampling by representatives of the Stormwater Compliance Team.

(2) Detailed inspection of the municipal infrastructure during the daily implementation of the catch basin clean-out and drainage system mapping program.

(3) Response to public, private or governmental agencies reports of possible sudden and/or identified discharge to the municipal storm system.

To provide a basis for the iterative dry weather inspection program and the observations recorded during this reporting period, the following excerpt from the City's IDDE work plan describes the methods and prioritization procedure maintained for this ongoing mitigation measure;

- Based upon the initial outfall monitoring data obtained, the City is currently implementing a Rapid-Assessment Prioritization approach through the targeted assessment of dry-weather flows in several areas within the City. Specifically the major tributaries to the most significant volume dry weather discharges to the Town Line Brook and the Malden River have been identified and sampled at key junction locations to initially determine the dry weather contributions from adjacent communities through major flood control infrastructure that is routed through the City of Malden.

During this reporting period, the results of the dry weather sampling program have led to the identification of a significant, long term discharge of raw sewage into the municipal drainage system that is currently being removed by representatives of the Gateway Apartments. Details pertaining to the identification of this illicit connection are presented in Section 3.1.1. The information obtained through the City's outfall sampling program, together with surface water quality data obtained by others, has led to the development of a partnership between the City, public and private educational officials, the local community and MyRWA to develop safety/guidance protocols for recreational uses on the Malden River.

By design, observations recorded during the dry weather inspections, together with the results of infrastructure sampling, serve as the basis for ongoing work plan tasks and updates to the original IDDE plan. Accordingly, the IDDE program maintained by the City is regarded as an ongoing and iterative effort that has successfully demonstrated the capability to quickly respond to water quality issues as needs and concerns are identified. The City of Malden has invested significant time and capital funding to develop a Stormwater Compliance Team (SCT) comprised of members of the Department of Public Works, Engineering and outside technical support. Activities performed by this group include the performance of dry weather inspections targeted

sampling efforts together with the systematic cleaning of catch basins, and related infrastructure components.

Since the initial implementation of the IDDE Plan, public outreach, postings of signage, daily work practices, interdepartmental meetings and local permitting processes have served to promote and understand the need for appropriate responses to illicit discharges. Increased involvement by engineering technical staff in the daily work practices of MDPW stormwater personnel is also intended to further this goal. Contact information is readily available through a variety of media, including mailings and web site postings to ensure implementation of appropriate response measures by members of the Stormwater Compliance Team. The current municipal leadership has made a significant effort to increase public awareness and participation through increased integration of digital and electronic media into daily practices. Public outreach has also included active participation by the Compliance Team through community workshops, educational presentations and regional watershed meetings.

3.1 Targeted Dry Weather Inspection/Sampling Program (NCA)

During this reporting period, representatives of NCA have conducted dry weather sampling events and evaluations of the City's infrastructure in the northeast and southeast sections of Malden, which contribute flows to Linden Brook and Town Line Brook, respectively. Central portions of Malden, which discharge to Lower Spot Pond Brook and ultimately the Malden River have also been the focus of activities performed during this reporting period. Historically, areas selected for inspection were generally based upon the results of the outfall sampling program and/or the identification of dry weather flows by MDPW staff during their routine maintenance and infrastructure locating program. In addition, and as described in further detail in Section 3.1.1, the City continues to share sampling results with MyRWA and has performed targeted sampling events to investigate discharges to outfalls that have been sampled by MyRWA. One particular area of interest is the Saugus Branch drainage system that discharges to the outfalls referred to as MR-2S and MR-2N.

A map depicting the approximate locations where targeted dry weather inspections have been conducted by NCA to date is presented as Figure 2. In addition, the drainage infrastructure is also inspected by the MDPW during the catch basin cleaning program. Upon the identification of previously unknown dry weather flows, the Engineering Department and NCA are immediately notified by MDPW personnel and targeted mass balance sampling efforts are performed. During dry weather inspections completed under the IDDE program, various dry weather flows have been identified. A summary of these flows within the municipal system that have been identified to date are shown on Table 2.0 and Figure 3. As stated previously, during this reporting period, dry weather investigations were performed within the Malden River watershed. Details pertaining to the sampling results may be referenced with Section 3.1.1.

3.1.1 Malden River Watershed

As outlined in previous submittals, the City of Malden is a flow through community that receives significant flows containing elevated bacteria levels during wet weather events. The primary outfall locations for these flows are Town Line Brook (Everett) and Spot Pond Brook (Melrose), which flow into the Malden River. As depicted on Figure 4, for crew activities, flow from Melrose and in particular Ell Pond (a.k.a. Crystal Pond) are of concern, as evidenced by the

summary of sampling data collected on June 1, 2015 at this location by MyRWA. As shown, E Coli levels of 86,640 col/100ml were detected at Ell Pond, which exhibited a consistent decline throughout downstream sampling locations in Malden, followed by a large increase at Route 16 in Everett (81,640 col/100ml). It is to be noted that elevated bacteria levels have been recorded at the Malden/Melrose town line through the period of IDDE plan implementation.

As a part of their Massachusetts Environmental Trust funded Mystic Recreation Flagging Project, MyRWA has collected hundreds of samples from six (6) locations, including the Malden River within the Mystic River watershed. The goal of their effort includes the interim development of a "flagging" system in the watershed to alert recreational users to safe or unsafe conditions, which will be followed by the development of "logistic models" that will allow for predictive guidance pertaining to water safety. Based upon the review of historic water quality information complied by the City and MyRWA, it was postulated that for rainfall events of less than half an inch, a 48 hour period of rebound would allow for the flushing of the River and reduction of bacteria levels to below safe boating standards. To test this hypothesis, sampling events were performed 48 hours following half inch rainfall events at the floating crew dock, located at 356 Commercial Street in Malden. These sampling events corresponded to the only periods of rainfall that met the qualifying criteria following the development of this approach. Additional details pertaining to the sampling events conducted at the floating crew dock may be referenced below.

As summarized above, the 48 hour rebounding protocol led to the documentation of bacteria levels below the USEPA safe boating standard for each applicable rainfall event. In addition, the corresponding safe swimming standard was met on 19 April and 7 July, with only a slight exceedences observed on 28 April 2016. It is proposed to continue with the sampling program to provide further background support for the 48 hour protocol that is enforced by the Malden Athletic Director. It is to be noted however, the region has been experiencing a prolonged period of either drought or extreme rainfall events. The City will also continue to share data and work with MyRWA on the development of a predictive model that will include the use of electronic signboards and development of a public advisory website.

In addition to the monitoring/modeling of water quality, the City performed a comprehensive review of available regional and national crew safety documentation to assist in the development of the protocols contained within the final guidance document, a copy of which is enclosed as Attachment A. A review of this document reveals that it is intended as a partnership agreement between students, parents and visiting users of the River, with the overall goal directed towards maintaining the highest standards for public safety and awareness of the environmental issues involved.

As described in earlier submittals, the City of Malden's stormwater compliance team initially targeted potential illicit discharges to the Malden River as its highest priority. Utilizing the outfall monitoring data and information obtained during dry weather sampling events, the City has identified significant base flow as surface waters, to the Malden River. Consistent with the original design of the MDC/DCR conveyance network; this occurs primarily thorough culverted channels/brooks located in northwestern portions of the City. This flow includes contributions that originate from the Fells Reservation and Lower Spot Pond Brook. As shown on Figure 5, a total of 26 outfalls to the Malden River have been identified. Periodic dry weather sampling has been performed by NCA, MyRWA and the USEPA. Water quality evaluations conducted this

reporting period along the Malden River have included the dry weather sampling of outfalls on 28 April 2016. During the 28 April sampling event, four (4) outfalls were identified as flowing and were sampled, with the other 22 outfalls either having no flow or were submerged. Reference to Table 3.0, shows that during this reporting period, E. coli levels ranged from 1.0 col/100ml (MR-6) to 8.6 col/100ml (MR-4). For the past several years portions of the MRA's property located at 356 Commercial Street have supported crew recreational activities from a temporary boathouse and floating dock. Users of the facility have included primarily private clubs who were subject to special conditions and agreements pertaining to the use of the property. Recently, this recreational activity has fallen under the jurisdiction of the Malden Athletic Department who has been working with representatives of the MRA, the City and outside technical assistance to develop safety protocols for both student requirements and issues associated with the water quality of the Malden River. With respect to the latter, dry and wet weather sampling performed by the City has clearly demonstrated that elevated bacteria levels occur within the river during and immediately after significant rainfall events due to the urban nature of the tributary watersheds within the cities of Malden, Medford, Melrose and Everett at a minimum.

As a general protocol, it has been recommended that crew activities be suspended immediately following significant rainfall events, however the duration of this restriction has lacked sufficient foundation to be adequately determined. Specifically, it is known that there is a period of rebound following wet weather events that directly corresponds to the duration and/or amount of rainfall following which dry weather sampling has revealed consistent bacteria levels below applicable boating (1260 col/100ml) and often swimming (235 col/100ml) EPA standards. To further evaluate this rebound condition, the City has worked with representatives of MyRWA to develop a post wet weather protocol for on river activity during this reporting period. Over the period of April 19, 2016 through July 7, 2016. As shown on Table 4.0, water samples collected on 19 April and 28 April 2016, contained E. coli levels of 210 col/100ml and 290 col/100ml, respectively, with a sample collected on July 7, 2016 containing an E. coli level of 47 col/100ml.

During this reporting period, the evaluation of the drainage system in Pleasant/Commercial/Exchange Street portion of the Malden River watershed was continued in response to the detection of high E. coli levels during a 25 June 2015 dry weather sampling event at manhole E28BY-MH1, which is located between Route 60 and Exchange Street, as shown on Figure 6. An evaluation of the drainage manhole revealed an approximate 48-inch RCP line with a flow that was observed to be approximately 10 – 12 gallons per minute. A sample collected from E28BY-MH1 on June 2015 revealed an E. coli level of 82,000 MPN/100 ml. Based upon a review of historic plan information, as well as field observations, this flow moves in a southerly direction into the Spot Pond Brook culvert, which ultimately discharges into the Malden River. Due to the high levels of E. coli encountered, a mass balance flow isolation of the drainage network within to the Exchange and Commercial Street area was conducted.

Dry weather sampling was conducted on 14 July 2015, by the Stormwater Compliance Team at E28BY-MHI several upstream drain manholes located on Exchange Street, Commercial Street and Pleasant Street. During this sampling event, an E. coli concentration of 9,800 MPN/100ml was encountered at E28BY-MH1, with elevated E. coli concentrations also detected at three (3) of the five (5) upstream manholes, with the highest levels encountered at E28-MH1 (19,000 MPN/100ml), which is approximately 400 feet northwest of E28BY-MH1.

A significant decrease in E. coli concentrations was observed at manholes S39-MH1 and P27-MH10, located in Pleasant Street. It is important to note that the Pleasant Street sampling waters are upstream of the flows containing high bacteria levels. Specifically, it is seen that E. coli levels of 30 and 34 MPN/100 mL were detected at S39-MH1 when elevated levels of E. coli were detected at E28-MH1 and F26-MH3. On 25 August 2015, another sampling round was conducted in the area, with the highest E. coli levels detected at manhole F26-MH3 (>483,920 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets. A concentration of 140,000 MPN/100ml was also detected at downstream manhole E28-MH1, where high E. coli levels were recorded during the 14 July sampling event. A significant decrease in E. coli levels was found at manhole P27-MH12 (27 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets, this sampling point is approximately 90 linear feet upstream of F26-MH3, where the highest E. coli levels were detected during the 25 August sampling event.

To further investigate the apparent illicit discharges into its drainage system in the area of Pleasant and Exchange Streets, three (3) additional E. coli samples were collected on 25 September 2015. Elevated E. coli concentrations were again encountered at F26-MH3 (>483,920 MPN/100ml) and downstream manhole E28-MH1. A reduction in E. coli concentrations was detected at E28BY-MH1 (5,800 MPN/100ml). A sample was also collected from the closest accessible manhole upstream of the Malden River outfall. This manhole, (C15-MH8.1) is located south of Charles Street and approximately 330 feet north of the Malden River and an E. coli level of 1,200 MPN/100ml was detected. It should be noted that the water in manhole C15-MH8.1 was stagnant at the time of sampling.

As summarized previously, during the inspection of Exchange Street drainage manhole E28-MH1 a strong sewage odor was identified and the evaluation of both the sewage and drainage infrastructure indicated that the invert elevations for the piping systems were very close, suggesting that possible exfiltration from the municipal sewage system was impacting the nearby drainage network. In response to the observations recorded within the Exchange Street area, representatives of CDM Smith Inc. (CDM) were requested to review the results of their inflow/ infiltration investigation in the area and according to CDM, no significant or obvious signs of infiltration or exfiltration were noted.

To further investigate the drainage system in the area, the City contracted National Water Main Cleaning Company (National) to camera the area of concern. On 2 June 2016, National, under the direction of the City, CDM and NCA initiated the CCTV inspection. To assist in the review of the following information, (referenced as Figure 7), which depicts the approximate location of drain manhole locations associated within this scope of work. Further, the National invoice for their services has been included as Attachment B.

The video inspection was initiated at the intersection of Pleasant and Florence Streets, at drain manhole P27-MH13. A visual inspection of this manhole revealed flow from the west (Pleasant Street) which then flowed in a southern direction down Commercial Street. While placing the video inspection equipment into the manhole, an intermittent flow was observed emanating from an 18-inch reinforced concrete pipe (RCP) drain line located in Florence Street (north). The video inspection of the drain line in Florence Street revealed no illicit connections, or indications of compromise to the pipe, which terminated approximately 115 feet to the north, at manhole F26-MH4. In addition, a colorimetric field

test for ammonia was performed by CDM Smith, with only low levels encountered, indicating this flow was most likely not the source of the elevated E. coli levels in the area. The camera was then sent approximately 100 feet west, along a 36-inch RCP to manhole P27-MH10, with no illicit connections or indications of compromise to the pipe noted.

A visual inspection of manhole P27-MH11 revealed that in addition to the 36-inch RCP line that flows from P27-MH10 there was a second 36-inch RCP line that was not identified on plans reviewed during this study. Field observations noted at manhole P27-MH11 included a strong sewage odor and visual indications of sewage contributions from the second 36-inch RCP line. A video inspection of this line revealed that it runs west along the center of Pleasant Street and then turns north to Summer Street (Figure 7), to manhole S39-MH3. It is to be noted that indications of sewage were observed along the entire length of pipe. The video inspection equipment was then moved to manhole S39-MH3 and visual observations of the manhole showed water entering the structure from a 12-inch RCP located of the western side of the manhole. Of particular importance to this mass balance flow isolation program was the absence of flow within the pipe from Summer Street (north). Video inspection of the 12-inch RCP revealed addition indications of sewage discharge and that the drainage line connected to manhole S39-MH3.1, approximately 50 feet to the west (Figure 7). A visual inspection of manhole S39-MH3.1 revealed two (2) 8-inch ductile iron pipe inverts within the structure. The video inspection of the ductile iron pipe that connects to manhole S39-MH3.2, located approximately 100 feet south-southwest of manhole S39-MH3.1, revealed no illicit connections or indications of compromise. However, indications of sewage discharge were identified during the video inspection of the 8-inch ductile iron pipe that connects to the Gateway at Malden Center Apartments (10 – 20 Summer Street), approximately 35 feet to the northwest of manhole S39-MH3.1.

Video observations noted included the presence of a stub and two (2) 8-inch ductile iron pipes which connect to 10 – 20 Summer Street building. Indications of sewage were noted within each of the pipes and flow from building was emanating from the northern pipe, which appears to run parallel with Summer Street. Representatives of the City, CDM and NCA spoke with the facility manager for the building and were allowed access to several common area bathrooms and locker rooms, as well as the building basement. A visual inspection of the sewerage and drain lines within the basement and several dye tests were performed to determine the origin of the sewage from within the building, however they were inconclusive. The City contacted the property owner and they engaged a plumbing contractor to determine the best course of action to resolve the illicit connection. After several camera inspections of the building utility lines, it was determined that a sewer riser was connected to a roof drain, which in turn discharges to the City storm drain system.

According to representatives of Gateway Apartments, 11 one (1) bedroom apartments are connected to this roof drain. More specifically, it was determined that sewer connections for each of the "07" apartments (i.e. 107, 207, etc.) for the entire building were connected to a roof drain riser pipe that discharges to the municipal drainage system. The City has been in constant contact with representatives of the Gateway Apartments, who have been cooperative and have engaged as the services of a plumbing contractor to remove the illicit connection as quickly as possible. A review of Assessor's record information reveals that the Gateway building was constructed in 1988. Accordingly, for the design flow rate described above, the total estimated discharge over the 28 year period would be 12,593,680 gallons. The removal of this illicit connection will represent a major reduction in potential surface water discharge and the most significant benefit derived from IDDE Plan implementation to date.

A second, though much smaller illicit discharge has been the focus of dry weather sampling events to investigate elevated E. coli levels encountered previously at LSP-4 which is an outfall for the drainage system located within Eldrich Drive (Figure 8). Base flow, as groundwater, is consistently observed within this drainage network and to isolate potential sewage contributions to this base flow, a comprehensive evaluation of the flow conveyance network associated with LSP-4 was completed in February 2012. Given the proximity of the sewer and drain lines to LSP-4, as well as the settlement of the drain line in the area of Buildings 1054 and 1056 Elrich Drive, attention was directed towards the sewer laterals and nearby drainage line servicing the two apartment buildings. Following dye testing by the Compliance Team, camera surveys performed by representatives of the property owner confirmed that compromises to the laterals servicing two (2) residential building had occurred.

Working with representatives of the Malden Engineering Department, repairs to the sewer laterals in the area of Building 1054 and 1056 were completed by the property owner in March 2012. Since that time, and as summarized on Table 3.0, dry weather flow samples collected from LSP-4 reveals a significant decrease in bacteria levels relative to concentrations detected in 2012. However, during the 2 July 2014, an E. coli concentration of 110,000 MPN/100 ml was detected at LSP-4. An additional sample was collected on 5 November 2014, with an E. coli concentration of 3,200 MPN/100 ml detected. The drainage system in Eldrich Drive receives base flow, as groundwater infiltration and it is likely that the levels of groundwater relative to the inverts and piping of the drainage system is a contributing factor. Specifically, while the sewer laterals were replaced/repaired, long impacted contact soils and underlying groundwater likely contain bacteria residuals that enter the drainage system during periods of high groundwater. To correct this condition, it is recommended that relining and restoring the structural integrity of the main drainage line and manholes be performed.

3.1.2 Town Line Brook Watershed

Town Line Brook in Malden begins at the Malden and Everett city boundary and is culverted until it daylights into an open concrete lined trapezoidal channel at Broadway. Significant tidal influences exist in the form of an approximate 2-3 foot change in surface water elevation between Broadway and the remaining length of the culvert to the Revere City line. As shown on Figure 9, a total of 29 outfalls to Town Line Brook in Malden have been identified. The historic monitoring data of Town Line Brook has revealed relatively uniform bacteria levels during dry weather sampling events. Several outfall locations have consistently exhibited bacteria loadings during dry weather sampling events, including S3-MH12, TL-0, TL-9 and Trifone Brook (TL-24). Manhole sample point S3-MH12 is the upstream sampling point for this section of the Brook as it enters the Malden system from Everett, while TL-0 is located at Broadway, where Town Line Brook daylights. TL-9 is located proximate to the terminus of Hadley Street in Malden and receives dry weather flows from the City of Everett, with Trifone Brook (TL-24), also flowing from Everett prior to discharging into Town Line Brook. Based upon the historic monitoring of these outfalls, it is apparent that contributions continue to enter the Malden system from upstream areas and the focus of dry weather sampling has been directed towards the area described within this submittal.

No sampling events were performed during this reporting period, as it has been determined that contributions from upstream areas remain a primary condition of concern. It is proposed to conduct wet weather sampling events in this watershed in the fall of 2016.

3.1.3 Linden Brook Watershed

Linden Brook Culvert is the major stormwater conveyance network located in northeasterly portions of the City. Dry weather inspections have revealed base flow throughout the culvert at all times, with E. coli levels detected historically within the mid-portion of the culvert, at manholes D17-MH1 and H43-MH1 (Figure 10) during prior sampling efforts. Flow isolation studies performed to date within this portion of the City had not revealed any specific source conditions for the results of prior sampling. Flow isolation studies have been continued for dry weather Flow # 18, which was identified in the areas of Cherry and Sylvan Streets, a part of the Linden Brook culvert (Figure 10) watershed. Dry weather flow samples collected from drainage manhole (C18-MH5) located on Cherry Street contained elevated E. coli levels and to further assess this condition, dry weather flows were sampled again from the approximate manhole locations shown on Figure 10. Reference to Table 3.0, indicates that the E. coli levels encountered at drainage manhole C18-MH5 contained an E. coli level of 1,300 MPN/100 ml. An upstream dry weather flow sample relative to C18-MH5 was also collected from a manhole located on Winship Street (W47-MH1), with a level of 1,700 MPN/100 ml of E. coli identified. This concentration is in the range of the E. coli level quantified at C18-MH5 (1,300 MPN/100 ml). As this flow (Flow 18) originates along Sylvan Street, proximate to the Forestdale School, a dry weather flow sample was collected from drainage manhole S45-MH4 along Sylvan Street, with a level of 8.5 MPN/100 ml of E. coli identified.

During the September 2012 sampling event, conducted with representatives of the USEPA, a water sample was collected from outfall LBR-1 (Figure 10), located in Revere, at which time distinct indications of sewage odors were noted. Consistent with identification of strong sewage odors and immediately apparent from a review of Table 3.0 is the significantly elevated level of E. coli (>241,920 MPN/100 ml) detected in sample LBR-1. To assess this condition and as described in prior status reports, the City of Malden contracted with National Water Main Cleaning Company, under the supervision of CDM Smith. As summarized in the following excerpt from an email to the City of Malden from CDM Smith, it is believed that line blockage due to grease build up may have been a crucial factor for the conditions identified at LBR-1, in addition to a "minor" defect in the form of a leaky joint.

> As you know, National Water Main Cleaning Company along with CDM Smith staff were out on site on Tuesday November 6, 2012 to investigate the potential illicit connection into the Linden Brook Culvert at Salem Street near the Route 1 underpass. The following in a summary of the day's events. The following figure graphically represents the results of the work.
>
> National Water Main was onsite to clean and CCTV the siphon under the Old Linden Brook culvert. Upon arrival the condition of the sewers had not changed from the previous visit held 2 weeks prior: The downstream manhole (MH 3 in the attached figure) and a manhole upstream of the siphon (MH 1 in the figure) were completely plugged with heavy grease. A limited amount of liquid was passing through MH 3. Heavy cleaning of MH 3 and the sewer under the culvert took longer than expected. From MH 3 upstream to MH 1 an enormous amount of grease and sediment was removed. The pipe was 100% clogged with slugs of grease in several spots.

The sewer between MH 1 and MH 2 was successfully CCTV'd with the aid of the jetter (upstream of the siphon). This pipe was found to be in good condition. The most notable defect was a leaking joint (runner) at 9pm 54-ft from MH 1 (while traveling downstream). This was a rather minor defect. Active I/I was observed, however, it is possible that when the siphon builds some head, a small amount of sewage could exfiltrate from this same joint.

We discovered what appears to be an external drop connection just downstream of MH 2. This prevented us from CCTV'ing any further as the camera could not pass the vertical 90 degree bend. CCTV from the upstream direction would require two jetters or bypass pumping, (one to keep MH 3 drained and one to intercept flow from upstream in MH 2). This vertical drop was heavily blocked with grease. Approximately 80% of the grease in this pipe was removed with a root cutter and the pipe is in much better condition.

Last we lowered the camera into the 12-in connection to the culvert that once housed a gate valve (in MH 3). It no longer houses any gate, instead there is a masonry plug that seems to be in good condition. As the intent of finding the definitive source of sewage into the culvert was inconclusive, we recommend that we resample the outfall and test for parameters consistent with sewage. If the results are consistent with the previous results we should develop a new approach to finding the source.

As described within this submittal, the focus of IDDE response actions during this reporting period has been directed towards the illicit connections identified within the Malden River watershed. The focus of future sampling in the fall of 2016 will include dry and wet weather sampling in the Linden Brook Watershed.

3.2 Inflow Infiltration Sewer System Evaluation & Capacity Analysis

The City of Malden has also completed a comprehensive Infiltration and Inflow (I&I) study for its municipal sewer system. CDM Smith, on behalf of the City, has prepared a Phase 3 Sanitary Sewer Evaluation Survey (SSES) report that includes a summary of findings and proposed recommendations to mitigate excessive infiltration and inflow into the City's sewer system. This report was presented for approval to MWRA during this permit year. Approval was received together with necessary funding. As described in Section 3.1.1, the City also has a contract in place for emergency repairs to the sewage infrastructure. This contract allowed for the video camera surveys recently performed in the Pleasant and Exchange Street area and the I&I investigations performed by CDM Smith.

4.0 SANITARY SEWER OVERFLOWS (SSO'S)

No SSOs were identified during this reporting period.

5.0 EVALUATION OF IDDE PROGRAM GOALS AND OBJECTIVES

The City of Malden has implemented a comprehensive illicit discharge elimination program that has resulted in the isolation and mitigation of numerous improper discharges/connections and reduced significant potable water losses due to the detection of leakages. During this reporting period, mas balance flow isolation and video camera surveys in response to dry weather sampling in the area of Exchange and Pleasant Streets demonstrated both the effectiveness and importance of the IDDE program. The City continues to demonstrate its commitment to the objectives of the IDDE Program through the hiring of additional staff, purchase of equipment, and the refinement of the Compliance Team leader who is responsible for the daily administration of this program and development of corresponding work plan objectives. At the recommendation of USEPA, the use of ammonia test strips will be incorporated into future sampling events.

Due to analytical costs and constraints, one issue that continues to cloud the understanding of dry weather discharges to the Malden River involves the distinction between human and waterfowl contributions of bacteria. Through the assistance of the USEPA, multiple lines of evidence testing has been performed to assist in the evaluation of this condition. The Compliance Team is continuing to work with Alpha Analytical to develop cost efficient sampling parameters, such as caffeine analysis and hopes to work with USEPA in implementing multiple lines of evidence testing within the Malden River Watershed. Further understanding of surface water quality characteristics and bacteria loadings has been obtained through the development of crew safety protocols, particularly as it pertains to wet weather rebound within the River. During the next reporting period, wet weather sampling of the Malden River outfalls will be performed to further this understanding.

Table 1.0 Summary of Illicit Connections/Discharges identifed as of 06/30/2016

Illicit Connections

Illicit Connection Identification	Date Identified	Discharge Type	Estimated Volume	Date Removed	Location
ID-1	1/15/2009	Sewage	40 gpd	2/16/2009	33 Lodgen Ct., Unit 1F
ID-2	1/15/2009	Grey Water	100 gpd	3/2/2009	34 Hanover Street
ID-4	8/28/2009	Sewage	60 gpd	9/4/2009	2-4 Hancock Street
ID-9	5/18/2010	Sewage	60 gpd	5/19/2010	36 Charles Street
ID-12	Apr-12	Confirmed Roof Drain	NA	NA	100-110 Pleasant Street
ID-13	Sep-12	Sewage	Unknown	January-13	Exchange Street
ID-15	Oct-13	Process Water	Unknown	N/A	Sharon Street
ID-16	6/2/2016	Sewage	1,210 gpd	Pending	Summer Street

Total Illicit Flow Removed to Date: ***1,470 gallons/day*** ***536,550 gallons/year***

Illicit Discharges

Illicit Discharge Identification	Date Identified	Discharge Type	Estimated Volume	Date Removed	Location
ID-3	8/11/2009	Oil Sheen	Unknown	n/a	Near 1081 Fellsway
ID-5	9/10/2009	#2 oil spill	<5 gallons	9/10/2009	269 Pearl Street
ID-6	9/21/2009	Poss. Washwater	Unknown	9/21/2009	120 Main Street
ID-7	12/9/2009	Trans. Dielectric fluid	<27 Gallons	12/10/2009	Near 6 Grove Street
ID-8	4/29/2010	Hydraulic Fluid	<10 Gallons	4/29/2010	496 Main Street
ID-10	2/10/2012	Sewage	Note 1	Pending	1056 Erlich Drive
ID-11*	9/11/2012	Sewage	Unknown	11/6/2012	Linden Brook @ Lynn St.
ID-14	8/15/2013	Grey Water	Unknown	13-Dec	Forestdale School

1 - approximately 1 gallon per minute observed discharging at LSP-4 during dry weather

* Possible discharge due to grease blockage-Syphon still under investigation

Table 2.0 Summary of Dry Weather Flows Identifed as of 06/30/2016

Flow Identification	Location	Flow Type	Status
Flow 1	Medford City Line	Water Line Leak	Removed
Flow 2	Saint Mary's Street	Groundwater	No Further Action
Flow 3	Fellsmere Reservation	Groundwater	No Further Action
Flow 4	Malden River	Surcharge-Submerged Invert	Evaluation Ongoing
Flow 5	DCR Spot Pond Brook	Base Flow	Evaluation Ongoing
Flow 6	Forestdale-Pine Banks Park	Base Flow	No Further Action
Flow 7	Wigglesworth Street	Groundwater-Illicit Discharge	Removed
Flow 8	Main Street	Water Line Leak	Removed
Flow 9	Pierce Street	Groundwater Breakout	No Further Action
Flow 10	Linden Brook	Base Flow	Evaluation Ongoing
Flow 11	LSP-4	Dry Weather Flow	Evaluation Ongoing
Flow 12	Kennedy Dr-Granada Highlands Apts.	Base Flow	No Further Action
Flow 13	Orchard Street	Dry Weather Flow	Evaluation Ongoing
Flow 14	Exchange Street	Intermittent Dry Weather Flow	Evaluation Ongoing
Flow 15	Lower Commercial Street	Dry Weather Flow	Evaluation Ongoing
Flow 16	Huntley Street	Dry Weather Flow	No Further Action
Flow 17	Goldcliff Road	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 18	Cherry & Gilbert Streets	Dry Weather Flow	Evaluation Ongoing
Flow 19	Sylvan Street	Dry Weather Flow	Evaluation Ongoing
Flow 20	First Street & Elwell Ave	Base Flow	No Further Action
Flow 21	Bowman Street	Base Flow	No Further Action
Flow 22	Springdale Street	Dry Weather Flow	No Further Action
Flow 23	Grant Street	Dry Weather Flow	Evaluation Ongoing
Flow 24	Wheeler Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 25	Revere Street	Dry Weather Flow: No flow on 7/2 & 11/5/14	No Further Action
Flow 26	Kennedy Dr & Fairfield Avenue	Base Flow	No Further Action
Flow 27	Sharon Street	Process Water	No Further Action
Flow 28	Pleasant/Commercial/Exchange Sts.	Dry Weather Flow	Evaluation Ongoing
Flow 29	Summer Street	Base Flow	No Further Action

Table 3.0 Dry Weather Conditions - E. Coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Designation	E. Coli (MF) (MPN/100ml) 30, 9223B ACTION LEVEL- 235 col/100ml																		
	8/4/2011	11/8/2011	12/13/2011	1/11/2012	4/13/2012	6/15/2012	9/11/2012[1]	9/27/2012	2/22/2013	4/5/2013	9/12/2013	9/24/2013	7/2/2014	11/5/2014	6/25/2015	7/14/2015	8/25/2015	9/29/2015	4/28/2016
Malden River																			
MR-0	-	-	9,200	-	-	-	3,090	-	-	490	980	-	-	-	-	-	-	-	-
MR-1	-	-	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-4	-	-	220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.6
MR-5	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-6	-	-	4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	580	1.0
MR-8	-	-	-	-	-	-	-	-	-	-	292	-	-	-	-	-	-	-	5.2
MR-11	-	-	ND (1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND (2.0)
MR-12	-	-	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LSP-0-Channel[2]	-	-	-	1,700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LSP-3	-	-	-	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LSP-4	17,000	-	-	>242,000	-	100,000	-	-	-	-	-	2,000	110,000	3,200	-	-	-	-	-
LSP-9	-	34	-	84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LSP-10-Channel[2]	-	-	-	10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CH-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-
C15-MH8.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,200	-
C46-MH19	-	-	-	-	-	-	850	-	-	-	-	-	-	-	500	-	-	-	-
E13-MH4 (Elrich)	-	-	-	-	-	-	-	-	-	-	-	2,000	-	-	-	-	-	-	-
E28-MH8	-	-	-	-	ND (1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E28-SP1	-		-	-	6,100	-	740	-	-	-	-	-	-	-	-	-	-	-	-
E28-SP2	-	-	-	-	5,200	-	310	-	-	-	-	-	-	-	-	-	-	-	-
E28-MH1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19,000	140,000	>483,920	-
E28-MH2W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9,000	-	-	-
E28-MH2N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-
E28-MH4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,500	-	-	-
E28-MH4A	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82,000	9,800	10,000	5,800	-
F26-MH3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,700	>483,920	>483,920	-
NG-C1	-	-	-	-	-	-	510	-	-	-	-	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	-	-	-
P27-MH12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	-	-
S29-MH1	-	-	-	-	-	-	-	-	-	160	-	-	-	-	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	13,330	-	-	190	-	-	-	-	-	-	-	-	-
S39-MH1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	30	-	-
Little Creek																			
LC-0	2,400	-	65	-	-	-	-	-	-	-	-	-	-	-	3,700	460	-	-	-
LC-N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,400	-	-	-	-
Saugus Branch																			
MR-2	-	-	1,200	-	-	-	-	-	-	-	550	-	-	-	-	-	-	-	-
MR-2N	-	-	-	-	-	-	-	-	-	-	-	-	150	490	390	35	310	3,100	-
MR-2S	-	-	-	-	-	-	-	-	-	-	-	-	130	440	440	75	290	440	-
Town Line Brook																			
TL-0[3]	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TL-3	-	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TL-9	-	130	-	-	-	-	410	-	-	-	-	-	-	-	-	-	-	-	-
TL-13	-	ND (1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B53-MH7	-	-	-	-	-	-	410	-	-	-	-	-	-	-	-	-	-	-	-
BP-MH3	-	-	-	-	-	-	200	-	-	-	-	-	-	-	-	-	-	-	-
S3-MH12[3]	-	-	-	-	-	-	2,880	-	-	-	-	-	-	-	-	-	-	-	-
S14-MH4	-	-	-	-	-	-	-	-	-	-	-	-	ND (1.0)	4.1	-	-	-	-	-
Linden Brook																			
B46-MH2	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-
C18-MH5	-	-	-	-	-	-	-	-	-	-	-	23,000	11,000	1,300	-	-	-	-	-
C36-MH1	-	-	-	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D17-MH1	-	-	-	460	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1-MH4	-	-	-	-	-	-	310	-	-	12	-	-	-	-	-	-	-	-	-
F23-MH2	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-
G36-MH2	-	-	-	-	-	-	-	-	-	-	-	-	1,700	290	-	-	-	-	-
H43-MH1	-	-	-	28,000	-	-	5,470	-	-	580	-	12	-	1,000	-	-	-	-	-
K6-MH1	-	-	-	-	-	-	-	49	-	-	-	-	-	-	-	-	-	-	-
L5-MH1	-	-	-	-	-	-	-	-	-	580	-	-	-	-	-	-	-	-	-
LBR-1	-	-	-	-	-	-	>241,920	-	<10	1	-	-	520	88	-	-	-	-	-
M31-MH1	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
O10-MH1	-	-	-	-	-	-	-	4,300	-	650	-	-	-	-	-	-	-	-	-
P24-MH1	-	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S27-MH2	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-
S45-MH4	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	-	-	-	-	-
V1-MH1	-	-	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W26-MH1	-	-	-	390	-	-	-	-	-	320	-	-	-	-	-	-	-	-	-
W47-MH1	-	-	-	-	-	-	-	-	-	-	-	-	3,500	1,700	-	-	-	-	-

File No. 465.09

[1]Samples collected by USEPA

Laboratory certificates contained within attachments.

Table 4.0 Malden River Boat House - E. Coli Concentrations

Site Location, Malden River - Malden, MA

Sample Designation	E. Coli (MF) (MPN/100ml) 30, 9223B ACTION LEVEL- 235 col/100ml		
	4/19/2016	4/28/2016	7/7/2016
Malden River			
BH-1	210	290	47

File No. 465.09

Laboratory certificates contained within attachments.

MALDEN HIGH SCHOOL CREW

SAFETY MANUAL AND PROCEDURES

For

COACHES, STUDENT PARTICIPANTS, PARENTS/GUARDIANS OF STUDENT PARTICIPANTS, GUEST COACHES, AND GUEST USERS/PARTICIPANTS

Created: July 5th, 2015
Last Updated: October, 10th 2015

Revised: April, 2016

AFTER READING THIS MANUAL PLEASE SIGN THE ACKNOWLEDGMENT PAGE CONFIRMING YOU HAVE READ AND AGREE TO THE POLICIES, PROTOCOLS, REQUIREMENTS AND EXPECTATIONS OF THE MALDEN HIGH SCHOOL CREW PROGRAM. SIGNED ACKNOWLEDGMENTS SHOULD BE RETURNED TO THE MALDEN HIGH SCHOOL ATHLETIC DIRECTOR.

The Malden High School Crew Team acknowledges the following publications in the creation of this program's Safety Manual: US Rowing Safety Guidelines, FISA Minimum Guidelines for the Safe Practice of Rowing; Saint Louis Rowing Club Safety Manual & Procedures, Lincoln Park Boat Club Safety Manual, Carnegie Lake Rowing Association Safety Manual and the Gentle Giant Rowing Club.

Table of Contents

A. PURPOSE

The purpose of this Manual is to establish, maintain and disseminate safety guidelines and ensure the safe operation of the team at all times, in all boat handling and on-the-water rowing at the Malden River, and any facility used by team members. The policies and procedures in this Manual shall be adhered to in all respects, together with the exercise of sound judgment. This Manual establishes safety expectations and guidelines for all team members and program participants. Safety is the responsibility of all team members and program participants, and the primary objective during the season.

All Coaches of the Malden High School Crew Team, Student Participants, Parents/Guardians of Student Participants, and Other Participants must review this Manual and adhere to the policies and procedures outlined. As in any sport, rowing involves specific inherent risks, and specifically water sports safety risks and waterborne illness risks associated with urban community waterways. This Manual identifies some safety risks and waterborne risks, in an effort to inform Parents/Guardians, Student Participants, and Other Participants of commonly known risks, but is not an exhaustive list of all safety or waterborne risks which may exist.

This Manual was compiled with input from many sources and professionals and is intended to create a safe environment for participating in this sport for Coaches, Student Participants, Other Participants and visitors. Continued safe conduct of the program is everyone's responsibility. Every Student who intends to participate, and each Parent/Guardian of a Student Participant, shall be required to sign and return the Student and Parent/Guardian Acknowledgment Form. No Student shall be allowed to participate until the signed form is provided to the Malden High School Athletic Director.

Other Participants shall, through their Guest Crew Coach/Athletic Director, provide a signed Guest Crew Coach/Athletic Director Acknowledgment Form to the Malden High School Athletic Director. It shall be the Guest Crew Coach/Athletic Director's obligation to review the guidelines and protocols herein and ensure guest crews and program participants are aware of and comply with the safety procedures and protocols identified. All Participants and Guests shall be required to review this Manual, complete and file the Acknowledgment Form annually at the beginning of each rowing season.

B. USE OF BOATHOUSE AND EQUIPMENT

1. Facilities: Use of the City of Malden's facilities, including building and boat storage facilities and equipment is restricted to Malden High School Crew Coaches, Student Participants, and authorized Guest Users. No one else is authorized to use the facilities or equipment without express permission of the Malden High School Athletic Director or the City of Malden. The boathouse should be treated respectfully and for the good of all.

2. Keys and Access: Keys shall be provided to authorized users only and no keys shall be duplicated by any user for any reason. Unauthorized duplication of keys and unauthorized

access shall result in termination of access to the Malden River and Malden facilities, termination from participation and use, and other consequences, subject to the Malden Athletic Director's discretion and/or the City of Malden's determination.

3. Rules: The rules for the boathouse use include:

- Close gate access to the boat yard when the boathouse is empty, even if crews are on the water.
- Only use equipment that a Coach has authorized you to use.
- Rowing is prohibited unless a Coach is present.
- Rowing before sunrise or after sunset is prohibited unless proper lights are used and a Coach is present.
- The dock will be slippery when wet. Running is prohibited; walk carefully.
- Carry oars with the blades in front of you. Stack oars out of the way on the dock.
- When carrying a boat, watch out for oars on the dock.
- Practice safe launching and docking.
    - Get on and off the dock promptly.
    - There will be no horseplay on, or around the docks.
    - Do not leave loose shoes on the dock; store in shoe bins or buckets so they do not obstruct traffic on the dock.
    - Do not step through a rigger when getting into or out of a boat
    - Follow coxswain and coaches' instructions at all times
    - Do not launch a boat or exit the Malden River on the River Bank; use the dock at all times for launching and existing.
- Coaches are responsible for the boats on the water under their direction.
- Coaches are responsible for crews on the water under their direction.
- Look for safety notices and follow recommendations during extreme weather and temperatures.
- Look for water quality warning notices and comply with no use notifications and Rain Event policy when in effect.

Motorized Boats: The use of motorized boats in connection with any athletic program or rowing crew shall be in accordance with local, state and federal regulations and requirements. All operators of motorized boats shall comply with local, state and federal licensing and boating regulations and requirements, and must provide proof of licensure and a certificate of liability insurance to the Malden High School Athletic Director prior to use of any motorized boat in connection with rowing activities.

C. RESPONSIBILITIES

All Coaches, Athletic Directors, Student Athletes and Parents/Guardians, rowers, and guest users/participants must be familiar with guidelines set forth in this Manual. Coaches are expected to uphold these guidelines to ensure the safety of the team. All athletes and staff are

expected to follow state and local laws and any mandates issued by the City of Malden. All team participants are responsible for ensuring safety and for reporting safety violations. All safety violations must be reported immediately to the Malden High School Athletic Director. Any person may report a safety concern. Failure to report a safety violation may result in termination from use, access and participation.

1. Annual Safety Training

All Student Participants must attend annual safety training. As part of this annual training, all athletes must view the US Rowing Safety Video. Training shall also include discussion of:

- safety on the water and at boathouse
- general boathouse rules and traffic patterns
- proper equipment care and handling
- weather situations including rain events, wind, lightning, fog and low light
- swamping situations
- man overboard situations
- hypothermia prevention and treatment
- washing/sanitizing post-practice to prevent infection

2. Coaches

Prior to the start of each season, Coaches shall review safety procedures with all team members. Coaches must recognize safety infractions and unsafe practices and make corrections as appropriate, and must:

- know the safety rules and procedures
- conduct themselves safely at all times ensure their crew teams conduct themselves safely at all times
- be aware of boats on the water during a session and that all boats under their supervision have returned to the boathouse at the end of a session
- do not exceed an appropriate number of people in a launch
- give instructions that are safe and follow the current traffic patterns
- cancel rowing activities if it is deemed that policies are not being followed or if unsafe conditions exist

cancel rowing activities in the event a rain event occurs prohibiting use of the Malden River

- provide assistance to ANY distressed boat, even if a pleasure boat or shell belonging to another club with the exercise of sound judgment
- secure the facility after practice
- ensure no shell goes out that is not in compliance with general safety guidelines, including a secure bow ball, tied foot stretchers, secure hatches, lights when necessary, etc.
- provide appropriate supervision and safety launches when sending crews out
- ensure all athletes are prepared and appropriately dressed for their time on the water, especially during hot and cold weather
- plan appropriate workouts for given weather conditions (example: providing rest, hydration breaks and not overly-exertive workouts during very hot weather)

- immediately report any safety violations observed to the Athletic Trainer and Athletic Director
- Contact emergency personnel in the event injury requires medical attention
- immediately report any injury requiring medical attention to the Athletic Trainer and Athletic Director

3. Student Athletes/Participants

Athletes are responsible for their own safe behavior and must:

- know and understand the safety rules and procedures
- conduct themselves safely at all times
- follow traffic patterns
- understand local traffic patterns and safety procedures when traveling to away sites
- keep seat area in working order (i.e., heel ties are intact so that they cannot be raised more than 3 inches, oarlock, rigger, seat and tracks) and report any concerns to the Coach
- follow instructions of Coaches, coxswains, referees and safety manual
- ensure he/she is medically and physically able to participate in rowing at the exertion level required of their team
- demonstrate his/her ability to meet the swim test requirements
- remain silent while the boat is moving: it makes it harder to hear commands and distracts the coxswain from their primary job: the safe guidance of the boat.
- notify the coxswain immediately if they see a hazard or possible collision that they believe the coxswain does not see, or if the coxswain is in violation of adhering to the standard traffic pattern without explaining to the crew their intentions. An emergency supersedes the rule for a crew member not to speak in a moving boat
- inform the coxswain or coach if they believe they hear thunder or see lightning
- be alert to unsafe conditions or conduct; and
- secure equipment and the boathouse at the end of practice

Novice rowers are generally considered to be in their first year of rowing.

4. Coxswains

Coxswains are responsible for all the athletes in their shell as well as themselves. They are expected to:

- act in way that preserves the safety of everyone in their shell from the moment the crew places hands on until the shell is returned to the racks
- ensure that no shell goes out that is not in compliance with safety guidelines including a secure bow ball, tied foot stretchers, and lights, when necessary
- have any necessary tools with them when they leave the dock
- follow traffic patterns and pass/yield to other crews correctly

- learn or review coxing and boat maneuvering procedures
- understand local traffic patterns and safety procedures when traveling to away sites.

Coxswains must be confident and clear in their knowledge and ability to instruct crews before they go on the water with a crew. Coxswains must have explicit permission from a coach to cox a shell without a coaching launch supervising.

D. PREPAREDNESS & SAFETY PREREQUISITES

1. Coaches

All coaches must have obtained the following minimum certifications within the previous 24 months:

- First Aid/CPR/AED certification, and
- MA Boating Safety course certification is strongly recommended

As part of the preparation for each season, all Coaches will ensure that each athlete under their supervision is familiar with the safety protocols, policies and recommendations as part of the safety briefing, and has provided athletes with opportunities to watch the US Rowing Safety Video

These rules apply to all coaches while on the water:

- All persons in a launch shall have a Personal Flotation Device (PFD) available at all times while on the water.
- Operators of launches should have an unobstructed view at all times, which may require the use of ballast in the bow of the launch
- Launch drivers need to be aware of their wake
- No novice rowing shells or sculls shall be no more than 500 meters from a launch
- The ratio of shells (sweep or sculling) to coaching launches should be as follows:
    - For novice sweep boats, a ratio of 2:1
    - For experienced sweep boats, no restriction
- Operators of launches shall know how to assist rowers entering the launch from the water. Rowers in the water should be approached from the downwind side, making sure to keep the propeller away from them
- Coaches with junior rowers and novice scullers must always take a launch to accompany the crews
- A coach must always use a launch and be in visual contact with novice crews.

2. Student Athletes/Participants

All Malden High athletes must meet minimum criteria prior to participating in the crew program. The minimum requirements are:

- Provide medical clearance and complete the appropriate paperwork through the Malden High School Athletic Office.
- Be able to pass the swim test which includes:
  - Tread water for 5 minutes,
  - Swim 100 yards,
  - Put on a life jacket while in the water
- Participate in team safety training and watch the US Rowing Safety Video

Furthermore, all athletes agree to give the command "Weigh Enough" or "Hold Water" if the situation demands to protect the crew or equipment, such as in the case of broken equipment, injury or unforeseen hazard.

3. Coxswains

Coxswains are in a unique position to be directly responsible for the safety of their crew and secondly, for their equipment. They are responsible for the equipment from the moment a crew places 'hands on' until the shell is returned safely to the rack.

E. EQUIPMENT

1. Launches

Launches shall be maintained in good working order. They all shall have working kill switches. It is a wise precaution to check that the engine is securely affixed to the hull and that the secondary safety fixing exists and is properly affixed every time the boat is used. Whenever a launch is used with crews it should be stocked with:

- cell phone
- kill switch
- bailer
- paddle
- PFDs for those in launch and shells
- at least one Safety Kit
- rope
- fire extinguisher.

Lights should be affixed to any launch that is used in the sunrise or sunset hours.

2. Fuel Storage and Spill Clean Up

All fuel must be stored in DOT approved storage containers and managed outside the boathouse, in an approved explosive proof cabinet, due to the explosive risk. Fuel must never be in the boathouse. All fuel tanks containing fuel must be stored in the explosive

proof cabinet with the lids facing up and cabinet doors fully closed. Launch drivers are responsible for ensuring they have ample fuel in the launch and for returning back-up fuel containers to the explosive proof cabinet at the conclusion of each practice. Do not use fuel belonging to anyone else. Users are responsible for their own fuel containers and must clean up any fuel spills immediately.

Any spilled fuel must immediately be cleaned using the spill prevention kit located at the boathouse and all waste generated during cleanup shall be properly disposed of in the appropriate container located at the boathouse. The Athletic Director must be notified immediately to ensure proper disposal of waste generated during clean up. Any fuel spills over ten (10) gallons must be reported to the Massachusetts EPA Spill hotline and the Malden Athletic Director immediately upon occurrence.

3. Fire.

If a fire is detected near the fuel cabinet, move at least 100 meters away and call 9-1-1 immediately. Do not attempt to put out the fire. In the event of any fire, contact the Malden Fire Department, at **781-397-7383**. In the Coach's discretion and if the Coach determines the Coach is able to extinguish the fire without threat of harm, the fire can be put out by the Coach with the dry chemical fire extinguisher located at the boathouse.

4. Shells

All racing and recreational shells shall be kept in good repair. Athletes are expected to report any damage immediately and return to dock immediately if a shell loses a skeg or is otherwise damaged in a way that makes rowing unsafe.

Coaches and/or crews are responsible for identifying and reporting any breakage that occurs during their instruction or use. Any breakage should be documented on the breakage, to be dealt with as quickly as possible. A shell must have the following elements secure at a minimum to be considered safe to row:

- bow ball
- secured heel restraints at a 3 inch measure
- lights (if there is low light), and
- hatches secure and sealed to ensure buoyancy of shell.

A. Coxed Boats

Eights are not to be rowed without a coxswain. Coxed fours may only be rowed without a coxswain if there is an operational bow-steering mechanism.

B. Sculling and Straight Boats

Sculling and straight boats (sweep boats without a coxswain) require different rules than

coxed boats. In uncoxed boats, the bow person is like a coxswain in many ways and has additional responsibility for equipment as well as the navigation. Coxwains driving these shells should always carry some noise-making device, such as a whistle, on board.

5. Coxswains

All coxswains should have an emergency communication device, such as a cell phone. Coxswains are particularly vulnerable in cold weather and should have proper clothing. When cold weather rowing restrictions are in place, the coxswain must be dressed appropriately and/or wear a floatation suit.

F. WATER SAFETY

Safety measures begin the moment the crew places hands on the boat. From that point forward, the coxswain or bow-man is in control and all rowers must be quiet and pay attention.

1. Launch & Recovery

Launching and recovery should be quick activities. All athletes should be quiet at the dock and expedient in their actions. Pay attention to the coxswain or bow person. Be considerate of other rowers. No horseplay will be tolerated at the dock at any time. Frost, dew and recent rainfall require rowers to observe particular attention at the docks as they can be slippery. After launching, crews with a coach shall row to a designated point and wait for a coach in a launch to accompany them.

2. Traffic Patterns

The normal traffic pattern used on the Mystic and Malden Rivers is posted in each boathouse. Traffic patterns may be modified at any time due to high winds, public boat traffic, regattas or other situations. Changes to the normal traffic pattern must be communicated among all coaches when they occur.

3. On the Water

While on the water, the following rules shall be followed, in order of importance:

- Blind boats (without a coxswain) have right of way.
- Larger shells have right of way over smaller shells due to their decreased maneuverability
- Overtaking crews have the right of way, i.e., crews being overtaken should move to the shore-side.
- Crews landing at the dock have priority over crews waiting to enter the dock to launch.

- Always keep one hand on the oar(s)
- Oarlocks shall remain locked until all athletes are out of the shell.

4. Hazards

The Mystic and Malden Rivers contain hazards that all users, participants, guests, student athletes, rowers, coxswains and coaches must be aware of, including exposure to bacteria in the water column and exposure to contaminants historically found in urban sediment within the river system. Other common hazards are low water, debris, bridges, and other boaters. Crews and coxswains should familiarize themselves with any potential hazards before launching. Coaches should communicate about any known hazards for coxswains and uncoxed boats to check before launching.

Coaches, athletes and participants must adhere to additional protocols to minimize exposure to water hazards inherent in rowing, including:

- no rowing during wet weather and adhere to the Rain Event policy
- no rowing until dry weather rebounds and adhere to the Rain Event policy
- if wet weather occurs while rowing, use sound judgment on continuing or concluding rowing, and adhere to the Rain Event policy
- always use gloves/protective hand gear when pulling up anchors
- always use gloves/protective hand gear when washing down boats/boating equipment
- avoid acute exposure to the water
- do not drink the water
- do not swim in the water
- do not splash water onto yourself or other participants
- do not capsize boats
- do not throw other participants into the water
- recognize that bacteria from the water could cause illness and infection if cuts, abrasions, sores, skin and body orifices come into contact with water
- wear appropriate foot and hand protective gear, and use proper bandages to prevent water from entering cuts and abrasions
- wash all clothing thoroughly which has been exposed to water
- report immediately to the wash down station in the event you are submerged into the water
- alert the Malden High School Athletic Director within two hours of being submerged in water if you or someone else has been submerged into the water
- shower thoroughly after contact with water or being submerged into water
- adhere to all posted signage in and around the water
- wash off immediately and thoroughly if you are submerged in the water
- see a physician and obtain testing if you are submerged in the water
- see a physician and obtain testing if you have any signs or symptoms of waterborne illness or infection

- alert your head coach and the Malden High School Athletic Director if you have been diagnosed with any waterborne illness or infection

G. WEATHER CONDITIONS

1. Rain Event

During rain events is it known that bacteria levels in the Malden and Mystic Rivers may rise to levels unsuitable for boating, and immediate testing may not always be available to determine bacteria levels immediately following a rain event. Rowing and boating are prohibited for the forty-eight (48) hour period following a rain event where precipitation has exceeded ½ inch. Rowing may resume following the forty-eight (48) hour period AFTER the rain event has concluded. In certain circumstances, the Malden High School Athletic Director and/or the City of Malden may prohibit rowing for longer periods in the event bacteria levels are deemed unsuitable for rowing. Decisions to launch are made by the Malden High School Athletic Director.

2. Inclement Weather

When there is inclement weather other than a rain event, for example, lightning, wind, fog, cold, flotsam/jetsam, or debris, Participants shall conform to US Rowing standards as to whether it is safe to go on the water. Decisions to launch are made by the Malden High School Athletic Director.

3. Rowing in Cold Weather

Rowing in cold weather poses potential danger for hypothermia when the water temperature is below 80° F (degrees) and is very dangerous when below 50° F. Rowing when the water temperature is below 50°F should be done with great consideration. Cold air temperatures and any moisture on the body (from being splashed, rain, sleet, snow) can lead to hypothermia. Hypothermia is a swift and incapacitating killer that strikes when the combination of cold weather and moisture work to decrease the body temperature. It can take mere minutes before adults are incapable of helping themselves once hypothermia has set in. Young athletes are particularly at risk of exposure to cold; exposed arms, legs and head heighten the risk.

Frostnip is a lesser cousin of frostbite and it is not full freezing. It usually affects skin on the face, ears and fingertips or toes. Signs are skin turns bright red and then turns to white, accompanied by numbness, and skin may appear blue-white for a while. Slow warming is the best treatment; however do not rub. Be aware that wind can accelerate frostnip to frostbite. Preparation and prevention are essential in protecting against the effects of the cold-water environment. All persons should wear protective clothing (not cotton) appropriate for the conditions and their activity, and as far as possible commensurate with the needs of the rowing motion and activity, with the objective being to keep the body dry and to insulate against heat loss. Coxswains should dress warmly and layer. All individuals should ask themselves before launching if being on the water is the best and only way to train.

4. Rowing in Hot Weather

As with cold weather, preparation and prevention are important in protecting against the effects of heat.

- Wear cool, light, protective clothing
- Use sunscreen with a high SPF factor
- Consider a hat and sunglasses
- Drink plenty of water before, during and after practice
- Address any symptoms of heat stress immediately

5. Rowing in Wind

Rowing in high wind and whitecaps is allowed only at the discretion of a coach and only when accompanied by the coach and safety launch.

6. Other Situations

A. Lightning
At the first sight of lightning, sound of thunder, crews should return to the boathouse.
Crews should never be on the water in a lightning storm. The first priority is to get close to shore; if storm is not upon the shell, follow close to the shoreline and quickly return to the boathouse. If caught in a sudden storm and the boathouse is too far, go to nearest shore, exit the boat and wait for the storm to pass. If lightning and thunder are not accompanied by rain, once 30 minutes have passed after the last thunder or strike of lightning is seen, crews may return to the water at the Coach's discretion. Put another way, rowing may begin again thirty (30) minutes after the last strike of lightening or thunder and any subsequent strike of thunder or lightening triggers another thirty (30) minute delay.

B. Fog
Fog obviously limits sight but also mutes sound. If caught in fog, it is recommended that crews proceed with extreme caution and appropriately slower speeds in the direction of the boathouse. Be prepared to stop quickly. If the fog is too extreme, it may be better to sit still. Be sure to make some noise so that others on the river can be alerted to your presence. Do not row if fog limits visibility to less than 100 meters.

C. Flood or High Water
When the rivers are experiencing high water, crews should take extra care to watch for debris.

D. ***Rowing in Reduced Light***
Boat lights are required when rowing 30 minutes or more before sunrise or 30 minutes or more after sunset. All boats launching or rowing during hours of darkness shall launch with a working bow and stern light. The proper lights for a boat are:

- Stern: white light
- Bow: red/green light
- Launch: as required by the U.S. Coast Guard

H. PERSONAL SAFETY AND EMERGENCY PROCEDURES

Local Emergency Contacts and Phone Numbers

The following important telephone numbers are posted in the boathouse:

- Malden Police Department – 781-397-7171
- Malden Fire Department – 781-397-7383
- Malden Athletic Director – 781-397-6000
- Mystic Valley Head Coach - (781) 388-0222
- Mystic Valley Athletic Director - (781) 388-0222

In Case of Emergency

If there is a health or safety emergency on the water the coach will use his or her judgment and:

- Call 911.
- Call another coach for assistance, if needed.
- Notify Head Coach within two (2) hours.
- When on shore, a coach will contact the Parent/Guardian or designated emergency contact of athlete(s) in distress.
- Head Coach must report all health and safety emergencies that occur immediately to the Malden High School Athletic Director.

I. WHAT TO DO IN VARIOUS SITUATIONS

General Guidelines

1. Stay calm.
2. Under no circumstances should a rower in the water leave the floating shell. NEVER SWIM TO SHORE ALONE, even if you consider yourself a strong swimmer. If a swamped shell is within swimming distance from the shore, the rower should swim the shell to shore, not swim by him or herself. The shell should float.
3. Count to make sure all rowers and the coxswain are accounted for.
4. In an emergency condition, the first action to perform is stopping the shell. Coxswain or bow person should give the command “Weigh enough, hold water!” Don’t ask questions; just respond immediately to the command. Square the blades in the water to bring the shell to a halt.

5. Use these distress signals to communicate to other boats: wave the arms or a shirt above the head, or raise one oar in the air.
6. Approach a shell carefully and from downwind /current of the shell/person if you are driving a launch. Be aware of the prop. Turn off motor when you have reached the crew.
7. If athletes are in cold water, attempt to get as much of the body out of the water as possible. Be still to prevent further heat loss.

Swamped Boat

A shell is swamped when the interior water reaches the gunwales.
1. Stay calm.
2. If the shell is swamped or taking on excessive water, the immediate command is "weigh enough!" If rescue is imminent, the coxswain or bow should direct the rowers to untie. If rescue is not imminent, unload the shell by pairs starting in the middle of the boat, as soon as possible to avoid damage to the boat.
3. The launch should approach the shell carefully between seats 3 and 5 or 4 and 6. Unload rowers by pairs - starting in the middle of the shell - as soon as possible in order to avoid damage to the shell. If all rowers cannot be rescued in one launch, take the middle pairs and then return for the bow and stern pairs and coxswain.
4. Pairs should form "buddies" and keep watch on each other. Pairs can link arms across the hull. The coxswain should buddy with the stern pair (or bow pair in bow-loaded shell).
5. If in a small shell, the rescue launch can stabilize the shell for re-entry. Entering the shell directly from the water may cause damage.
6. If rescue is not imminent, take the following steps:
   First: Remove oars or place them parallel to the shell.
   Second: All persons should move to the two ends of the shell (it is dangerous to roll a shell when near riggers).
   Third: Then roll the shell to form a more stable floatation platform so rowers can either lie on top of the hull or buddies can hold onto each other across the hull.
   Fourth: Do not attempt to roll the shell if rescue is on the way.
7. Coaches should not abandon their own crews to assist another coach with a rescue. Have crews row to the scene and stand off nearby or return to the dock, then assist. Do not overload a launch.

Wakes and/or Waves

1. If approaching wakes are higher than the gunwale, the shell should be turned parallel to the wake to avoid having parts of the shell unsupported by the water. It is possible to split a shell under these conditions. Rower(s) should stop rowing and lean away from the approaching wake, with oar handle(s) on the wake side lifted slightly.
2. If wakes are lower than the gunwale and widely spaced, continue to row without a course adjustment. Closely spaced wakes that are lower than the gunwale may be taken at a 90-degree angle with the bow directly toward them.
3. Turning in waves is tricky; allow plenty of room, energy and time.

Injury

1. Coxswain or bow should give the immediate command: “Weigh enough!”
2. Signal launch if first aid is needed.
3. If no launch is available, have uninjured rowers row the shell back to the boathouse and call for help.

Flipped boat

1. Stay calm and stay with the boat.
2. Count rowers.
3. Determine who will take charge and give directions if no coxswain.
4. Identify any hazards that may affect your recovery attempt – wind, current, etc.
5. Decide how best to move into position to work the shell. Move slowly.
6. Recover any items that have floated away from the shell, if possible.
7. Determine if the shell is in danger of sinking due to damage. If not, proceed as follows to use a launch to drag the shell to shore.
8. If shell is in danger of sinking, stay with the shell until it cannot be used for floatation.
9. Maintain buddy pairs and stay together.

10. If shell is a small boat and can be flipped back and rower can get in, do so.

    a. Place oars parallel to shell in order to ease the flipping. Try not to remove oars from oarlocks.
    b. Pick a side; press down on the rigger to bring the boat over and then reach up and grab the rigger in the air and pull down to right the boat.
    c. Return oars to perpendicular to the boat.
    d. Place handles together in the center of the shell and press them down on the seat area or foot stretchers where they can be stabilized.
    e. Holding the oars in one hand, kick one body up onto the shell. f. Position onto the seat.
    g. Second rower repeats process to re-enter shell. Be careful of the gunwales.

Water Contact/ Submersion

1. Stay Calm.
2. At the conclusion of each practice, all athletes are expected to use hand sanitizer.
3. Oar handles will be cleaned periodically to remove tape residue, bacteria and river water.
4. If a rower falls into the water from a shell or off the edge of the dock, the rower will be completely hosed down and will use soap and water to clean themselves. Athletes will then change clothes and put submerged clothing in a bag to be cleaned separately when they return home. Extra clothing will be provided if the rower does not have any available.

J. WATER QUALITY NOTIFICATION AND USE POLICY

Coaches, Athletic Directors, Student Athletes, Parents/Guardians of Student Athletes, Users and Participants acknowledge waterborne issues exist at times relating to the quality of urban community waterways including the Mystic and Malden Rivers, particularly after heavy rainfall events, including potential exposure to contaminants, toxins, bacteria, waterborne infectious diseases, and other storm related issues impacting water quality.

Coaches, Athletic Directors, Student Athletes, Parents/Guardians of Student Athletes, Users and Participants are encouraged to access available online resources which regularly test and determine water quality levels; use of the Malden River shall be subject to the discretion of the Malden High School Athletic Director. There may be occasions on which the Malden High School Athletic Director deems it necessary to temporarily close access to the Malden River. On these occasions, all Coaches, Athletic Directors, Student Athletes, Users and Participants shall abide by the determination of the Malden High School Athletic Director and shall not use or access the Malden River for rowing until further notification is received.

Notice of closure shall be posted on the Malden High School website and it shall be the responsibility of each Coach, Athletic Director and Participant to regularly monitor and access the notification section for such notifications.

K. ADDITIONAL RESOURCES

Malden High School website: www.maldenps.org

Logan Airport Weather: www.massport.com/about-massport/weather/?AirportID-BOS

Mystic River Watershed Association: www.mysticriver.org

Gentle Giant Rowing Club: www.gentlegiantrowing.org

L. REVISIONS

This Manual and the protocols and guidelines contained herein are subject to change and revision without notice and in the sole discretion of the Malden High School Athletic Director and City of Malden. It is the responsibility of Coaches, Student Athletes, Participants, Users and Guests to be awarene of all changes and revisions.

MALDEN HIGH SCHOOL STUDENT ATHLETE/PARTICIPANT ACKNOWLEDGMENT AND INDEMNIFICATION FORM

I, _____, acknowledge receipt of the Malden High School Crew Safety Manual and Procedures, and agree to comply with all terms, conditions, policies, procedures and protocols outlined in the Manual. I acknowledge that failure to comply may result in my removal from the Malden High School Crew program which decision is non-appealable and in the sole discretion of the Malden High School Athletic Director. I acknowledge that I assume the risk of all loss, injury or damages which may occur from participating in the Malden High School Crew Program, and that the Malden High School and the City of Malden shall not be responsible for any loss, injury or damages, including any bodily injury or harm and/or property damages which I may sustain as a result of participation in this water sports program. I indemnify and hold harmless the City of Malden, the Malden High School, and their agents, servants, employees and officials.

Signed: _____
Printed Name: _____
Address: _____

I, _____, as Parent/Guardian of Student Athlete/Participant whose signature is above, acknowledge receipt of the Malden High School Crew Safety Manual and Procedures, and agree to comply with all terms, conditions, policies, procedures and protocols outlined in the Manual. I acknowledge that my Child/Ward's failure to comply may result in his/her removal from the Malden High School Crew program which decision in non-appealable and in the sole discretion of the Malden High School Athletic Director. I acknowledge that I assume the risk on behalf of my Child/Ward for all loss, injury or damages which may occur from his/her participation in the Malden High School Crew Program, and that the Malden High School and the City of Malden shall not be responsible for any loss, injury and/or damages, including any bodily injury or harm and/or property damages, which my Child/Ward may sustain as a result of participation in this water sports program. I indemnify and hold harmless the City of Malden, the Malden High School, and their agents, servants, employees and officials.

Signed: _____
Printed Name: _____
Address: _____

EMERGENCY CONTACT INFORMATION:

Emergency Contact Name: _____
Relationship to Student Athlete/Participant: _____
Contact telephone: _____

GUEST PARTICIPANT – GUEST ORGANIZATION – GUEST ATHLETIC DIRECTOR ACKNOWLEDGMENT AND INDEMNIFICATION FORM

I, _____, on behalf of _____ acknowledge receipt of the Malden High School Crew Safety Manual and Procedures, and I agree to ensure that all participants in the rowing program of the organization with which I am affiliated shall review and comply with all terms, conditions, policies, procedures and protocols outlined in this Manual. I acknowledge that failure to adhere with and comply with these policies and procedures may result in refusal to permit participants from the organization and/or the organization from using the Malden River, by the Malden High School Athletic Director, which determination is in the sole discretion of the Malden High School Athletic Director. This determination shall be non-appealable.

I acknowledge on behalf of the participants from my organization that my organization and participants assume the risk of all loss, injury and/or damages which may occur from participating in the organization's rowing program and rowing activities, and that the Malden High School and the City of Malden shall not be responsible for any loss, injury and/or property loss or damages, including bodily injury or harm and/or property damages which participants may sustain as a result of participation in this program. My organization indemnifies and holds harmless the City of Malden and the Malden High School, their agents, servants, employees and officials, for any and all personal and/or property loss which may occur as a result of my organization's use of the Malden River and Mystic River and participation in my organization's rowing program.

I acknowledge I am authorized to execute the within Acknowledgment and will ensure that all organization participants will review the Manual and adhere to and comply with policies and procedures outlined in this Manual.

Signed: _____
Printed Name: _____
Title: _____
Organization: _____
Address: _____

NATIONAL WATER MAIN CLEANING CO.
Specializing in today's needs for environmental protection
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Tel: (781) 828-0863 • Fax: (781) 828-4397

INVOICE: 029802

Original Invoice 029802

City of Malden
Engineering Dept.
200 Pleasant Street, Room 617
Malden, MA 02148

Invoice No.: 029802
Date: 6/30/16
Our Job No.: MAL009-1
Your Reference:
Requisition No.:
Authority:

Item/Description	Quantity	Unit Price	Total Price
Services rendered to clean and TV in Malden, MA on June 2, 2016 as follows:			
Combination Vactor Jet Rodder & Mobile TV Studio with crew			
Clean and TV IDDE for City	8 HR	@ $400.00	$3,200.00

Subtotal **$ 3,200.00**

Total **$ 3,200.00**

ANALYTICAL REPORT

Lab Number:	L1611436
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	04/21/16

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1611436
Report Date: 04/21/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1611436-01	BH-1	WATER	MALDEN, MA	04/19/16 12:45	04/19/16

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1611436
Report Date: 04/21/16

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name:	CITY OF MALDEN	**Lab Number:**	L1611436
Project Number:	465.09	**Report Date:**	04/21/16

Case Narrative (continued)

Sample Receipt

The samples were received at the laboratory above the required temperature range. The samples were transported to the laboratory in a cooler with ice and delivered directly from the sampling site.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Melissa Cripps

Title: Technical Director/Representative Date: 04/21/16

INORGANICS
&
MISCELLANEOUS

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1611436
Report Date: 04/21/16

SAMPLE RESULTS

Lab ID: L1611436-01
Client ID: BH-1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 04/19/16 12:45
Date Received: 04/19/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	210		MPN/100ml	1.0	NA	1	-	04/19/16 15:40	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1611436
Report Date: 04/21/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01 Batch: WG885223-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	04/19/16 15:40	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1611436
Report Date: 04/21/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1611436-01A	Bacteria Cup Na2S2O3 preserved	A	N/A	7.2	Y	Absent	E-COLI-QT(.33)
L1611436-01B	Bacteria Cup Na2S2O3 preserved	A	N/A	7.2	Y	Absent	E-COLI-QT(.33)

Container Comments

L1611436-01A

*Values in parentheses indicate holding time in days

Project Name:	CITY OF MALDEN	**Lab Number:**	L1611436
Project Number:	465.09	**Report Date:**	04/21/16

GLOSSARY

Acronyms

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A - Spectra identified as "Aldol Condensation Product".

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1611436
Project Number:	465.09	**Report Date:**	04/21/16

Data Qualifiers

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1611436
Project Number:	465.09	**Report Date:**	04/21/16

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 524.2: 1,2-Dibromo-3-chloropropane, 1,2-Dibromoethane, m/p-xylene, o-xylene
EPA 624: 2-Butanone (MEK), 1,4-Dioxane, tert-Amylmethyl Ether, tert-Butyl Alcohol, m/p-xylene, o-xylene
EPA 625: Aniline, Benzoic Acid, Benzyl Alcohol, 4-Chloroaniline, 3-Methylphenol, 4-Methylphenol.
EPA 1010A: NPW: Ignitability
EPA 6010C: NPW: Strontium; SCM: Strontium
EPA 8151A: NPW: 2,4-DB, Dicamba, Dichloroprop, MCPA, MCPP; SCM: 2,4-DB, Dichloroprop, MCPA, MCPP
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene, Isopropanol; SCM: Iodomethane (methyl iodide), Methyl methacrylate (soil); 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Pentachloronitrobenzene, 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Pentachloronitrobenzene, 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 9010: NPW: Amenable Cyanide Distillation, Total Cyanide Distillation
EPA 9038: NPW: Sulfate
EPA 9050A: NPW: Specific Conductance
EPA 9056: NPW: Chloride, Nitrate, Sulfate
EPA 9065: NPW: Phenols
EPA 9251: NPW: Chloride
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
EPA 8270D: NPW: Biphenyl; SCM: Biphenyl, Caprolactam
EPA 8270D-SIM Isotope Dilution: SCM: 1,4-Dioxane
SM 2540D: TSS
SM2540G: SCM: Percent Solids
EPA 1631E: SCM: Mercury
EPA 7474: SCM: Mercury
EPA 8081B: NPW and SCM: Mirex, Hexachlorobenzene.
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA 8270-SIM: NPW and SCM: Alkylated PAHs.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene, n-Butylbenzene, n-Propylbenzene, sec-Butylbenzene, tert-Butylbenzene.
Biological Tissue Matrix: ***8270D-SIM; 3050B; 3051A; 7471B; 8081B; 8082A; 6020A:*** Lead***; 8270D:*** bis(2-ethylhexyl)phthalate, Butylbenzylphthalate, Diethyl phthalate, Dimethyl phthalate, Di-n-butyl phthalate, Di-n-octyl phthalate, Fluoranthene, Pentachlorophenol.

The following analytes are included in our Massachusetts DEP Scope of Accreditation, Westborough Facility:

Drinking Water
EPA 200.8: Sb,As,Ba,Be,Cd,Cr,Cu,Pb,Ni,Se,Tl; **EPA 200.7**: Ba,Be,Ca,Cd,Cr,Cu,Na; **EPA 245.1:** Mercury;
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, Enterolert-QT.**

Non-Potable Water
EPA 200.8: Al,Sb,As,Be,Cd,Cr,Cu,Pb,Mn,Ni,Se,Ag,Tl,Zn;
EPA 200.7: Al,Sb,As,Be,Cd,Ca,Cr,Co,Cu,Fe,Pb,Mg,Mn,Mo,Ni,K,Se,Ag,Na,Sr,Ti,Tl,V,Zn;
EPA 245.1, SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2340B, SM2320B, SM4500CL-E, SM4500F-BC, SM426C, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F,**
EPA 353.2: Nitrate-N**, SM4500NH3-BC-NES, EPA 351.1, SM4500P-E, SM4500P-B, E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, SM14 510AC, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

Serial_No:04211611:07

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 4/19/16

ALPHA Job #: L1611436

8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: NCA

Address: 45 Dan Road - Suite 115
Canton Ma 02021

Phone: 781-821-0521

Email:

Project Information

Project Name: City of Malden

Project Location: Malden Ma

Project #: 465.09

Project Manager:

ALPHA Quote #:

Turn-Around Time

☐ Standard ☒ RUSH (only confirmed if pre-approved!)

Date Due: 4/21/16 C.O.B

Additional Project Information:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☒ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: VOC: ☐ 8260 ☐ 624 ☐ 524.2	SVOC: ☐ ABN ☐ PAH	METALS: ☐ MCP 13	METALS: ☐ MCP 14 ☐ RCP 15	EPH: ☐ RCRA5 ☐ RCRA8	VPH: ☐ Ranges & Targets ☐ PP13	☐ PCB ☐ PEST ☐ Ranges Only	TPH: ☐ Quant Only ☐ Fingerprint ☐ Ranges Only	E.Coli - Enumeration	SAMPLE INFO: Filtration ☐ Field ☐ Lab to do; Preservation ☐ Lab to do	Sample Comments	TOTAL # BOTTLES
11436-01	BH-1	4/19/16	12:45	SW	CA									X			2

Container Type	P
Preservative	H

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	4/19/16 13:30	AM	4/19/16 13:30

All samples submitted are subject to Alpha's Terms and Conditions
See reverse side

FORM NO 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1612692
Client:	Nangle Consulting Associates 45 Dan Road Suite 115 Canton, MA 02021
ATTN:	Chuck Altobello
Phone:	(781) 821-0521
Project Name:	CITY OF MALDEN
Project Number:	465.09
Report Date:	05/04/16

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1612692-01	BH-1	WATER	MALDEN, MA	04/28/16 11:45	04/28/16
L1612692-02	MR-11	WATER	MALDEN, MA	04/28/16 12:10	04/28/16
L1612692-03	MR-8	WATER	MALDEN, MA	04/28/16 12:25	04/28/16
L1612692-04	MR-6	WATER	MALDEN, MA	04/28/16 12:40	04/28/16
L1612692-05	MR-4	WATER	MALDEN, MA	04/28/16 13:00	04/28/16

Project Name: CITY OF MALDEN **Lab Number:** L1612692
Project Number: 465.09 **Report Date:** 05/04/16

Case Narrative

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Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

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Please contact Client Services at 800-624-9220 with any questions.

Project Name: CITY OF MALDEN **Lab Number:** L1612692
Project Number: 465.09 **Report Date:** 05/04/16

Case Narrative (continued)

E. Coli (MPN)

L1612692-02: The sample has an elevated detection limit due to the dilution required by the sample matrix.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Kelly Stenstrom

Title: Technical Director/Representative Date: 05/04/16

INORGANICS
&
MISCELLANEOUS

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

SAMPLE RESULTS

Lab ID: L1612692-01
Client ID: BH-1
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 04/28/16 11:45
Date Received: 04/28/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	290		MPN/100ml	1.0	NA	1	-	04/28/16 16:00	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

SAMPLE RESULTS

Lab ID: L1612692-02
Client ID: MR-11
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 04/28/16 12:10
Date Received: 04/28/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	<2		MPN/100ml	2	NA	2	-	04/28/16 16:00	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

SAMPLE RESULTS

Lab ID: L1612692-03
Client ID: MR-8
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 04/28/16 12:25
Date Received: 04/28/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	5.2		MPN/100ml	1.0	NA	1	-	04/28/16 16:00	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

SAMPLE RESULTS

Lab ID: L1612692-04
Client ID: MR-6
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 04/28/16 12:40
Date Received: 04/28/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	1.0		MPN/100ml	1.0	NA	1	-	04/28/16 16:00	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

SAMPLE RESULTS

Lab ID: L1612692-05
Client ID: MR-4
Sample Location: MALDEN, MA
Matrix: Water

Date Collected: 04/28/16 13:00
Date Received: 04/28/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab										
E. Coli (MPN)	8.6		MPN/100ml	1.0	NA	1	-	04/28/16 16:00	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09
Lab Number: L1612692
Report Date: 05/04/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Microbiological Analysis - Westborough Lab for sample(s): 01-05 Batch: WG888461-1										
E. Coli (MPN)	<1		MPN/100ml	1	NA	1	-	04/28/16 16:00	121,9223B	KE

Project Name: CITY OF MALDEN
Project Number: 465.09

Lab Number: L1612692
Report Date: 05/04/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1612692-01A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-01B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-02A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-02B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-03A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-03B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-04A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-04B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-05A	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)
L1612692-05B	Bacteria Cup Na2S2O3 preserved	A	N/A	4.4	Y	Absent	E-COLI-QT(.33)

*Values in parentheses indicate holding time in days

Project Name:	CITY OF MALDEN	**Lab Number:**	L1612692
Project Number:	465.09	**Report Date:**	05/04/16

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1612692
Project Number:	465.09	**Report Date:**	05/04/16

Data Qualifiers

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the reporting limit (RL) for the sample.

Report Format: Data Usability Report

Project Name:	CITY OF MALDEN	**Lab Number:**	L1612692
Project Number:	465.09	**Report Date:**	05/04/16

REFERENCES

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 524.2: 1,2-Dibromo-3-chloropropane, 1,2-Dibromoethane, m/p-xylene, o-xylene
EPA 624: 2-Butanone (MEK), 1,4-Dioxane, tert-Amylmethyl Ether, tert-Butyl Alcohol, m/p-xylene, o-xylene
EPA 625: Aniline, Benzoic Acid, Benzyl Alcohol, 4-Chloroaniline, 3-Methylphenol, 4-Methylphenol.
EPA 1010A: NPW: Ignitability
EPA 6010C: NPW: Strontium; SCM: Strontium
EPA 8151A: NPW: 2,4-DB, Dicamba, Dichloroprop, MCPA, MCPP; SCM: 2,4-DB, Dichloroprop, MCPA, MCPP
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene, Isopropanol; SCM: Iodomethane (methyl iodide), Methyl methacrylate (soil); 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Pentachloronitrobenzene, 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Pentachloronitrobenzene, 1-Methylnaphthalene, Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 9010: NPW: Amenable Cyanide Distillation, Total Cyanide Distillation
EPA 9038: NPW: Sulfate
EPA 9050A: NPW: Specific Conductance
EPA 9056: NPW: Chloride, Nitrate, Sulfate
EPA 9065: NPW: Phenols
EPA 9251: NPW: Chloride
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
EPA 8270D: NPW: Biphenyl; SCM: Biphenyl, Caprolactam
EPA 8270D-SIM Isotope Dilution: SCM: 1,4-Dioxane
SM 2540D: TSS
SM2540G: SCM: Percent Solids
EPA 1631E: SCM: Mercury
EPA 7474: SCM: Mercury
EPA 8081B: NPW and SCM: Mirex, Hexachlorobenzene.
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA 8270-SIM: NPW and SCM: Alkylated PAHs.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene, n-Butylbenzene, n-Propylbenzene, sec-Butylbenzene, tert-Butylbenzene.
Biological Tissue Matrix: ***8270D-SIM; 3050B; 3051A; 7471B; 8081B; 8082A; 6020A:*** Lead***; 8270D:*** bis(2-ethylhexyl)phthalate, Butylbenzylphthalate, Diethyl phthalate, Dimethyl phthalate, Di-n-butyl phthalate, Di-n-octyl phthalate, Fluoranthene, Pentachlorophenol.

The following analytes are included in our Massachusetts DEP Scope of Accreditation, Westborough Facility:

Drinking Water
EPA 200.8: Sb,As,Ba,Be,Cd,Cr,Cu,Pb,Ni,Se,Tl; **EPA 200.7**: Ba,Be,Ca,Cd,Cr,Cu,Na; **EPA 245.1:** Mercury;
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT, Enterolert-QT.**

Non-Potable Water
EPA 200.8: Al,Sb,As,Be,Cd,Cr,Cu,Pb,Mn,Ni,Se,Ag,Tl,Zn;
EPA 200.7: Al,Sb,As,Be,Cd,Ca,Cr,Co,Cu,Fe,Pb,Mg,Mn,Mo,Ni,K,Se,Ag,Na,Sr,Ti,Tl,V,Zn;
EPA 245.1, SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2340B, SM2320B, SM4500CL-E, SM4500F-BC, SM426C, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F,**
EPA 353.2: Nitrate-N**, SM4500NH3-BC-NES, EPA 351.1, SM4500P-E, SM4500P-B, E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, SM14 510AC, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Date Rec'd in Lab: 4/28/16

ALPHA Job #: L1612692

Client Information

Client: NCA

Address: 45 Dan Road-Suite 115
Canton Ma 02021

Phone: 781-821-0521

Email:

Project Information

Project Name: City of Malden

Project Location: Malden, Ma

Project #: 465.09

Project Manager:

ALPHA Quote #:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☒ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Additional Project Information:

X1 = drainage

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	ANALYSIS: E.Coli-Enumeration	SAMPLE INFO: Filtration ☐ Field ☐ Lab to do; Preservation ☐ Lab to do; Sample Comments	TOTAL # BOTTLES
12692-01	BH-1	4/28/16	11:45	SW	CA	X		2
02	MR-11	4/28/16	12:10	X1	CA	X		2
03	MR-8	4/28/16	12:25	X1	CA	X		2
04	MR-6	4/28/16	12:40	X1	CA	X		2
05	MR-4	4/28/16	13:00	X1	CA	X		2

Container Type	P
Preservative	H

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
	4/28/16 1400		4/28/16 1400

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

NANGLE CONSULTING ASSOCIATES, INC

APPENDIX B

Environmental Engineering and Land Use Planning

45 Dan Road - Suite 115 Canton, MA 02021 Telephone (781) 821-0521 email: nangle@ncaenv.com Facsimile (781) 821-4182

Table 1.0 Dry Weather Conditions - E. coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml								
	9/12/2013	9/24/2013	7/2/2014	11/5/2014	6/25/2015	7/14/2015	8/25/2015	9/29/2015	4/28/2016
Malden River									
MR-0	980	-	-	-	-	-	-	-	NS-stagnent
MR-1	-	-	-	-	-	-	-	-	NS-stagnent
MR-3	-	-	-	-	-	-	-	-	NF
MR-4	-	-	-	-	-	-	-	-	8.6
MR-4.1	-	-	-	-	-	-	-	-	NF
MR-5	-	-	-	-	-	-	-	-	NF
MR-6	-	-	-	-	-	-	-	580	1.0
MR-6.1	-	-	-	-	-	-	-	-	NF
MR-7	-	-	-	-	-	-	-	-	NF
MR-8	292	-	-	-	-	-	-	-	5.2
MR-8.1	-	-	-	-	-	-	-	-	NF
MR-9	-	-	-	-	-	-	-	-	NF
MR-10	-	-	-	-	-	-	-	-	NF
MR-11	-	-	-	-	-	-	-	-	ND (2.0)
MR-11.1	-	-	-	-	-	-	-	-	NF
MR-12	-	-	-	-	-	-	-	-	-
MR-12.1	-	-	-	-	-	-	-	-	NF
MR-12.2	-	-	-	-	-	-	-	-	-
MR-13	-	-	-	-	-	-	-	-	-
LSP-0-Channel[2]	-	-	-	-	-	-	-	-	-
LSP-3	-	-	-	-	-	-	-	-	-
LSP-4	-	2,000	110,000	3,200	-	-	-	-	-
LSP-9	-	-	-	-	-	-	-	-	-
LSP-10-Channel[2]	-	-	-	-	-	-	-	-	-
CH-1	-	-	-	-	-	<1	-	-	-
C15-MH8.1	-	-	-	-	-	-	-	1,200	-
C46-MH19	-	-	-	-	500	-	-	-	-
E13-MH4 (Elrich)	-	2,000	-	-	-	-	-	-	-
E28-MH8	-	-	-	-	-	-	-	-	-
E28-SP1	-	-	-	-	-	-	-	-	-
E28-SP2	-	-	-	-	-	-	-	-	-
E28-MH1	-	-	-	-	-	19,000	140,000	>483,920	-
E28-MH2W	-	-	-	-	-	9,000	-	-	-
E28-MH2N	-	-	-	-	-	3.1	-	-	-
E28-MH4	-	-	-	-	-	4,500	-	-	-
E28-MH4A	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	82,000	9,800	10,000	5,800	-
F26-MH3	-	-	-	-	-	6,700	>483,920	>483,920	-
NG-C1	-	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	39	-	-	-
P27-MH12	-	-	-	-	-	-	27	-	-
S29-MH1	-	-	-	-	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	-	-	-
S39-MH1	-	-	-	-	-	34	30	-	-
Little Creek									
LC-0	-	-	-	-	3,700	460	-	-	NS-stagnent
LC-N	-	-	-	-	2,400	-	-	-	NS-submerged
LC-S	-	-	-	-	-	-	-	-	NS-submerged
Saugus Branch									
MR-2	550	-	-	-	-	-	-	-	NS-stagnent
MR-2N	-	-	150	490	390	35	310	3,100	NS-stagnent
MR-2S	-	-	130	440	440	75	290	440	NS-stagnent
Town Line Brook									
TL-0[3]	-	-	-	-	-	-	-	-	-
TL-3	-	-	-	-	-	-	-	-	-
TL-9	-	-	-	-	-	-	-	-	-
TL-13	-	-	-	-	-	-	-	-	-
B53-MH7	-	-	-	-	-	-	-	-	-
BP-MH3	-	-	-	-	-	-	-	-	-
S3-MH12[3]	-	-	-	-	-	-	-	-	-
S14-MH4	-	-	ND (1.0)	4.1	-	-	-	-	-
Linden Brook									
B46-MH2	-	<1	-	-	-	-	-	-	-
C18-MH5	-	23,000	11,000	1,300	-	-	-	-	-
C36-MH1	-	-	-	-	-	-	-	-	-
D17-MH1	-	-	-	-	-	-	-	-	-
F1-MH4	-	-	-	-	-	-	-	-	-
F23-MH2	-	13	-	-	-	-	-	-	-
G36-MH2	-	-	1,700	290	-	-	-	-	-
H43-MH1	-	12	-	1,000	-	-	-	-	-
K6-MH1	-	-	-	-	-	-	-	-	-
L5-MH1	-	-	-	-	-	-	-	-	-
LBR-1	-	-	520	88	-	-	-	-	-
M31-MH1	-	12	-	-	-	-	-	-	-
O10-MH1	-	-	-	-	-	-	-	-	-
P24-MH1	-	-	-	-	-	-	-	-	-
S27-MH2	-	-	-	17	-	-	-	-	-
S45-MH4	-	-	-	8.5	-	-	-	-	-
V1-MH1	-	-	-	-	-	-	-	-	-
W26-MH1	-	-	-	-	-	-	-	-	-
W47-MH1	-	-	3,500	1,700	-	-	-	-	-

NS-not sampled
NF-no flow
- not evaluated
ND - None Detected above Reported Detection Limit
(results in parentheses represent the detection limit)
Laboratory certificates contained within attachments

File No. 465.09

Table 2.0 Wet Weather Conditions - E. coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	E. coli (MPN/100ml) 30, 9223B ACTION LEVEL- 235 MPN/100ml	
	11/30/2016	1/3/2017
Malden River		
BH-1	2,900	-
MR-0	NS-stagnent	-
MR-1	NS-stagnent	-
MR-3	NF	-
MR-4	180	-
MR-4.1	870	-
MR-5	190	-
MR-6	43	-
MR-6.1	NF	-
MR-7	NF	-
MR-8	7,000	-
MR-8.1	NF	-
MR-9	NF	-
MR-10	NF	-
MR-11	3.1	-
MR-11.1	NF	-
MR-12	-	-
MR-12.1	NF	-
MR-12.2	-	-
MR-13	-	-
Saint Mary St.	-	-
Fellsmere Pond	-	-
LSP-4	15,000	-
LSP-5.1-Channel	-	-
LSP-9	-	-
LSP-10-Channel	-	-
Little Creek		
LC-0	3,200	-
LC-N	NS-submerged	-
LC-S	NS-submerged	-
P12-MH10	-	-
Saugus Branch		
MR-2	-	-
MR-2N	4,600	-
MR-2S	4,900	-
Broadway/Eastern	-	-
Town Line Brook		
TL-0	-	-
TL-9	-	-
TL-13	-	-
TL-16	-	-
TL-24	-	-
TL-BL-EV	-	-
S3-MH12	-	-
Linden Brook		
C18-MH5	2,400	-
H43-MH1	260	-
LBR-1	480,000	2,000
W47-MH1	3,500	-

NS-not sampled
NF-no flow
- not evaluated

ND - None Detected above Reported Detection Limit
(results in parentheses represent the detection limit)
Laboratory certificates contained within attachments.

File No. 465.09

Table 3.0 Wet Weather Conditions - Ammonia Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Description: Water

Sample Identification	Ammonia (ppm)
	11/30/2016
Malden River	
BH-1	-
MR-0	NS-stagnent
MR-1	NS-stagnent
MR-3	NF
MR-4	2
MR-4.1	0
MR-5	0
MR-6	4
MR-6.1	NF
MR-7	NF
MR-8	0
MR-8.1	NF
MR-9	NF
MR-10	NF
MR-11	6
MR-11.1	NF
MR-12	-
MR-12.1	NF
MR-12.2	-
MR-13	-
LSP-4	-
LSP-9	-
Little Creek	
LC-0	0
LC-N	NS-submerged
LC-S	NS-submerged
P12-MH10	-
Saugus Branch	
MR-2	-
MR-2N	0.5
MR-2S	0.5
Linden Brook	
C18-MH5	1
H43-MH1	0
LBR-1	6
W47-MH1	1

Samples field analyzed using
Hach Ammonia (Nitrogen) Test Strips (0-6.0 ppm).
NS-not sampled
NF-no flow
- not evaluated

Table 4.0 Malden River Boat House - E. Coli Concentrations

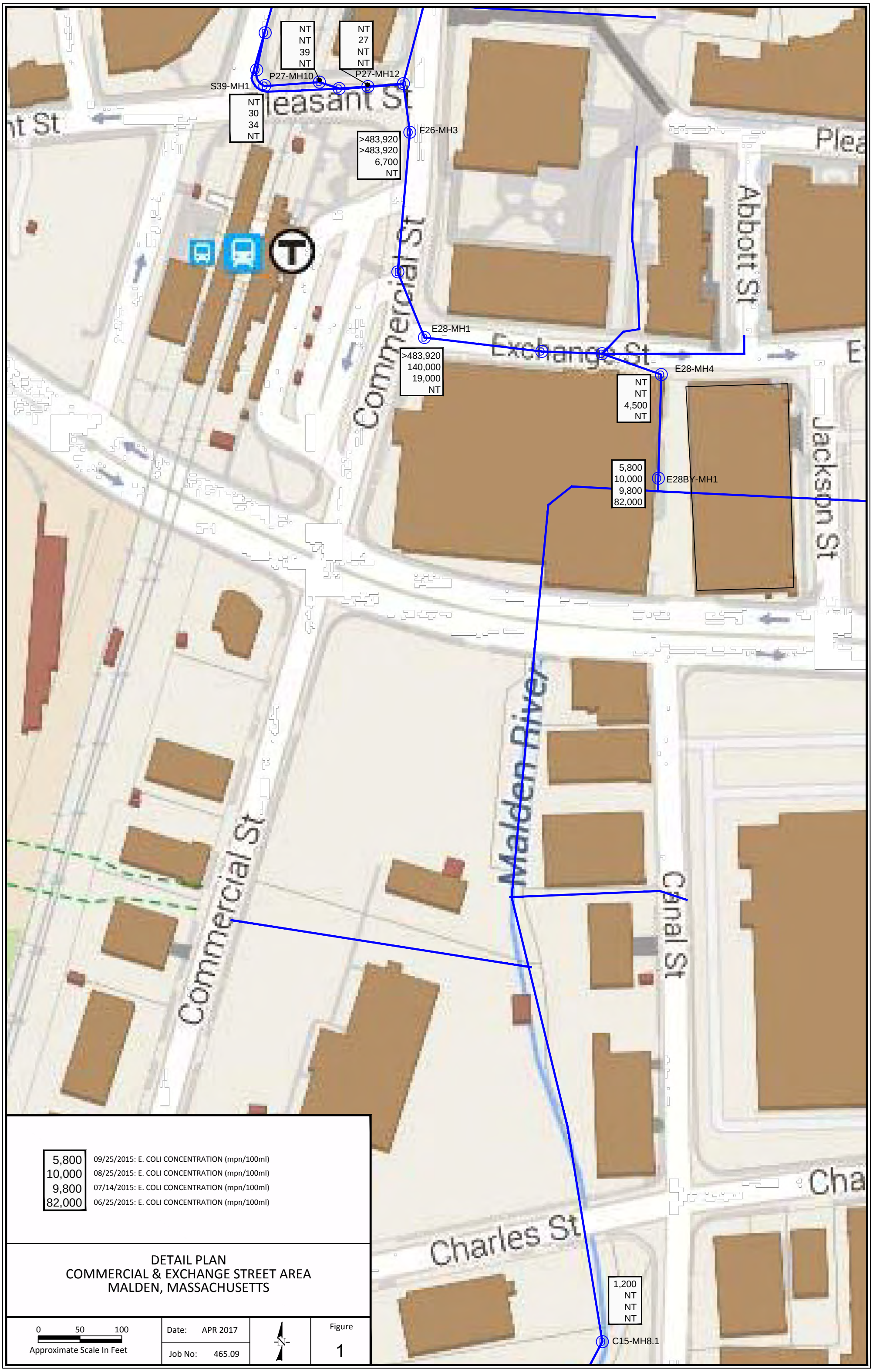
Site Location, Malden River - Malden, MA

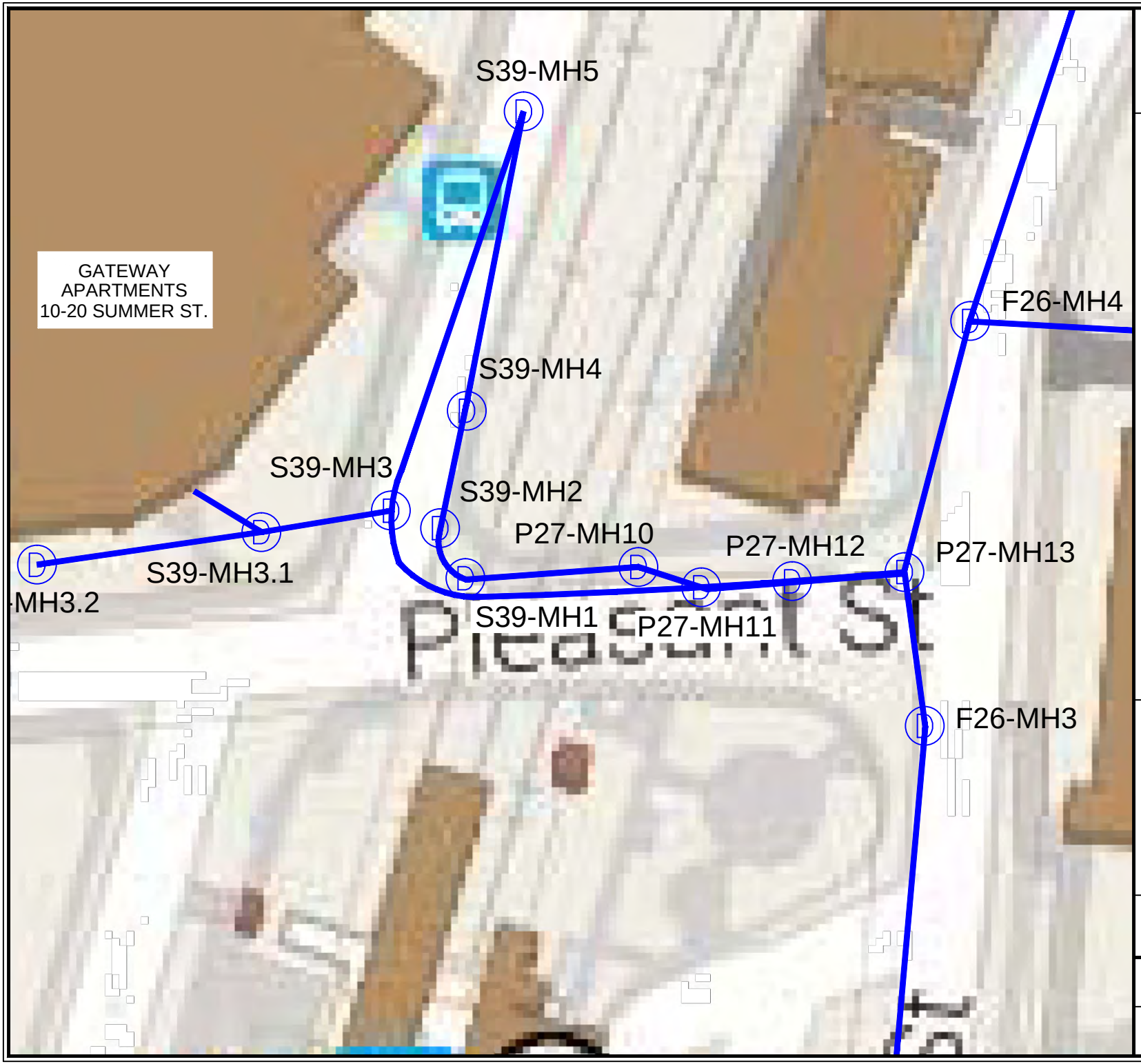
Sample Description: Water

Sample Designation	E. coli (MPN/100ml) 9223B ACTION LEVEL- 235 MPN/100ml				
	4/19/2016	4/28/2016	7/7/2016	10/4/2016	11/30/2016
Sample Collection Time	**12:45**	**11:45**	**13:00**	**13:15**	**7:25**
Time Elasped from Rain Event	**6.45 hrs**	**46.5 hrs**	**51.5 hrs**	**53 hrs**	**10.8 hrs**
Rainfall Amount	**0.02"**	**0.27"**	**0.34"**	**0.03"**	**0.42"**
BH-1	210	290	47	140	2,900

File No. 465.09

Laboratory certificates contained within attachments.


NT
NT
39
NT
NT
27
NT
NT
P27-MH10
P27-MH12
S39-MH1
NT
30
34
NT
F26-MH3
>483,920
>483,920
6,700
NT
Pleasant St
Commercial St
Abbott St
E28-MH1
>483,920
140,000
19,000
NT
Exchange St
E28-MH4
NT
NT
4,500
NT
5,800
10,000
9,800
82,000
E28BY-MH1
Jackson St
Malden River
Canal St
Charles St
1,200
NT
NT
NT
C15-MH8.1
5,800 09/25/2015: E. COLI CONCENTRATION (mpn/100ml)
10,000 08/25/2015: E. COLI CONCENTRATION (mpn/100ml)
9,800 07/14/2015: E. COLI CONCENTRATION (mpn/100ml)
82,000 06/25/2015: E. COLI CONCENTRATION (mpn/100ml)
DETAIL PLAN
COMMERCIAL & EXCHANGE STREET AREA
MALDEN, MASSACHUSETTS
0 50 100
Approximate Scale In Feet
Date: APR 2017
Job No: 465.09
N
Figure
1



NCA
Nangle Consulting Associates, Inc.
45 Dan Road - Suite 115
Canton, Massachusetts

LEGEND

SKETCH PLAN OF SITE

DETAIL PLAN
SUMMER &
PLEASANT STREET AREA
MALDEN
MASSACHUSETTS

0 25 50
Approximate Scale In Feet

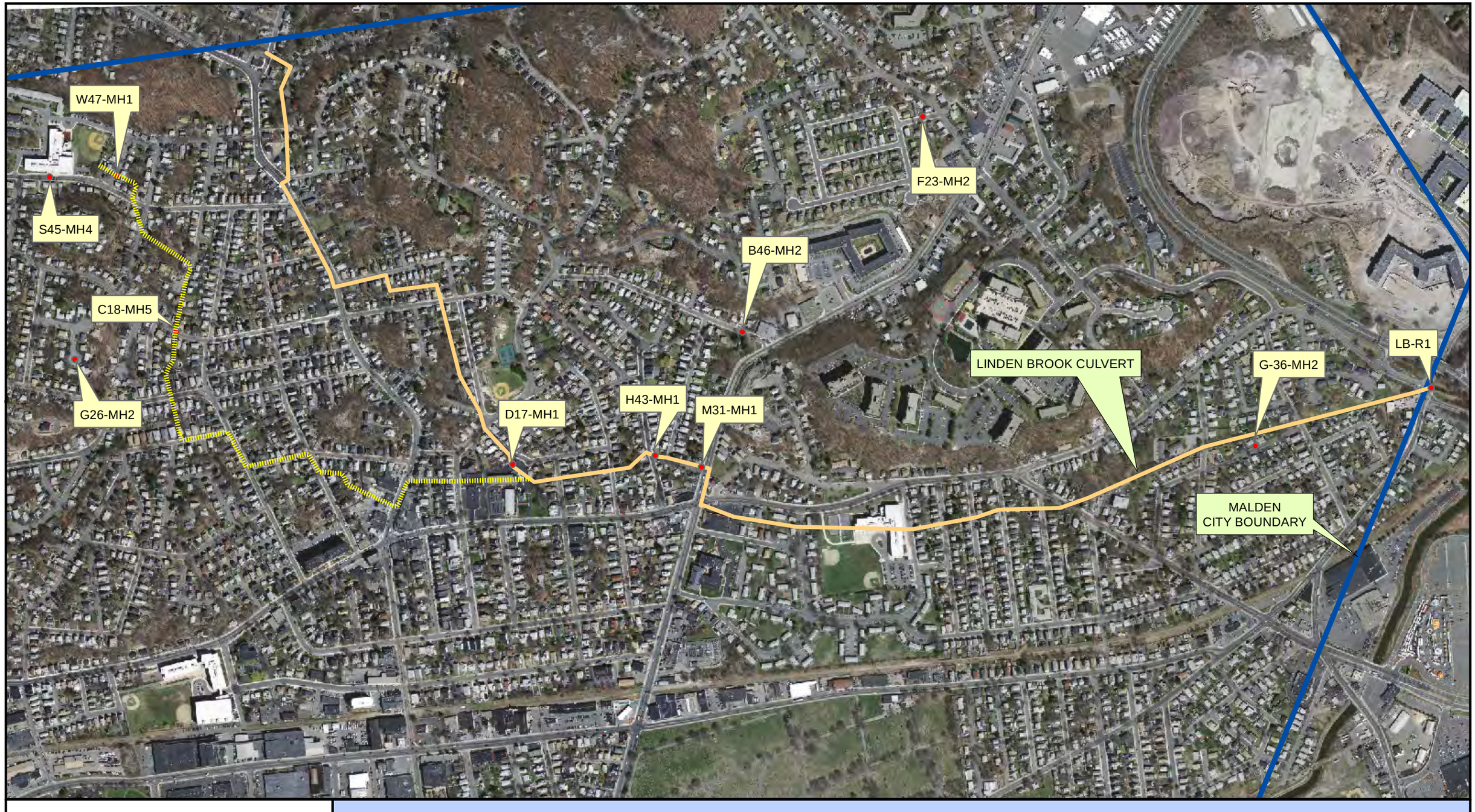
Date:
APR 2017

Job No:
465.09

Figure
2

Figure 3 - Malden River Outfalls

0 55 110 220 330 440
Feet



NANGLE CONSULTING ASSOCIATES, INC.
Environmental Engineering and Land Use Planning
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Figure 4 - Dry and Wet Weather Sampling Program-Linden Brook

MALDEN, MASSACHUSETTS

0 900 1,800 2,700 3,600 Feet