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MAYOR GREG VERGA

CITY OF GLOUCESTER
OFFICE OF THE MAYOR

**TO:** City Council

**FROM:** Jill Cahill, Chief Administrative Officer and Mike Hale, Director of Public Works

**CC:** Board of Health

**DATE:** January 12, 2023

**RE:** Woodard & Curran Report - Good Harbor Creek

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The City of Gloucester, as well as all other communities in Massachusetts, are required to sample surface waters at public beaches to minimize the risk of illness from contaminated water.

In order to test for potentially harmful fecal material and fecal pathogens, MA law requires sampling for "indicator" bacteria (enterococci is indicator bacteria for salt water).
Previous water quality samples taken at Good Harbor Creek in 2021 and 2022 have resulted in elevated levels of enterococci in the waters coming from Good Harbor Creek, resulting in mandated closures to minimize the risk of illness from contaminated water.
Although these bacteria are not typically disease causing, they are associated with fecal contamination. When at high concentrations their presence is indicative of the likely presence of waterborne pathogens.

Over the past few years, the Department of Public Works has been working diligently to investigate, identify, and eliminate potential sources of bacteria within the drainage catchment area of Good Harbor Creek which discharges to the waters of Good Harbor Beach. The drainage catchment area of Good Harbor Creek (and tributaries) covers a large area in excess of 500 acres, and includes a complex network of City drainage and sanitary sewer infrastructure. The City has completed investigations and repairs to the drainage and sewer infrastructure in several areas to eliminate potential sources of bacteria.

In 2022 the City of Gloucester, through the Health Department, also contracted with Woodard & Curran to undertake a bacteria source investigation along Good Harbor Creek. In this packet you will find a summary memorandum as well as the full report from Woodard & Curran.

Upon receiving the report and a presentation from Woodard & Curran, the Mayor's office met with the Health Director, Director of Public Works, Board of Health Chair, and the Title 5 Sanitarian to discuss next steps. Through this collaborative effort, and with the additional information provided by the Woodard & Curran report, it has been determined that additional sewer infrastructure investigation is needed in order for the DPW to determine next steps for the infrastructure repairs needed.

DPW is currently under contract to complete additional investigations and rehabilitations, including some of the recommendations from the "Good Harbor Creek - Bacterial Source Investigation Summary Memorandum", dated December 22, 2022.

The Health Department will resume the traditional weekly beach testing, as prescribed by the Massachusetts Department of Public Health under 105 CMR 445.000, in May 2023. These regulations prescribe in detail the role of local boards of health in beach testing and public notification.

Through DPW's continued investigation we will collect wet and dry surface water samples throughout the winter and spring and share the data with the Board of Health/Health Department. We anticipate that we will continue to see the trend of elevated bacteria detections that coincide with short-duration, high-intensity precipitation events. If this trend continues you can expect creek closures that coincide with these precipitation events throughout the beach season.

The collaboration of the DPW and the Health Department is key to a successful beach season. To this end we have established an internal working group with representatives from these departments as well as Engineering and Conservation. They will provide regular updates to the Mayor's office that we will then share with the City Council and Board of Health.

Another key to a successful beach season is clear and concise communication regarding the roles of each department (as described above) and the open/close status of Good Harbor Creek. The Health Department remains responsible for testing, determining if closure is needed, and public notification as prescribed by Massachusetts Department of Public Health under 105 CMR 445.000.

The full report and accompanying memos will be posted to the City's website. In the meantime, City Councilors should send all questions or concerns to the Mayor's office.

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# MEMORANDUM

TO: Mary Ellen Rose (Health Department Director – City of Gloucester)

CC: Michael Hale (Director of Public Works – City of Gloucester)
Garrett Bergey (Director of Field Operations – SDE)

FROM: Janelle Bonn (Technical Manager – Woodard & Curran)
Scott Salvucci, PE (Project Manager – Woodard & Curran)

DATE: December 22, 2022

RE: Summary of Bacteria Source Investigation Results – Good Harbor Creek

## EXECUTIVE SUMMARY

Good Harbor Beach, including the section along Good Harbor Creek, attracts thousands of visitors to the City and surrounding areas each summer and also provides important ecological habitat. We understand the importance of keeping this destination fully accessible and open to the public during its peak seasonal demand, considering the public and economic benefits. High bacteria concentrations have contributed to the closure of the Creek to recreation for the past two summer seasons, creating public health and environmental concerns. This memorandum summarizes the bacteria source investigation completed in 2022, highlights the findings, and outlines recommended next steps.

Bacteria source investigation was performed through a comprehensive sampling and visual inspection program, as defined by the EPA. Surface water sampling and drainage outfall sampling were performed along Good Harbor Creek to identify the areas experiencing the highest bacteria concentrations. Working with the Health Department and with support from the Public Works Department, Woodard & Curran along with our subcontractor SDE performed strategic investigations of the City's drainage and sanitary sewer infrastructure. These investigations were conducted with the goal of identifying illicit discharges of wastewater entering the drainage system or structural defects of the sanitary sewer pipelines which could lead to wastewater exfiltrating from the pipes into the groundwater or surrounding waterbodies.

Investigation Findings

- No substantial bacteria sources were identified in the investigated drainage infrastructure discharging to Good Harbor Creek. This suggests there are no non-stormwater discharges entering the drainage network from a sewer source that would contribute to previously detected high bacteria concentrations.
- CCTV investigations identified locations in the Neptune Place cross-country sewer main and the Hartz Street sewer main where sewage is susceptible to leaking out of the pipes when flows reach an elevated or surcharged capacity.
- Surface water samples collected from both sides of the Creek during dry weather conditions identified bacteria concentrations above water quality standards (WQS) in select samples. However, laboratory analyses of the samples did not identify a significant human source for the detected bacteria.

- Surface water samples collected from the Creek during wet weather identified bacteria concentrations above WQS in all the eastern and western parts of the Creek. Additional laboratory analyses of the samples identified a significant human source for detected bacteria in samples collected immediately downstream of the Neptune Place cross-country sewer main, the Hartz Street sewer main, and the Thatcher Road crossing of the Creek.

Conclusions

Elevated bacteria detections coincide with short duration, high intensity precipitation events across all evaluated sampling events (City and Woodard & Curran), indicating Beach and Creek closures are currently dependent on rainfall. The City can expect Beach and Creek closures to continue when samples are collected immediately after these types of precipitation events.

Sewer infrastructure appears to be exfiltrating sewage from minor pipe defects observed during CCTV into the western portion of the Creek during short duration, high intensity precipitation events. Evidence of surcharging (when the pipe is transporting flow at higher capacities) was observed in the Hartz Street sewer main. This indicates non-sewer related flow is entering the sewer system from a currently undefined source, likely linked to the precipitation events.

In the eastern portion of the Creek, human derived bacteria were detected immediately downstream of the sewer force main located within Thatcher Road. The force main has not been investigated, but since there is less sewer infrastructure in this area and upstream samples did not contain human derived bacteria, it is probable the Thatcher Road force main is an additional source of bacteria contributions to the Creek.

Non-human derived bacteria were also present in surface water samples collected from the eastern and western portions of the Creek, in significantly higher concentrations during wet weather sampling. Based on the abundance of wildlife habitat adjacent to sample locations, notably birds, it is suspected that birds are contributing bacteria to the Creek.

Recommendations

- Additional sewer infrastructure investigations are recommended at the Neptune Place cross-country sewer main, the Hartz Street sewer main, and the Thatcher Road force main to determine the scope and nature of rehabilitation/repairs required to prevent sewage exfiltration and, for Hartz Street, the reason why the sewer main is experiencing surcharging.
- Wet and dry weather samples are recommended to be collected and submitted for laboratory analysis for avian-derived bacteria to determine the impact birds are having on the bacteria levels in the Creek. If birds are identified as a significant bacteria source, we recommend conducting an avian population assessment to determine whether the birds are native or non-native. Mitigation measures for non-native species are commonly implemented to decrease bacteria contributions to waterbodies.

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# MEMORANDUM

TO: Mary Ellen Rose (Health Department Director – City of Gloucester)

CC: Garrett Bergey (Director of Field Operations – SDE)

FROM: Janelle Bonn (Technical Manager – Woodard & Curran)
Scott Salvucci, PE (Project Manager – Woodard & Curran)

DATE: November 2, 2022

RE: Good Harbor Creek – Bacterial Source Investigation Summary Memorandum

## PURPOSE AND BACKGROUND

This Bacterial Source Investigation Summary Memorandum describes the results of drainage and sanitary sewer infrastructure investigations conducted proximal to Good Harbor Creek and surface water sampling events conducted within Good Harbor Creek. The purpose of these investigations was to evaluate the potential source(s) of elevated bacteria concentrations previously detected in surface waters collected from Good Harbor Creek that caused sporadic closures of Good Harbor Beach and/or Good Harbor Creek to recreational activities during the 2021 and 2022 recreational seasons.

As part of the investigations, sections of drainage infrastructure conveying stormwater to Good Harbor Creek were visually inspected in accordance with the methodology prescribed in the illicit discharge detection and elimination (IDDE) requirements of the US EPA MS4 General Permit (Permit). Additional components of the investigations included the collection of dry and wet weather surface water samples from Good Harbor Creek and closed-circuit television (CCTV) inspections of two sewer pipe segments that extend across Good Harbor Creek.

The City's recent monitoring data is summarized below and provided the initial basis for the investigation rationale, methodology, evaluation criteria, and findings, as described in the following sections. Additionally, conclusions and recommendations for future investigations and actions are provided within this memorandum to assist the City with potential actions to mitigate and/or eliminate bacteria contributions to Good Harbor Creek and, ultimately Good Harbor Beach.

## CITY MONITORING DATA

The City's Department of Public Works (DPW) collected surface water samples from Good Harbor Creek and a tributary draining to Good Harbor Creek between August 2 and August 20, 2021 and submitted the samples for laboratory analysis for enterococci. This information was provided to Woodard & Curran in an Excel spreadsheet that summarized the location, date, tide at the time of sample collection, and laboratory results.

The DPW surface water sample results identified elevated enterococci concentrations at several locations adjacent to the western and eastern branches of Good Harbor Creek, with decreasing enterococci concentrations in samples located farther away from the creek. This data was used to determine the investigation area described in this memorandum. The DPW surface water sampling summary table and associated maps of surface water sample locations provided by the City are included as **Attachment A**.

## INVESTIGATION APPROACH

The Study Area was developed based on a review of mapped MS4 and sanitary sewer infrastructure locations discharging to Good Harbor Creek in relation to the locations of surface water samples collected by the DPW in August 2021 and the associated detected enterococcus concentrations. Additional discussion describing the Study Area selection is provided below, and an overview map depicting the Study Area is provided as **Figure 1**.

Drainage Infrastructure

Drainage infrastructure investigations focused on areas where the infrastructure was identified proximal to sanitary sewer infrastructure and discharged to Good Harbor Creek to determine whether the drainage infrastructure network was a source of bacterial input to the creek through an illicit cross connection or effluent migration from the sanitary sewer. Drainage infrastructure investigation locations were selected based on information provided by the City of Gloucester's (City) GIS consultant, AppGeo, that included GIS geospatial datasets depicting the location of drainage infrastructure discharging to Good Harbor Creek and nearby sanitary sewer infrastructure.

Surface Water

Surface water sample locations were selected after evaluating the City's surface water sampling data from Good Harbor Creek in 2021. Dry weather surface water samples were collected during low tide in locations that corresponded to the most elevated 2021 enterococci concentrations. Wet weather samples were collected from the same sample locations, as well as an additional downstream location, during slack tide into low tide. Wet weather sampling was conducted during a high intensity, short duration precipitation event that occurred on September 22, 2022 where 0.56-inches of precipitation fell within a 45-minute period to replicate weather conditions that occurred during a similar August 2021 event that corresponded with the most elevated detected enterococci concentrations identified in samples collected by the DPW. These weather conditions were targeted to determine whether increased precipitation is causing exfiltration of sewage from the sanitary sewer pipes that is reaching Good Harbor Creek.

Sanitary Sewer

CCTV investigations were performed on two sanitary sewer pipes that spanned segments of Good Harbor Creek based on their locations relative to elevated bacteria concentrations detected in the August 2021 surface water samples.

The methodology, evaluation criteria, and results for each component of the investigations are described below.

## DRAINAGE INFRASTRUCTURE INVESTIGATION METHODOLOGY

Between May 9 and May 17, 2022, Stacey DePasquale Engineering, Inc. (SDE) of Lawrence, Massachusetts performed strategic investigations of drainage infrastructure draining to outfalls DO_100, DO_101, DO_127, DO_1717, DO_1724, DO_1727, and DO_6223. GIS-based information provided by the City's consultant, AppGeo, did not contain catchment delineations and no additional catchment delineation information was available. Investigations proceeded at the most upstream mapped representative drainage structure connected by drainage pipe to the outfall and continued downstream to the outfall.

Dry weather drainage infrastructure investigations were conducted during periods where <0.1 inches of precipitation occurred within the preceding 24-hour period, in accordance with Permit requirements. Using the methodology prescribed in Part 2.3.4.8 of the Permit, drain manholes, and in some cases catch basins, were opened, and examined to determine the presence or absence of dry weather flow and visible and/or olfactory indicators of sewage. When dry weather flow was observed, samples were collected and screened using field test kits and/or laboratory analyses for potential illicit discharge indicators, as described below. Field test kit results were evaluated to determine whether parameters indicative of potential illicit discharges were present in dry weather flow that warranted investigation of adjacent drainage structures. When dry weather flow was not observed, sandbags were placed in the inlets of accessed drainage structures for 48-hours to determine whether intermittent flows were present.

Information obtained during outfall screening and limited drainage infrastructure investigation activities was recorded in ESRI's ArcGIS Field Maps application. The resulting GIS geospatial datasets will be provided to the City electronically concurrently with this submittal.

**DRY WEATHER DRAINAGE INFRASTRUCTURE SCREENING DATA EVALUATION CRITERIA**

The Permit considers dry weather flow collected from MS4 screening locations that exceed the one of the following threshold criteria as a potential indication of sewer contribution to drainage infrastructure and therefore, represent a potential illicit discharge:

- Olfactory or visual evidence of sewage;
- Ammonia ≥0.5 ppm, Surfactants ≥0.25 ppm, enterococci ≥ 130 cfu/100 mL (based on the Massachusetts Department of Environmental Protection (MassDEP) applicable surface water criteria); or
- Ammonia ≥0.5 ppm, Surfactants ≥0.25 ppm, and detectable chlorine.

Test kit results where ammonia and/or surfactants are detected above their individual Permit threshold criteria are potential indicators of other illicit discharges, such as incorrectly connected washing machine laterals, or the result of diluted flow from sewer-related sources. Under the Permit, these types of potential illicit discharge indicators require additional investigation, but potential sewer indicators are generally given higher priority for additional investigation due to the detrimental impacts to public health from sewage exposure.

In addition to the Permit required dry weather flow parameter sample analysis, the City elected to submit samples for laboratory analysis for total bacteroides and human bacteroides. The results of these analyses are used to differentiate whether bacteria present in dry weather flow is primarily originating from a human source or other sources such as birds or dog by analyzing samples for DNA markers present in different types of feces. There are no established regulatory threshold criteria for bacteroides in water samples; however, academic literature suggests that human bacteroides concentrations between 500 – 1,000 copies/100 mL of bacteroides indicate human waste impacts are present that warrant additional investigation to determine the source (Boehm and Soller, "Refined ambient water quality thresholds for human-associated fecal indicator HF183 for recreational waters with and without co-occurring gull fecal contamination", Elsevier, Microbial Risk Analysis 16, 2020).

Dry weather sample screening results obtained during limited drainage infrastructure investigations were compared against these criteria to determine the potential presence of human sewage related illicit discharges.

## DRAINAGE INFRASTRUCTURE INVESTIGATION RESULTS

An evaluation of the dry weather drainage infrastructure investigation results did not identify Permit-defined potential illicit discharges related to sanitary sewer contributions in investigated infrastructure. Elevated concentrations of two potential illicit discharge parameters were identified in one isolated pipe segment within drainage infrastructure discharging to DO_100. Dry weather flow was also observed in drainage infrastructure discharging to DO_127 but did not contain concentrations of potential illicit discharge parameters above Permit threshold criteria. Sample results in these locations are discussed further below. The remaining investigated infrastructure was observed to be dry. A summary of the investigation findings is provided in **Table 1**.

**Table 1: Summary of Limited Drainage Infrastructure Investigation Results**

| Drainage Outfall ID | Potential Illicit Discharge(s) Detected | Notes |
|---|---|---|
| DO_100 | No | Dry weather flow observed in one drainage pipe segment upstream of the outfall containing low levels of potential illicit discharges associated with sewage below Permit criteria. Remaining investigated downstream infrastructure contained standing water, impeding further screening efforts. |
| DO_101 | No | Standing water was observed in investigated infrastructure, impeding screening efforts. |
| DO_127 | No | Standing water was observed in one pipe segment connected to the drainage manhole immediately upgradient of the outfall. Dry weather flow was observed the other drainage pipe segment connected to the drainage manhole immediately upstream of the outfall. No potential illicit discharge parameters were identified in the sample collected from the dry weather flow. |
| DO_1717 | No | No dry weather flow observed in investigated infrastructure. |
| DO_1724 | No | Standing water was present in most of the investigated infrastructure along Abbott Road. However, pipe segment connected to DO_1724 was observed to be dry. |
| DO_1727 | No | No dry weather flow observed in upstream infrastructure. Standing water in downstream infrastructure impeded further investigations and/or confirmation of pipe connectivity to DO_1727. |
| DO_6223 | No | No dry weather flow observed in investigated infrastructure. |

*DO_100 Drainage Area Investigation Findings*

Outfall DO_100 is located on Witham Street north of the intersection with Thatcher Road and discharges to a marshy area near a tributary to Good Harbor Creek. The drainage area, as mapped, collects stormwater from the northeastern portion of Thatcher Road, discharging to the outfall. Two potential illicit discharge parameters were identified above Permit individual

threshold criteria for illicit discharges in a drainage pipe discharging to DO_100. The results from testing dry weather flow present in the drainage pipe, located between the Good Harbor Beach Condominiums at 78 Thatcher Road and the building to the northeast located at 76 Witham Street (**Figure 2**), suggests non-stormwater discharges are entering the drainage infrastructure in this location.

Surfactants were detected at a concentration of 0.55 mg/L, and chlorine was detected at a concentration of 0.2 mg/L, which is above the Permit individual threshold criteria of 0.25 mg/L and "detectable concentrations", respectively. Ammonia, which was detected at 0.20 mg/L, was below the Permit individual threshold criteria of 0.5 mg/L and enterococci detections were below the Massachusetts Surface Water Quality Standard (WQS) of 130 cfu/100 mL.

Standing water was observed in surrounding drainage infrastructure and was not sampled because it is not representative of conditions where flowing non-stormwater sources are present and can cause elevated detections of bacteria because it is stagnant. The drainage outfall DO_100 could not be screened because it was submerged.

*DO_127 Drainage Area Investigation Findings*

Outfall DO_127 is located southwest of the Marina Drive and Loma Drive intersection and discharges to a marshy area adjacent to Good Harbor Creek. The drainage area, as mapped, collects stormwater from a nearby portion of Marina Drive and the intersection of Loma Drive. Standing water was observed in the northwest inlet of the drainage manhole immediately upgradient of DO_127. Dry weather flow was detected in the other drainage pipe segment connected to this manhole and was sampled at the northeast inlet entering DMH_396. No potential illicit discharge indicators were detected in the sample above Permit threshold concentrations. Drainage infrastructure upstream of DO_127 was either dry or contained standing water. DO_127 was not located. Although dry weather flow was present in a small drainage pipe segment discharging to the drainage outfall, no potential illicit discharges were identified in investigated infrastructure during this investigation. Investigations of drainage infrastructure discharging to DO_127, as mapped, are complete. The DO_127 drainage area investigations are depicted on **Figure 3**.

**Table 2**, below, summarizes the screening results obtained from dry weather flow observed in infrastructure discharging to DO-100 and DO_127. Laboratory analytical reports are provided as **Attachment B**.

**Table 2: Dry Weather Screening Results for DO_100 and DO_127**

| Associated Drainage Outfall | DO_100 | DO_127 |
|---|---|---|
| **Sample Date** | 5/17/2022 | 5/12/2022 |
| **Pipe ID** | DMH_3490: DMH_13804 | DML_1299 |
| **Flow/Velocity/Color** | Yes/Slow/Clear | Yes/Slow/Clear |
| **Ammonia (mg/L)** | 0.20 | <0.05 |
| **Surfactants (mg/L)** | **0.55*** | <0.125 |
| **Chlorine (mg/L)** | **0.20** | <0.02 |
| **Enterococci (MPN/100mL)** | 75 | 1 |
| **Total Bacteroides (CE/100mL)** | 5,261 | 480 |
| **Human Bacteroides (CE/100mL)** | Not Detected | Not Detected |

Notes:
* = surfactant value obtained via laboratory sample analysis.
Bold values exceed Permit individual threshold criteria for this parameter.

*DO_101 and DO_6223 Drainage Area Investigation Findings*

Outfall DO_101 is located on Witham Street south of Joppa Way and discharges to a marshy area adjacent to a tributary of Good Harbor Creek. The drainage area, as mapped, collects stormwater from the northern portion of Witham Street in the vicinity of Joppa Way. Mapped drainage infrastructure discharging to DO_101 was accessed and observed to contain standing water.

Outfall DO_6223 is north of Bass Avenue, approaching a cross-country sanitary sewer line originating from Neptune Place to the north. This outfall discharges to Good Harbor Creek. The drainage area, as mapped, collects stormwater from the intersection of Bass Avenue with Amero Court. Mapped drainage infrastructure No dry weather flow was observed in mapped drainage infrastructure discharging to DO_6223. Investigations of drainage infrastructure, as currently mapped in these areas, are considered complete, as shown in **Figures 4 and 5**.

*DO_1717 and DO_1724 Drainage Area Investigation Findings*

Outfall DO_1717 is located northeast of the intersections of Abbott Road, Eastern Avenue, and Helen's Way. The outfall discharges to a marshy area adjacent to Good Harbor Creek. The drainage area, as mapped, collects stormwater from the vicinity of Eastern Avenue and Abbott Road.

Outfall DO_1724 is located at the end of Abbott Road and discharges to a marshy area adjacent to Good Harbor Creek. The drainage area, as mapped, appears to collect stormwater from Abbott Road.

Limited drainage infrastructure draining to DO_1717 and DO_1724 has been investigated and no potential illicit discharges were identified, as shown in **Figure 6**.

*DO_1727 Drainage Area Investigation Findings*

Outfall DO_1727 is located northeast of the intersections of Hartz Street and Bass Avenue, behind the sewer pump station. The outfall discharges to a marshy area adjacent to Good Harbor Creek. The drainage area, as mapped, collects stormwater from Brightside Avenue; however, the connection between upstream drainage infrastructure on Brightside Avenue and DO_1727 was not able to be verified during the investigation.

Attempts were made to inspect drainage infrastructure draining to outfall DO_1727, however, lack of mapped connectivity and the presence of standing water in accessed structures impeded this process. Drainage infrastructure located within Brightside Avenue approaching Bass Avenue was observed to be dry. Drainage infrastructure located at the approximate intersection of Bass Avenue and Hartz Street was observed to contain standing water, impeding further investigations, and limiting visibility to determine pipe connectivity within the accessed structures (CB_296, DMH_189, and DMH-190). AT DO_1727, the outfall was not directly observed, but water was overflowing in the area where the outfall was mapped, indicating that the outfall may be partially submerged.

The DO_1727 drainage area investigations are depicted on **Figure 7**.

## SURFACE WATER SAMPLING METHODOLOGY

Dry weather samples were collected between May 9 and May 19, 2022. No precipitation was recorded during the previous 24-hour period prior to sample collection. Wet weather sampling was conducted during a high intensity, short duration precipitation event that occurred on September 22, 2022 where 0.56-inches of precipitation fell within a 45-minute period. Samples were collected from approximately surface to 6-inches below surface within Good Harbor Creek from either the creek bank or an upstream location to avoid sediment disturbance when entering the creek. Where possible, samples were collected directly using laboratory supplied bottles. In locations where this was not possible, samples were collected using a sampling rod equipped with a collection bottle pre-cleaned with fresh water and then purged with flow to be sampled prior to sample collection. Water collected in the collection bottle was then decanted into a laboratory supplied bottle. Upon collection, sample bottles were labelled with laboratory provided labels and placed on ice within a cooler for submittal to the laboratory.

The dry weather surface water samples were submitted to Rhode Island Analytical Laboratory (RIAL) in Warwick, RI and the wet weather samples were submitted to Biomarine Laboratory in Gloucester, MA for analysis for enterococci via the IDEXX Enterolert method. Additionally, surfactant samples were collected during dry weather surface water sampling at each location and submitted to RIAL for laboratory analysis via the SM5540C 18-21ed method to provide information to correlate concentrations of this parameter that may be present in drainage outfall discharges with concentrations potentially present in Good Harbor Creek.

Total bacteroides and human bacteroides samples collected during dry and wet weather sampling events were submitted to EMSL Analytical, Inc. laboratory in Cinnaminson, NJ for analysis by Quantitative PCR.

Note that the sample point identification numbers used to identify samples correlate with the DPW sample point identification used during the August 2021 surface water sampling event.

## SURFACE WATER SAMPLE DATA EVALUATION CRITERIA

Surface water sample results were evaluated against the Massachusetts Surface Water Quality Standard (WQS) in 314 CMR 4.00 and the Massachusetts Department of Public Health criteria for enterococci in marine waters, which is 104 cfu/100 mL. Note that the DPH criteria relates to the statistical threshold value (STV); however, if more than five recent samples are collected, the geomean average of 35 cfu/100 mL applies. As discussed in the Dry Weather Drainage Infrastructure Screening Evaluation Criteria section above, there are no established regulatory threshold criteria for bacteroides in water samples; however, academic literature suggests that human bacteroides concentrations between 500 – 1,000 CEs/100 mL of bacteroides indicate human waste impacts are present that warrant additional investigation to determine the source.

## DRY WEATHER SURFACE WATER SAMPLE RESULTS

Dry weather surface water sample results identified elevated concentrations of enterococci above WQS in the Marina and Loma Drive Outfall sample (sample point 16), collected from the western portion of Good Harbor Creek. However, detected total and human bacteroides concentrations in this sample does not indicate a human-derived source of bacteria. Low levels of human bacteroides were detected in the samples collected adjacent to the Cross-Country Sewer Line south of Neptune Place and the Hartz Street Culvert, but below concentrations that suggest human waste impacts to surface water. Both dry weather surface water samples collected from the eastern portion of Good Harbor Creek contained enterococci above WQS. Like the Marina and Loma Drive Outfall sample, total and human bacteroides results did not identify a significant concentration of human-derived bacteria. A summary of laboratory analytical data from dry weather surface water samples is presented in **Table 3**.

**Table 3: Summary of Dry Weather Surface Water Sampling Results**

| Sample Location | Sample Date | Enterococci (MPN/100mL) | Total Bacteroides (CE/100mL) | Human Bacteroides (CE/100mL) | Surfactants (mg/L) |
|---|---|---|---|---|---|
| **Western Good Harbor Creek Samples** | | | | | |
| Cross-Country Sewer Line/Creek Intersection; North of DO-6223, South of Neptune Place (Sample Point 15) | 5/09/2022 | 2 | 2,296 | 421 | <0.12 |
| Hartz Street Culvert (Sample Point 5) | 5/10/2022 | 11 | 19,409 | 450 | 0.18 |
| Marina and Loma Drive Outfall (Sample Point 16) | 5/19/2022 | 884 | 119,821 | None Detected | 1.8 |
| **Eastern Good Harbor Creek Samples** | | | | | |
| Thatcher Road Crossing (Sample Point 13) | 5/19/2022 | 556 | 2,506 | None Detected | 1.2 |
| Witham at Western End of Pond (Sample Point 39) | 5/19/2022 | 301 | 90,655 | None Detected | 1.1 |

## WET WEATHER SURFACE WATER SAMPLE RESULTS

Wet weather surface water sample results identified elevated concentrations of enterococci above WQS in all samples. Total and human bacteroides results indicate a human source of bacteria is entering the creek in samples collected from downgradient locations adjacent to sanitary sewer infrastructure located at the cross-country sewer line south of Neptune Place, the Hartz Street Culvert, and point where Thatcher Road crosses Good Harbor Creek. Human bacteroides was not present in samples collected from surface water adjacent to the drainage outfall located at Marina and Loma Drive and the western side of the pond abutting Witham Street, at Joppa Way. Low concentrations of human bacteroides were detected at the Good Harbor Beach Boardwalk.

A summary of laboratory analytical data from wet weather surface water samples is presented in **Table 4** below.

**Table 4: Summary of Wet Weather Surface Water Sampling Results**

| Sample Location | Sample Date | Enterococci (MPN/100mL) | Total Bacteroides (CE/100mL) | Human Bacteroides (CE/100mL) |
|---|---|---|---|---|
| **Western Good Harbor Creek Samples** | | | | |
| Cross-Country Sewer Line/Creek Intersection; North of DO-6223, South of Neptune Place (Sample Point 15) | 9/22/2022 | 14,136 | 48,821 | 4,344 |
| Hartz Street Culvert (Sample Point 5) | 9/22/2022 | 19,863 | 148,839 | 50,133 |
| Marina and Loma Drive Outfall (Sample Point 16) | 9/22/2022 | 3,654 | 26,973 | None Detected |
| **Eastern Good Harbor Creek Samples** | | | | |
| Thatcher Road Crossing (Sample Point 13) | 9/22/2022 | 15,531 | 42,114 | 7,950 |
| Witham at Western End of Pond (Sample Point 39) | 9/22/2022 | >24,196 | 3,187,990 | None Detected |
| **Downgradient Good Harbor Creek Sample** | | | | |
| Good Harbor Beach Boardwalk (Sample Point 1-GHB) | 9/22/2022 | 1,616 | 48,821 | 1,180 |

Surface water sample locations are provided in **Figure 8**. Surface water laboratory analytical reports are provided as **Attachment B**.

## CCTV INVESTIGATION METHODOLOGY AND EVALUATION CRITERIA

In May 2022, Next Level Environmental (Next Level) of Canton, Massachusetts conducted CCTV inspections of sanitary sewer pipes on Hartz Street and south of Neptune Place. These

inspections were conducted in accordance with the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) Version 7.0.3 and are described in more detail below. The targeted sewer infrastructure included three (3) 8-inch sewer segments from SMH-1895 to SMH-1892 and two (2) 10-inch sewer segments from SMH-700 to SMH-708.

***Hartz Street Sanitary Sewer Main Inspection Results***

Next Level inspected a portion of the sanitary sewer main on Hartz Street, including the pipe segment SMH-1894 to SMH-1893 which crosses directly over the Hartz Street culvert, to evaluate the potential of sewage exfiltration from defects in the pipe. **Figure 9** depicts the extent of sewer main inspected.

Beginning at SMH-1985, it was observed that the 8-inch pipe had a Cured-in-Place-Pipe (CIPP) installed and original pipe material was unknown. Four sewer service connections were observed in the pipe segment downstream, which all showed evidence of infiltration. Additionally, heavy grease deposits were observed along the top of the main sewer pipe and sewer services, which is evidence of surcharging within the sewer main. Build-up of fats, oils, and greases (FOG) were observed at the top of the sewer main and service connections located approximately 38 and 46 linear feet downstream of SMH-1895, as shown in **Photograph 1** and **Photograph 2** below.

**Photograph 1: Fats, oils, and greases observed 38 feet downstream of SMH_1895**


**Photograph 2: Fats, oils, and greases observed 46 feet downstream of SMH_1895**

Next Level then mobilized at SMH_1894, to continue their inspection of the sewer main, which also had a CIPP Liner installed. Approximately 17 linear feet downstream of SMH_1894 a polyvinyl chloride (PVC) sewer service wye was observed, which appears to have been installed after the CIPP liner and appeared to be in acceptable condition. Next Level documented offsets between the CIPP pipe and PVC wye on the upstream and downstream ends due to the installation.

Evidence of infiltration drips were identified approximately 30 linear feet downstream of SMH_1894 and grease deposits were observed in several locations, extending to the downstream sewer manhole, SMH_1893. Beginning at approximately 60 linear feet downstream of SMH_1894, Next Level observed both major and minor sags in the sewer main, causing standing water and limiting the ability to fully inspect this portion of the pipe. A major sag located approximately 145 linear feet downstream of SMH_1894 is shown in **Photograph 3** below.


**Photograph 3: Major pipe sag observed 145 linear feet downstream of SMH_1894**

Next Level moved to the next downstream manhole, SMH_1893, to finish their inspection of this portion of the Hartz Street 8-inch sewer main. This pipe segment also had a CIPP liner installed. Infiltration staining approximately 78 linear feet downstream of SMH_1893 and grease deposits throughout the entire pipe segment were observed. Grease was observed at the top of the pipe in some locations, as shown in **Photograph 4** below, which is evidence of surcharging within the sewer main.


**Photograph 4: Grease observed at the top of the pipe approximately 110 linear feet downstream of SMH_1893.**

***Neptune Place Cross-Country Sanitary Sewer Main Inspection Results***

Next Level inspected a portion of the cross-country sanitary sewer line that runs from Neptune Place to Bass Ave to evaluate the potential of sewage exfiltration from defects in the pipe. Next Level were unable to access the full length of the pipe for inspections due to obstructions caused by wrinkling of the pipe's CIPP liner. Next Level observed two sewer services in the pipe segment downstream of sewer manhole SMH_700. Both sewer services were not sealed with grout, exhibited penetrations from tree roots, and showed evidence of infiltration. If infiltration is present at each of these locations, which are adjacent to Good Harbor Creek, it is likely that high flows and surcharging in the sewer main could cause exfiltration of sewage into the surrounding soils. **Photograph 5**, below, shows one of the sewer service connections.


**Photograph 5: Sewer service located approximately 56 linear feet down stream of SMH_700**

Next Level moved to the manhole SMH_700A, which was reportedly installed during a 2021 repair to the cross-country sewer main to continue their inspection of the pipe. Cracks were observed at the connection between the manhole and the downstream pipe, which could possibly allow exfiltration of sewage if water level rises within the manhole. Next Level had to abandon their inspection approximately 62 linear feet downstream of SMH_700A, due to wrinkles and bulges within the pipe's CIPP liner. The liner walls in this section of the pipe were observed to be darker than the rest of the pipe. This could be a result of wastewater contents building up inside of the pipe or could be an indicator of infiltration. Further investigation of the pipe would be required to determine the source of this discoloration.

The extent of investigated sewer main, as well as the approximate location of the unmapped manhole SMH_700A, is provided in **Figure 10,** below.

## BACTERIA SOURCE INVESTIGATION FINDINGS

Dry weather surface water sample results did not identify a significant source of enterococci present in Good Harbor Creek. One dry weather surface water sample collected from the western portion of Good Harbor Creek (Marina and Loma Drive Outfall, sample point 16) contained enterococci above WQS, but it isn't apparent that the detected concentration would be sufficient to exceed WQS downgradient in the portion of the creek adjacent to Good Harbor Beach. Human bacteroides were not detected in this sample. Low levels of enterococci below WQS were detected in dry weather surface water samples collected adjacent to sanitary sewer

infrastructure located south of Neptune Place and the Hartz Street culvert, along with low levels of human bacteroides.

Wet weather surface water sample enterococci results significantly exceeded WQS in all locations sampled within the western and eastern portions of Good Harbor Creek. Human bacteroides were detected in the samples collected adjacent to sanitary sewer infrastructure (cross-country sewer line south of Neptune Place, Hartz Street culvert, and the Thatcher Road crossing) in concentrations that indicate this infrastructure is introducing elevated enterococci concentrations from a sanitary sewer source into Good Harbor Creek. Negligible enterococci concentrations were detected in the downgradient point of convergence where Good Harbor Creek discharges to Good Harbor Beach and are likely the result of diluted human bacteroides concentrations detected upstream at the Thatcher Road crossing sample.

Although high concentrations of enterococci were detected in samples collected from the vicinity of the Marina and Loma Drive outfall and Witham Street at the western end of the adjacent pond, no human bacteroides were detected. This suggests that detected enterococci in these locations is derived from a non-human source such as birds. Both locations contain considerable amounts of marsh, providing suitable habitat for shoreline birds, which were observed in these areas during the investigation.

Based on the results of the dry and wet weather sampling program, in conjunction with sanitary sewer conditions observed during CCTV investigations, sewage appears to be exfiltrating from sewer infrastructure in the western portion of the creek during high intensity, short duration precipitation events in quantities large enough to cause significantly elevated concentrations of enterococci in Good Harbor Creek.

Enterococci concentrations detected in the eastern side of Good Harbor Creek appear to be driven by wildlife, except for less elevated but still significant concentrations of enterococci and human bacteroides detected adjacent to the sanitary sewer force main located within Thatcher Road that crosses the creek. In this area, it is likely that the sewer infrastructure is contributing to the detected elevated enterococci concentrations.

Drainage infrastructure investigated during dry weather conditions does not appear to be contributing bacteria to Good Harbor Creek.

## RECOMMENDATIONS

Woodard & Curran's initial recommendations focus on continued investigation of sanitary sewer infrastructure, along with potential repair and/or rehabilitation of the infrastructure depending on the findings of the investigation. Additionally, we recommend additional investigation of low-level concentrations of some illicit discharge parameters detected in drainage infrastructure associated with network draining to DO_100, and further evaluation of enterococci detections attributed to non-human sources in the western portion of Good Harbor Creek to verify the source. Where sanitary sewer recommendations are enacted, the City should continue to monitor water quality post-infrastructure improvements, where applicable, to verify the bacteria sources have been abated.

A discussion of recommended actions related to the sanitary sewer system, drainage system, and watershed management is provided below.

**Sanitary Sewer System**

*Hartz Street Sewer Main Recommendations*

Based on the completed inspection of the 8-inch sewer main on Hartz Street from SMH_1895 to SMH_1892, we recommend the following rehabilitation and additional investigations to confirm the source of sanitary sewerage exfiltration, further investigate the source of FOG within the system and identify operational issues that could be causing surcharging:

- Perform grouting of the sanitary service connections found to be in poor conditions. This will eliminate the possibility of sewerage exfiltration sources at the service connections.
- Utilize a lateral launching CCTV camera to perform inspection of the sanitary service laterals on the Hartz Street sewer main. This will confirm the condition of the service laterals and identify any sewerage exfiltration sources.
- Perform manhole inspections for sanitary sewer manholes on Hartz Street near Good Harbor Creek. This will identify any defects, structural issues, and evidence of surface surcharging at the sewer manholes.
- Perform additional CCTV investigations within the upstream contributing sewershed area contributing to the Hartz Street sewer main. Although it is currently unknown if the surcharging in the system is being caused fully or partially by the presence of FOG, it is critical to identify and eliminate sources of excessive FOG.
- Continue to monitor flows and operation at the Hartz Street/Bass Ave Pump Station during storm events and high flow circumstances to confirm there are no downstream operational issues that could be causing surcharging sewer conditions upstream.

*Neptune Place Cross-Country Sewer Main Recommendations*

Based on the incomplete inspection of the 10-inch Neptune Place Cross-Country Sewer Main from SMH_700 to SMH_710, we recommend the following additional investigations and rehabilitation to confirm the source of sanitary sewerage exfiltration:

- Due to the reduced size of the wrinkled CIPP lined sewer main, utilize a lateral launching CCTV camera to inspect the Neptune Place Cross-Country sewer main. This will confirm the condition of the sewer main and identify any sewerage exfiltration sources.
- Perform manhole inspections for sanitary sewer manholes on the Neptune Place Cross-Country sewer main close to Good Harbor Creek. This will identify any defects, structural issues, and evidence of surface surcharging at the sewer manholes.
- Perform root removal and grouting of the sanitary service connections found to be in poor conditions. This will eliminate the possibility of sewerage exfiltration sources at the service connections.
- Once service connection rehabilitation is complete, utilize a lateral launching CCTV camera to perform inspection the sanitary service laterals on the Neptune Place Cross-Country sewer main. This will confirm the condition of the service laterals and identify any sewerage exfiltration sources.

*Thatcher Road Force Main Recommendations*

This sewer infrastructure has not been investigated as part of the activities discussed in this memorandum. Woodard & Curran recommends the City investigate the condition of the sewer force main segment extending over Good Harbor Creek to determine whether pipe defects are present that have the potential to contribute sewage to the creek.

**Drainage System**

*DO-100 Drainage Area Investigations*

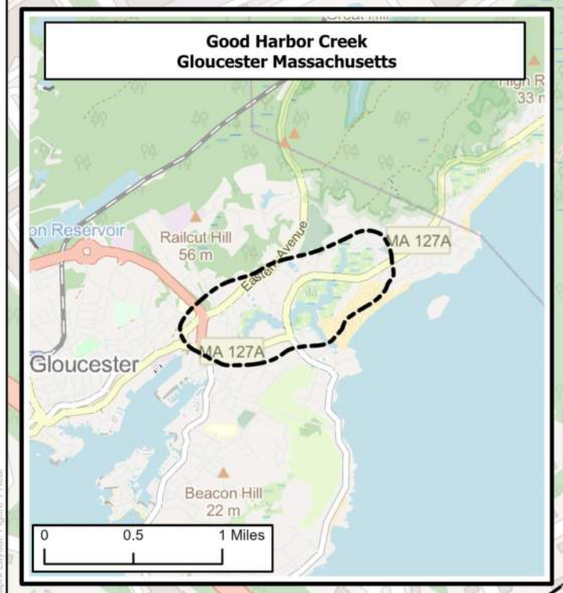
Concentrations of surfactants, chlorine, and ammonia detected in the pipe segment DMH_3490 : DMH_13804, located between the Good Harbor Beach Condominiums at 78 Thatcher Road and the building to the northeast located at 76 Witham Street (**Figure 1**) indicate a non-stormwater discharge is entering the City's drainage infrastructure in this location. Standing water was observed in surrounding drainage infrastructure, which may be due to blockages in the pipe network or tidal influence. This portion of the MS4 should be inspected to remove blockage sources, if present, to promote proper flow through the drainage pipes, and proximal drainage pipes should be investigated to determine the source of the detections. Additionally, building inspections including dye testing of sanitary sewer and drainage infrastructure should be conducted at 78 Thatcher Road and 76 Witham Street to determine whether service connections in these buildings are properly connected to the appropriate City infrastructure.

The City should investigate locations where drainage structure was accessed and observed to contain standing water to determine whether blockages are present that are impeding flow or infrastructure is subject to tidal influence. Blockages should be removed, where identified, to promote stormwater flow through the MS4.

**Watershed Management**

Further evaluation of the source of enterococci concentrations not attributed to human sources is recommended to refine the City's understanding of bacterial contributions to Good Harbor Creek not attributed to sanitary sewer infrastructure. Recommended initial actions include collection of surface water samples for avian bacteroides analysis to verify that bacteria concentrations are coming from bird populations. This data can be used to determine future mitigation options for non-human enterococci contributions to the creek.

# FIGURES




# Study Area Overview

Good Harbor Creek
Bacterial Source Investigation

**Figure 1**

| FIGURE | DESCRIPTION |
|---|---|
| FIGURE 2 | Drainage Investigation to DO_100 |
| FIGURE 3 | Drainage Investigation to DO_127 |
| FIGURE 4 | Drainage Investigation to DO_101 |
| FIGURE 5 | Drainage Investigation to DO_6223 |
| FIGURE 6 | Drainage Investigation to DO_1727 |
| FIGURE 7 | Drainage Investigations to DO_1717 and DO_1724 |
| FIGURE 8 | Wet Water & Dry Water Surface Water Sampling |
| FIGURE 9 | Approximate Extent of CCTV Investigation: Cross-Country Sanitary Sewer Line at Neptune Place |
| FIGURE 10 | Approximate Extent of Sanitary Sewer CCTV Inspection : Hartz Street |

*Legend*

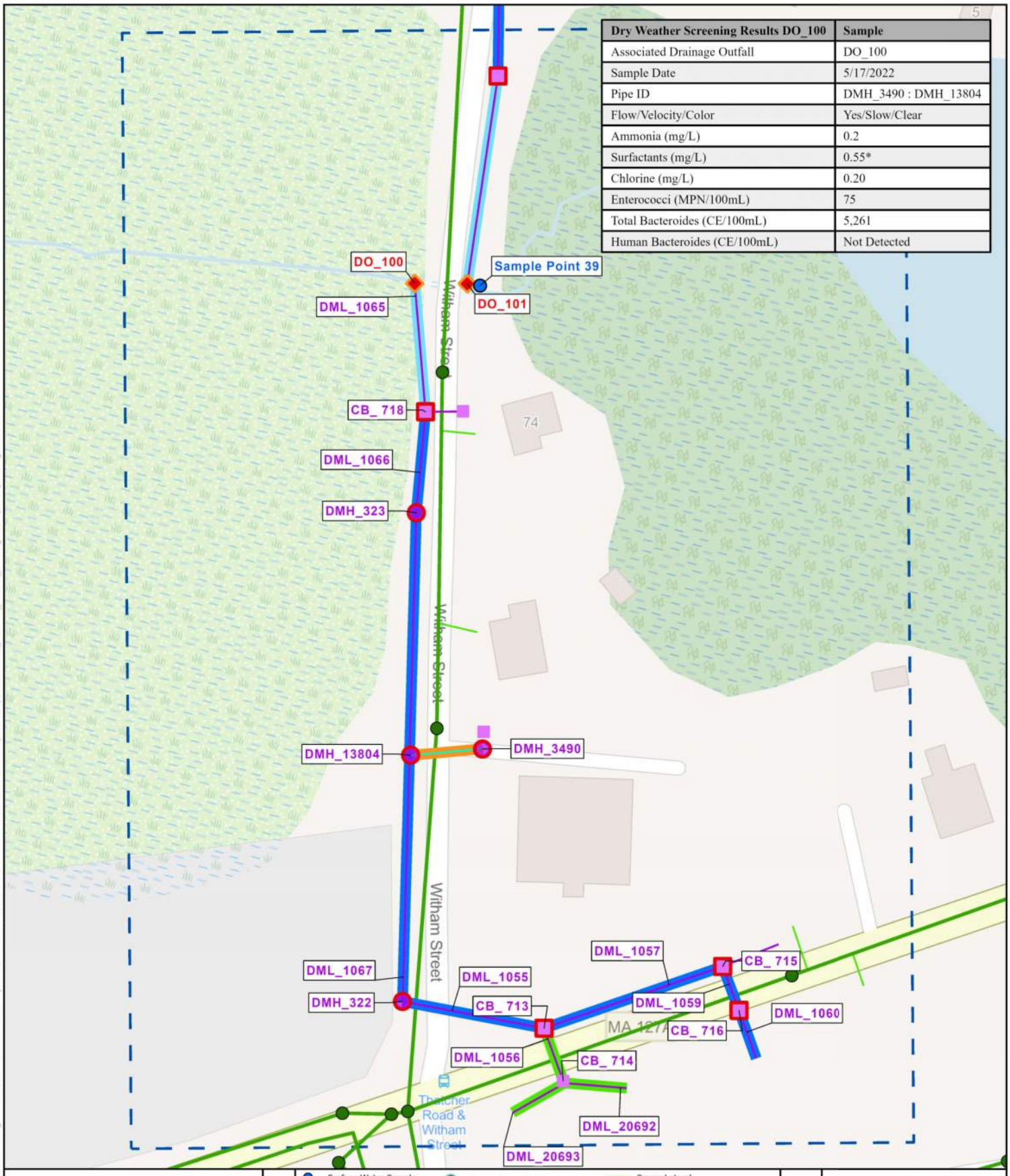
- Surface Water Sample
- Outfall
- Storm Manhole
- Catch Basin
- Sewer Manhole
- Drainage Pipe
- Sewer Main
- Sewer Lateral
- Investigated Areas
- Study Area

0 200 400 800 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022




| Dry Weather Screening Results DO_100 | Sample |
|---|---|
| Associated Drainage Outfall | DO_100 |
| Sample Date | 5/17/2022 |
| Pipe ID | DMH_3490 : DMH_13804 |
| Flow/Velocity/Color | Yes/Slow/Clear |
| Ammonia (mg/L) | 0.2 |
| Surfactants (mg/L) | 0.55* |
| Chlorine (mg/L) | 0.20 |
| Enterococci (MPN/100mL) | 75 |
| Total Bacteroides (CE/100mL) | 5,261 |
| Human Bacteroides (CE/100mL) | Not Detected |

# Study Area Detail

Drainage Investigation to DO_100

**Figure 2**

Legend

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole
- Sewer Pump Station

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

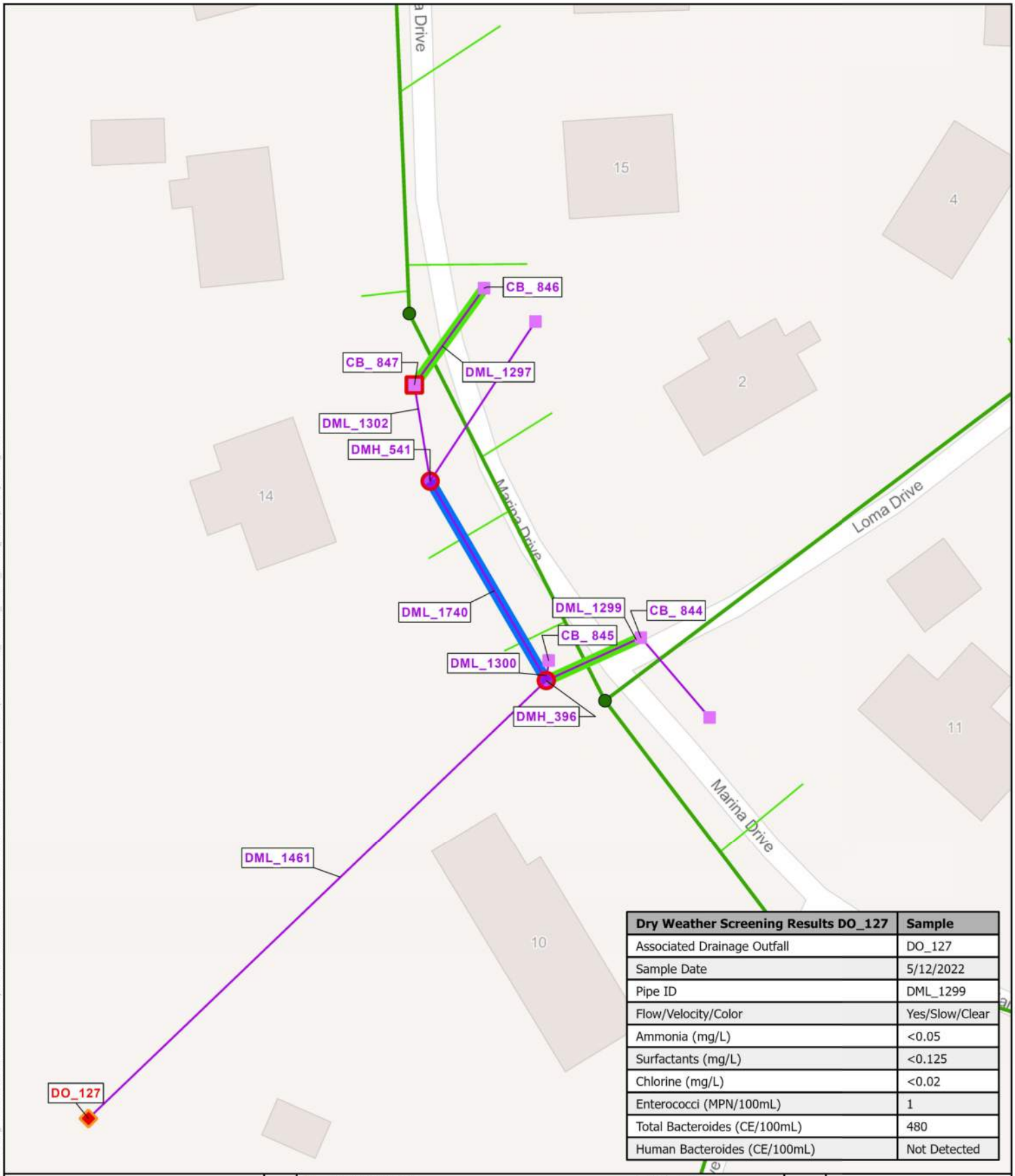
0 15 30 60 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022

Figure Exported: 11/1/2022 By: NLandin Using: \\woodardcurran.net\shared\Projects\0234330.00 Gloucester MA - Good Harbor Creek IDDE\wip\GIS\Maps\Gloucester_Bacteria_Source_Investigation.aprx Layout: Figure 2 Real




| Dry Weather Screening Results DO_127 | Sample |
|---|---|
| Associated Drainage Outfall | DO_127 |
| Sample Date | 5/12/2022 |
| Pipe ID | DML_1299 |
| Flow/Velocity/Color | Yes/Slow/Clear |
| Ammonia (mg/L) | <0.05 |
| Surfactants (mg/L) | <0.125 |
| Chlorine (mg/L) | <0.02 |
| Enterococci (MPN/100mL) | 1 |
| Total Bacteroides (CE/100mL) | 480 |
| Human Bacteroides (CE/100mL) | Not Detected |

# Study Area Detail

Drainage Investigation to DO_127

**Figure 3**

Legend

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

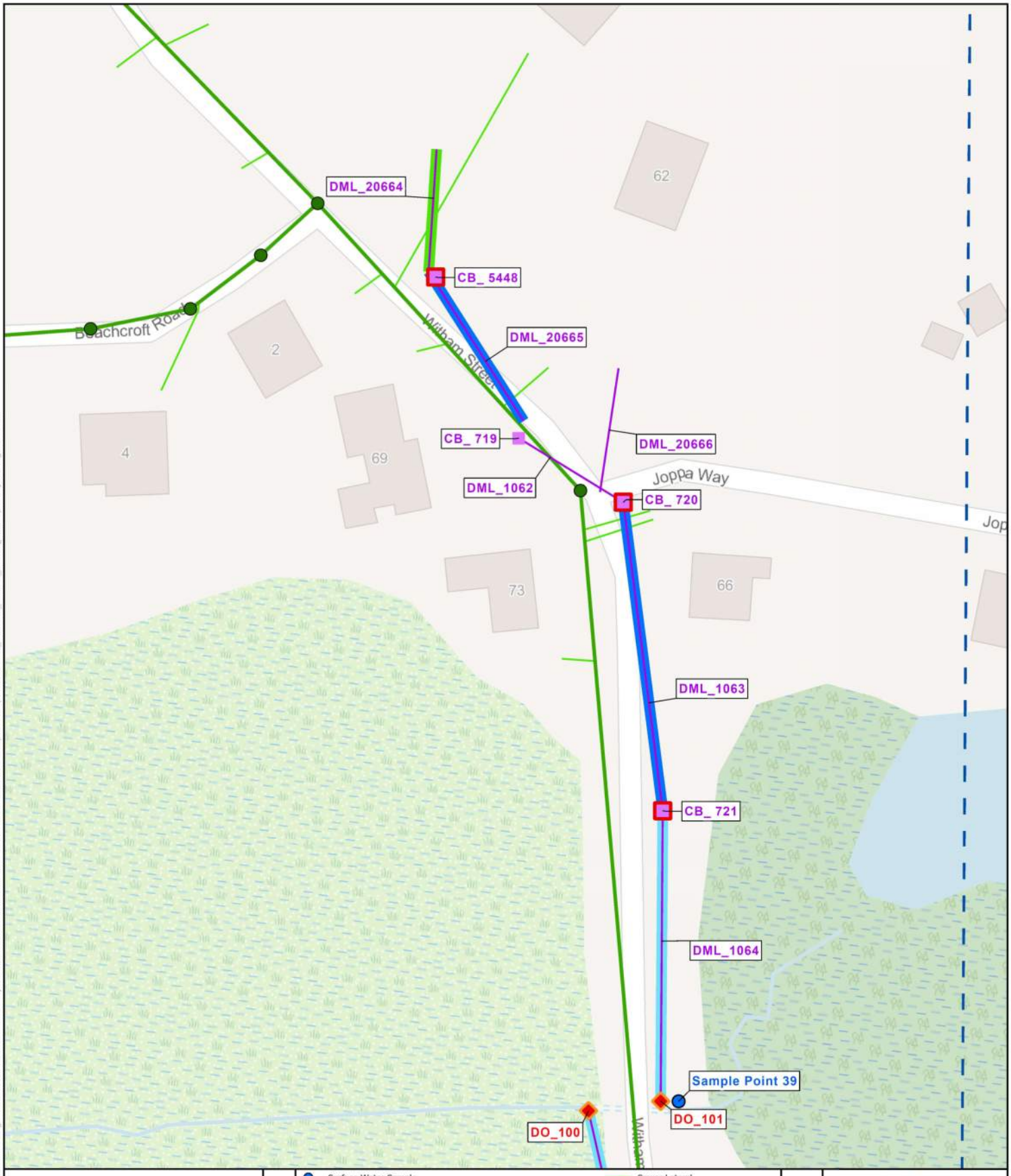
- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

0 5 10 20 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022




# Study Area Detail

Drainage Investigation
to DO_101

**Figure 4**

*Legend*

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

0 15 30 60 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022

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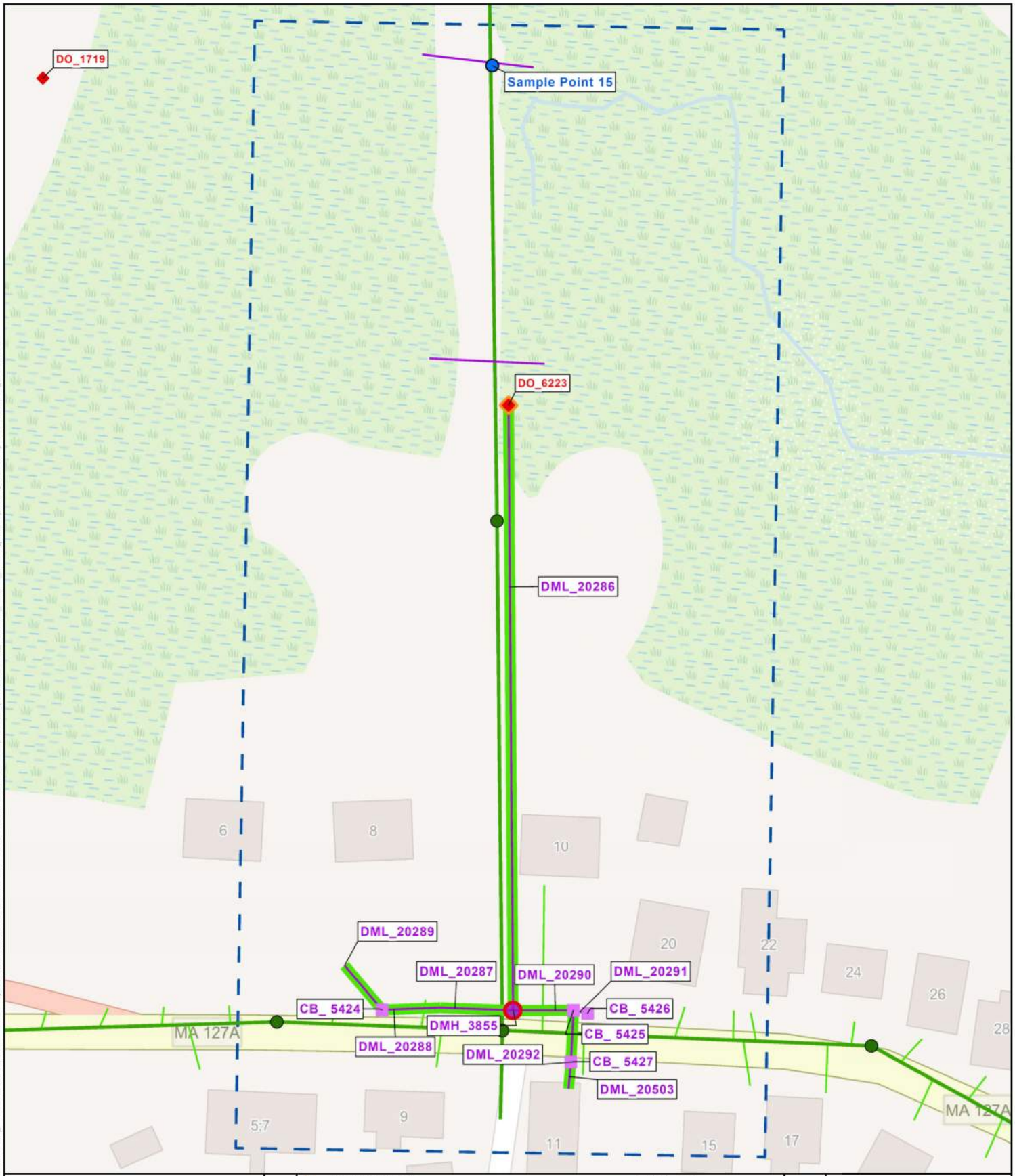



# Study Area Detail

Drainage Investigation to DO_6223

**Figure 5**

Legend

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

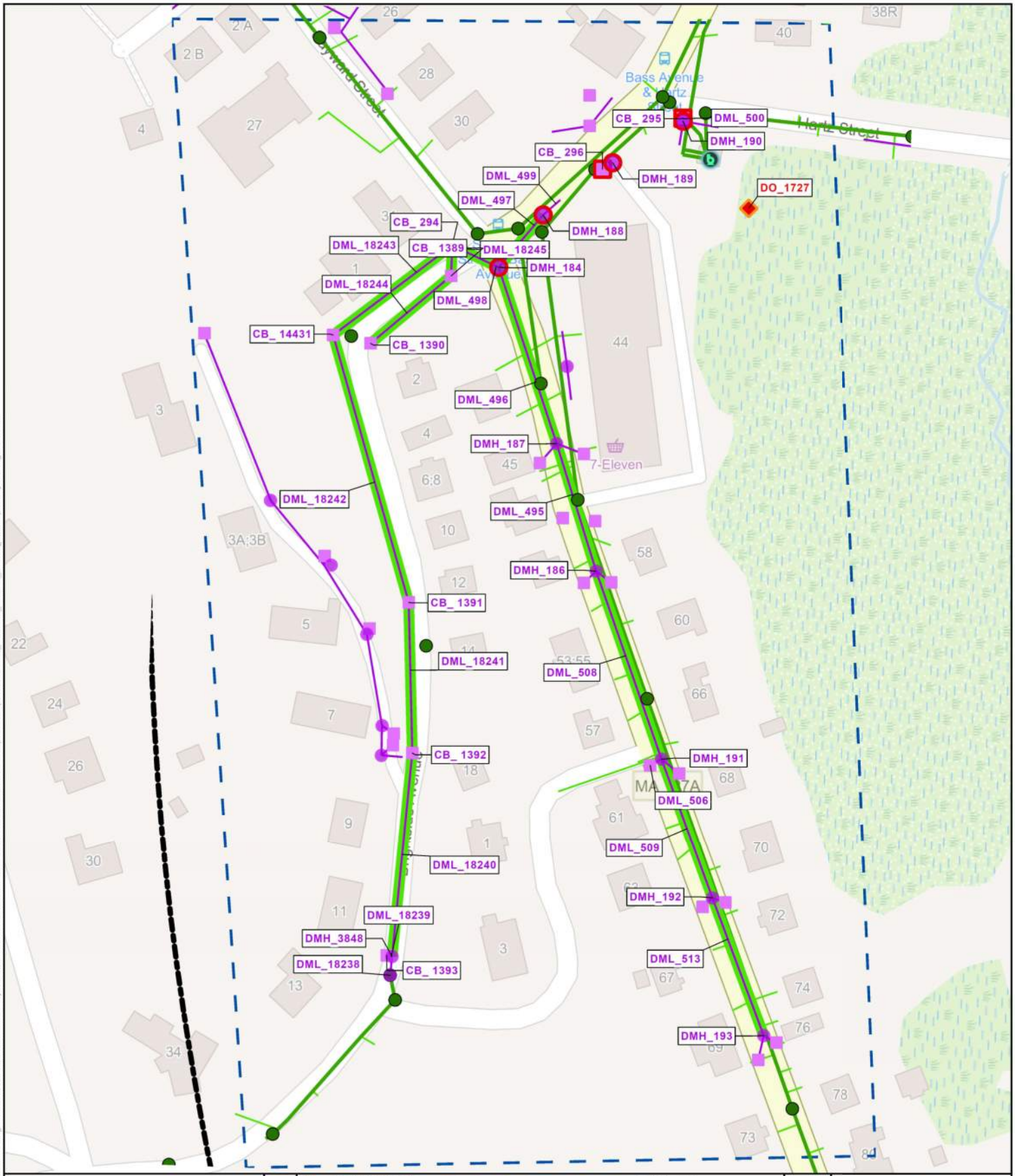
0 15 30 60 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022

Figure Exported: 11/1/2022 By: NLandin Using: \\woodardcurran.net\shared\Projects\0234330.00 Gloucester MA - Good Harbor Creek IDDE\wip\GIS\Maps\Gloucester_Bacteria_Source_Investigation.aprx Layout: Study Area Detail Figure 5REAL




# Study Area Detail

Drainage Investigation
to DO_1727

**Figure 6**

*Legend*

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole
- Sewer Pump Station

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

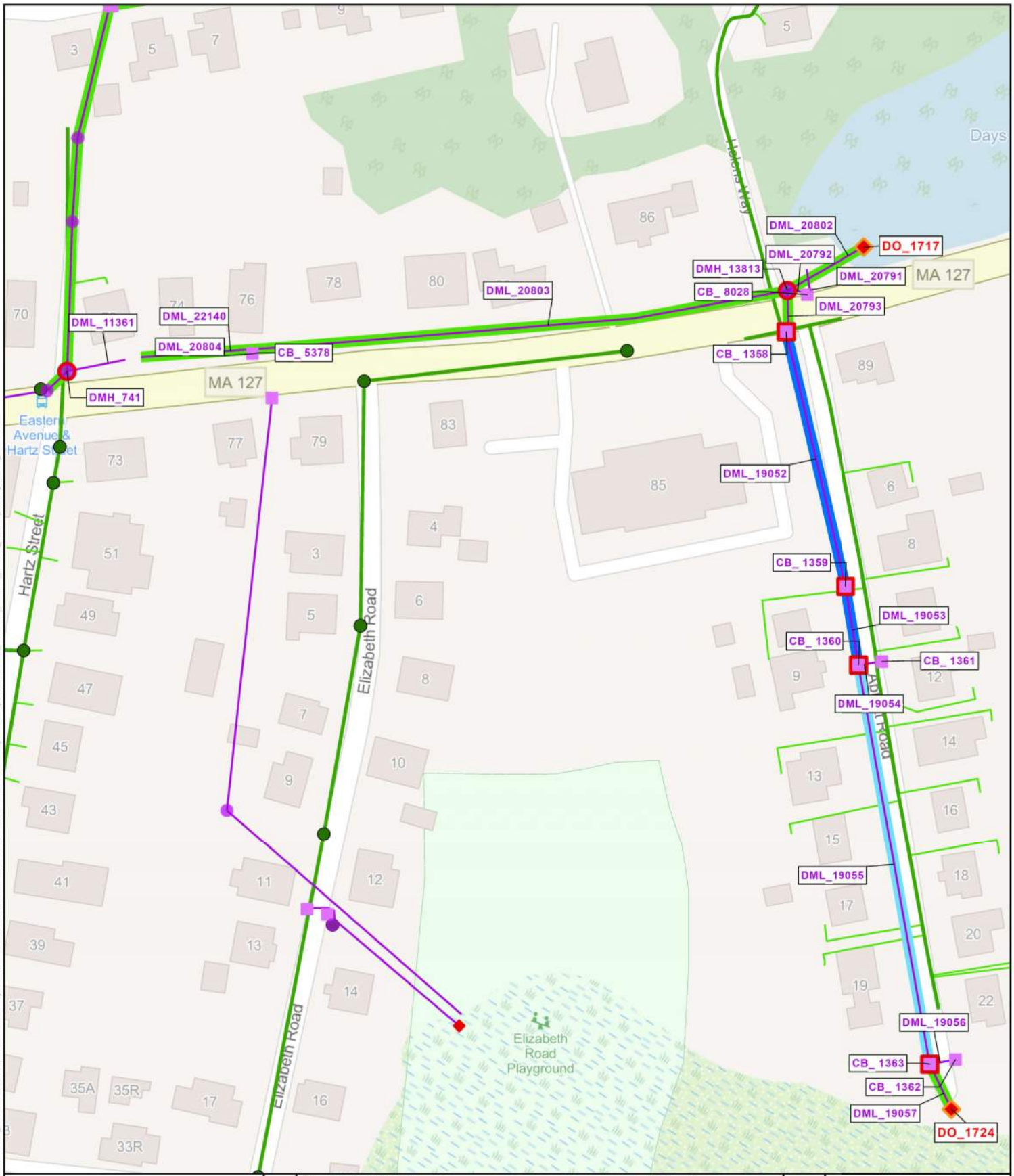
0 25 50 100 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022

Figure Exported: 11/7/2022 By: NLandin Using: \\woodardcurran.net\shared\Projects\0234330.00 Gloucester MA - Good Harbor Creek IDDE\wip\GIS\Maps\Gloucester_Bacteria_Source_Investigation.aprx Layout: Figure 6 Real




# Study Area Detail

Drainage Investigations to DO_1717 and DO_1724

**Figure 7**

Legend

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

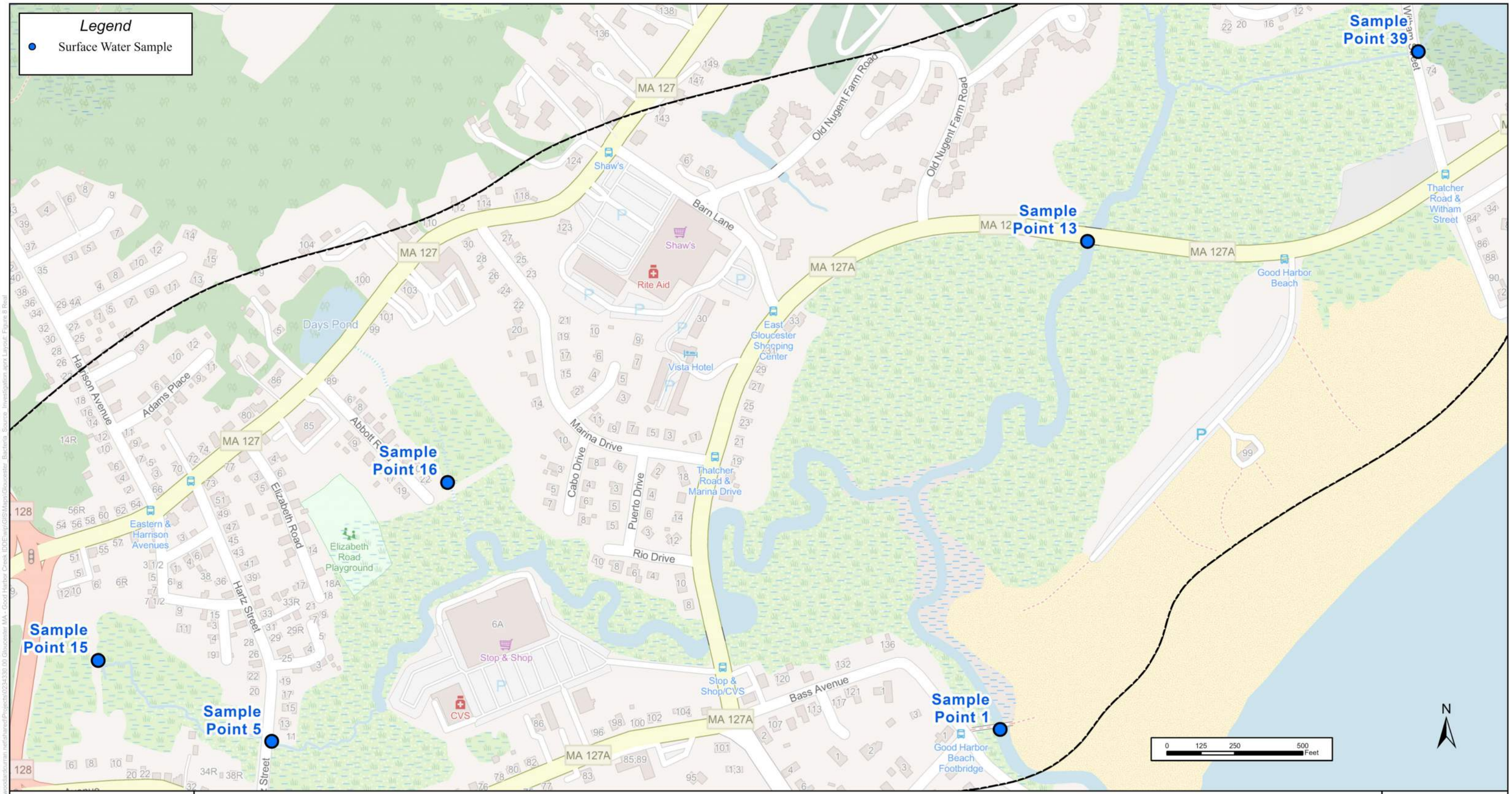
- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

0 20 40 80 Feet

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022

Figure Exported: 11/7/2022 By: NLandin Using: \\woodardcurran.net\shared\Projects\0234330.00 Gloucester MA - Good Harbor Creek IDDE\wip\GIS\Maps\Gloucester_Bacteria_Source_Investigation.aprx Layout: Figure 7 Real




# Sample Location Map

Wet Water & Dry Water Surface Water Sampling

**Figure 8**

**Surface Water Sample Results**

| Sample Location | Sample Point 15 | Sample Point 15 | Sample Point 5 | Sample Point 5 | Sample Point 16 | Sample Point 16 | Sample Point 13 | Sample Point 13 | Sample Point 39 | Sample Point 39 | Sample Point 1-GHB | Sample Point 1-GHB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weather Type | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Sample Date | 5/09/2022 | 9/22/2022 | 5/10/2022 | 9/22/2022 | 5/19/2022 | 9/22/2022 | 5/19/2022 | 9/22/2022 | 5/19/2022 | 9/22/2022 | Not Sampled | 9/22/2022 |
| Enterococci (MPN/100mL) | 2 | 14,136 | 11 | 19,863 | 884 | 3,654 | 556 | 15,531 | 301 | >24,196 | Not Sampled | 1,616 |
| Total Bacteroides (CE/100mL) | 2,296 | 48,821 | 19,409 | 148,839 | 119,821 | 26,973 | 2,506 | 42,114 | 90,655 | 3,187,990 | Not Sampled | 48,821 |
| Human Bacteroides (CE/100mL) | 421 | 4,344 | 450 | 50,133 | None Detected | None Detected | None Detected | 7,950 | None Detected | None Detected | Not Sampled | 1,180 |
| Surfactants (mg/L) | <0.12 | Not Analyzed | 0.18 | Not Analyzed | 1.8 | Not Analyzed | 1.2 | Not Analyzed | 1.1 | Not Analyzed | Not Sampled | Not Analyzed |

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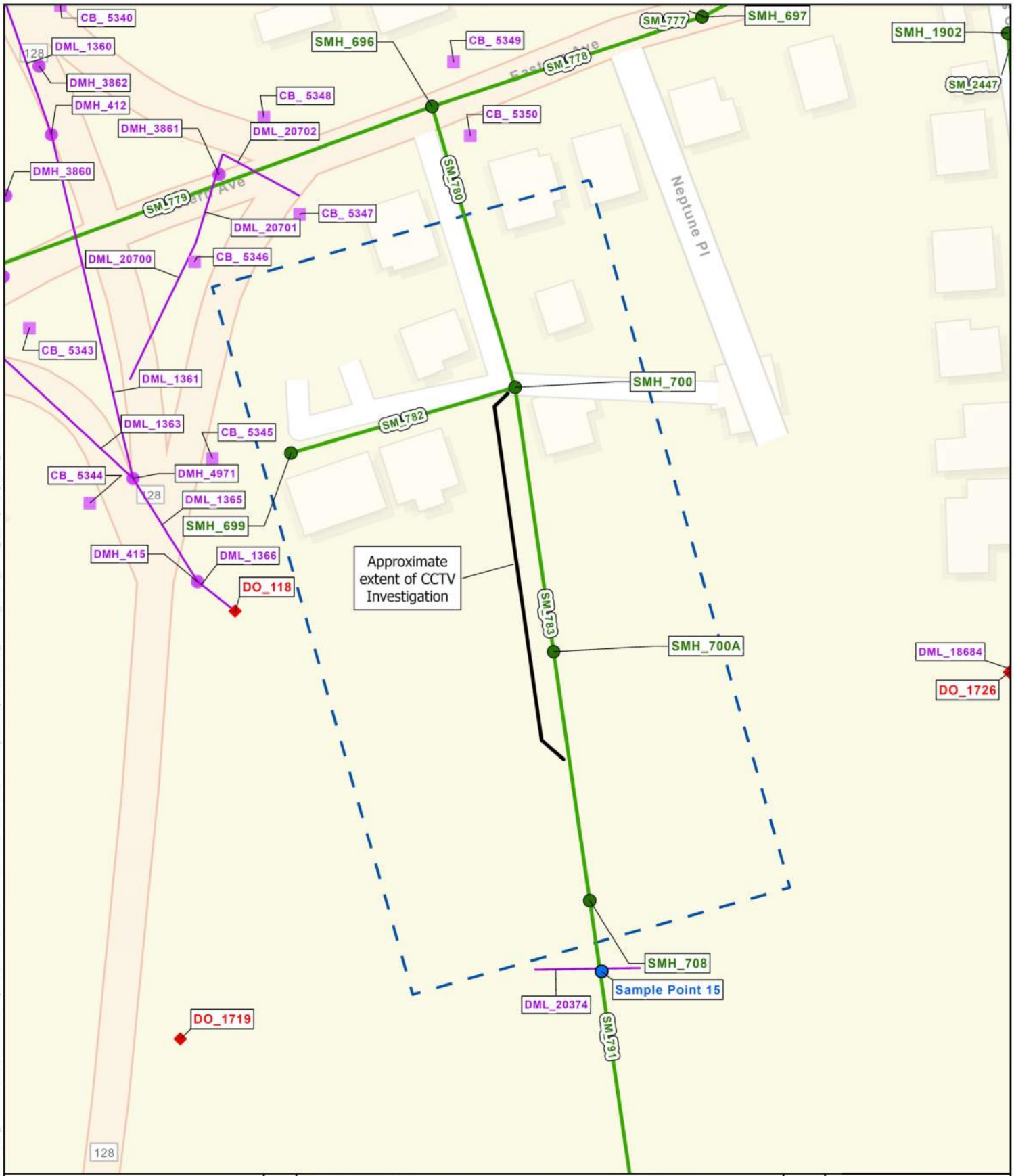
Project #: 0234330.00
Map Created: November 2022




# Study Area Detail

Approximate Extent of CCTV Inspection: Cross-Country Sanitary Sewer Line at Neptune Place

**Figure 9**

Legend

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

- Sewer Lateral
- Drainage Pipe
- Sewer Main
- Investigated Areas

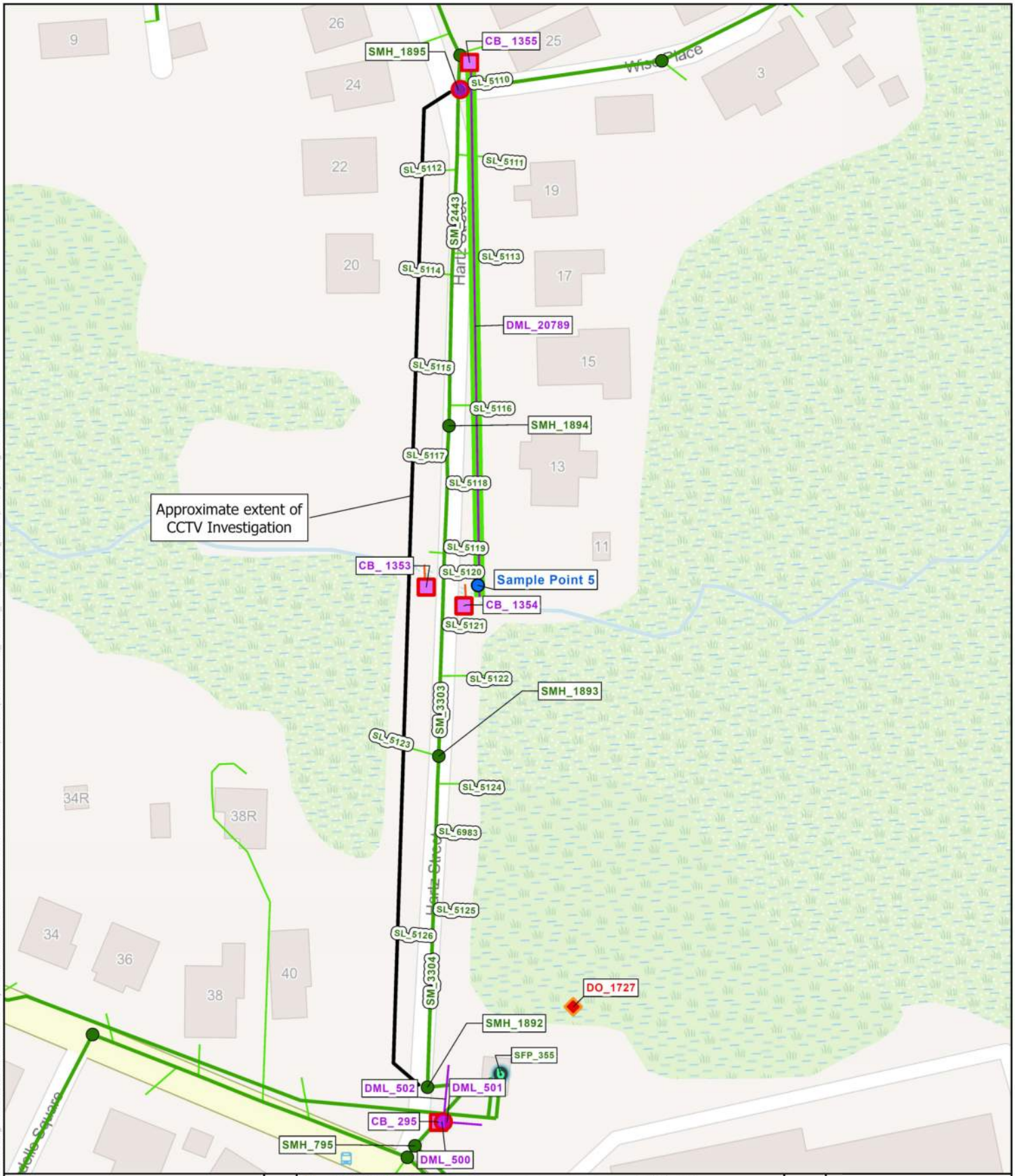
0 15 30 60 Feet

N

Woodard & Curran

Project #: 0234330.00
Map Created: November 2022

Figure Exported: 11/7/2022 By: NLandin Using: \\woodardcurran.net\shared\Projects\0234330.00 Gloucester MA - Good Harbor Creek IDDE\wip\GIS\Maps\Gloucester_Bacteria_Source_Investigation.aprx Layout: Figure 9 Real




# Study Area Detail

Approximate Extent of Sanitary Sewer CCTV Inspection: Hartz Street

**Figure 10**

Legend

- Surface Water Sample
- Outfall
- Inspected Outfall
- Storm Manhole
- Inspected Storm Manhole
- Catch Basin
- Inspected Catch Basin
- Sewer Manhole
- Sewer Pump Station

Drainage Pipe Inspection Status

- Confirmed - Visual Indicator
- Suspected - Positive Test Kit
- Assessed - Upstream Indicator
- Cleared - No Evidence
- N/A - Standing Water
- Other
- Not Assessed

- Sewer Lateral
- Drainage Pipe
- Drainage Pipe - Field Sketch
- Sewer Main
- Investigated Areas

0 15 30 60 Feet

N

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Project #: 0234330.00
Map Created: November 2022

Figure Exported: 11/1/2022 By: NLandin Using: \\woodardcurran.net\shared\Projects\0234330.00 Gloucester MA - Good Harbor Creek IDDE\wip\GIS\Maps\Gloucester_Bacteria_Source_Investigation.aprx Layout: Figure 10 Real

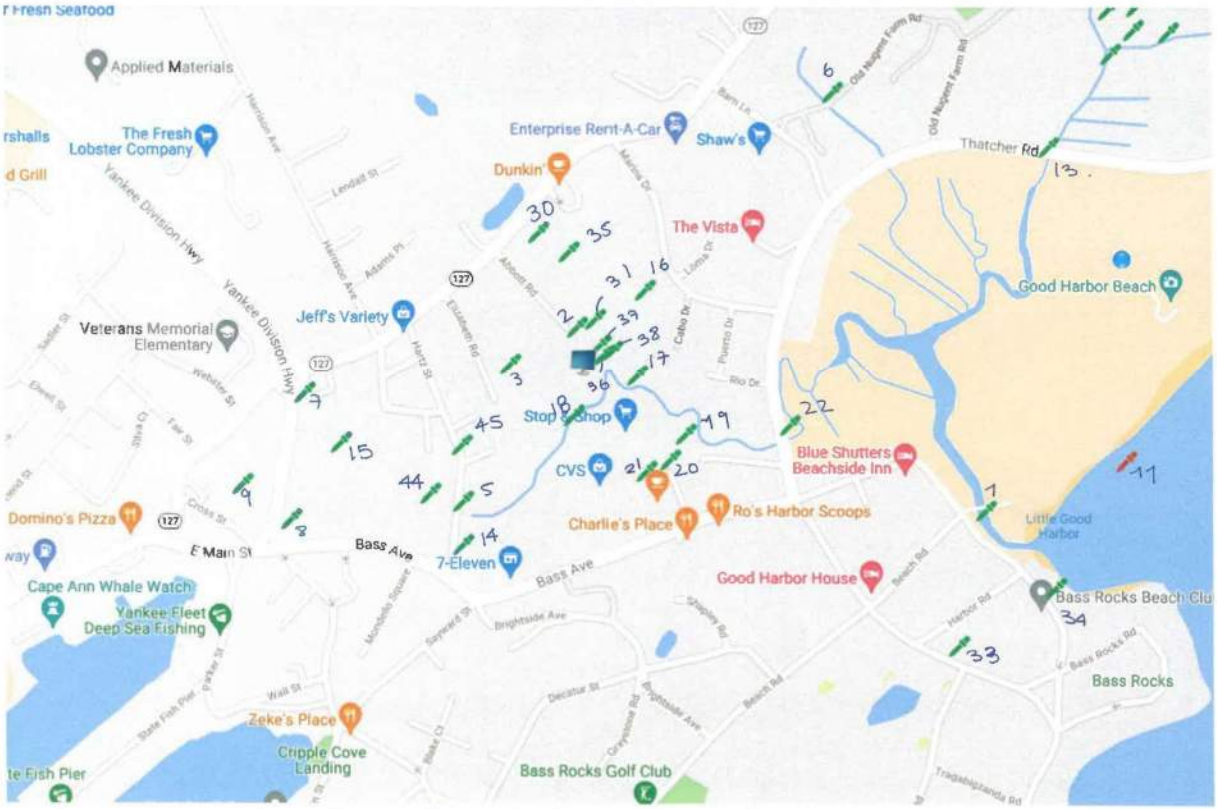
# ATTACHMENT A: CITY OF GLOUCESTER DEPARTMENT OF PUBLIC WORKS SURFACE WATER SAMPLING RESULTS – AUGUST 2021

| Good Harbor Creek | | | | | |
|---|---|---|---|---|---|
| Asset (S - #) | Date Collected | Time | Enterococci-CSU/ML | Tidal | Sample Location |
| 1 | 08/20/2021 | 7:30 AM | 7700 | Low | Creek |
| 1 | 08/13/2021 | 8:10 AM | 389 | Low | Creek |
| 1 | 08/10/2021 | 1:06 PM | 30 | High | Creek |
| 1 | 08/09/2021 | 8:34 AM | 1309 | Low | Creek |
| 1 | 08/05/2021 | 9:05 AM | 5475 | Incoming | Creek at footbridge |
| 2 | 08/02/2021 | 12:18 PM | 431 | - | |
| 2 | 08/03/2021 | 7:44 AM | 512 | - | Creek |
| 2 | 08/05/2021 | 10:00 AM | 3076 | Incoming | Creek |
| 3 | 08/02/2021 | 12:45 PM | 241 | - | |
| 3 | 08/05/2021 | 10:55 AM | 2481 | - | Drain Outfall |
| 4 | 08/09/2021 | 10:05 AM | 121 | Low | Stream |
| 4 | 08/10/2021 | 2:10 PM | 161 | High | Culvert |
| 5 | 08/17/2021 | 5:15 PM | 1050 | Incoming | Creek |
| 5 | 08/13/2021 | 8:35 AM | 1070 | Low | Creek at culvert |
| 5 | 08/17/2021 | 6:25 PM | 464 | Incoming | Creek |
| 5 | 08/03/2021 | 7:52 AM | 1178 | | Creek |
| 5 | 08/02/2021 | 12:55 PM | 1043 | | |
| 5 | 08/04/2021 | 2:00 PM | 1223 | | Creek at culvert |
| 5 | 08/18/2021 | 1:00 PM | | Low | Creek |
| 5 | 08/19/2021 | 12:00 PM | 24200 | Outgoing | Creek |
| 5 | 08/17/2021 | 7:45 PM | 216 | High | Creek |
| 5 | 08/05/2021 | 12:20 PM | 2909 | Outgoing | Creek |
| 5 | 08/09/2021 | 10:50 AM | 565 | Low | Creek at culvert |
| 5 | 08/17/2021 | 9:10 AM | 1100 | Outgoing | Creek |
| 5 | 08/20/2021 | 7:55 AM | 2610 | Low | Creek |
| 5 | 08/19/2021 | 10:15 AM | 2810 | Outgoing | Creek |
| 5 | 08/10/2021 | 1:20 PM | 771 | High | Creek at culvert |
| 5 | 08/17/2021 | 8:35 PM | 1170 | Outgoing | Creek |
| 5 | 08/17/2021 | 1:15 PM | 1080 | Low | Creek |
| 5 | 08/19/2021 | 1:50 PM | 24200 | Low | Creek |
| 6 | 08/10/2021 | 2:35 PM | 435 | High | Stream |
| 6 | 08/09/2021 | 10:40 AM | 313 | Low | Stream |
| 7 | 08/02/2021 | 1:20 PM | 10 | | Outfall |
| 7 | 08/03/2021 | 8:00 AM | 10 | | Outfall |
| 7 | 08/13/2021 | 8:25 AM | 10 | Low | Drain Outfall |
| 7 | 08/04/2021 | 2:05 PM | 10 | | Outfall |
| 11 | 08/02/2021 | 8:37 AM | 10 | | Good Harbor Beach |
| 13 | 08/11/2021 | 8:30 AM | 2987 | Low | Creek |
| 13 | 08/09/2021 | 8:50 AM | 990 | Low | Creek |
| 13 | 08/05/2021 | 9:45 AM | 24196 | Incoming | Creek |
| 13 | 08/11/2021 | 4:30 PM | 882 | Outgoing | Creek |
| 13 | 08/11/2021 | 2:15 PM | 20 | High | Creek |
| 13 | 08/20/2021 | 8:20 AM | | Incoming | Creek |
| 13 | 8/13/2021 | 9:50 AM | 512 | Low | Creek |
| 13 | 08/11/2021 | 6:05 PM | 714 | Low | Creek |

| Good Harbor Creek | | | | | |
|---|---|---|---|---|---|
| Asset (S - #) | Date Collected | Time | Enterococci-CSU/ML | Tidal | Sample Location |
| 13 | 08/10/2021 | 1:45 PM | 121 | High | Creek |
| 13 | 08/11/2021 | 12:25 PM | 546 | Incoming | Creek |
| 14 | 08/02/2021 | 1:00 PM | 1314 | | Outfall |
| 15 | 08/17/2021 | 6:35 PM | 627 | Incoming | Creek |
| 15 | 08/17/2021 | 1:20 PM | 708 | Low | Creek |
| 15 | 08/20/2021 | 8:15 AM | 933 | Low | Creek |
| 15 | 08/05/2021 | 12:40 PM | 3076 | Incoming | Creek |
| 15 | 08/03/2021 | 8:00 AM | 495 | | Creek Culvert |
| 15 | 08/02/2021 | 1:10 PM | 754 | | |
| 15 | 08/17/2021 | 7:50 PM | 820 | High | Creek |
| 15 | 08/04/2021 | 1:50 PM | 556 | | Creek |
| 15 | 08/13/2021 | 8:30 AM | 537 | Low | Creek |
| 16 | 08/05/2021 | 10:35 AM | 24196 | Incoming | Creek |
| 17 | 8/20/2021 | 7:45 AM | 5480 | Low | Creek |
| 17 | 08/09/2021 | 10:45 AM | 631 | Low | Creek |
| 17 | 08/19/2021 | 2:00 PM | 24200 | Outgoing | Creek |
| 17 | 08/05/2021 | 8:50 AM | 17329 | Incoming | Creek |
| 17 | 08/19/2021 | 10:25 AM | 670 | Outgoing | Creek |
| 17 | 08/17/2021 | 5:05 PM | 110 | Incoming | Creek |
| 17 | 08/10/2021 | 1:30 PM | 160 | High | Creek |
| 17 | 08/19/2021 | 12:10 PM | 10400 | Outgoing | Creek |
| 17 | 8/13/2021 | 8:55 AM | 1520 | Low | Creek |
| 17 | 08/17/2021 | 6:15 PM | 30 | Incoming | Creek |
| 17 | 08/17/2021 | 7:35 PM | 72 | High | Creek |
| 17 | 08/17/2021 | 12:55 PM | 135 | Low | Creek |
| 18 | 08/17/2021 | 7:40 PM | 226 | High | Creek |
| 18 | 08/20/2021 | 7:50 AM | 3870 | Low | Creek |
| 18 | 08/17/2021 | 6:20 PM | 122 | Incoming | Creek |
| 18 | 08/17/2021 | 9:00 AM | 538 | Outgoing | Creek |
| 18 | 08/19/2021 | 10:20 AM | 860 | Outgoing | Creek |
| 18 | 08/17/2021 | 5:10 PM | 377 | Incoming | Creek |
| 18 | 08/19/2021 | 1:55 PM | 24200 | Outgoing | Creek |
| 18 | 08/19/2021 | 12:05 PM | 24200 | Outgoing | Creek |
| 18 | 8/17/2021 | 1:00 PM | 173 | Low | Creek |
| 19 | 08/05/2021 | 8:40 AM | 1317 | Incoming | Drain Manhole |
| 20 | 08/05/2021 | 8:30 AM | 7270 | Incoming | Drain Manhole |
| 21 | 08/05/2021 | 8:24 AM | 480 | Incoming | Drain Manhole |
| 22 | 08/11/2021 | 4:20 PM | 226 | Outgoing | Creek |
| 22 | 08/17/2021 | 5:00 PM | 41 | Incoming | Creek |
| 22 | 08/11/2021 | 6:00 PM | 414 | Low | Creek |
| 22 | 8/19/2021 | 12:15 PM | 2760 | Outgoing | Creek |
| 22 | 08/11/2021 | 7:55 AM | 3448 | Low | Creek |
| 22 | 08/17/2021 | 7:30 PM | 75 | High | Creek |
| 22 | 8/19/2021 | 10:30 AM | 109 | Outgoing | Creek |
| 22 | 08/10/2021 | 1:40 PM | 10 | High | Creek |
| 22 | 08/09/2021 | 8:43 AM | 2247 | Low | Creek |
| 22 | 08/11/2021 | 12:20 PM | 262 | Incoming | Creek |
| 22 | 08/17/2021 | 12:50 PM | 85 | Low | Creek |
| 22 | 08/11/2021 | 2:10 PM | 10 | High | Creek |
| 22 | 8/19/2021 | 2:05 PM | 24200 | Outgoing | Creek |
| 22 | 8/20/2021 | 7:40 AM | 9140 | Low | Creek |

| Good Harbor Creek | | | | | |
|---|---|---|---|---|---|
| Asset (S - #) | Date Collected | Time | Enterococci-CSU/ML | Tidal | Sample Location |
| 22 | 08/13/2021 | 9:55 AM | 1370 | Low | Creek |
| 22 | 08/17/2021 | 6:10 PM | 20 | Incoming | Creek |
| 24 | 08/09/2021 | 10:30 AM | 110 | - | Outfall stream |
| 26 | 8/10/2021 | 2:20 PM | 364 | High | Stream |
| 26 | 08/09/2021 | 10:20 AM | 63 | Low | Stream |
| 27 | 08/11/2021 | 6:15 PM | 1529 | Low | Creek |
| 27 | 08/11/2021 | 4:40 PM | 2064 | Outgoing | Creek |
| 27 | 08/11/2021 | 8:10 AM | 1106 | Low | Creek |
| 27 | 08/13/2021 | 9:35 AM | 862 | Low | Creek |
| 27 | 08/16/2021 | 11:30 AM | 364 | Outgoing | Creek |
| 27 | 08/17/2021 | 3:15 PM | 776 | Low | Creek |
| 27 | 08/11/2021 | 12:40 PM | 573 | Incoming | Creek |
| 27 | 8/11/2021 | 2:30 PM | 108 | High | Creek |
| 27 | 08/17/2021 | 8:35 AM | 703 | Outgoing | Creek |
| 27 | 08/20/2021 | 8:55 AM | 10500 | Incoming | Creek |
| 28 | 08/09/2021 | 9:00 AM | 637 | Low | Outfall culvert |
| 28 | 08/10/2021 | 1:50 PM | 1989 | High | Culvert Creek |
| 28 | 08/13/2021 | 9:45 AM | 1990 | Low | Creek |
| 28 | 08/17/2021 | 3:30 PM | 2140 | Low | Creek |
| 28 | 08/17/2021 | 8:50 AM | 2490 | Outgoing | Creek |
| 29 | 08/17/2021 | 8:25 AM | 733 | Outgoing | Creek |
| 29 | 08/09/2021 | 9:30 AM | 201 | Low | Creek |
| 29 | 08/11/2021 | 12:45 PM | 323 | Incoming | Creek |
| 29 | 08/16/2021 | 11:25 AM | 384 | Outgoing | Creek |
| 29 | 08/20/2021 | 8:35 AM | 2380 | Incoming | Creek |
| 29 | 08/11/2021 | 2:35 PM | 223 | High | Creek |
| 29 | 08/11/2021 | 8:15 AM | 355 | Low | Creek |
| 29 | 08/17/2021 | 3:10 PM | 309 | Low | Creek |
| 29 | 08/11/2021 | 4:45 PM | 884 | Outgoing | Creek |
| 29 | 08/10/2021 | 2:00 PM | 855 | High | Creek |
| 29 | 08/13/2021 | 9:30 AM | 1400 | Low | Creek |
| 29 | 08/11/2021 | 6:20 PM | 144 | Low | Creek |
| 30 | 08/16/2021 | 11:40 PM | 0 | Low | Creek |
| 30 | 08/20/2021 | 9:05 AM | 122 | Incoming | Creek |
| 30 | 08/13/2021 | 9:05 AM | 10 | Low | Drain Outfall |
| 30 | 08/08/2021 | 9:00 AM | 1956 | Incoming | Creek |
| 31 | 08/17/2021 | 5:20 PM | 7270 | Incoming | Creek |
| 31 | 08/17/2021 | 1:25 PM | 2910 | Low | Creek |
| 31 | 08/13/2021 | 9:20 AM | 3260 | Low | Outfall |
| 31 | 08/20/2021 | 10:00 AM | 1190 | Low | Creek |
| 31 | 08/16/2021 | 11:50 AM | 132 | Low | Creek |
| 31 | 08/17/2021 | 6:30 PM | 1850 | Incoming | Creek |
| 32 | 08/11/2021 | 8:05 AM | 1529 | Low | Creek |
| 32 | 08/20/2021 | 8:50 AM | 3260 | Incoming | Creek |
| 32 | 08/11/2021 | 4:35 PM | 3255 | Outgoing | Creek |
| 32 | 08/11/2021 | 6:10 PM | 354 | Low | Creek |
| 32 | 08/17/2021 | 8:45 AM | 241 | Outgoing | Creek |
| 32 | 08/11/2021 | 12:35 PM | 457 | Incoming | Creek |
| 32 | 08/17/2021 | 3:25 PM | 41 | Low | Creek |
| 32 | 08/10/2021 | 1:55 PM | 789 | High | Creek |
| 32 | 08/11/2021 | 2:25 PM | 631 | High | Creek |

| Good Harbor Creek | | | | | |
|---|---|---|---|---|---|
| Asset (S - #) | Date Collected | Time | Enterococci-CSU/ML | Tidal | Sample Location |
| 32 | 08/09/2021 | 9:50 AM | 1439 | Low | Creek |
| 33 | 08/13/2021 | 8:20 AM | 529 | Low | Drain Outfall |
| 34 | 08/13/2021 | 8:15 AM | 144 | Low | Drain Outfall |
| 34 | 08/20/2021 | 7:35 AM | 512 | Low | Creek |
| 35 | 08/16/2021 | 11:45 AM | 130 | Low | Creek |
| 35 | 08/20/2021 | 9:10 AM | 262 | Incoming | Creek |
| 35 | 08/13/2021 | 9:10 AM | 1380 | Low | Creek |
| 36 | 08/20/2021 | 8:00 AM | 7270 | Low | Creek |
| 36 | 08/16/2021 | 8:45 AM | 161 | Outgoing | Creek |
| 37 | 08/16/2021 | 8:50 AM | 473 | Outgoing | Creek |
| 38 | 08/20/2021 | 8:05 AM | 14100 | Low | Creek |
| 38 | 08/16/2021 | 9:00 AM | 379 | Outgoing | Creek |
| 39 | 08/19/2021 | 10:40 AM | 14100 | Outgoing | Creek |
| 39 | 08/20/2021 | 9:25 AM | 19900 | Incoming | Creek |
| 39 | 08/16/2021 | 9:10 AM | 1300 | Outgoing | Creek |
| 40 | 08/17/2021 | 8:15 AM | 1220 | Outgoing | Creek |
| 40 | 08/17/2021 | 3:00 PM | 1110 | Low | Creek |
| 40 | 08/16/2021 | 11:15 AM | 520 | Outgoing | Creek |
| 40 | 08/20/2021 | 8:25 AM | 1010 | Incoming | Creek |
| 41 | 08/20/2021 | 8:30 AM | 1150 | Incoming | Creek |
| 41 | 08/17/2021 | 8:20 AM | 776 | Outgoing | Creek |
| 41 | 08/16/2021 | 11:20 AM | 246 | Outgoing | Creek |
| 41 | 08/20/2021 | 8:45 AM | 1920 | Incoming | Creek |
| 41 | 08/17/2021 | 3:05 PM | 583 | Low | Creek |
| 42 | 08/17/2021 | 8:35 AM | 908 | Outgoing | Creek |
| 42 | 08/20/2021 | 9:00 AM | 5480 | Incoming | Creek |
| 42 | 08/17/2021 | 3:20 PM | 1790 | Low | Creek |
| 43 | 08/17/2021 | 8:40 AM | 393 | Outgoing | Creek |
| 45 | 08/18/2021 | 12:25 PM | | Low | Creek |
| 46 | 08/20/2021 | 9:15 AM | 3080 | Incoming | Creek |
| 46 | 08/19/2021 | 10:35 AM | 85 | Outgoing | Creek |
| 48 | 08/20/2021 | 9:20 AM | 13000 | Incoming | Creek |
| 48 | 08/19/2021 | 10:45 AM | 4880 | Outgoing | Creek |
| 49 | 08/20/2021 | 8:40 AM | 2760 | Incoming | Creek |




Entero Sampling - Good harbor area (1)


Entero Sampling - Good harbor area (2)

## ATTACHMENT B: LABORATORY ANALYTICAL REPORTS

Biomarine
Experts in Seafood and Water Testing since 1973

Biomarine Report No.: 75072
Date: September 26, 2022

# CERTIFICATE OF ANALYSIS

**CUSTOMER INFORMATION:**

Janelle Bonn
Woodard & Curran
40 Shattuck Rd.
Andover, MA 01810

**SAMPLE INFORMATION:**

Sample(s) Collected By: Hector Ortega

Sample Information: Collected 9/22/22 see location and time below

Date and Time Received: 9/22/22, 1615

Date and Time Analyzed: 9/22/22, 1630

**FINDINGS:**

| Biomarine Sample ID | Sample Location | Time Sampled | Enterococci/100 mL |
|---|---|---|---|
| 75072 A | 15-Good Harbor Creek-Cross Country Sewer Line | 1545 | 14,136 |
| 75072 B | 5-GHC-Hartz St. Culvert | 1518 | 19,863 |
| 75072 C | 1-GHB- Good Harbor Beach Boardwalk | 1415 | 1,616 |
| 75072 D | 13-GHC-Thatcher Road Crossing | 1445 | 15,531 |

**METHOD:** IDEXX Enterolert (MPN)

Jim Groleau, Laboratory Director




16 East Main Street Gloucester, MA 01930 978-281-0222 biomarine@biomarinelab.com www.biomarinelab.com

**EMSL ANALYTICAL, INC.**
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DnaLab2@emsl.com | www.emsl.com

**EMSL ORDER ID:** 612202151
**EMSL CUSTOMER ID:** WOCU33

**Attention:** Janelle Bonn
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40 Shattuck Road, Suite 110
Andover, MA 01810

**Phone:** (978) 557-8150
**Email:**

**Customer PO:**
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 9/24/2022
**Date Analyzed:** 9/28/2022
**Date Reported:** 9/29/2022
**Date Amended:**

## *Test Report: Rapid Detection of Human Bacteroides by Quantitative PCR*

EMSL Test: M199

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 2151-1 | 13 | GHC - Thaichee Road Crossing | 550 | 550 | 7,950 |
| 2151-2 | 5 | GHC - Hartz Street Culvert | 550 | 550 | 50,133 |
| 2151-3 | 1 | GHC - Good Harbor Beach Boardwalk | 925 | 925 | 1,180 |
| 2151-4 | 16 | Marina Drive & Lenna Drive MS4 Outfall | 180 | 180 | None Detected |
| 2151-5 | 39 | Witham St, South of Juppa Way at Wester End of Pond | 150 | 150 | None Detected |
| 2151-6 | 15 | Good Harbor Creek - Cross Country Sewer Line | 500 | 500 | 4,344 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.



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**Phone:** (978) 557-8150
**Email:**

**Customer PO:**
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 9/24/2022
**Date Analyzed:** 9/28/2022
**Date Reported:** 9/29/2022
**Date Amended:**

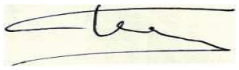
## *Test Report: Rapid Detection of Total Bacteroides by Quantitative PCR*

EMSL Test: M095

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 2151-1 | 13 | GHC - Thaichee Road Crossing | 550 | 550 | 42,114 |
| 2151-2 | 5 | GHC - Hartz Street Culvert | 550 | 550 | 148,839 |
| 2151-3 | 1 | GHC - Good Harbor Beach Boardwalk | 925 | 925 | 5,853 |
| 2151-4 | 16 | Marina Drive & Lenna Drive MS4 Outfall | 180 | 180 | 26,973 |
| 2151-5 | 39 | Witham St, South of Juppa Way at Wester End of Pond | 150 | 150 | 3,187,990 |
| 2151-6 | 15 | Good Harbor Creek - Cross Country Sewer Line | 500 | 500 | 48,821 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity



**Sergey Balashov, Ph.D.**

Biomarine
Experts in Seafood and Water Testing since 1973

Biomarine Report No.: 75077
Date: September 26, 2022

# CERTIFICATE OF ANALYSIS

**CUSTOMER INFORMATION:**

Janelle Bonn
Woodard & Curran
40 Shattuck Rd.
Andover, MA 01810

**SAMPLE INFORMATION:**

| | |
|---|---|
| Sample(s) Collected By: | Hector Ortega |
| Sample Information: | Collected 9/22/22 see location and time below (*Samples received out of hold time. The client was notified and requested that samples be run out of holding time*). |
| Date and Time Received: | 9/23/22, 1145 |
| Date and Time Analyzed: | 9/23/22, 1600 |

**FINDINGS:**

| Biomarine Sample ID | Sample Location | Time Sampled | Enterococci/100 mL |
|---|---|---|---|
| 75077 A | 16-Marina Dr. and Loma Dr. MS4 Outfall | 1700 | 3,654 |
| 75077 B | 39-Whitham St. south of Topra Way at western end of pond | 1745 | >24,196 |

**METHOD:** IDEXX Enterolert (MPN)

Jim Groleau, Laboratory Director




16 East Main Street Gloucester, MA 01930 978-281-0222 biomarine@biomarinelab.com www.biomarinelab.com

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**EMSL ORDER ID:** 612201048
**EMSL CUSTOMER ID:** SDEC42

**Attention:** Garrett Bergey
SDE Civil & Environmental Engineering
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Lawrence, MA 01843

**Phone:** (978) 975-0500
**Email:**

**Customer PO:** SDEC42
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/10/2022
**Date Analyzed:** 5/12/2022
**Date Reported:** 5/13/2022
**Date Amended:**

## *Test Report: Rapid Detection of Total Bacteroides by Quantitative PCR*

EMSL Test: M095

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1048-2 | Creek | Surface Water | 275 | 275 | 2,296 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

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**Customer PO:** SDEC42
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/10/2022
**Date Analyzed:** 5/12/2022
**Date Reported:** 5/13/2022
**Date Amended:**

# *Test Report: Rapid Detection of Human Bacteroides by Quantitative PCR*

EMSL Test: M199

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1048-1 | Creek | Surface Water | 275 | 275 | 421 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

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**Sergey Balashov, Ph.D.**

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**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/11/2022
**Date Analyzed:** 5/13/2022
**Date Reported:** 5/16/2022
**Date Amended:**

## *Test Report: Rapid Detection of Total Bacteroides by Quantitative PCR*

EMSL Test: M095

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1056-2 | Hartz Culvert | Surface Water/Culvert | 280 | 280 | 19,409 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

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**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/11/2022
**Date Analyzed:** 5/13/2022
**Date Reported:** 5/16/2022
**Date Amended:**

## *Test Report: Rapid Detection of Human Bacteroides by Quantitative PCR*

EMSL Test: M199

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1056-1 | Hartz Culvert | Surface Water/Culvert | 275 | 275 | 450 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

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**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/20/2022
**Date Analyzed:** 5/24/2022
**Date Reported:** 5/25/2022
**Date Amended:**

## *Test Report: Rapid Detection of Total Bacteroides by Quantitative PCR*

EMSL Test: M095

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1144-1 | 13 | Creek | 1050 | 1050 | 2,506 |
| 1144-2 | 39 | Creek | 1000 | 1000 | 90,655 |
| 1144-3 | 16 | Creek | 1050 | 1050 | 119,821 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.



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**Email:**

**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/20/2022
**Date Analyzed:** 5/24/2022
**Date Reported:** 5/25/2022
**Date Amended:**

## *Test Report: Rapid Detection of Human Bacteroides by Quantitative PCR*

EMSL Test: M199

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1144-1 | 13 | Creek | 1050 | 1050 | None Detected |
| 1144-2 | 39 | Creek | 1000 | 1000 | None Detected |
| 1144-3 | 16 | Creek | 1050 | 1050 | None Detected |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity of

**Sergey Balashov, Ph.D.**

**EMSL ANALYTICAL, INC.**
200 Route 130 North,
Cinnaminson, NJ 08077
DnaLab2@emsl.com | www.emsl.com

**EMSL ORDER ID:** 612201090
**EMSL CUSTOMER ID:** SDEC42

**Attention:** Garrett Bergey
SDE Civil & Environmental Engineering
354 Merrimack Street, Suite 200
Lawrence, MA 01843

**Phone:** (978) 975-0500
**Email:**

**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/13/2022
**Date Analyzed:** 5/17/2022
**Date Reported:** 5/18/2022
**Date Amended:**

## *Test Report: Rapid Detection of Total Bacteroides by Quantitative PCR*

EMSL Test: M095

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1090-2 | DMH_396 | Storm Drain Manhole | 260 | 260 | 480 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity

**Sergey Balashov, Ph.D.**

**EMSL ANALYTICAL, INC.**
200 Route 130 North,
Cinnaminson, NJ 08077
DnaLab2@emsl.com | www.emsl.com

**EMSL ORDER ID:** 612201090
**EMSL CUSTOMER ID:** SDEC42

**Attention:** Garrett Bergey
SDE Civil & Environmental Engineering
354 Merrimack Street, Suite 200
Lawrence, MA 01843

**Phone:** (978) 975-0500
**Email:**

**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/13/2022
**Date Analyzed:** 5/17/2022
**Date Reported:** 5/18/2022
**Date Amended:**

## *Test Report: Rapid Detection of Human Bacteroides by Quantitative PCR*

EMSL Test: M199

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1090-1 | DMH-396 | Storm Drain Manhole | 250 | 250 | None Detected |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity of

**Sergey Balashov, Ph.D.**

**EMSL ANALYTICAL, INC.**
200 Route 130 North,
Cinnaminson, NJ 08077
DnaLab2@emsl.com | www.emsl.com

**EMSL ORDER ID:** 612201124
**EMSL CUSTOMER ID:** SDEC42

**Attention:** Garrett Bergey
SDE Civil & Environmental Engineering
354 Merrimack Street, Suite 200
Lawrence, MA 01843

**Phone:** (978) 975-0500
**Email:**

**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/18/2022
**Date Analyzed:** 5/19/2022
**Date Reported:** 5/23/2022
**Date Amended:**

## *Test Report: Rapid Detection of Total Bacteroides by Quantitative PCR*

EMSL Test: M095

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1124-1 | DMH_13804 | Storm Drain Manhole | 1025 | 1025 | 5,261 |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. When the information supplied by the customer can affect the validity

**Sergey Balashov, Ph.D.**

R.I. ANALYTICAL
Specialists in Environmental Services

# LABORATORY REPORT

Woodard & Curran
Attn: Janelle bonn
33 Broad Street
One Weybosset Hill, Floor 7
Providence, RI 02903

**Date Received:** 5/10/2022
**Date Reported:** 5/12/2022
**P.O. Number**

**Work Order #:** 2205-07633

**Project Name:** PROJECT # 22.01B GLOUCESTER IDDE

Enclosed are the analytical results and Chain of Custody for your project referenced above. The sample(s) were analyzed by our Warwick, RI laboratory unless noted otherwise. When applicable subcontracted results are noted and subcontracted reports are enclosed in their entirety.

All samples were analyzed within the established guidelines of US EPA approved methods with all requirements met, unless otherwise noted at the end of a given sample's analytical results or in a case narrative.

The Detection Limit is defined as the lowest level that can be reliably achieved during routine laboratory conditions.

These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:

Nicole Skyleson

Nicole Skyleson
Data Reporting Manager

**R.I. Analytical Laboratories, Inc.**

**Laboratory Report**

Woodard & Curran

Work Order #: 2205-07633

**Project Name:** PROJECT # 22.01B GLOUCESTER IDDE

---

**Sample Number:** 001
**Sample Description:** TB-1
**Sample Type :** GRAB
**Sample Date / Time :** 5/10/2022 @ 09:58

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | ANALYST |
|---|---|---|---|---|---|---|
| E. Coli 18 Hour | <1.0 | 1.0 | MPN/100 ml | SM9223B | 5/10/2022 16:59 | LKB |

---

**Sample Number:** 002
**Sample Description:** HARTZ CULVERT
**Sample Type :** GRAB
**Sample Date / Time :** 5/10/2022 @ 10:00

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | ANALYST |
|---|---|---|---|---|---|---|
| Enterococci | 10.9 | 1.0 | MPN/100 ml | IDEXX Enterolert | 5/10/2022 17:02 | LKB |
| LAS Surfactants (MBAS) | 0.18 | 0.12 | mg/l | SM5540C 18-21ed | 5/10/2022 17:58 | JEP |

# R.I. ANALYTICAL
Specialists in Environmental Services

# CHAIN OF CUSTODY RECORD

41 Illinois Avenue
Warwick, RI 02888-3007
Tel: 800-937-2580

131 Coolidge St., Suite 105
Hudson, MA 01749-1331
Tel: 800-937-2580

| Date Collected | Time Collected | Field Sample Identification | Grab or Composite | # of Containers & Type C | Preservation Code P | Matrix Code M | E. coli | Entero | Surfactants |
|---|---|---|---|---|---|---|---|---|---|
| 5/10/22 | 9:58 am | TB-1 | G | 1St | T | SW | ✓ | | |
| 5/10/22 | 10:00 am | Hartz Culvert | G | 2SVP | T/HP | SW | | ✓ | ✓ |

3

**Client Information**

Company Name: Woodard and Curran inc
Address: 33 Broad Street / one Weybosset
City / State / Zip: Providence RI 02903
Main Telephone: 401-743-2661
Contact Person: Janelle Bonn

**Project Information**

Project Name: Gloucester IDDE
P.O. Number:
Project Number: 22.016
Report To: Janelle Bonn / Garrett Bergey
Cell:
Phone: 978-975-0500
Sampled by:
Quote No:
Email addresses: jbonn@woodardcurran.com; gbergey@sde-inc.com

| Relinquished By Signatures | Date | Time | Received By Signatures | Date | Time |
|---|---|---|---|---|---|
| | 5/10/22 | 2:56 PM | | 5/10/22 | 14:55 |
| | 5/10/22 | 16:55 | | 5/10/22 | 16:55 |
| | 5/10/22 | 16:15 | | 5/10/22 | 16:15 |

**Turn Around Time**

✓ Normal ✓ EMAIL Report
5-7 Business days
Rush – Date Due: ___/___/___

**Reporting Options**

- MCP Standard
- MWRA eSMART
- State Report & Upload

**Project Comments**

3.1
1.2 °C
Temp. Upon Receipt

**Lab Use Only**

- Sample Pick Up Only
- RIAL sampled; attach field hours
- ✓ Received on Ice | No Ice
- Workorder No: 2205-07633

Containers: P=Poly, G=Glass, AG=Amber Glass, V=Vial, St=Sterile Preservatives: A=Ascorbic Acid, NH4=$NH_4Cl$, DI=DI-$H_2O$, H=HCl, M=MeOH, N=$HNO_3$, NP=None, S=$H_2SO_4$, SH=NaOH, T=$Na_2S_2O_3$, Z=ZnOAc
Matrix Codes: GW=Groundwater, SW=Surface Water, WW=Wastewater, DW=Drinking Water, S=Soil, SL=Sludge, A=Air, B=Bulk/Solid, WP=Wipe, O=

**EMSL ANALYTICAL, INC.**
200 Route 130 North,
Cinnaminson, NJ 08077
DnaLab2@emsl.com | www.emsl.com

**EMSL ORDER ID:** 612201124
**EMSL CUSTOMER ID:** SDEC42

**Attention:** Garrett Bergey
SDE Civil & Environmental Engineering
354 Merrimack Street, Suite 200
Lawrence, MA 01843

**Phone:** (978) 975-0500
**Email:**

**Customer PO:** 22.016
**LIMS Project ID:**
**Project ID:** Gloucester IDDE

**Date Received:** 5/18/2022
**Date Analyzed:** 5/19/2022
**Date Reported:** 5/23/2022
**Date Amended:**

## *Test Report: Rapid Detection of Human Bacteroides by Quantitative PCR*

EMSL Test: M199

| Lab Sample Number | Client Sample ID | Description | Water Received (mL) | Water Sampled (mL) | CEs */100 mL |
|---|---|---|---|---|---|
| 1124-1 | DMH_13804 | Storm Drain Manhole | 1025 | 1025 | None Detected |

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

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**Sergey Balashov, Ph.D.**

R.I. ANALYTICAL
Specialists in Environmental Services

# LABORATORY REPORT

Woodard & Curran
Attn: Janelle Bonn
33 Broad Street
One Weybosset Hill, Floor 7
Providence, RI 02903

**Date Received:** 5/19/2022
**Date Reported:** 5/24/2022
**P.O. Number**

**Work Order #:** 2205-08258

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

Enclosed are the analytical results and Chain of Custody for your project referenced above. The sample(s) were analyzed by our Warwick, RI laboratory unless noted otherwise. When applicable subcontracted results are noted and subcontracted reports are enclosed in their entirety.

All samples were analyzed within the established guidelines of US EPA approved methods with all requirements met, unless otherwise noted at the end of a given sample's analytical results or in a case narrative.

The Detection Limit is defined as the lowest level that can be reliably achieved during routine laboratory conditions.

These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:

Nicole Skyleson

Nicole Skyleson
Data Reporting Manager

Laboratory Certification Numbers (as applicable to sample's origin state):
Warwick RI * RI LAI00033, MA M-RI015, CT PH-0508

**R.I. Analytical Laboratories, Inc.**

**Laboratory Report**

Woodard & Curran

Work Order #: 2205-08258

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

---

**Sample Number:** 001
**Sample Description:** TB-1
**Sample Type :** GRAB
**Sample Date / Time :** 5/19/2022 @ 09:08

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | | ANALYST |
|---|---|---|---|---|---|---|---|
| E. Coli 18 Hour | <1.0 | 1.0 | MPN/100 ml | SM9223B | 5/19/2022 | 18:51 | MS |

The E.Coli coliform sample was received and analyzed outside the recommended hold time.

---

**Sample Number:** 002
**Sample Description:** 13
**Sample Type :** GRAB
**Sample Date / Time :** 5/19/2022 @ 09:28

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | | ANALYST |
|---|---|---|---|---|---|---|---|
| LAS Surfactants (MBAS) | 1.2 | 0.12 | mg/l | SM5540C 18-21ed | 5/19/2022 | 15:17 | JEP |
| Enterococci | 556 | 10 | MPN/100 ml | IDEXX Enterolert | 5/19/2022 | 17:49 | HMA |

The Enterococci coliform sample was received close to hold time expiration and was analyzed outside the recommended hold time.

---

**Sample Number:** 003
**Sample Description:** 39
**Sample Type :** GRAB
**Sample Date / Time :** 5/19/2022 @ 09:10

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | | ANALYST |
|---|---|---|---|---|---|---|---|
| LAS Surfactants (MBAS) | 1.8 | 0.12 | mg/l | SM5540C 18-21ed | 5/19/2022 | 15:17 | JEP |
| Enterococci | 301 | 10 | MPN/100 ml | IDEXX Enterolert | 5/19/2022 | 17:49 | HMA |

The Enterococci coliform sample was received and analyzed outside the recommended hold time.

**R.I. Analytical Laboratories, Inc.**

**Laboratory Report**

Woodard & Curran

Work Order #: 2205-08258

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

---

**Sample Number:** 004
**Sample Description:** 16
**Sample Type :** GRAB
**Sample Date / Time :** 5/19/2022 @ 10:00

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | | ANALYST |
|---|---|---|---|---|---|---|---|
| LAS Surfactants (MBAS) | 1.1 | 0.12 | mg/l | SM5540C 18-21ed | 5/19/2022 | 15:17 | JEP |
| Enterococci | 884 | 10 | MPN/100 ml | IDEXX Enterolert | 5/19/2022 | 17:49 | HMA |

# R.I. ANALYTICAL
Specialists in Environmental Services

# CHAIN OF CUSTODY RECORD

41 Illinois Avenue
Warwick, RI 02888-3007
800-937-2580 • Fax: 401-738-1970

131 Coolidge St., Suite 105
Hudson, MA 01749-1331
800-937-2580 • Fax: 978-568-0078

| Date Collected | Time Collected | Field Sample Identification | Grab or Composite (05-12-22) | # of Containers & Type [C] | Preservation Code [P] | Matrix Code [M] | Surfactants | Entero | E. Coli |
|---|---|---|---|---|---|---|---|---|---|
| 5/19 | 9:08 | TB-1 | G | 1/P | NP | SW | | | ✓ |
| 5/19 | 9:28 am | 13 | G | 2/P | NP | SW | ✓ | ✓ | |
| 5/19 | 9:10 am | 39 | G | 2/P | NP | SW | ✓ | ✓ | |
| 5/19 | 10:00 am | 16 | G | 2/P | NP | SW | ✓ | ✓ | |
| | | | | | | | 4 | | |

## Client Information

| | |
|---|---|
| Company Name: | Woodard & Curran, Inc. |
| Address: | 33 Broad Street/One Weybosset Hill |
| City / State / Zip: | Providence, RI 02903 |
| Telephone: | 401-793-2661 Fax: |
| Contact Person: | Janelle Bonn |

## Project Information

| | |
|---|---|
| Project Name: | Gloucester IDDE |
| P.O. Number: | Project Number: 22.016 |
| Report To: | Janelle Boon Phone: Fax |
| Sampled by: | Email report to these addresses: jbonn@woodardcurran.com gbergey@sde-inc.com |
| Quote No: | |

| Relinquished By Signatures | Date | Time | Received By Signatures | Date | Time |
|---|---|---|---|---|---|
| | 5/19/22 | 3:18 | | 5/19/22 | 15:18 |
| | 5/19/22 | 15:50 | | 5/19/22 | 15:50 |
| | 5/19/22 | 17:15 | | 5-19-22 | (715) |

## Turn Around Time

| | | |
|---|---|---|
| | Normal | EMAIL Report |
| X | 5-7 Business days | |
| | Rush – Date Due: __/__/__ | |

## Project Comments

Circle if applicable: GW-1, GW-2, GW-3, S-1, S-2, S-3 MCP Data Enhancement QC Package? Yes No 38

Temp. Upon Receipt 10.2 °C

## Lab Use Only

- Sample Pick Up Only
- RIAL sampled; attach field hours
- ~~Shipped~~ on ice
- Workorder No: 22052258

Containers: P=Poly, G=Glass, AG=Amber Glass, V=Vial, St=Sterile Preservatives: A=Ascorbic Acid, NH4=$NH_4Cl$, H=HCl, M=MeOH, N=$HNO_3$, NP=None, S=$H_2SO_4$, SB=$NaHSO_4$, SH=NaOH, T=$Na_2S_2O_3$, Z=ZnOAc

R.I. ANALYTICAL
Specialists in Environmental Services

# LABORATORY REPORT

Woodard & Curran
Attn: Janelle Bonn
33 Broad Street
One Weybosset Hill, Floor 7
Providence, RI 02903

**Date Received:** 5/9/2022
**Date Reported:** 5/12/2022
**P.O. Number**

**Work Order #:** 2205-07553

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

Enclosed are the analytical results and Chain of Custody for your project referenced above. The sample(s) were analyzed by our Warwick, RI laboratory unless noted otherwise. When applicable subcontracted results are noted and subcontracted reports are enclosed in their entirety.

All samples were analyzed within the established guidelines of US EPA approved methods with all requirements met, unless otherwise noted at the end of a given sample's analytical results or in a case narrative.

The Detection Limit is defined as the lowest level that can be reliably achieved during routine laboratory conditions.

These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:

Nicole Skyleson

Nicole Skyleson
Data Reporting Manager

Laboratory Certification Numbers (as applicable to sample's origin state):
Warwick RI * RI LAI00033, MA M-RI015, CT PH-0508

**R.I. Analytical Laboratories, Inc.**

**Laboratory Report**

Woodard & Curran

Work Order #: 2205-07553

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

---

**Sample Number:** 001
**Sample Description:** TB-1
**Sample Type :** GRAB
**Sample Date / Time :** 5/09/2022 @ 11:15

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | | ANALYST |
|---|---|---|---|---|---|---|---|
| E. Coli 18 Hour | <1.0 | 1.0 | MPN/100 ml | SM9223B | 5/9/2022 | 16:40 | MS |

---

**Sample Number:** 002
**Sample Description:** CREEK
**Sample Type :** GRAB
**Sample Date / Time :** 5/09/2022 @ 11:20

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | | ANALYST |
|---|---|---|---|---|---|---|---|
| Enterococci | 2.0 | 1.0 | MPN/100 ml | IDEXX Enterolert | 5/9/2022 | 16:19 | MS |
| LAS Surfactants (MBAS) | <0.12 | 0.12 | mg/l | SM5540C 18-21ed | 5/10/2022 | 17:58 | JEP |

# R.I. ANALYTICAL
Specialists in Environmental Services

# CHAIN OF CUSTODY RECORD

41 Illinois Avenue
Warwick, RI 02888-3007
Tel: 800-937-2580

131 Coolidge St., Suite 105
Hudson, MA 01749-1331
Tel: 800-937-2580

| Date Collected | Time Collected | Field Sample Identification | Grab or Composite | # of Containers & Type C | Preservation Code P | Matrix Code M | Ecoli | Entero | Surfactants |
|---|---|---|---|---|---|---|---|---|---|
| 5/9/22 | 11:15 | TB-1 | G | 1/St | T | SW | X | | |
| 5/9/22 | 11:20 | Creek | G | 2/St | P T/NA | SW | | X | X |

**Client Information**

Company Name: Woodard & Curran
Address: 33 Broad St / One Weybosset Hill FL7
City / State / Zip: Providence RI 02903
Main Telephone:
Contact Person: Janelle Bonn

**Project Information**

Project Name: Gloucester IDE
P.O. Number:
Project Number: 22.016
Report To: Janelle Bonn / Gillian Bergey
Phone: 978 975 0500
Sampled by: NK/SR
Email addresses: gbergey@sde-inc.com
Quote No:

| Relinquished By Signatures | Date | Time | Received By Signatures | Date | Time |
|---|---|---|---|---|---|
| | 5/9/22 | 2:47 | | 5/9/22 | 1945 |
| | 5/9/22 | 1600 | | 5.9.22 | 1600 |
| | | | | | |

**Turn Around Time**

Normal | EMAIL Report
5-7 Business days
Rush – Date Due: ___/___/___

**Reporting Options**

- MCP Standard
- MWRA eSMART
- State Report & Upload

**Project Comments**

Expect bacteria results between 0 – 80,000

3.2°C

Temp. Upon Receipt °C

**Lab Use Only**

- Sample Pick Up Only
- RIAL sampled; attach field hours
- Received on Ice | No Ice
- Workorder No. 22205-07553

Containers: P=Poly, G=Glass, AG=Amber Glass, V=Vial, St=Sterile Preservatives: A=Ascorbic Acid, NH4=$NH_4Cl$, DI=DI-$H_2O$, H=HCl, M=MeOH, N=$HNO_3$, NP=None, S=$H_2SO_4$, SH=NaOH, T=$Na_2S_2O_3$, Z=ZnOAc
Matrix Codes: GW=Groundwater, SW=Surface Water, WW=Wastewater, DW=Drinking Water, S=Soil, SL=Sludge, A=Air, B=Bulk/Solid, WP=Wipe, O=_____

R.I. ANALYTICAL
Specialists in Environmental Services

# LABORATORY REPORT

Woodard & Curran
Attn: Mr. Garrett Rose
33 Broad Street
One Weybosset Hill, Floor 7
Providence, RI 02903

**Date Received:** 5/12/2022
**Date Reported:** 5/16/2022
**P.O. Number**

**Work Order #:** 2205-07816

**Project Name:** PROJECT#22.016 GLOUCESTER IDDE

Enclosed are the analytical results and Chain of Custody for your project referenced above. The sample(s) were analyzed by our Warwick, RI laboratory unless noted otherwise. When applicable subcontracted results are noted and subcontracted reports are enclosed in their entirety.

All samples were analyzed within the established guidelines of US EPA approved methods with all requirements met, unless otherwise noted at the end of a given sample's analytical results or in a case narrative.

The Detection Limit is defined as the lowest level that can be reliably achieved during routine laboratory conditions.

These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:

Nicole Skyleson

Nicole Skyleson
Data Reporting Manager

Laboratory Certification Numbers (as applicable to sample's origin state):
Warwick RI * RI LAI00033, MA M-RI015, CT PH-0508

**R.I. Analytical Laboratories, Inc.**

**Laboratory Report**

Woodard & Curran

Work Order #: 2205-07816

**Project Name:** PROJECT#22.016 GLOUCESTER IDDE

---

**Sample Number:** 001
**Sample Description:** TB-1
**Sample Type :** GRAB
**Sample Date / Time :** 5/12/2022 @ 10:45

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | ANALYST |
|---|---|---|---|---|---|---|
| E. Coli 18 Hour | <1.0 | 1.0 | MPN/100 ml | SM9223B | 5/12/2022 18:37 | MS |

---

**Sample Number:** 002
**Sample Description:** DMH_396
**Sample Type :** GRAB
**Sample Date / Time :** 5/12/2022 @ 10:50

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | ANALYST |
|---|---|---|---|---|---|---|
| Enterococci | 1.0 | 1.0 | MPN/100 ml | IDEXX Enterolert | 5/12/2022 18:35 | MS |

# R.I. ANALYTICAL
Specialists in Environmental Services

# CHAIN OF CUSTODY RECORD

41 Illinois Avenue
Warwick, RI 02888-3007
800-937-2580 • Fax: 401-738-1970

131 Coolidge St., Suite 105
Hudson, MA 01749-1331
800-937-2580 • Fax: 978-568-0078

| Date Collected | Time Collected | Field Sample Identification | Grab or Composite (05-12-22) | # of Containers & Type C | Preservation Code P | Matrix Code M | E. coli | Enterococci |
|---|---|---|---|---|---|---|---|---|
| 5/12/22 | 10:45 | TB-1 | G | 1/St | T | SW | X | |
| 5/12 | 10:50 | DMH-396 | G | 1/st | T | SW | | X |

## Client Information

Company Name: Woodard & Curran, Inc.
Address: 33 Broad Street/One Weybosset Hill
City / State / Zip: Providence, RI 02903
Telephone: 401-793-2661 Fax:
Contact Person: Janelle Bonn

## Project Information

Project Name: Gloucester IDDE
P.O. Number: Project Number: 22.016
Report To: Janelle Boon Phone: Fax
Sampled by: SP/NK
Quote No:
Email report to these addresses: jbonn@woodardcurran.com; gbergey@sde-inc.com

| Relinquished By Signatures | Date | Time | Received By Signatures | Date | Time |
|---|---|---|---|---|---|
| | 5/12 | 2:58 | | 5/12/22 | 14:58 |
| | 5/12/22 | | | 5/12/22 | 1655 |
| | 5/12/22 | 1730 | | 5-12-22 | 1730 |

## Turn Around Time

| | Normal | | EMAIL Report |
|---|---|---|---|
| X | 5-7 Business days | | |
| | Rush – Date Due: __/__/__ | | |

## Project Comments

Circle if applicable: GW-1, GW-2, GW-3, S-1, S-2, S-3 MCP Data Enhancement QC Package? Yes No

Temp. Upon Receipt 4.6 / 2.5 °C

## Lab Use Only

- Sample Pick Up Only
- RIAL sampled; attach field hours
- X Shipped on ice

Workorder No: 2205-07816

Containers: P=Poly, G=Glass, AG=Amber Glass, V=Vial, St=Sterile Preservatives: A=Ascorbic Acid, NH4=$NH_4Cl$, H=HCl, M=MeOH, N=$HNO_3$, NP=None, S=$H_2SO_4$, SB=$NaHSO_4$, SH=NaOH, T=$Na_2S_2O_3$, Z=ZnOAc

R.I. ANALYTICAL
Specialists in Environmental Services

# LABORATORY REPORT

Woodard & Curran
Attn: Janelle Bonn
33 Broad Street
One Weybosset Hill, Floor 7
Providence, RI 02903

**Date Received:** 5/17/2022
**Date Reported:** 5/19/2022
**P.O. Number**

**Work Order #:** 2205-08052

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

Enclosed are the analytical results and Chain of Custody for your project referenced above. The sample(s) were analyzed by our Warwick, RI laboratory unless noted otherwise. When applicable subcontracted results are noted and subcontracted reports are enclosed in their entirety.

All samples were analyzed within the established guidelines of US EPA approved methods with all requirements met, unless otherwise noted at the end of a given sample's analytical results or in a case narrative.

The Detection Limit is defined as the lowest level that can be reliably achieved during routine laboratory conditions.

These results only pertain to the samples submitted for this Work Order # and this report shall not be reproduced except in its entirety.

We certify that the following results are true and accurate to the best of our knowledge. If you have questions or need further assistance, please contact our Customer Service Department.

Approved by:

Nicole Skyleson

Nicole Skyleson
Data Reporting Manager

Laboratory Certification Numbers (as applicable to sample's origin state):
Warwick RI * RI LAI00033, MA M-RI015, CT PH-0508

**R.I. Analytical Laboratories, Inc.**

**Laboratory Report**

Woodard & Curran

Work Order #: 2205-08052

**Project Name:** PROJECT# 22.016 GLOUCESTER IDDE

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**Sample Number:** 001
**Sample Description:** TB-1
**Sample Type :** GRAB
**Sample Date / Time :** 5/17/2022 @ 09:05

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | ANALYST |
|---|---|---|---|---|---|---|
| E. Coli 18 Hour | <1.0 | 1.0 | MPN/100 ml | SM9223B | 5/17/2022 17:37 | HMA |

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**Sample Number:** 002
**Sample Description:** DMH_13804
**Sample Type :** GRAB
**Sample Date / Time :** 5/17/2022 @ 09:15

| PARAMETER | SAMPLE RESULTS | DET. LIMIT | UNITS | METHOD | DATE/TIME ANALYZED | ANALYST |
|---|---|---|---|---|---|---|
| Enterococci | 75 | 10 | MPN/100 ml | IDEXX Enterolert | 5/17/2022 17:39 | HMA |
| LAS Surfactants (MBAS) | 0.55 | 0.12 | mg/l | SM5540C 18-21ed | 5/17/2022 19:40 | JEP |

The E.Coli/Enterococci coliform samples were received close to hold time expiration and were analyzed outside the recommended hold time.

# R.I. ANALYTICAL
Specialists in Environmental Services

# CHAIN OF CUSTODY RECORD

41 Illinois Avenue
Warwick, RI 02888-3007
800-937-2580 • Fax: 401-738-1970

131 Coolidge St., Suite 105
Hudson, MA 01749-1331
800-937-2580 • Fax: 978-568-0078

| Date Collected | Time Collected | Field Sample Identification | Grab or Composite | # of Containers & Type [C] | Preservation Code [P] | Matrix Code [M] | E. Coli | Enters | Surfactants |
|---|---|---|---|---|---|---|---|---|---|
| 5/17 | 9:05 | TB-1 | G | 1/P | NP | SW | X | | |
| 5/17 | 9:15 | DMH_13804 | G | 2/P | NP | SW | | X | X |

05-12-22

## Client Information

| | |
|---|---|
| Company Name: | Woodard & Curran, Inc. |
| Address: | 33 Broad Street/One Weybosset Hill |
| City / State / Zip: | Providence, RI 02903 |
| Telephone: | 401-793-2661 Fax: |
| Contact Person: | Janelle Bonn |

## Project Information

| | |
|---|---|
| Project Name: | Gloucester IDDE |
| P.O. Number: | Project Number: 22.016 |
| Report To: | Janelle Boon Phone: Fax |
| Sampled by: | SR |
| Quote No: | Email report to these addresses: jbonn@woodardcurran.com gbergey@sde-inc.com |

| Relinquished By Signatures | Date | Time | Received By Signatures | Date | Time |
|---|---|---|---|---|---|
| | 5/17 | 2:30 | | 5/17/22 | 14:30 |
| | 5/17/22 | 1520 | | 5/17/22 | 1520 |
| | 5/17/22 | 1640 | | 5/17/22 | 1640 |

## Turn Around Time

| | | |
|---|---|---|
| | Normal | EMAIL Report |
| X | 5-7 Business days | |
| | Rush – Date Due: ___/___/___ | |

## Project Comments

Circle if applicable: GW-1, GW-2, GW-3, S-1, S-2, S-3 MCP Data Enhancement QC Package? Yes No

Expect bacteria results between 0-80000

Temp. Upon Receipt 2.1 °C

## Lab Use Only

| | |
|---|---|
| | Sample Pick Up Only |
| | RIAL sampled; attach field hours |
| X | Shipped on ice |
| Workorder No: | 22050512 |

Containers: P=Poly, G=Glass, AG=Amber Glass, V=Vial, St=Sterile Preservatives: A=Ascorbic Acid, NH4=$NH_4Cl$, H=HCl, M=MeOH, N=$HNO_3$, NP=None, S=$H_2SO_4$, SB=$NaHSO_4$, SH=NaOH, T=$Na_2S_2O_3$, Z=ZnOAc
Matrix Codes: GW=Groundwater, SW=Surface Water, WW=Wastewater, DW=Drinking Water, S=Soil, SL=Sludge, A=Air, B=Bulk/Solid, WP=Wipe, O=_____