City of Cambridge
Department of Public Works

FIELD INSPECTION & PRE-DESIGN MEMORANDUM

For

CAM400 COMMON MANHOLE SEPARATION PROJECT

Submitted to:
City of Cambridge
Department of Public Works

Submitted by:

September 17, 2009

VOLUME 1

6.0 BUILDING INSPECTIONS OF RESIDENTIAL BUILDINGS

Building inspections were carried out over the course of a five week period (4/6/2009-5/7/2009). In total, 87 buildings in the CAM 400 Project Area were successfully inspected, while access could not be gained to the remaining 13 of the 100 buildings identified for inspection; all of which are residential properties. Building inspection logs, photos and notes can be found in Appendix F. The building inspection conclusions have been summarized and portrayed in Figure 2 - GIS Map of Existing Conditions.

6.1 Sanitary Sewer Connections to Storm Drains

3-5 Harrison Avenue

Dye testing of the sanitary sewer from this property confirmed an illicit connection to the storm drain on Harrison Ave. This service is currently impacted by backwater conditions in the storm drain system as described in greater detail in the Appendix F building inspection report for this property.

16-18 Kimball Street
Dye testing of this property confirmed an illicit connection to the 24-inch diameter storm drain on Kimball Street.

15-17 and 19-21 Kimball Street
Dye testing of these properties confirmed connections to the 18-inch diameter combined sewer on Kimball Street. This sewer may have been constructed as a combined sewer and the services may have been properly installed. However, if the 18-inch diameter combined sewer is found to be more effectively utilized as a storm drain, these services are recommended to be reconnected to the existing 10-inch diameter sanitary sewer on Kimball Street as part of the proposed design.

5-6, 9-10, and 27-28 Seagrave Road
During the manhole inspections conducted on Seagrave Road, none of the common manhole separation plates were in place and dry weather flow was noted in the drain line of all manholes. Dye testing of buildings at 5-6 and 27-28 Seagrave Road confirmed illicit connections to the storm drain on Seagrave Road. Subsequent review of TV tapes identified 9-10 Seagrave Road as an additional illicit connection to the storm drain.

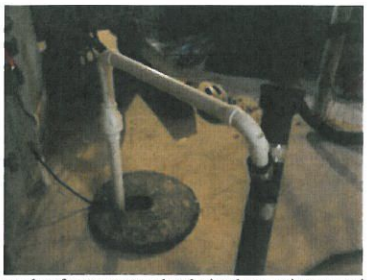

Looking southwest on Seagrave at S75SMH1515


Inlet sewer and inlet drain in S75COM1515
Shows drain flowing into sewer

Figure 8 – Manhole S75COM1515 – Illicit Flow in Drain

6.2 Sump Pump Connections to Building Sanitary Sewers

6 Properties with Sump Pump Connections to Sanitary Sewer
Building inspection protocol included documentation of basement flooding conditions and sump pump arrangements at each residence to determine individual means and necessity of dewatering. In most cases, existing sump pumps were found to discharge to the surface, or one did not exist at the residence. However, six properties have sump pumps whose discharge was found to be hard piped or manually connected to the building's main sanitary discharge. Within this group of properties, four property owners report regular or seasonal flooding by means of groundwater infiltration and/or sanitary backups in which the use of their sump pump is necessary, adding to the loading of the street's sanitary line. These properties include 11-13 Harrison Avenue, 15 Kassul Park, 16-18 Kimball Street, and 24 Madison Avenue. The remaining two residences, 19 Magoun Street and 24 Columbus Avenue, reported negligible flooding issues where their sump pump was rarely, if ever, used.



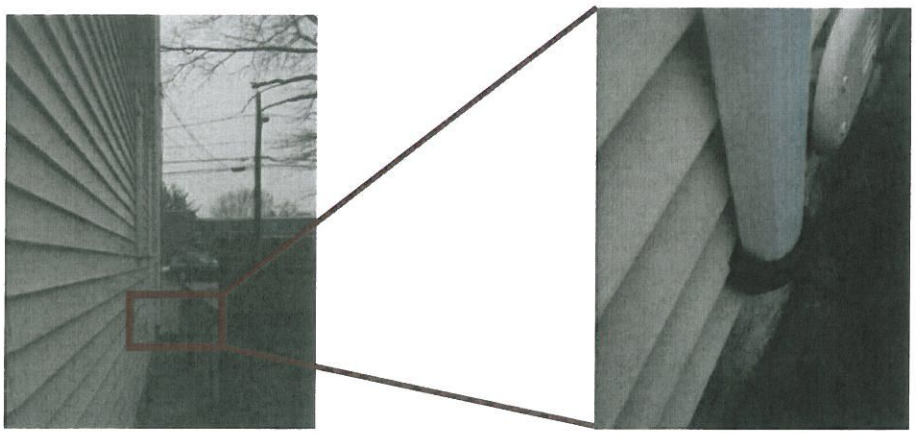
Example of sump pump hard piped to sanitary service, easily removed and redirected to surface.

Figure 9 – Sump Pump Connection to Building Sewer

6.3 Roof Drain Connections to Building Sanitary Service

5 Confirmed and 11 Probable Connections to Sewers

None of the pitched roofs were observed to have downspouts that entered the buildings and connect to the sanitary sewer within the building. Flat roof drains are more difficult to identify and more difficult to separate. Within the CAM 400 study area, a total of 17 residential buildings were found to have flat roofs and the locations of these building are shown in Figure 2. Building inspections were conducted on 12 of the 17 buildings, four of which had internal drain pipes that were connected to the sanitary sewer within the building and one had an external downspout that connected to the sanitary service through a hole in the foundation wall. Those with internal drain pipes include 24 Madison Avenue, 42 Madison Avenue, 39 Magoun Street, and 2578 Massachusetts Avenue. The building with the external downspout connection was 58 Madison Avenue. At 22 and 38-40 Madison Avenue, separate sanitary and flat roof drain lines were found exiting the building and these provide the potential for separating the flat roofs wherever a storm drain exists in the street. In addition, 54-56 Madison Avenue was inspected and was found to have a flat roof which drains to the surface. The connection of the remaining flat roof buildings could not be confirmed but are most likely connected to the sewer system. These cases consisted of flat roof drains that go into the basement floor, or where no line could be found at all. No flat roof drains were dye tested in the field to confirm connectivity.



Roof drain gutter, at 58 Madison Avenue, hard piped to sanitary service, easily redirected to surface

Figure 10 – Flat Roof Drain Connection to Building Sewer

6.4 Buildings Not Inspected

After building inspection notifications were circulated, followed by up to three separate cold call attempts at each residence over the 5 weeks building inspections were carried out, 13 building inspections remained outstanding. Of the 13 properties that were not inspected, all were residential properties. These consist of five properties on Madison Avenue, five on Magoun Street, and three on Seagrave Road.

Out of these 13 properties, 12 are assumed to be connected correctly and one is a probable illicit connection. The one property that could be illicit is 9-10 Seagrave Road. This was determined after reviewing CCTV tapes of Seagrave Road (Tapes and TV Logs D2 and D3). An active break-in connection with visible sewage was found coming from the direction of 9-10 Seagrave Road approximately five feet upstream of manhole S75COM1510 in the storm drain.

Since 20 Magoun, 28 Magoun, 30 Madison, 34 Madison, 35 Madison, and 39 Madison are all located in portions of streets not serviced by storm drains they are assumed to be connected correctly. In addition, 3-4 Seagrave, 21-22 Seagrave, 23-25 Madison, 44-46 Magoun, 47-49 Magoun, and 48-50 Magoun were all assumed to be connected correctly after review of CCTV tapes (See Appendix E).

6.5 Major Flooding Issues

Of the residential properties inspected, 44 properties report regular, seasonal, or annual flooding. Among these 44 properties, 15 report regular basement flooding (2+ times per year) in which a sump pump was used. Of these properties, 12 were from groundwater infiltration and 3 due to sanitary sewer backups.

The areas with the highest concentration of buildings which experience flooding issues are Seagrave Road (11 of 12 inspected addresses) and Columbus Avenue (6 of 8 inspected addresses); however, three properties on Seagrave Road were not inspected. Incidentally, these streets represent the northern border of the CAM 400 Project Area and both face Alewife Brook directly. Details on flooding issues for individual properties are located with the corresponding building inspection form located in Appendix F.4.

38 of the 83 tested residential addresses had a confirmed sump pump discharge to the surface at the driveway near the sidewalk. Discussions with the City of Cambridge will identify if storm drain service connections will be provided to these addresses.

6.6 Comments on Surface Flooding

In the course of building inspections, property owners reported the following problems relating to surface drainage that should be addressed as part of the surface enhancement phase of the project.

Low points in the curb line were found in front of 50 Madison Avenue, as well as in front of 18-20 and 24-26 Harrison Avenue. The owner of 50 Madison Avenue reported regular ponding in front of the residence during rain storms, even in light rain. On Harrison Avenue, property owners reported that during heavy storms, storm water accumulated on

the street and was sluggish in draining to a catch basin located at the end of the driveway of 18-20 Harrison Avenue.

At 150-152 Whittemore Avenue, the owner reported heavy ponding from rain and melting snow during the winter around the perimeter of the residence. The building is located adjacent to one Alewife Center, which owns the land surrounding 150-152 Whittemore Avenue. During construction at one Alewife Center, the grade was apparently raised on the entire plot, creating a low point at 150-152 Whittemore Avenue, which is where surface water drains during storms and accumulates around his home.

7.0 BUILDING INSPECTIONS OF COMMERCIAL BUILDINGS

7.1 One Alewife Center

This building was inspected with the assistance of maintenance personnel, who allowed the crew to view building plans of the property. The building is a multi-story building, but was constructed without a basement and therefore does not have the need for a sump pump or sanitary grinder pump. Record plans dated 1986 show sanitary service lines connecting directly into manhole S75SMH1715, however no such connections were seen to exist in the manhole. Despite this inconsistency, it was determined the building's sanitary service was connected correctly to the sanitary sewer.

The building has a flat roof, but the inspection was not able to determine whether drainage was connected to the storm water or sanitary system on Whittemore Avenue. The building's record plans showed a catch basin in the alley on the east side of the building connecting to the Whittemore Avenue drain line, but none was found to exist. It was not determined whether record drawings provided were construction or as-built plans. During review of the CCTV tapes for the drain line in front of the building, a 6-inch diameter PVC connection was found coming from the direction of One Alewife Center approximately 72 feet upstream of manhole S75COM1713. Though it cannot explicitly be confirmed without dye testing, this is possibly the building's flat roof and/or catch basin discharge to the storm drain (TV Log D19, Appendix E.2). Since the building seems to have separate infrastructure for its sanitary and drain lines and the CCTV tapes provide additional clarity, services from One Alewife Center should not contribute any major issues to potential sewer separation designs in the project area.

7.2 Greenhouses (#12 Whittemore Avenue)

The property at #12 Whittemore Avenue consists of a series of abandoned greenhouses and related structures currently owned by the Fawcett Oil Company. A manager at the company accompanied the field crew to the property for its inspection, as well as access to a manhole located on private property. The structures, formerly a flower nursery, had been abandoned for at least five years. It was discovered that the water service had been manually disconnected from the building and had no active electric service.

A manhole that is located in the driveway was opened for inspection. Inside this manhole, there was a second cover underneath which looked to be bolted down.

Additionally, there was a piped connection from an unknown source that discharged through the second cover. Photographs of this manhole are included Appendix F.

Record plans of this area show a drain over sewer system entering the property and ending with lampholes. CCTV inspection of the sanitary line (TV Log S37Appendix E.2) confirmed the sewer lamphole S71LPH2420 approximately 88 feet upstream of manhole S71SMH2415, as well as an open connection about 18 inches downstream of the lamphole, most likely the existing service to the property. CCTV inspection of the drain line also confirmed the drain lamphole, D40LPH2420, 77 feet upstream of manhole S71SMH2415. While the inspection did end at the drain lamphole, the drain line continues upstream, but changes from a 15-inch diameter pipe to a 10-inch diameter pipe immediately after the lamphole (TV Log D22 and Photo 110_10a, Appendix E.2).

The location of the sanitary discharge of the building was documented, as well as what appeared to be a pump discharge potentially connecting directly to the lamphole. Visual observations also confirmed that all stormwater went to the surface via surface downspouts from the main building and runoff from the greenhouses' glass roofs.

Currently the property is not contributing to the sanitary line in any way and, at this time, Fawcett Oil has no approved plans to redevelop the property. During the design of the CAM 400 Project it is recommended that Fawcett Oil be contacted to determine if potential locations for sanitary and drain services may compliment any future development plans they may have for the property. Photographs documenting all findings at this property can be found in Appendix F.

7.3 W.R. Grace Facilities

The management at Grace provided valuable assistance and information that expedited the inspection of their facilities. They provided three utility plans that described the approximate location and description of many pipelines within their buildings. These plans are included as Appendix D.10, D.11, and D.12. Plan D.11 is duplicated as Figure 11 on the following page.

#99 Whittemore Ave.

The small building located at #99 Whittemore Avenue is owned by Grace. No building inspection was conducted for this property; however according to Grace there is no sump pump for the building. Based on service card information (Appendix B) and CCTV inspections of the pipes on Kimball Street, it is probable that the sanitary service is correctly connected to the sanitary sewer on Kimball Street.

Sewer and Drain Service Connections to the City Collection Systems

The Grace facilities have multiple sewer service connections and multiple drain service connections to the City's collection system. These connections are shown schematically on Figure 11. A two day inspection of the facilities generally provided visual confirmation of the layout as shown on Figure 11. Only limited dye tracing was performed to confirm connectivity of the system. It did appear that within the buildings, the process wastewater, sanitary wastewater and roof drainage are collected and

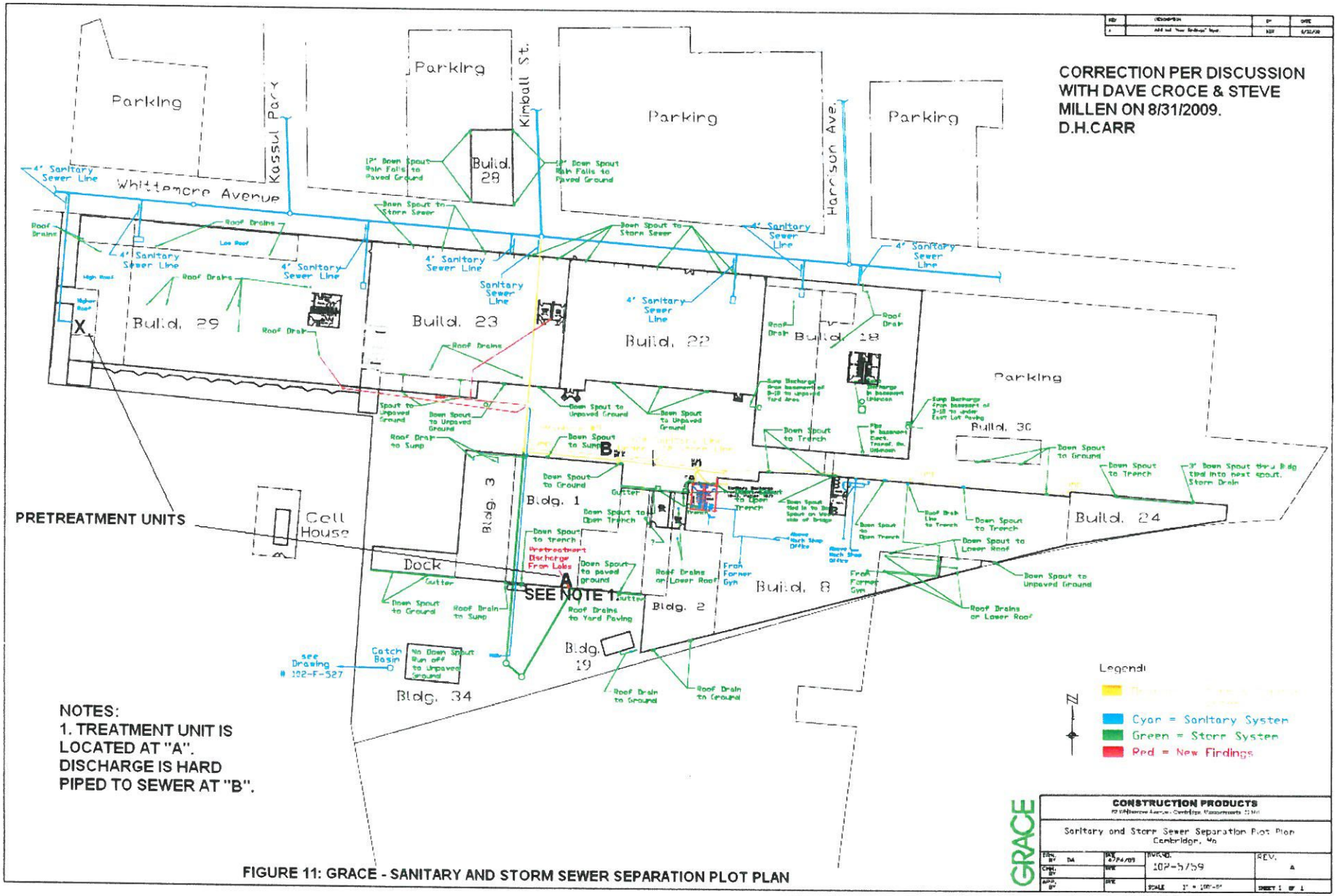


FIGURE 11: GRACE - SANITARY AND STORM SEWER SEPARATION PLOT PLAN

conveyed in separate systems. In most cases, it appeared that separate sewer and drain pipes were leaving the building.

The connections to the City's system along Whittemore Ave. consist of eight sanitary sewer in-line connections and an unknown number of drain service connections. Along the City's easement through Grace's property, the connections consist of three sanitary and one drainage connection to manhole S75COM1900, one sanitary and one drainage in-line connection about 160 feet upstream of S75COM1900, one boiler blow-down connection to the manhole S75COM1905 (the pit), and one drain connection to manhole S75COM1910.

The task of matching the multiple locations of those service discharge points shown on Figure 11 with the connections shown on CCTV logs for the sewers and drains on Whittemore Avenue is a task that has yet to be done. An important observation from the CCTV inspections is that none of the service connections observed in the sewer or drain located directly beneath any of Grace owned buildings appeared to be active.

Basements
All buildings on the south side of Grace lot (#1, #3, #2, #8 and #24) and Building #22 and 23 on the north side of the Grace lot do not have basements.

Roof drains
Roofs of the Grace facilities are primarily flat. The roof drains from Building #29 connect to the 12-inch drain which drains to manhole S75COM1900.

Drainage from the front halves of roofs on Buildings #22 and #23 drain to downspouts that are Roof drains are constructed behind metal panels built into the vertical façade of buildings. At the sidewalk level, the downspouts are connected horizontally to other downspouts. It is not clear if these downspouts are connected to the sewer or drain on Whittemore Avenue or where these connections are located. I may be necessary to dye test the roof gutters to locate the connections as part of the final design.

Internal Plumbing
It appeared that a significant effort has been made to modify the internal plumbing within the Grace Facilities to collect all wastewater from laboratory, testing, and manufacturing operations and to convey that wastewater to pretreatment units. Many of the laboratories and testing areas on the ground level had sanitary grinder pumps under the sinks to collect the wastewater and to pump the wastewater in overhead pipelines to the treatment units. It was noted that the boiler blow-off line which does contain corrosion inhibitors discharges to a settling basin with an overflow connection to common manhole S75COM1905 (the pit) located behind Building #1 (See Figure 2).

Wastewater Pretreatment Units
There are two pretreatment units that receive wastewater from areas that deal with manufacturing operations or wet laboratory and testing operations. The location of the two treatment units are shown on Figure 11. One unit is located on the western side of

Building #29 and discharges to the sanitary sewer on Whittemore Avenue through a sanitary sewer in the alley between the Grace building and One Alewife Center. The second unit is located on the north side of Building #1 and discharges to the sanitary sewer in Reach 1-3 (See Figure 2). It is believed that these facilities neutralize pH to within acceptable limits before discharging the wastewater to the City's sewer system.

The treatment unit on the western end of Building #29 receives wastewater from the area that mixes cement and aggregate to form concrete test cylinders. The treatment unit included a baffled settling tank, two submersible pumps that lift the wastewater from the settling tank to a rapid mix tank where chemicals are added before flow it is allowed to discharge by gravity to the City's sanitary sewer. No measurements were made as to the amount of sediment in the settling tank. However, the discharge from this unit is a possible source of the large amounts of sand that were removed from the sanitary sewer on Columbus Avenue during the cleaning and TV inspection phase of the investigation. This issue is recommended to be discussed with Grace during the final design phase of the project.