Municipality/Organization:	City of Malden
EPA NPDES Permit Number:	MA041046
MADEP Transmittal Number:	**041088**
Annual Report Number & Reporting Period:	**No. 13: April 1, 2015-March 31, 2016**

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: John J Russell

Printed Name: John J. Russell

Title: City Engineer

Date: 4/29/2016

Part II. Self-Assessment

During this 2015-2016 reporting period the City of Malden has expended over $500,000 for new equipment and personnel to meet the goals of the MS4 Stormwater program. Capital expenditures have included a new street sweeper and Vactor truck. Staffing has also been added to support the catch basin cleaning and inventory program, which is a foundation for improved stormwater quality discharges and the implementation of Best Management Practices (BMPs). More specifically, 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 the highly urbanized study area.

City representatives have been meeting with stewardship organizations such as the Mystic River Watershed Association (MyRWA) and the Friends of the Malden River throughout the last year to promote partnerships and the dissemination of water quality information. The City has also incorporated stormwater quality improvement practices into ongoing development activities. This has included the requirements for onsite retention and a comprehensive evaluation of the drainage and sewage infrastructure in the downtown area. During this reporting period, 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. It has been reported that funding constraints are an issue and conditions continue 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, as well as channel integrity. In addition, the City of Malden is working with regional watershed groups, neighboring communities and civic 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 Illicit Discharge Detection and Elimination (IDDE) Plan. Dry weather sampling events have also identified deficiencies in the over a century old infrastructure that have been repaired and/or replaced. 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 Malden receives substantial dry weather flows from neighboring communities, particularly from Ell Pond in Melrose. In addition to water quality goals, 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 13:
The City has and continues to expand on community outreach through maintenance of an informational website and work 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 the citizens group, referred to as the Friends of the Malden River, has become more actively involved in ecosystem restoration and water quality improvement projects for the Malden River. 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 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 13
MDPW sponsors two (2) paint waste collection and recycling days annually. As summarized in Part V, Section 2.5, these two (2) collection days resulted in the accumulation of a volume that incurred disposal costs of approximately $10,000. 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 13:
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 surface water body 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 13:

The Stormwater Compliance Team spoke to Malden school students at the Beebe and Ferrway Schools regarding 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 13:
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 in areas of public outreach and curriculum development.

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 13:

The City of Malden is currently working 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 Massachusetts Department of Environmental Protection (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.

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. Additional outreach activities for the community included a public meeting conducted by the City and MyRWA on understanding rain gardens.

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 13:
The recently completed South Broadway Park restoration project has included significant stormwater quality enhancement measures for the Town Line Brook watershed. 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 13:

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 was replaced this permit year.

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 13:
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 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 13:

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 13:
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 13:
The reorganization of Engineering and MDPW support staff has advanced the understanding, communication 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 13:
During this permit year, four (4) dry weather sampling events were 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 13:
A summary table with historic dry weather sampling results, together with figures depicting approximate sample locations may be referenced as Appendix B. Following seasonal changes, dry weather sampling will continue during the next permit year and a wet weather sampling event is proposed to be performed during the next qualifying rainfall event.

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 13:

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.

NCA's initial dry weather sampling event for this reporting period was conducted on 25 June 2015. A summary table with dry weather sampling results obtained this reporting period, as well as historic dry weather sampling results, together with figures depicting approximate sample locations may be referenced in Appendix B. During the 25 June 2015 dry weather sampling event, NCA also sampled manhole E28BY-MH1, which is located between Route 60 and Exchange Street. 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 was collected from E28BY-MH1during this reporting period, with an E. coli level of 82,000 MPN/100 ml detected. Based upon a review of historic plan information, as well as field observations, it appears the 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 an evaluation of the drainage network proximate to the Exchange and Florence Street area was conducted.

Due to the high levels of E. coli encountered at E28BY-MH1, an additional sampling round was conducted on 14 July 2015 by the Stormwater Compliance Team at this location and 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 initially encountered during the 14 July sampling event. A significant decrease in E. coli levels was detected at manhole P27-MH12 (27 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets, 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 high levels detected during the 25 August sampling event, three (3) additional E. coli samples were collected on 25 September 2015. Elevated E. coli concentrations were again encountered, with a concentration of >483,920 MPN/100ml detected at F26-MH3 and downstream manhole E28-MH1. A reduction in E. coli concentrations was detected at E28BY-MH1, where a concentration of 5,800 MPN/100ml was encountered. To determine if the elevated E. coli levels encountered within the drainage system in the Exchange Street area were impacting the Malden River, a sample was collected from the closest accessible manhole upstream of the river. This manhole, (C15-MH8.1) is located south of Charles Street and approximately 330 feet north of

the Malden River. An E. coli level of 1,200 MPN/100ml was detected and 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 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. As the comprehensive assessment of the drainage system in the Exchange Street/Commercial Street area reveled no illicit connections or discharges, it is likely that the elevated E. coli levels are attributable to sewer discharge infiltration. In response to the observations recorded within the Exchange Street area, representatives of 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. The City has allocated targeted emergency funding from the upcoming sewer repair contract to re-line the sewer lines in Pleasant and Exchange Streets, however according to City representatives, this work will not begin until at least August of 2016. In the interim, the City is in the process of hiring a water main company to camera the area of concern to investigate as necessary. Following the winter season, an increase in sampling frequency for E. coli will be initiated in the Pleasant and Exchange Street area.

In addition to the above, the sampling of baseline water flow from MR-2N and MR-2S was conducted, which receive flows from the Saugus Branch. Representatives of MyRWA have met with the City and identified this dry weather flow as a potential issue of concern, based upon the results of their sampling efforts. During the four (4) sampling events, E. coli levels ranged from 35 MPN/100 ml (MR-2N) to 3,100 MPN/100 ml (MR-2N) were identified. With the exception of the 3,100 MPN/100 ml encountered at MR-2N, the levels detected were within the range identified by NCA during past sampling events. It should be noted that these locations were sampled by MyRWA in June of 2013, with elevated bacterial levels reported. At that time, to further investigate the elevated bacteria loadings identified in June 2013, NCA reviewed the MyRWA outfall monitoring data, as well as online U. S. Geologic Survey (USGS) precipitation data and noted that an antecedent rainfall event approximating the recommended precipitation limit had occurred in the area on 24 June 2013.

Additional assessment activities conducted this reporting period included an evaluation of the drainage network which discharges into Little Creek, including manhole C46-MH19. An E. coli concentration of 500 MPN/100 ml was encountered at C46-MH19, which is similar to the results obtained from prior sampling events. To assess the discharge point of the drainage network for this area, several samples were collected within Little Creek. Samples were collected from LC-0 (base flow from Little Creek) and LC-N (northern pipe invert). An E. coli concentration of 3,700 MPN/100 ml was detected at LC-0, while an E. coli level of 2,400 MPN/100 ml was encountered at LC-N. It should be noted that there was very limited water flow observed within Little Creek during sample collection. The continued evaluation of the drainage network associated with C46-MH19 will be performed next reporting period.

Additional details pertaining to dry weather inspections 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 13:
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. 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 13:
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 13:
The City continues to implement its 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 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. 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 13:
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 13:
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 13:
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.

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 13:
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. This has involved the upgrade of private sewer connections to the municipal system, removal of illicit discharge connections and the cleanup/maintenance of private properties exhibiting the potential to adversely contribute to wet weather runoff.

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 13:
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 13:
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 13:
In addition to increased engineering involvement in daily work practices, the City has substantially increased its DPW staff. Day to day responsibilities for implementation of the stormwater compliance program has been given to the Water Department and 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. In addition, during this permit year, MyRWA, in conjunction with Horsley-Whitten Group held a series of surface water quality education seminars for City staff.

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 13:
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 13:
Several meetings and two (2) site walks were held with DCR last reporting period concerning 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 13:
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 13:
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 includes bank clean up, potential public opportunities and enhancement alternatives for the Malden River Corridor. During last reporting period, bank stabilization measures were completed and significant compromises to the drainage infrastructure that conveys both groundwater outbreak and drainage flow in the area of Fellsmere Pond were identified and addressed. In November 2015, hydro-raking was performed at Fellsmere Pond by the firm of Aquatics Control and involved the removal of approximately 50 – 60 cubic yards of vegetation and sediments.

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 13:

The ongoing maintenance program includes repairs to catch basins and laterals, which reduces the potential for sediment entrainment and reduces flooding issues. During the 2015-2016 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 23 catch basin structures
- Replacement/restoration of 6 sewer manhole structures
- Replacement/restoration of 3 drain manhole structures
- Clearing of 4,200 linear feet of drain laterals
- Cleaning of 200 catch basins

In addition, the following capital improvements were purchased during this permit year:

- Vactor truck $360,000
- Water pump $3,500
- Truck repairs $7,800
- Vactor/backhoe repairs $3,200

- Misc. (tools, attachments) $5,500

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 13:

During the last reporting period, a $3 million dollar contract (2014 S-1) was signed by the City for extensive sewer relining/cleaning services. This contract was completed in April of 2015 with the finalization of several punch list items. In addition, the City has allocated targeted emergency funding from the next sewer repair contract to re-line the sewer lines in Pleasant and Exchange Streets (See BMP 3-3), however according to City representatives, this work will not begin until at least August of 2016. In the interim, the City is in the process of hiring a water main company to camera the area of concern to investigate as necessary.

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 13:
No SSOs were identified during Year 13. The continued assessment of possible grease blockages within a sewer siphon located at the intersection of Salem and Lynn Streets that passes beneath Linden Brook was conducted this reporting period. 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 13:
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 13:
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 the recently promulgated revision 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

See Appendix A

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	$ 650,000 – 750,000

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	$10,000
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	260 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	3
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	200
7.4	Storm drain cleaned	4,200 LF
7.5	Qty. of screening/debris removed from storm sewer infrastructure	400 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	$50,000
7.13	Street sweepers purchased/leased	1
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

45 Dan Road - Suite 115 Canton, MA 02021 Telephone (781) 821-0521 email: nangle@ncaenv.com Facsimile (781) 821-4182

CITY OF MALDEN

Illicit Discharge Detection and Elimination Program
Semi-Annual Status Report

July 1, 2015 – December 31, 2015

Prepared by:

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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 July through 31 December 2015 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 led to the removal of illicit connections/discharges and substantial reduction of historic flooding concerns. During this reporting period the Stormwater Compliance Team has added additional MDPW staff and has expanded its capabilities through the acquisition of a new vacuum truck to improve the efficiency of maintenance activities.

This report has been prepared to document and summarize IDDE activities that have been undertaken by the City during the July 2015 through December 2015 reporting period and identify key goals and objectives to be considered during future phases of plan implementation. The targeted monitoring of isolated dry weather flows containing discrete bacteria loadings and outfall monitoring has been performed. Utilizing the data and information obtained during this reporting period, an updated work plan of prioritized tasks for the next 6 month period has also been prepared and is included within Section 5.0 of this report.

2.0 DOCUMENTED ILLICIT DISCHARGES AND CONNECTIONS

During this reporting period, no illicit discharges/connections were identified. 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 2015 – DECEMBER 2015)

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.

IDDE Program activities continue to focus upon the sampling of target areas identified during dry weather sampling events through the continued implementation of mass balance flow isolation studies. Dry weather inspections are driven in large part by the results of dry weather sampling at outfalls which discharge to surface water conveyances, principally the Malden River, Lower Spot Pond Brook, West End (Edgeworth Brook) Culvert, Little Creek, Linden Brook and the Town Line Brook. 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.

As described in prior status reports, a comprehensive dry weather sampling effort using multiple lines of evidence testing was performed by representatives of USEPA and NCA in the fall of 2012. The focus of this extensive USEPA analytical program was directed towards the isolation of potential human based contributions to dry weather flows, using an approach that greatly exceeds the limitations of simple bacteria sampling. Specifically, this approach was intended to resolve traditional limitations involving reliance upon bacteria analysis associated with animal waste contributions. NCA is continuing to work with Alpha Analytical to develop representable and low cost analytical methods to quantify caffeine levels in collected water samples. If successful, additional targeted sampling of priority areas utilizing this approach, as well as additional lines of evidence will be performed.

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. In addition, their efforts have led to the identification of infrastructure needs, rapid response to illicit discharges, posting of outfall signage, general system maintenance and mitigation of environmental conditions of concern as they are being identified.

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)

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 the Mystic River Watershed Association (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 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, nine (9) of which have been identified as flowing during dry weather conditions. Periodic dry weather sampling has been performed by NCA, MyRWA and the USEPA.

During this reporting period, three (3) sampling events were conducted within the Exchange Street/Florence Street portion of the Malden River watershed 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 (Figure 5). As outlined with the last status report, 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. Based upon a review of historic plan information, as well as field observations, it appears the 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 at E28BY-MH1, an additional sampling round was conducted on 14 July, 2015 by the Stormwater Compliance Team at E28BY-MH1 and several upstream drain manholes located on Exchange Street, Commercial Street and Pleasant Street. As shown on Table 3.0 and Figure 5, an E. coli concentration of 9,800 MPN/100ml was encountered at E28BY-MH1. Elevated E. coli concentrations were 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 (Figure 5).

As summarized on Table 3.0 and Figure 5, 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 initially encountered during the 14 July sampling event. A significant decrease in E. coli levels was detected at manhole P27-MH12 (27 MPN/100ml), which is located at the intersection of Pleasant and Commercial Streets, 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 high levels detected during the 25 August sampling event, three (3) additional E. coli samples were collected on 25 September 2015. Elevated E. coli concentrations were again encountered, with a concentration of >483,920 MPN/100ml detected at F26-MH3 and downstream manhole E28-MH1. A reduction in E. coli concentrations was detected

at E28BY-MH1, where a concentration of 5,800 MPN/100ml was encountered. To determine if the elevated E. coli levels encountered within the drainage system in the Exchange Street area were impacting the Malden River, a sample was collected from the closest accessible manhole upstream of the river. This manhole, (C15-MH8.1) is located south of Charles Street and approximately 330 feet north of the Malden River (Figure 5). As shown on Table 3.0, 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. Further, the inspection of E39-MH1 revealed strong sewage odor and the evaluation of both the sewage and drainage infrastructure indicated that the invert elevations for the piping systems were very close. As the comprehensive assessment of the drainage system in the Exchange Street/Commercial Street area reveled no illicit connections or discharges, it is likely that the elevated E. coli levels are attributable to sewer discharge infiltration. In response to the observations recorded within the Exchange Street area, representatives of 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. The City has allocated targeted emergency funding from the upcoming sewer repair contract to re-line the sewer lines in Pleasant and Exchange Streets, however according to City representatives, this work will not begin until August of 2016. In the interim, the City is in the process of hiring a water main company to camera the area of concern to investigate as necessary. Following the winter season, an increase in sampling frequency for E. coli will be initiated in the Pleasant and Exchange Street area.

In addition to the above, the sampling of baseline water flow from MR-2N and MR-2S was conducted, which receive flows from the Saugus Branch. Representatives of MyRWA have met with the City and identified this dry weather flow as a potential issue of concern, based upon the results of their sampling efforts. As shown on Table 3.0, during the three (3) sampling events, E. coli levels ranged from 35 MPN/100 ml (MR-2N) to 3,100 MPN/100 ml (MR-2N) were identified. With the exception of the 3,100 MPN/100 ml encountered at MR-2N, the levels detected were within the range identified by NCA during past sampling events. It should be noted that these locations were sampled by MyRWA in June of 2013, with elevated bacterial levels reported. At that time, to further investigate the elevated bacteria loadings identified in June 2013, NCA reviewed the MyRWA outfall monitoring data, as well as online U. S. Geologic Survey (USGS) precipitation data and noted that an antecedent rainfall event approximating the recommended precipitation limit had occurred in the area on 24 June 2013.

The Stormwater Compliance Team has conducted numerous dry weather sampling events to investigate the elevated E. coli levels encountered previously at LSP-4, an outfall for the drainage system located within Eldrich Drive (Figure 6). 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, the focus of assessment activities 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. Recommendations made by the SCT involved restoring the integrity of the main drainage line to stop the discharges that have been documented at LSP-4.

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 has decreased significantly 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. Field observations noted at that time by NCA included an increased discharge relative to prior sampling events. According to the City Engineering Department, the Eldrich Drive complex is under new ownership and the City has attempted to contact the property owner numerous times to discuss the sampling results, however the owner has been unresponsive. Accordingly, more formal enforcement measures are under consideration at this time.

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 7, 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.

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 8) 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 8) 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 8. 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. After the winter season, dry weather sampling will be continued within the Linden Brook watershed.

During the September 2012 sampling event, conducted with representatives of the USEPA, a water sample was collected from outfall LBR-1 (Figure 8), 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. Although maintenance was routinely performed on this siphon, the extent of grease build up indicates that a higher frequency of cleaning and maintaining is necessary to further understand the condition.

> 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.

Based upon the "inconclusive finding" cited by CDM Smith, higher frequency inspections of the siphon and related service connections have been performed. During the inspections, which are conducted on a weekly basis, grease cutter and enzymes are added on an as needed basis. The higher frequency inspections, as well as dry weather sampling of LBR-1 will be continued during the next reporting period.

3.2 Drainage System Mapping-IDDE Inspection Program (MDPW)

The City has converted its paper storm drain system mapping to a working GIS format through the compilation of digitized plans, field GPS data collection and planimetric mapping information obtained from recent aerials. In addition, drainage infrastructure information including components pipe sizes, type, connections and flow parameters are also inventoried as a part of the ongoing system wide maintenance, service and inspection program. Upon the identification of previously unknown dry weather flow, the MDPW personnel notify engineering and outside technical staff to further investigate the conditions identified.

3.3 Inflow Infiltration Sewer System Evaluation & Capacity Analysis

The City of Malden has also completed a comprehensive Infiltration and In-flow (I&I) study for its municipal sewer system. CDM Smith, on behalf of the City, has prepared a Phase 3 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 is being expanded to include the re-lining of lines in Pleasant and Exchange Streets, which will be followed by higher frequency sampling for E. coli to assess the effectiveness of the repairs relative to the apparent exfiltration of sewerage that is impacting the nearby stormwater drainage system.

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. The dry weather sampling program being performed has identified several target areas of intermittent bacteria loadings and infrastructure needs which have been addressed to improve stormwater quality and reduce flooding impacts. 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. Specifically, the SCT program is now under the direction of the Water Department Superintendent.

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. It must be emphasized that ecosystem restoration efforts along the Malden River, including the River's Edge project, the capping of the former General Electric site and related activities have significantly increased animal and waterfowl populations within the Malden River corridor. For example, swan habitats, once not present in the area, have increased substantially within the oxbow for the Malden River. The City is working to integrate inspections and upgrade programs into community development practices, particularly involving tie-ins to the mains which have and are being addressed by CDM Smith, to bring more focus to this condition that is arising from over a century old infrastructure.

During the next reporting period, dry weather sampling and mass balance flow isolation studies will be performed to address the issues described within this submittal, as well as any new issues that are identified. Of particular importance are the implementation of enforcement activities to address the continued seepage of sewerage residuals into the drainage system at LSP-4 and the probable compromises to the sewer infrastructure in Pleasant and Exchange Streets. The use of multiple lines of evidence testing for discharges to the Malden River is also a priority to be met.

Table 1.0 Summary of Illicit Connections/Discharges identifed as of 12/31/2015

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

Total Illicit Flow Removed to Date: ***260 gpd*** ***(94,900 gal/yr)***

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 12/31/2015

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	Commercial/Exchange Sts.	Dry Weather Flow	Evaluation Ongoing
Flow 29	Summer Street	Dry Weather Flow	Evaluation Ongoing

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
Malden River																		
MR-0	-	-	9,200	-	-	-	3,090	-	-	490	980	-	-	-	-	-	-	-
MR-1	-	-	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-4	-	-	220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-5	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-6	-	-	4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	580
MR-8	-	-	-	-	-	-	-	-	-	-	292	-	-	-	-	-	-	-
MR-11	-	-	ND (1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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.

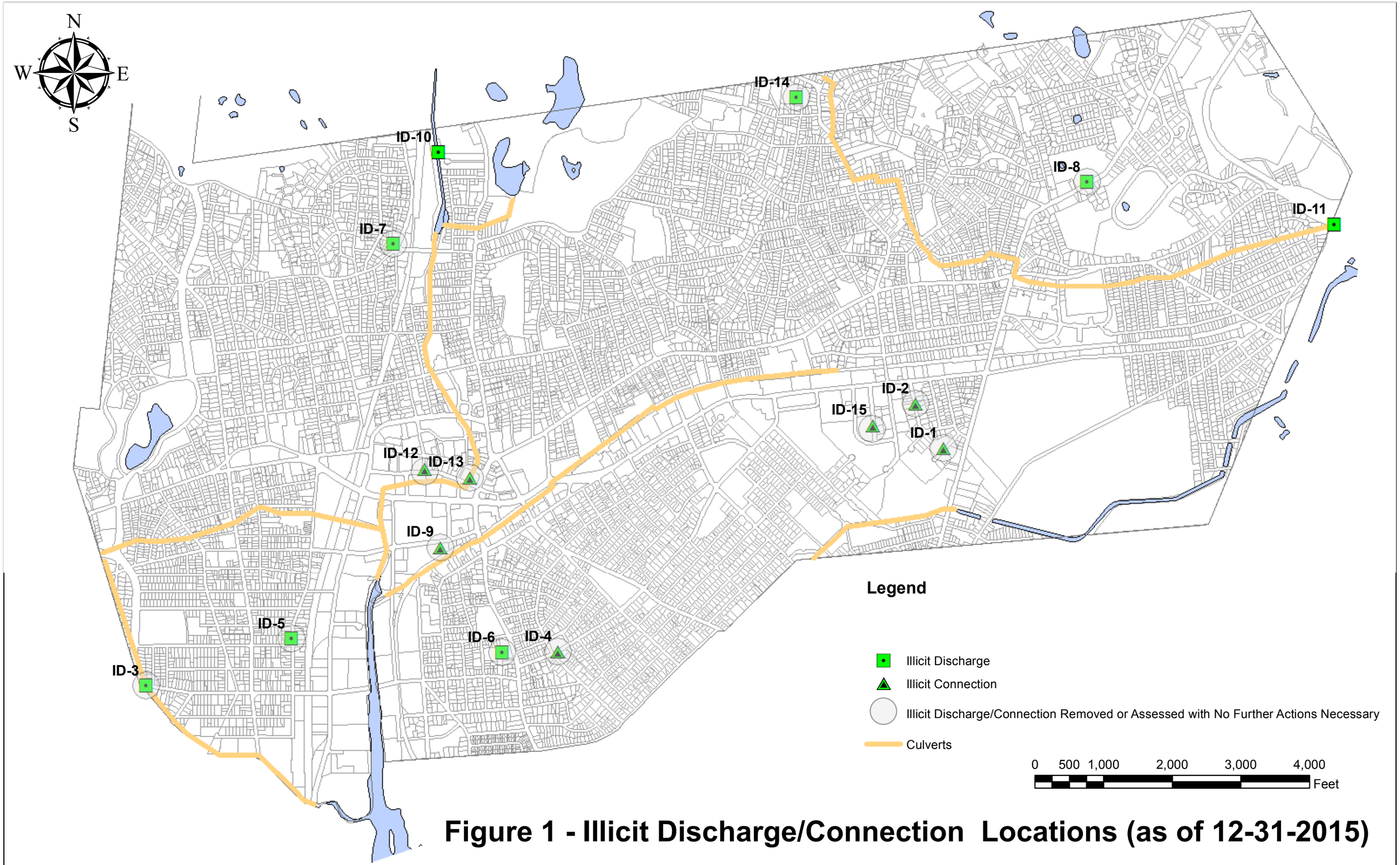


Figure 1 - Illicit Discharge/Connection Locations (as of 12-31-2015)

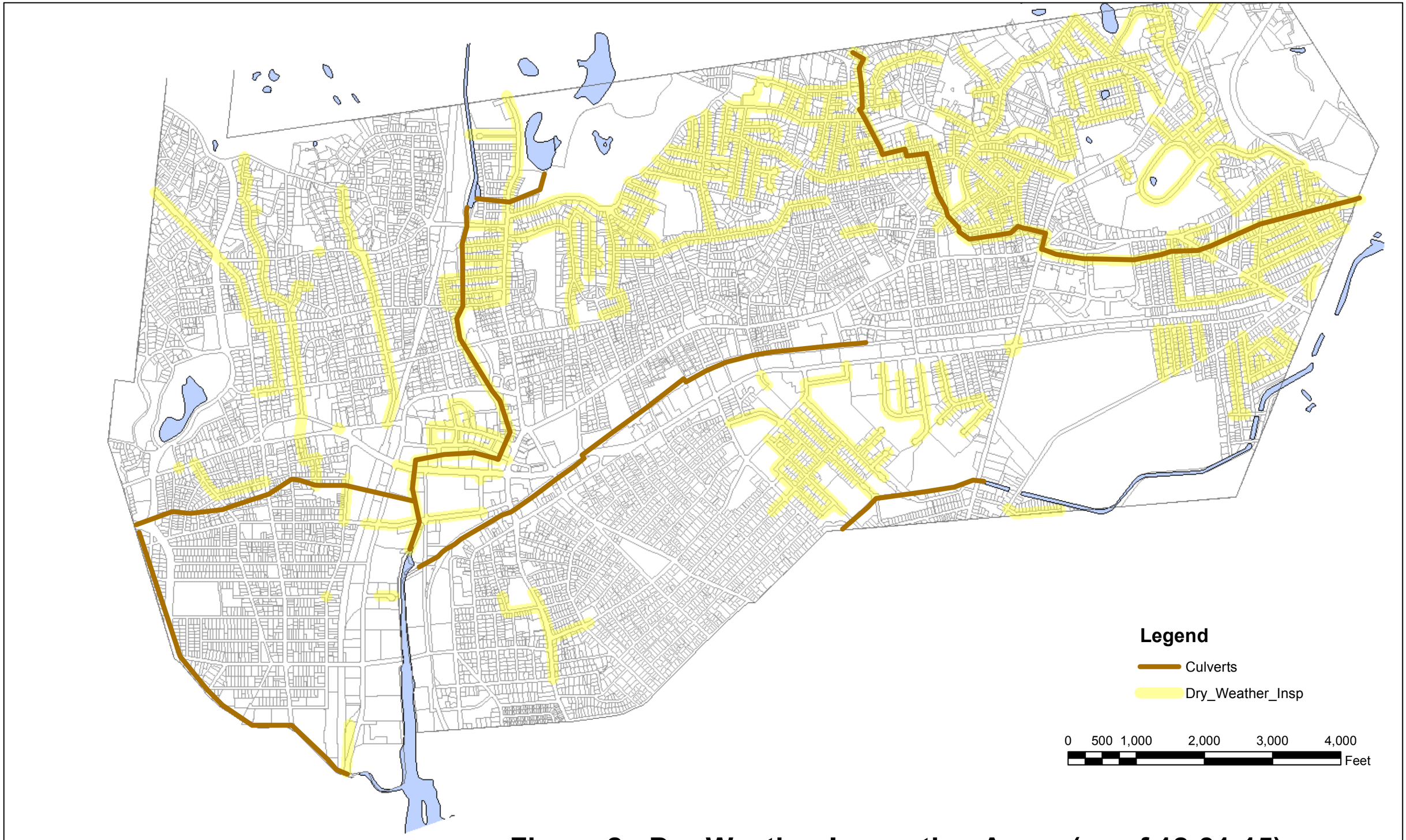


Figure 2 - Dry Weather Inspection Areas (as of 12-31-15)

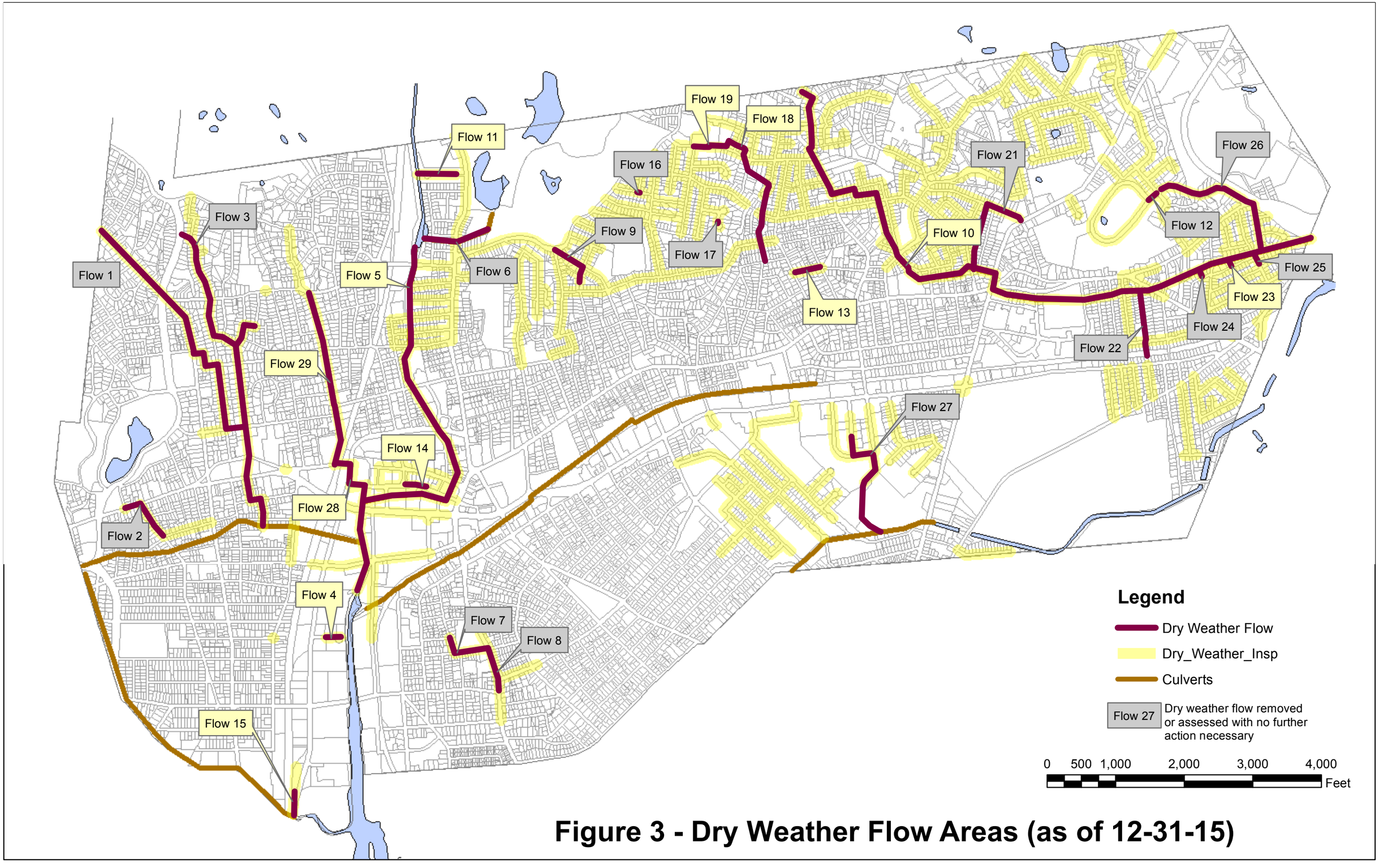
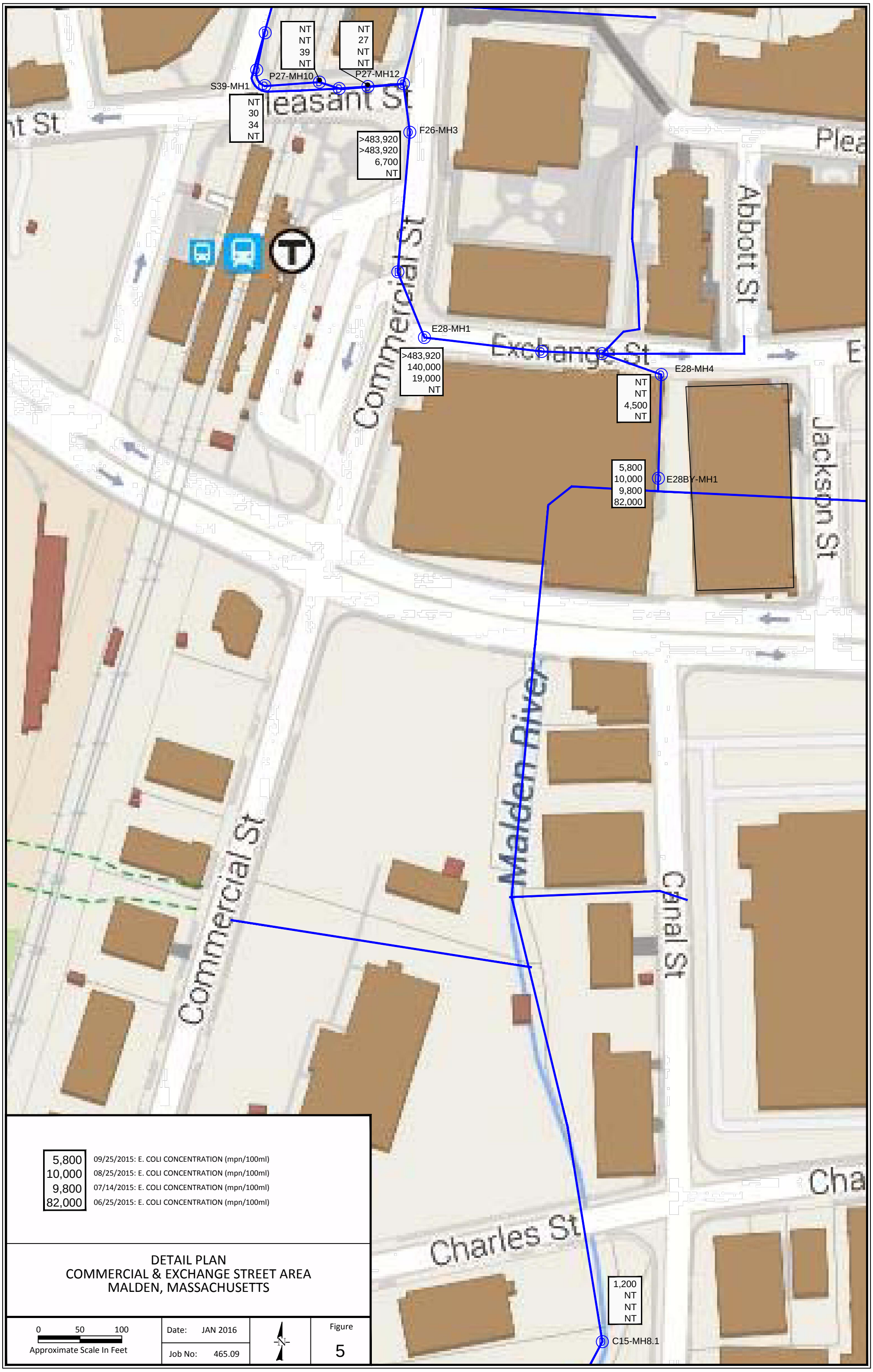


Figure 3 - Dry Weather Flow Areas (as of 12-31-15)

NANGLE CONSULTING ASSOCIATES, INC.
Environmental Engineering and Land Use Planning
369 Turnpike Street, Canton, Massachusetts 02021

Figure 4 - Malden River Outfalls

0 55 110 220 330 440
Feet


NT
NT
39
NT
NT
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NT
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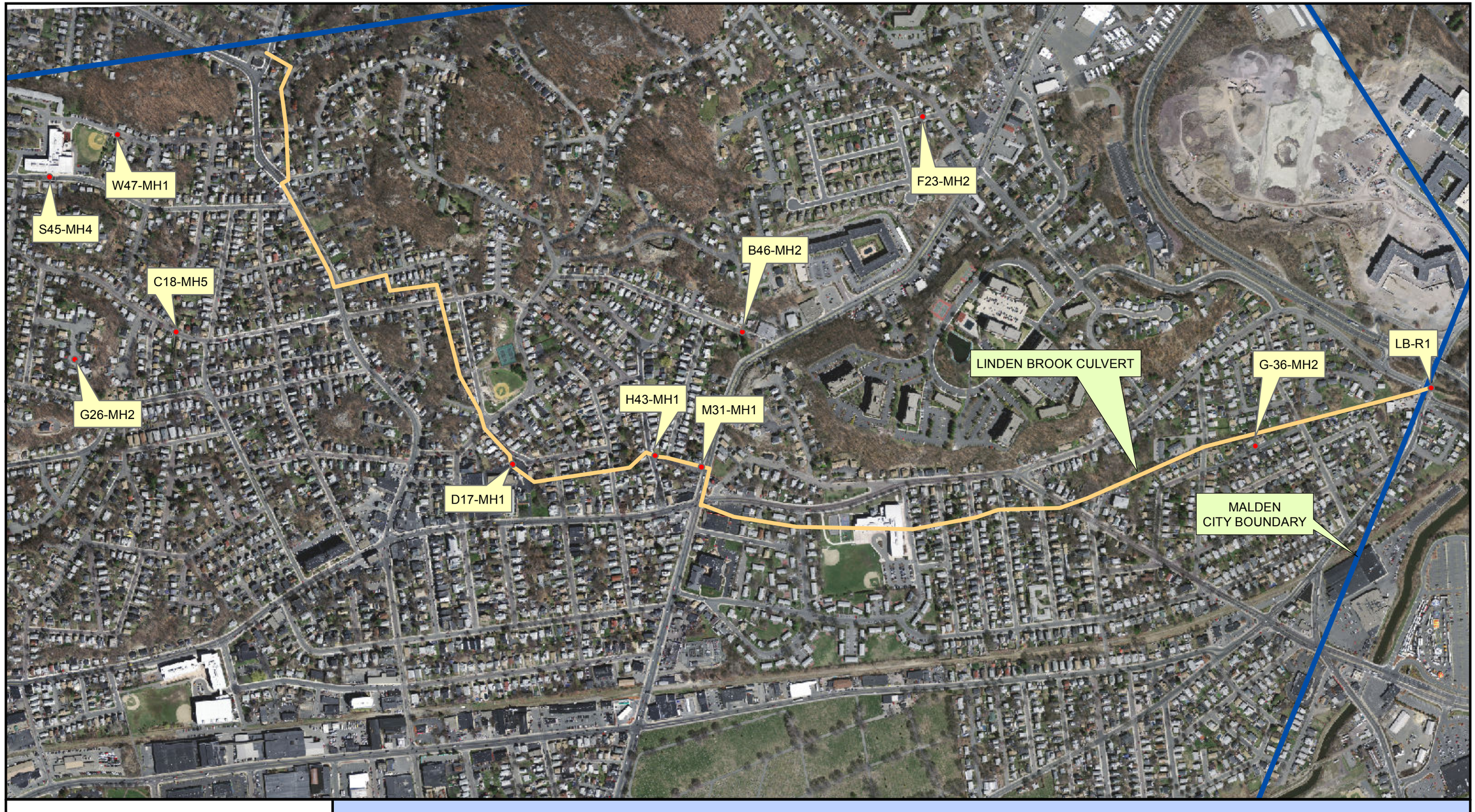
P27-MH10
P27-MH12
S39-MH1
NT
30
34
NT
F26-MH3
>483,920
>483,920
6,700
NT
Pleasant St
Commercial St
Abbott St
E28-MH1
>483,920
140,000
19,000
NT
Exchange St
E28-MH4
NT
NT
4,500
NT
5,800
10,000
9,800
82,000
E28BY-MH1
Jackson St
Malden River
Canal St
Charles St
1,200
NT
NT
NT
C15-MH8.1
5,800 09/25/2015: 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: JAN 2016
Job No: 465.09
Figure
5

Figure 6 - Lower Spot Pond Brook Outfalls

Figure 7 - Town Line Brook Outfalls



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Environmental Engineering and Land Use Planning
960 Turnpike Street, Canton, Massachusetts 02021

Figure 8 - Dry Weather Sampling Program-Linden Brook

MALDEN, MASSACHUSETTS

0 900 1,800 2,700 3,600 Feet

CITY OF MALDEN

Illicit Discharge Detection and Elimination Program
Semi-Annual Status Report

January 1, 2015 – June 30, 2015

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

TABLE OF CONTENTS

TABLES

ATTACHMENTS

FIGURES

1.0 INTRODUCTION

This status report pertains to the period of 1 January through 30 June 2015 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 repairs to components of the drainage infrastructure. To support this effort, a comprehensive GIS mapping and catch basin cleaning/repair program has been developed, 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 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. To address the constraints associated with an aging 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 water quality concerns. These direct response mitigation/repair measures have led not only to the removal of illicit connections/discharges, but improved flow conveyance to eliminate historic flooding concerns. During this reporting period the Stormwater Compliance Team has added additional MDPW staff and has expanded capabilities through the acquisition of a new vacuum truck to improve the efficiency of maintenance activities.

This report has been prepared to document and summarize IDDE activities that have been undertaken by the City during the January 2015 through June 2015 reporting period and identify key goals and objectives to be considered during future phases of plan implementation. The targeted monitoring of isolated dry weather flows containing discrete bacteria loadings and outfall monitoring has been performed. Utilizing the data and information obtained during this reporting period, an updated work plan of prioritized tasks for the next 6 month period has also been prepared and is included within Section 5.0 of this report.

2.0 DOCUMENTED ILLICIT DISCHARGES AND CONNECTIONS

During this reporting period, no illicit discharges/connections were identified. 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 2015 – JUNE 2015)

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.

IDDE Program activities continue to focus upon the sampling of key target areas, specifically the Malden River watershed area and the continued implementation of mass balance flow isolation at historically identified dry weather flows of concern. Targeted dry weather inspections are driven in large part by the results of dry weather sampling at outfalls which discharge to surface water conveyances, principally the Malden River, Lower Spot Pond Brook, West End (Edgeworth Brook) Culvert, Little Creek, Linden Brook and the Town Line Brook. 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.

As described in prior status reports, a comprehensive dry weather sampling effort using multiple lines of evidence testing was performed by representatives of USEPA and NCA in the fall of 2012. The focus of this extensive USEPA analytical program was directed towards the isolation of potential human based contributions to dry weather flows, using an approach that greatly exceeds the limitations of simple bacteria sampling. Specifically, this approach was intended to resolve traditional limitations involving reliance upon bacteria analysis associated with animal waste contributions. NCA is continuing to work with Alpha Analytical to develop representable and low cost analytical methods to quantify caffeine levels in collected water samples. If successful, additional targeted sampling of priority areas utilizing this approach, as well as additional lines of evidence will be performed.

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. In addition, their efforts have led to the identification of infrastructure needs, rapid response to illicit discharges, posting of outfall signage, general system maintenance and mitigation of environmental conditions of concern as they are being identified.

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)

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, as well as central portions of Malden, which discharge to Lower Spot Pond Brook and ultimately the Malden River. 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 the Mystic River Watershed Association (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 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, nine (9) of which have been identified as flowing during dry weather conditions. Periodic dry weather sampling has been performed by NCA, MyRWA and the USEPA.

NCA conducted a dry weather sampling event at several key outfalls that discharge to the Malden River on 25 June 2015. This included the sampling of baseline water flow from MR-2N and MR-2S, which receive flows from the Saugus Branch. Representatives of MyRWA have met with the City and identified this dry weather flow as a potential issue of concern, based upon the results of their sampling efforts. As shown on Table 3.0, E. coli levels of 390 MPN/100 ml (MR-2N) and 440 MPN/100 ml (MR-2S) were identified, respectively. The levels encountered were similar to the results obtained by NCA in November 2014. It should be noted that these locations were sampled by MyRWA in June of 2013, with elevated bacterial levels reported. At that time, to further investigate the elevated bacteria loadings identified in June 2013, NCA reviewed the MyRWA outfall monitoring data, as well as online U. S. Geologic Survey (USGS) precipitation data and noted that an antecedent rainfall event approximating the recommended precipitation limit had occurred in the area on 24 June 2013.

During the 25 June 2015 dry weather sampling event, NCA also sampled manhole E28BY-MH1, which is located between Route 60 and Exchange Street (Figure 5). 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 was collected from E28BY-MH1during this reporting period and as shown on Table 3.0, an E. coli level of 82,000 MPN/100 ml was detected. Based upon a review of historic plan information, as well as field observations, it appears the 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 an ongoing evaluation of the drainage network proximate to the Exchange and Florence Street area is currently underway and the results to be obtained will be presented at the end of the next reporting period. At this time, the focus of ongoing investigations is being directed towards recent utility repairs that have been performed within the applicable watershed.

During the 25 June sampling event an evaluation of the drainage network which discharges into Little Creek, including manhole C46-MH19, was performed. As shown on Table 3.0, an E. coli concentration of 500 MPN/100 ml encountered at C46-MH19, which is similar to the results obtained from prior sampling events. To assess the discharge point of the drainage network for this area, several samples were collected within Little Creek. Samples were collected from LC-0 (base flow from Little Creek) and LC-N (northern pipe invert). As shown on Table 3.0, an E. coli concentration of 3,700 MPN/100 ml was detected at LC-0, while an E. coli level of 2,400 MPN/100 ml was encountered at LC-N. It should be noted that there was very limited water flow observed within Little Creek during sample collection. The continued evaluation of the drainage network associated with C46-MH19 will be performed next reporting period.

The Stormwater Compliance Team has conducted numerous dry weather sampling events to investigate the elevated E. coli levels encountered previously at LSP-4, an outfall for the drainage system located within Eldrich Drive (Figure 6). 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, the focus of assessment activities 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. Recommendations made by the SCT involved restoring the integrity of the main drainage line to stop the discharges that have been documented at LSP-4.

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 has decreased significantly 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. Field observations noted at that time by NCA included an increased discharge relative to prior sampling events. According to the City Engineering Department, the Eldrich Drive complex is under new ownership and the City has attempted to contact the property owner numerous times to discuss the sampling results, however the owner has been unresponsive. Accordingly, more formal enforcement measures are being implemented at this time.

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 7, 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.

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 8). 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. During the last reporting period flow isolation studies were continued for dry weather Flow # 18, which was identified in the areas of Cherry and Sylvan Streets, which are a part of the Linden Brook culvert (Figure 8) 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 on 5 November 2014 from the approximate manhole locations shown on Figure 8. 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. The continued targeted sampling of dry weather flow in this area will be performed next reporting period.

In addition to the above, a follow-up inspection of dry weather flows initially identified in July of 2014 was conducted during the last reporting period within the eastern portion of Malden in the area of Grant Street, which also contributes to the eastern portion of Linden Brook Culvert. Dry weather flow was again encountered on Grant Street during the 5 November 2104 sampling event in drainage manhole G36-MH2. A dry weather flow sample was collected from the manhole and as shown on Table 3.0, an E. coli concentration of 290 MPN/100 ml was encountered, significantly lower than the 1,700 MPN/100 ml detected in July of 2014. Dry weather flow sampling will also be performed at this location during the next reporting period.

During the September 2012 sampling event, conducted with representatives of the USEPA, a water sample was collected from outfall LBR-1 (Figure 8), 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. Although maintenance was routinely performed on this siphon, the extent of grease build up indicates that a higher frequency of cleaning and maintaining is necessary to further understand the condition.

> 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.

Based upon the "inconclusive finding" cited by CDM Smith, higher frequency inspections of the siphon and related service connections have been performed. During the inspections, which are conducted on a weekly basis, grease cutter and enzymes are added on an as needed basis. In addition to the higher frequency inspections, a sampling event was performed at LBR-1 last reporting period. As shown on Table 3.0, the dry weather sample collected at LBR-1 on 5 November 2014 indicated concentrations of 88 MPN/100ml. The higher frequency inspections, as well as dry weather sampling of LBR-1 will be continued during the next reporting period.

3.2 Drainage System Mapping-IDDE Inspection Program (MDPW)

The City has converted its paper storm drain system mapping to a working GIS format through the compilation of digitized plans, field GPS data collection and planimetric mapping information obtained from recent aerials. In addition, drainage infrastructure information including components pipe sizes, type, connections and flow parameters are also inventoried as a part of the ongoing system wide maintenance, service and inspection program. Upon the identification of previously unknown dry weather flow, the MDPW personnel notify engineering and outside technical staff to further investigate the conditions identified.

3.3 Inflow Infiltration Sewer System Evaluation & Capacity Analysis

The City of Malden now maintains a strategic GIS Implementation plan that was developed with the assistance of CDM Smith. The City of Malden has also completed a comprehensive Infiltration and In-flow (I&I) study for its municipal sewer system. CDM Smith, on behalf of the City, has prepared a Phase 3 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. Currently, contract drawings and specifications are being prepared to address the recommendations of the Phase III Study.

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. In addition to this, the dry weather sampling program has identified several target areas of intermittent bacteria loadings. During this reporting period, the City has continued 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. The delineation of discrete drainage watersheds and continued implementation of the catch basin cleaning, inspection and inventory program remains a priority of work practices that are being performed by the SCT.

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. Over the past several years ecosystem restoration efforts along the Malden River, including the River's Edge project and capping of the former General Electric site, have significantly increased animal and waterfowl populations. For example, swan habitats, once not present in the area, have increased substantially within the oxbow for the Malden River. This issue is recommended for quantitative evaluation through the use of multiple lines of evidence testing, which will be perused in greater detail during the next reporting period. The City is working to integrate inspections and upgrade programs into community development practices, particularly involving tie-ins to the mains which have and are being addressed by CDM Smith, to bring more focus to this condition that is arising from over a century old infrastructure.

During the next reporting period, the following areas of dry weather flow, and where applicable, continued enforcement of applicable zoning guidance will be performed.

- Outfall LSP-4
- Outfalls MR-2S & MR-2N
- Dry weather flows identified within the Linden Brook watershed
- Multiple line of evidence testing at key outfalls to the Malden River
- Dry weather flow identified along Commercial & Exchange Streets
- Flow isolation studies, within the Saugus branch stormwater watershed

Table 1.0 Summary of Illicit Connections/Discharges identifed as of 6/30/2015

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

Total Illicit Flow Removed to Date: ***260 gpd*** ***(94,900 gal/yr)***

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 6/30/2015

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	Commercial/Exchange Sts.	Dry Weather Flow	Evaluation Ongoing
Flow 29	Summer Street	Dry Weather Flow	Evaluation Ongoing

Table 3.0 Dry Weather Conditions - E. Coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

Sample Designation	Sample Description: Water														
	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
Malden River															
MR-0	-	-	9,200	-	-	-	3,090	-	-	490	980	-	-	-	-
MR-1	-	-	390	-	-	-	-	-	-	-	-	-	-	-	-
MR-4	-	-	220	-	-	-	-	-	-	-	-	-	-	-	-
MR-5	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-
MR-6	-	-	4.1	-	-	-	-	-	-	-	-	-	-	-	-
MR-8	-	-	-	-	-	-	-	-	-	-	292	-	-	-	-
MR-11	-	-	ND (1.0)	-	-	-	-	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E28-MH2W	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E28-MH2N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E28-MH4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E28-MH4A	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-
E28BY-MH1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82,000
F26-MH3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NG-C1	-	-	-	-	-	-	510	-	-	-	-	-	-	-	-
P27-MH10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S29-MH1	-	-	-	-	-	-	-	-	-	160	-	-	-	-	-
S29-MH3	-	-	-	-	-	-	13,330	-	-	190	-	-	-	-	-
S39-MH1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Little Creek															
LC-0	2,400	-	65	-	-	-	-	-	-	-	-	-	-	-	3,700
LC-N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,400
Saugus Branch															
MR-2	-	-	1,200	-	-	-	-	-	-	-	550	-	-	-	-
MR-2N	-	-	-	-	-	-	-	-	-	-	-	-	150	490	390
MR-2S	-	-	-	-	-	-	-	-	-	-	-	-	130	440	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.

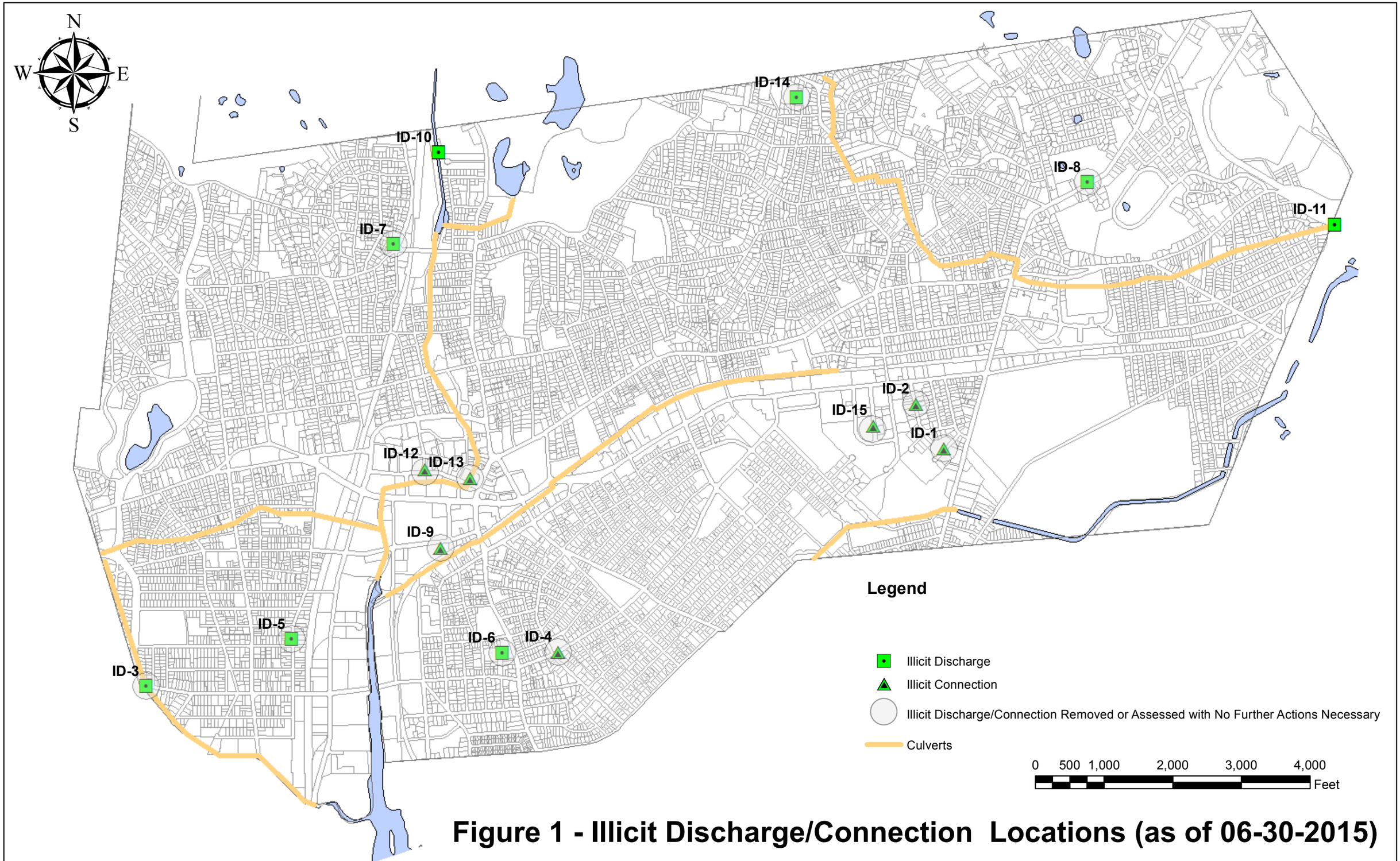

Figure 1 - Illicit Discharge/Connection Locations (as of 06-30-2015)

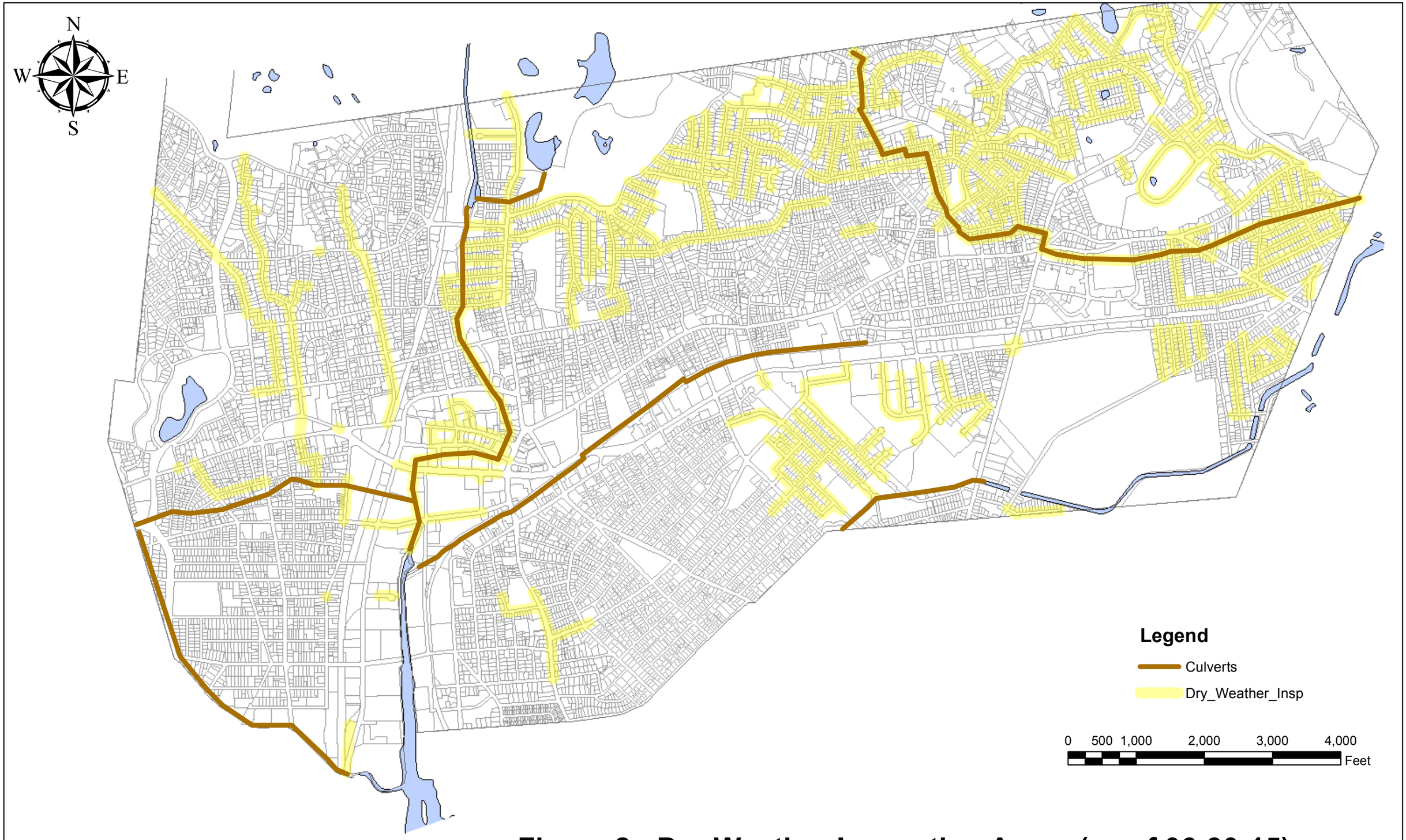

Figure 2 - Dry Weather Inspection Areas (as of 06-30-15)

N
W
E
S

Flow 1
Flow 2
Flow 3
Flow 4
Flow 5
Flow 6
Flow 7
Flow 8
Flow 9
Flow 10
Flow 11
Flow 12
Flow 13
Flow 14
Flow 15
Flow 16
Flow 17
Flow 18
Flow 19
Flow 21
Flow 22
Flow 23
Flow 24
Flow 25
Flow 26
Flow 27
Flow 28
Flow 29

Legend

- Dry Weather Flow
- Dry_Weather_Insp
- Culverts

Flow 27 — Dry weather flow removed or assessed with no further action necessary

0 500 1,000 2,000 3,000 4,000 Feet

Figure 3 - Dry Weather Flow Areas (as of 6-30-15)

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Environmental Engineering and Land Use Planning
369 Turnpike Street, Canton, Massachusetts 02021

Figure 4 - Malden River Outfalls

0 55 110 220 330 440
Feet

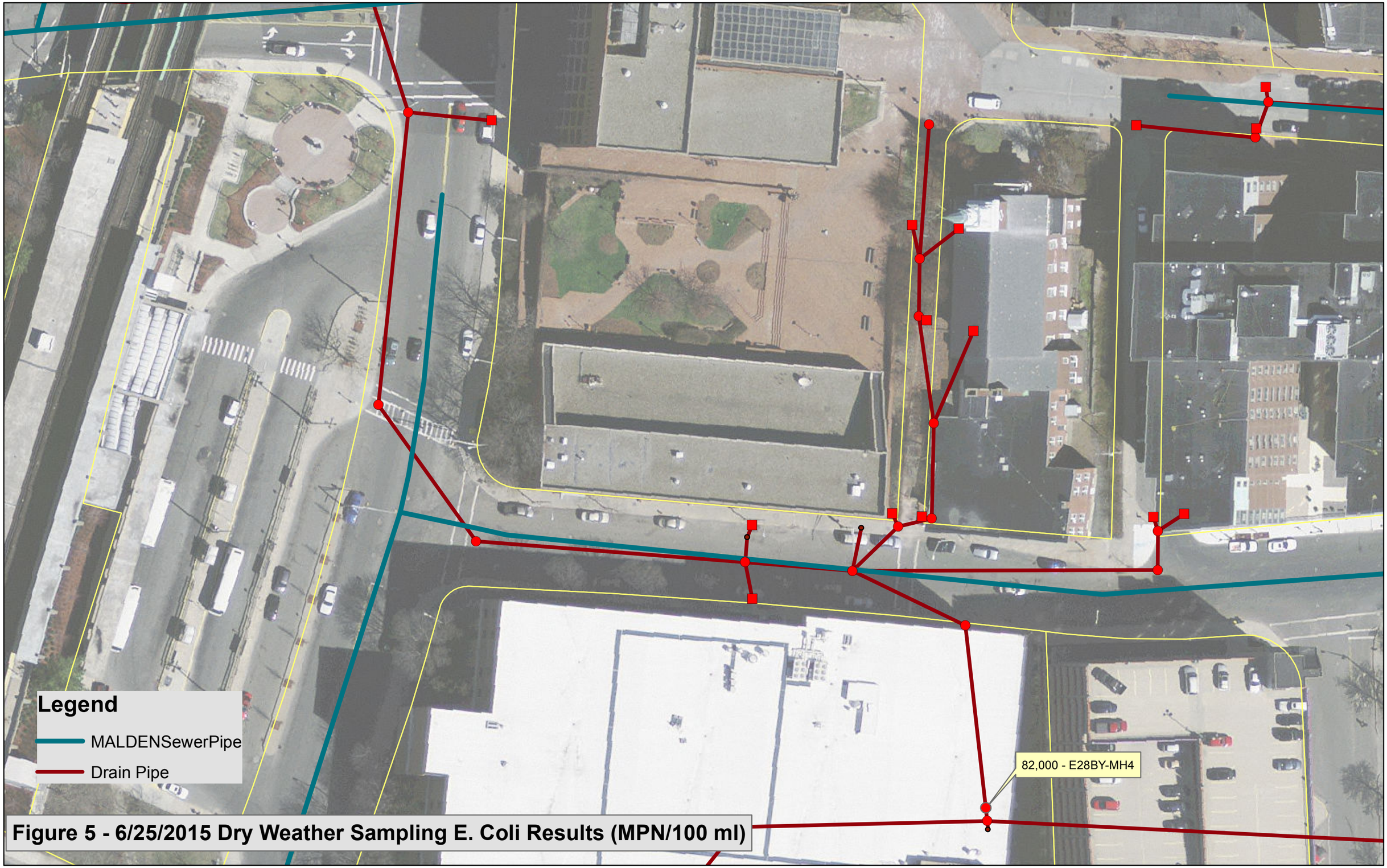


Figure 5 - 6/25/2015 Dry Weather Sampling E. Coli Results (MPN/100 ml)

Figure 6 - Lower Spot Pond Brook Outfalls

Figure 7 - Town Line Brook Outfalls

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 3.0 Dry Weather Conditions - E. Coli Concentrations

Site Location, Outfalls/Manholes Malden, MA

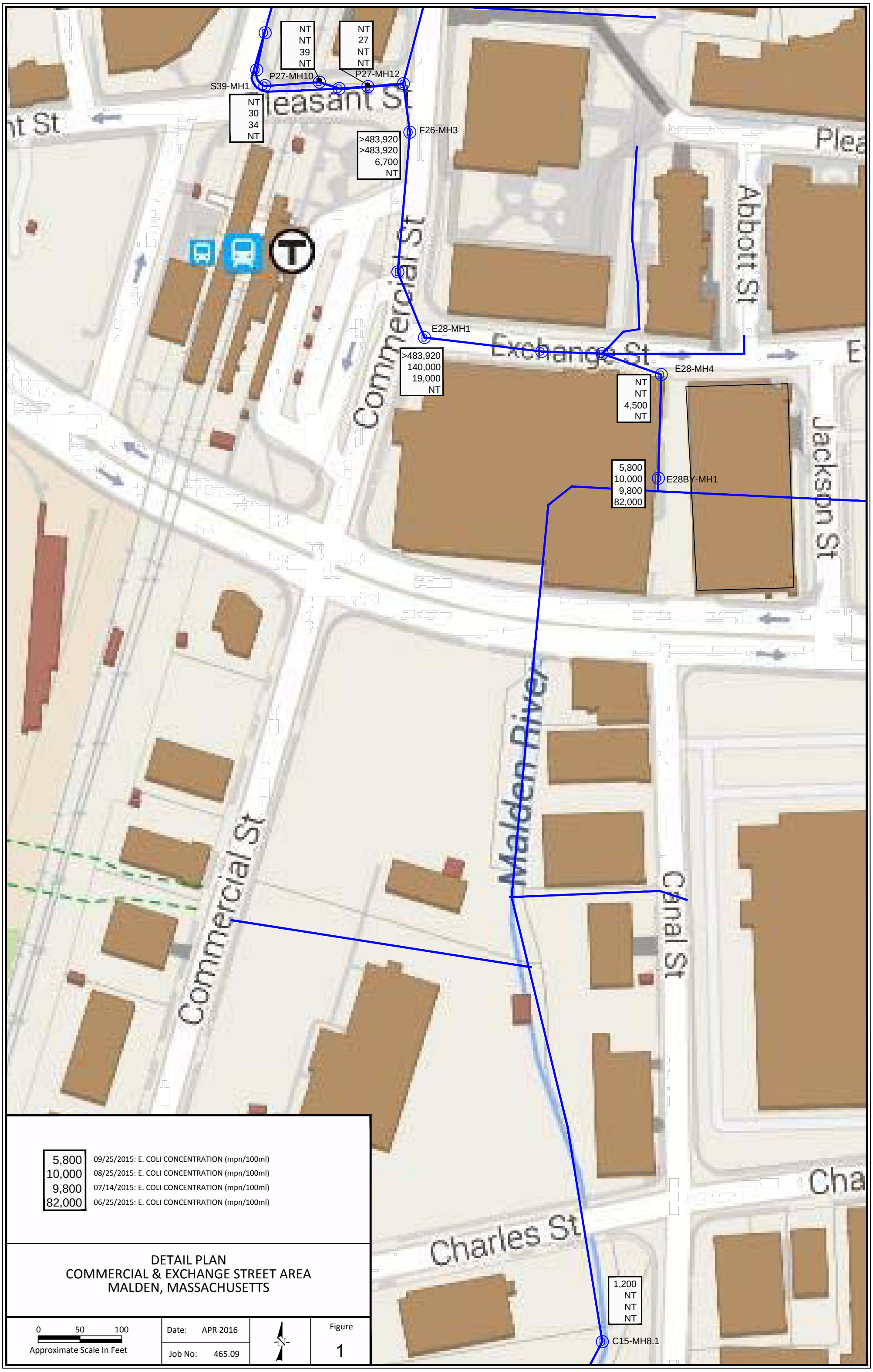
Sample Description: Water

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
Malden River																		
MR-0	-	-	9,200	-	-	-	3,090	-	-	490	980	-	-	-	-	-	-	-
MR-1	-	-	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-4	-	-	220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-5	-	-	9.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR-6	-	-	4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	580
MR-8	-	-	-	-	-	-	-	-	-	-	292	-	-	-	-	-	-	-
MR-11	-	-	ND (1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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.


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 2016
Job No: 465.09
N
Figure
1

N
W
E
S
MR-0
MR-1
MR-2N
MR-2S
MR-2
MR-3
MR-3.1
MR-4
MR-4.1
MR-5
MR-6
MR-6.1
MR-9
MR-7
MR-8
MR-10
MR-8.1
MR-11
MR-11.1
MR-12
MR-12.1
C46-MH19
LC-0
LC-1
LC-2
MR-12.2
MR-13
Legend
Outfall_nca
NANGLE CONSULTING ASSOCIATES, INC.
Environmental Engineering and Land Use Planning
0 55 110 220 330 440
Feet

Figure 2 - Malden River Outfalls