DRAINAGE INVESTIGATION AND FLOODING ANALYSIS FOR MALBONE ROAD

PREPARED FOR: Julia Forgue, P.E.
Director of Utilities
City of Newport

COPY TO: Rob Shultz/NEWPORT
Peter von Zweck/CH2M HILL
Dingfang Liu/CH2M HILL
Nic Warrens/CH2M HILL

PREPARED BY: Eric Kelley/BOS
Kenneth Yu/BOS

ORIGINAL DATE: April 2, 2013

REVISION DATE: June 18, 2013

PROJECT NUMBER: 401892.DS

This memorandum summarizes the findings of drainage system characteristics that contributed to flooding at Hillside Avenue at Bedlow Avenue area during the July 28, 2012, August 10, 2012, and August 15, 2012 rainstorms as well as develops and assesses flood mitigation alternatives.

Background

A series of three intense summer thunderstorm events occurred on July 28, 2012, August 10, 2012, and August 15, 2012, respectively, resulting in street flooding and private property flooding in the vicinity of Cummings Road, Smith Road, and Burdick Avenue. The drainage area is depicted in the maps included as Figures 1 through 5 in Attachment 1. The conditions observed during and immediately following the three storm events included:

- Localized street flooding and ponding in the area of Malbone Road, Cummings Road, Smith Avenue, Hillside Avenue, Bedlow Avenue, and Yale Street.
- A significant volume of storm water was observed traveling along streets and overland through private property in the subject area.

The Department of Utilities requested CH2M HILL to perform drainage analysis and flood assessment of the storm drain system in the flooded area and its contributing watershed as well as develop several mitigation alternatives to alleviate the problem.

CH2M HILL presented the preliminary results of the drainage study to the Department of Utilities on December 11, 2012 and this document has been updated to address the City's comments in regards to the development of the mitigation alternatives and their potential impacts on the drainage system downstream of the Malbone Channel.

Task A – Field Reconnaissance, Data Collection and Review

CH2M HILL staff completed a field reconnaissance survey of the study area to verify the existing conditions of the storm drain system, the Malbone Channel, as well as portions of the City and State drainage systems downstream of the Malbone Channel. CH2M HILL also reviewed the existing GIS data for the City's drainage system and requested the available drainage system records and GIS data from the Town of Middletown Engineering Department and the Rhode Island Department of Transportation (RIDOT).

The following summarizes the results of CH2M HILL's field reconnaissance and data collection efforts:

- Completed 20 drainage manhole inspections along the Malbone Channel, Malbone Road, Cummings Road, Bedlow Avenue, Smith Avenue, Thurston Avenue, and Hillside Avenue;
- Completed a walking and windshield survey of the drainage area in both Newport and Middletown;
- Reviewed historical weather data for the three storm events;
- Reviewed Middletown GIS Data and RIDOT drainage record plans. Electronic copies of the RIDOT records are provided on the enclosed CD;
- Reviewed the August 17, 2012 CCTV Inspection Report for the drainage system along Malbone Road, Cummings Road, Bedlow Avenue, and Hillside Avenue;
- Reviewed the September 17-18, 2012 CCTV inspection Report provided by United Water for the drainage system for the 48" storm drain extending from the end of the Malbone Channel to the drainage swale located to the rear of the Department of Utilities facility on Halsey Street. Inspection report and subsequent field visit by United Water confirmed that drain line is 48" diameter. Previously reviewed storm drain system GIS data and maps had identified the storm drain as being 42" diameter;
- The existing drainage system consists of four primary elements: (1) 18" to 36" storm drain extending along Hillside Avenue, Bedlow Avenue, Cummings Road, and Malbone Road; (2) Malbone Channel, a trapezoidal masonry block channel extending west from Malbone Road across the Newport Grand parcels; (3) the 48" storm drain and drainage ditch extending between Malbone Channel and State Road 138 to the rear of the City's public works facility on Halsey Street Extension; and (4) the RIDOT drainage system downstream of the City's system.
- Confirmed three connections between the drainage system in Middletown and Newport at the following locations:
    - Beacon Street.
    - Stockton Drive in Middletown to Eisenhower Street/Dexter Street in Newport.
    - Boulevard to West Main Road in Middletown to Admiral Kalbfus Road in Newport.
- Completed a limited walking survey of the City and State drainage systems downstream of the Malbone Channel that identified several maintenance issues for further consideration.

The results of the field reconnaissance and data collection supported the development of the hydrologic and hydraulic model (H/H Model) as well as the development of the field maps provided in Attachment 1. The field maps identify the perimeter boundary, drainage system and subcatchments of the drainage area contributing to the Malbone Channel (Figure 1), the topographic contours of the drainage area (Figure 2), the location of the weather station in relation to the drainage area (Figure 3), a 3D graphical depiction of the drainage area (Figure 4), and a soils classification map of the study area (Figure 5). Photographs from a walking survey of the Malbone Channel and the City and State drainage swales downstream of the Malbone Channel are also provided in Attachment 1.

Task B – Hydrologic/Hydraulic Condition Definition

As part of this task, CH2M HILL reviewed the available rainfall records of the subject storms, established and delineated the storm drainage area to be included in the study, utilized existing LIDAR data to develop the rim elevations for the storm drain manholes within the study area, and developed a hydrologic/hydraulic model.

Rainfall Records Review. Flooding occurred during the subject 2012 storms (July 28th, August 10th, and August 15th). These were summer thunder storms that had short durations and high peak intensities. There is no official rain gauge data available with 5 or 15 minutes interval (the WPCP gauge was read daily). A Middletown Weather Underground rain gauge data was selected for its close proximity to the study area and its location is shown on Figure 3 of Attachment 1. Intensity-duration-frequency analysis of the three events is summarized in Table 1 below and graphically depicted in the hyetograph, Figure 1, of these storms, which are plotted together with a standard type III storm that are typical in Northeast of United States.

Table 1 – Storm Event Summary

Start Time	*Duration (hrs)*	*Total rain (inches)*	*Return Frequency (TP-40)*	*Return Frequency (NRCC RR 93-5)*
7:16 pm, July 28	2	2.83	25-year	10-year
3:40 pm, Aug. 10	3	1.44	1-year	< 1-year
8:42 am, Aug. 15	0.5	1.25	5-year	2-year
***Design Storm**	**6**	**3.5**		**10-year**

*Recommended for mitigation alternative assessments. The Rhode Island Department of Environmental Management uses the 10 Year 24 Hour Storm for storm water conveyance design

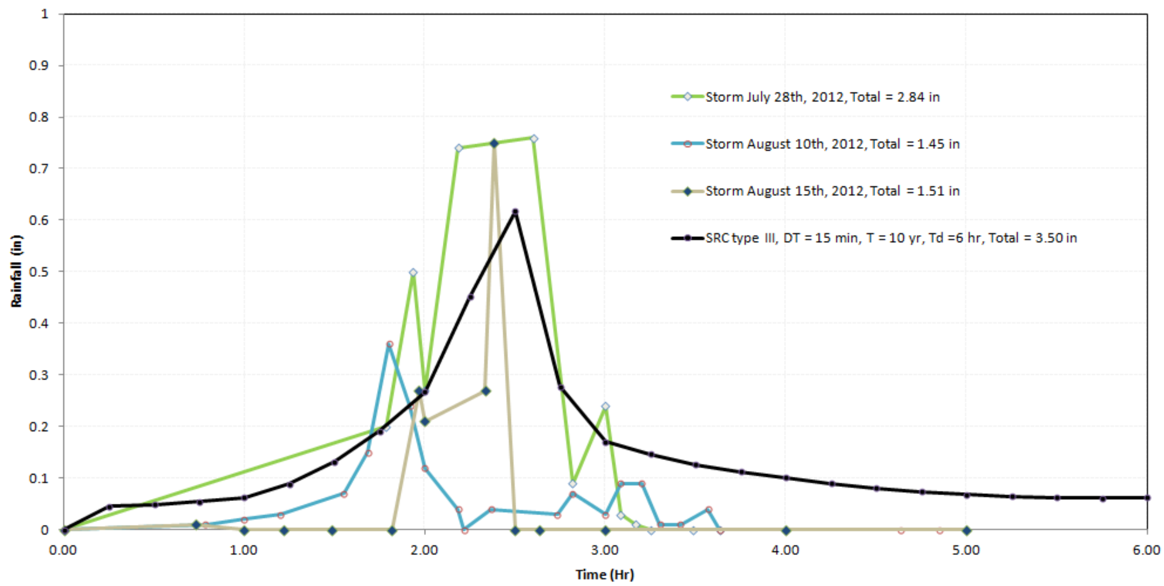


Figure 1 - Hyetograph of the 2012 storms.

LIDAR Data review and extrapolation. Available LIDAR data was obtained and reviewed for use in determining the topography of the study area, performing drainage delineations and pertinent ground and/or manholes rim elevations for manholes

Storm Drain Tributary Area Delineation. Drainage areas were delineated using the LIDAR data and the City of Newport GIS maps of the storm drain system. The drainage areas tributary to the storm drain systems located within the Middletown area was delineated using existing LIDAR information and verified by the field inspection of drainage structures.

H/H Model development. A hydrologic/hydraulic model was developed for use in the hydraulic analysis. The model hydrology and hydraulic elements were obtained by the following procedures.

Hydrology:

- Subcatchments were delineated using an ArcHydro procedure based on LIDAR Digital Elevation Model (DEM) data and aerial imagery.
- Subcatchment slopes were determined base on LIDAR DEM data.
- Subcatchment imperviousness values stem from RIGIS impervious raster data.
- Infiltration parameters and soil characteristics were defined based on Web Soil Survey (WSS) data for Rhode Island according to the Natural Resources Conservation Service (NRCS).

Hydraulics:

- A number of manholes located at critical intersections were field-inspected to acquire elevations and connection information. Interpolation was applied to junctions when manholes were not found in the field.
- Newport's storm drain system data was acquired from the Citrix GIS database (originally used for the Newport CSO Project).
- Gutter flow was simulated as open channel flow with the assumption of 6 inch high curbs with 2% road crown slope.
- The model's downstream boundary was set to the middle of the 48" drain at the casino's parking lot. A fixed tailwater level of 4' was set as a conservative (worst-case scenario) boundary condition, which represents the 48" drain being completely full.
- Future Development – Analysis assumed that future development within the study area would require on-site storm water best management practices.
- Private inflow – Analysis assumed that sources of private inflow could be accommodated by storm drainage system.

Existing Conditions of 48" Drain Line. The City provided CH2M HILL with a copy of United Water's CCTV inspection report for the 48" drain line that extends from the end of the Malbone Channel across the casino parking lot to the drainage swale located at the rear of the Department of Utilities Facility at Halsey Street Extension. The inspection report was completed in September 2012 so it is assumed to be reflective of the conditions similar to those present during the summer 2012 storm events. The inspection report indicated that the 48" drain line was partially filled with sediment and debris, and the drain outlet had become obstructed by a dam of sediment that was approximately as high as the crown of the pipe. The sediment dam likely restricted flow through the 48" drain line such that the pipe would remain full under typical conditions. The actual conditions observed in the 48" drain line support our conservative boundary condition that established the 48" drain line as full, but the drainage model did not initially consider the potential for sediment constricting the hydraulic capacity and performance of the pipe.

Based on the observations detailed in the inspection report, the pipe was approximately 33% full of sediment at various locations. The drainage model was adjusted to simulate the loss in hydraulic capacity and increased roughness created by the sediment by decreasing the pipe size to 30" and increasing the roughness coefficient to 0.050. Table 2 summarizes the impacts that the accumulated sediment predicted by the model on headwater depth and peak flow at the end of the Malbone Channel and compares them conditions with a cleaned out pipe.

Table 2 - Peak flow and headwater depth at the 48" drain

Comparison of conditions during design storms under clear and constricted pipe conditions

	Headwater Depth (ft)	Peak Flow (cfs)
Existing Conditions (48" Clean Pipe, n=0.018)	5.4	76.3
Existing Conditions (Constricted Pipe 30", n=0.050)	7.5	18.7

The flow restrictions imposed by the accumulated sediment in the 48" drain resulted in increasing the head water depth at the pipe inlet by 2.1 feet and reduced the hydraulic capacity of the drain resulting in a 57.6 cfs reduction in peak flow when compared to conditions with a clean pipe. Additionally, the photographs included with the inspection report identified an earthen headwall at the outlet of the 48" drain to the drainage swale. The potential exists for this earthen headwall to erode and obstruct the drain outlet. The City should consider stabilizing this slope or installing a concrete headwall to minimize the potential for slope erosion to restrict flow out of the 48” drain. Based upon the observations in the CCTV inspection report, routine inspection of the 48” drain line should be performed in order to identify conditions that have the potential to contribute to increased tail water conditions at the outlet of the Malbone Channel. Maintenance activities should be completed as necessary to mitigate the build-up of sediment and debris in the drain.

Task C – Drainage Analysis, Flood Assessment and Mitigation Alternatives

Utilizing the model developed under the previous task, CH2M HILL performed a drainage analysis of the existing storm drain systems in the project area in addition to the evaluation of several mitigation alternatives:

Drainage Analysis and Flood Assessment. Based on the records reviewed and the field investigation of the study area, the subcatchment areas that were delineated based on LIDAR DEM data were routed to the model network nodes. The model runs were performed to simulate hydrologic/hydraulic conditions during 2012 summer thunder storms that caused substantial flooding of the road way and residential area. Figure 1 of Attachment 2 shows the model schematic network and its peak flood condition during the July 28th storm. When you compare the validation model run results, it matches well with field observation of street ponding and residential lot flooding during that storm for which the flood was wide spread where the downstream end low lying areas (Malbone Street and Cumming Road) experienced the most severe street ponding and flooding in backyards of private property. Table 1 of Attachment 2 summarizes flood location, volume and duration during each of the three storms and for a 10 year type III 6 hour storm. The flood volume in the gutter flow column is an indication of street ponding while gutter overflow is an indication of street runoff overtopping the roadway curbing and running overland and into private property. The model results matched the field observations fairly closely with street ponding occurring during all three storms with the most severe flooding occurred during the July 28th storm and in the low lying areas.

Within the study area, the Middletown drainage area is approximately 30% of total tributary area and generated about the same proportion of stormwater runoff volume and peak flowrate during a 10 year 6 hour design storm. The subcatchment runoff for Middletown and Newport are summarized in Table 3 below.

Table 3 - Summary of subcatchment runoff from Middletown and Newport tributary areas

Town	Subcatchment Name	Area (Acres)	Runoff Volume (MG)	Peak Runoff (CFS)	No. of Existing Catch Basins	Catch Basin Inlet Capacity*
Middletown	Beacon_Middletown	5.2	0.3	10.9	5	7.5
	Dexter_Middletown_Lower	13.1	0.9	28.6	Unknown	Unknown
	Dexter_Middletown_Upper	18.3	0.9	27.7	19	28.5
	Dudley_Middletown	1.6	0.1	3.4	0	0
	Eisenhower_Middletown	0.8	0.1	1.9	2	3
	Kalbfus_Middletown	14.7	1.2	34.1	13	19.5
	Kennedy_Middletown	1.0	0.1	2.3	0	0
	Subtotal	**54.7**	**3.5**	**109.0**	**39**	**58.5**

Table 3 - Continued

Town	Subcatchment Name	Area (Acres)	Runoff Volume (MG)	Peak Runoff (CFS)	No. of Existing Catch Basins	Catch Basin Inlet Capacity*
Newport	Beacon	4.2	0.3	9.9	22	33
	Bedlow	17.1	1.3	39.2	11	16.5
	Burdick	4.8	0.4	11.2	5	7.5
	Cummings	3.6	0.3	8.1	2	3
	Dexter	11.9	0.5	13.9	7	10.5
	Dexter_Stormwall	2.9	0.0	0.1	0	0
	Dudley	8.0	0.2	5.2	3	4.5
	Dudley_Stormwall	5.5	0.0	0.3	0	0
	Eisenhower	12.8	1.0	28.8	20	30
	Eisenhower_Stormwall	4.9	0.0	0.2	0	0
	Hillside_L	2.8	0.2	6.0	4	6
	Hillside_R	3.7	0.3	8.7	4	6
	Kalbfus	11.8	0.8	25.6	19	28.5
	Kalbfus_Stormwall	0.4	0.0	0.7	0	0
	Kennedy	7.7	0.6	17.7	21	31.5
	Kennedy_Stormwall	2.8	0.1	1.9	0	0
	Madeline	4.8	0.3	10.9	5	7.5
	Malbone	1.4	0.1	3.3	3	4.5
	Pennacook_L	4.7	0.4	11.1	7	10.5
	Pennacook_R	13.7	1.0	30.2	17	25.5
	Russell	6.0	0.4	13.8	8	12
	Smith	5.1	0.4	11.9	5	7.5
	Thurston	2.9	0.2	6.8	3	4.5
	Subtotal	**143.5**	**8.8**	**265.5**	**166**	**249**
	Total	**198.2**	**12.3**	**374.5**	**205**	**307.5**

*Assumes an inlet capacity of 1.5 cfs per basin.

Table 3 also lists the number of existing catch basins within each subcatchment together with their estimated inlet capacity of approximately 1.5 cfs for the typical gutter inlet style catch basins observed throughout the study area. It appears that most areas have sufficient inlet capacity to capture the peak flow during a 10 year design storm with the notable exceptions of the Middletown flow onto Admiral Kalbfus Road (Peak Flow: 34.1 cfs; Existing Inlet Capacity: 19.5 cfs) and Bedlow Avenue (Peak Flow: 39.2 cfs; Existing Inlet Capacity: 16.5 cfs). The surface flow on Bedlow Avenue directly contributes surface runoff to the unrelieved sag at the intersection of Hillside Avenue and Bedlow Avenue. However, the locations, the shapes of roadway crown and the conditions of catch basins can reduce the inlet capacity significantly. The effectiveness of gutter inlet type catch basins is also strongly impacted by the formation of gutter flow, which for this study, was negatively impacted due to the poor (sometimes nonexistent) shape of the gutter and the steep slope of the side streets connecting to a relatively flat Hillside Avenue.

It is suspected that the inadequate catch basin inlet capacity from poor gutter flow conditions and the steep slopes along the side streets resulted in excess surface sheetflow that overwhelmed the inlet capacity on Hillside Avenue during 2012 storm events. Subsequently, the peak runoff channelized within the confines of Hillside Avenue and caused street ponding in the low lying area near the intersections of Hillside Avenue, Cummings

Road, and Bedlow Avenue. Regular maintenance of inlet structures, better gutter shape and appropriate placement of catch basin should be considered as part of drainage improvement projects in addition to the additional storm drains and upsizing of existing storm drains discussed in greater detail below.

Mitigation Alternatives. CH2M HILL developed H/H models to simulate various mitigation options based upon the 10 year design storm. The mitigation alternatives initially were developed to address the flooding observed in the upper section of the watershed upland of the Malbone Channel. Following discussion of the preliminary results for the mitigation alternatives, the mitigation alternatives were expanded to also address flooding concerns for the lower section of the watershed including the Malbone Channel and the 48” drain line. The lower watershed mitigation alternatives are discussed further in a later section.

The watershed mitigation options are:

- **Option 1 – Increase Existing Pipe Sizes (i.e. Gray Conveyance #1)**
  This option addresses the flooding issue in the upper portion of the watershed strictly by increasing the capacity of the system. Nearly 2,700 linear feet of storm drains are replaced with larger pipes (namely segments along Malbone Road, Cummings Road, and Hillside Avenue). The potential for flooding at the in the lower section of the watershed at the outlet of the Malbone Channel is addressed by installing 826 linear feet of new 48” diameter storm drain in a parallel alignment to the existing 48” storm drain from the Malbone Channel Outlet across the casino parking lot to the swale at the rear of the public works facility on Halsey Street Extension. Option 1 mitigation components are shown in Figures 3 and 4 of Attachment 2

- **Option 2– Add new Smith Avenue Relief (i.e. Gray Conveyance #2)**
  It provides additional relief at the intersection of Hillside Avenue and Bedlow Avenue by creating a new connection along Smith Avenue to the Malbone Channel at Malbone Road. Existing pipe sizes must also be increased along Malbone Road and Cummings Road. Additionally, the relief sewer requires lowering the system by increasing the depth of the existing manhole DMH-033-35 at the corner of Bedlow Avenue and Smith Avenue. No changes are proposed for the drainage network along Hillside Avenue. The potential for flooding at the in the lower section of the watershed at the outlet of the Malbone Channel is addressed by installing 830 linear feet new 48” diameter storm drain in a parallel alignment to the existing 48” storm drain from the Malbone Channel Outlet across the casino parking lot to the swale at the rear of the public works facility on Halsey Street Extension. Option 2 mitigation components are shown in Figures 5 and 6 of Attachment 2

- **Option 3– Increase Pipe Size and Proposed Detention Pond at Miantonomi Memorial Park (i.e. Green Infrastructure #1)**
  This option provides a green infrastructure alternative for mitigating the upper and lower watershed flooding concerns. A 0.5 million gallon (MG) detention pond is proposed for Miantonomi Memorial Park adjacent to Hillside Avenue. The detention pond will take inflow from Eisenhower Street, Dexter Street and Dudley Avenue, while the effluent of the pond will be connected to the manhole at Admiral Kalbfus Road. Pipe sizes will be increased along segments of Malbone Road, Cummings Road and a single segment of Hillside Avenue, totaling approximately 2,200 linear feet of storm drains. The potential for flooding at the lower section of the watershed at the outlet of the Malbone Channel is addressed by including a 1.7 MG detention pond at that location. Option 3 mitigation components are shown in Figures 7 and 8 of Attachment 2

- **Option 4: – Smith Avenue Relief Option and Proposed Detention Pond at Miantonomi Memorial Park (i.e. Green Infrastructure #2)**
  This option combines Options 2 & 3. A larger detention pond, 1.0 MG, is proposed in this option such that drainage work will not be needed along Hillside Avenue, and the Malbone Channel detention pond storage volume can be reduced to 1.2 MG provided as shown in Figure 9 and 10 in Attachment 2.

Table 2 of Attachment 2 summarizes the model run results during a 10 year design storm for existing conditions and for flood mitigation options. Option 1 eliminates flooding during the design storm. There is minor street ponding (short duration, less than 30 minutes, and small volumes) remaining for Options 3 and 4. Although this option improves the drainage conditions, Option 2 alone does not alleviate the flooding issues entirely.

With the provided higher conveyance capacity, upland runoff arrives at the Malbone channel (the study limit) slightly sooner and subsequently raises the head water level between 0.7 feet and 1.1 feet for the mitigation options. However, the inlet constraint at the 48” drain under the casino parking lot limits the amount of flow that can be conveyed downstream as shown in Table 4 below when comparing to the existing conditions.

Table 4 – Comparison of Peak flow and Headwater Depth at 48” Drain Inlet –

Without Supplemental Mitigation at Malbone Channel Outlet

	Headwater Depth (ft)*	Peak Flow (cfs)*
Existing Conditions	5.4	76.3
Option 1	6.5	81.3
Option 2	6.5	81.3
Option 3	6.3	79.9
Option 4	6.1	78.6

*Conditions modeled with clean 48” drain line and using 10-Year Design Storm

Table 5 below provides a comparison of the effects on headwater depth and peak flow from the hydraulic restrictions presented by accumulated sediment in the 48” drain under existing conditions and Mitigation Alternative 1.

Table 5 – Comparison of Peak Flow and Headwater Depth at 48” Drain Inlet –

Clean vs. Constricted Conditions

	Headwater Depth (ft)	Peak Flow (cfs)
Existing Conditions (48” Clean Pipe, n=0.018)	5.4	76.8
Existing Conditions (Constricted Pipe 30”, n=0.050)	7.5	18.7
Option 1 (48” Clean Pipe, n=0.018)	6.5	81.3
Option 1 (Constricted Pipe 30”, n=0.050)	8.1	27.1

Similar to under the effects observed modeling existing conditions (clean vs. constricted pipe based observations from September 2012 CCTV Inspection Report), Mitigation Alternative 1 showed similar increases in headwater depth (+1.6 feet) and reduced peak flow (-54.2 cfs) when comparing a clean pipe to that of a constricted pipe. The increased headwater depths were limited to the downstream end of the Malbone Channel and did not have an impact on the Hillside Avenue/Bedlow Avenue area.

The potential for upper watershed mitigation to result in increased headwater depths and peak flows at the Malbone Channel outlet required that supplemental mitigation alternatives be developed to address the lower section of the watershed as outlined above. Table 6 summarizes the headwater depths and peak flows at the Malbone Channel under each option with its respective supplemental mitigation measure.

Table 6 – Comparison of Peak flow and Headwater Depth at 48" Drain Inlet –

With Supplemental Mitigation at Malbone Channel Outlet

	Headwater Depth (ft)*	Peak Flow (cfs)*
Existing Conditions	5.4	76.3
Option 1 + 48" Parallel Storm Drain	5.4	76.6
Option 2 + 48" Parallel Storm Drain	5.3	80.5
Option 3 + 1.7 MG Detention Pond	4.8	76.0
Option 4 +1.2 MG Detention Pond	5.1	76.1

*Conditions modeled with clean 48" drain line and using 10-Year Design Storm

The addition of the parallel 48" storm drain to Options 1 and 2 maintains the headwater depth at or below existing conditions, but the peak flow rates are slightly above existing conditions. The addition of the detention ponds to Options 3 and 4 resulted in headwater depths and peak flows slightly below existing conditions.

Evaluation of hydraulic impacts and need for potential drainage improvements further downstream of the 48" drain line would require a system-wide study incorporating the other drainage watersheds and drainage systems (City, State, and Navy) that also contribute flow to the drainage system downstream of the 48" drain line.

Option 1 – Gray Conveyance #1

The first option evaluated was considered to be the conventional "gray" infrastructure option focusing on increasing the hydraulic capacity of the primary drain line along Hillside Avenue, Bedlow Avenue, Cummings Road, and Malbone Road. The following provides details for the option, its advantages, and disadvantages:

Details:

- Replace approximately 2,700 linear feet of existing drainage between Malbone Channel and Dexter Street;
- Existing 12-, 15-, and 18-inch pipe on Malbone Rd proposed increase to either 24-inch;
- Existing 36-inch pipe on Hillside Avenue, Bedlow Avenue, Cummings Road, and Malbone Road proposed increase to 48-inch, 54-inch, or 60-inch depending on the segment; and
- New 48-inch pipe from Malbone Channel outlet, across the casino parking lot to the drainage swale at the rear of the public works facility on Halsey Street Extension.

Advantages:

- Replacement of drainage pipe and structures within existing trench;
- Increases hydraulic capacity to convey the design storm event to the Malbone Channel without any street flooding in the upper portion of the watershed;
- Reduces gutter flow below existing inlet capacity;
- Supplemental drain pipe at Malbone Channel outlet maintains headwater depth at or below existing conditions at channel outlet; and
- Conventional materials and methods of construction.

Disadvantages:

- Local traffic impacts;
- Construction disturbances to residential areas;
- Supplemental drain pipe at Malbone Channel outlet does not provide attenuation of peak flow to levels at or below existing conditions;
- Potential for easement across casino property; and
- Potential utility interferences related to increased pipe size and trench width.

Option 2 – Gray Conveyance #2

The second option evaluated was presented originally by the City to provide new drainage where none currently exists along Smith Avenue between Thurston Avenue and Malbone Road. The option was expanded to provide drainage relief from the intersection of Hillside Avenue and Bedlow Avenue by reversing the slope of the current drainage between Bedlow Avenue and Thurston Avenue. This would also convey drainage from Bedlow Avenue and Thurston Avenue to Malbone Road via Smith Avenue. The option provides a secondary means of conveying flow to the Malbone Channel from Hillside Avenue. The following provides details for the option, its advantages, and disadvantages:

Details:

- Replace approximately 1,380 linear feet of drainage between Malbone Channel and intersection of Hillside Avenue and Bedlow Avenue;
- Existing 12-, 15-, and 18-inch pipe on Malbone Rd proposed increase to 18-inch or 24-inch depending on the segment;
- Existing 36-inch pipe on Hillside Avenue, Bedlow Avenue, Cummings Road, and Malbone Road proposed increase to 60-inch;
- Existing 12-inch pipe on Bedlow Avenue and Smith Avenue increased to 48-inch and slope reversed towards Malbone Road;
- Proposed 48-inch pipe along Smith Avenue to Malbone Road; and
- New 48-inch pipe from Malbone Channel outlet, across the casino parking lot to the drainage swale at the rear of the public works facility on Halsey Street Extension.

Advantages:

- Replacement of drainage pipe and structures within existing trench;
- Increases hydraulic capacity to convey the design storm event to the Malbone Channel without street flooding at intersection of Hillside Avenue and Bedlow Avenue;
- Reduces gutter flow below existing inlet capacity for portions of Hillside Avenue;
- Supplemental drain pipe at Malbone Channel outlet maintains headwater depth at or below existing conditions at channel outlet;
- Reduced construction limits of work compared to Option 1; and
- Conventional materials and methods of construction.

Disadvantages:

- Local traffic impacts;
- Construction disturbances to residential and commercial areas;
- Potential utility interferences related to increased pipe size and trench width;
- Street flooding still present at intersection of Hillside Avenue and Pennacook Street;
- Gutter flow rates exceeding 75 cfs along Hillside Avenue between Admiral Kalbfus Road and Bedlow Avenue;
- Supplemental drain pipe at Malbone Channel outlet does not provide attenuation of peak flow to levels at or below existing conditions; and
- Potential for easement across casino property.

Option 3 – Green Infrastructure #1

This option provides a green infrastructure alternative with a modified version of Option 1. A 500,000 gallon detention pond is proposed for Miantonomi Memorial Park adjacent to Hillside Avenue and Admiral Kalbfus Road. The detention pond will take inflow from Eisenhower Street, Dexter Street and Dudley Avenue. The pond effluent is connected to the manhole at Admiral Kalbfus Road. Existing pipe sizes are increased along segments of Malbone Road, Cummings Road and one segment of Hillside Avenue. A proposed 1.7 MG detention pond at

Malbone Channel outlet to attenuate flows from Malbone Channel. The following provides details for the option, its advantages, and disadvantages:

Details:

- Replace approximately 2,200 linear feet of drainage between Malbone Channel and intersection of Hillside Avenue and Pennacook Street;
- Existing 12-, 15-, and 18-inch pipe on Malbone Road proposed increase to either 18-inch or 24-inch depending on the segment;
- Existing 36-inch pipe on Hillside Avenue, Bedlow Avenue, Cummings Road, and Malbone Road proposed increase to 60-inch;
- Proposed 24-inch influent connections from Eisenhower Street, Dexter Street and Dudley Avenue to 500,000 gallon detention pond at Miantonomi Park;
- Proposed 6-inch effluent connection from detention pond to Admiral Kalbfus Road; and
- Proposed 1.7 MG detection pond at Malbone Channel outlet has a 35-foot long weir set 1-foot below the top of the channel sidewall.

Advantages:

- Replacement of drainage pipe and structures within existing trench;
- Provides green infrastructure approach for storm water attenuation and infiltration;
- Increases hydraulic capacity to convey the design storm event to the Malbone Channel with exception of minor street ponding on Thurston Avenue;
- Reduces gutter flow below existing inlet capacity for portions of Hillside Avenue;
- Reduced quantity of drainage pipe replacement compared to Option 1;
- Malbone Channel detention pond maintains headwater depth and peak flow at or below existing conditions for the channel outlet; and
- Conventional materials and methods of construction.

Disadvantages:

- Local traffic impacts;
- Construction disturbances to residential areas;
- Potential utility interferences related to increased pipe size and trench width;
- Minor amount of street flooding at one drainage manhole on Thurston Avenue;
- Modification to Miantonomi Memorial Park;
- Potential for unsuitable subsurface conditions at Miantonomi Memorial Park;
- Potential for easements for Malbone Channel Detention Pond siting; and
- Public safety concerns with detention ponds.

Option 4 – Green Infrastructure #2

This option combines Options 2 and 3 and includes a larger detention pond, 1.0 MG, such that no drainage improvements would be required along Hillside Avenue, and a smaller detention pond, 1.2 MG, at the Malbone Channel outlet. The following provides details for the option, its advantages, and disadvantages:

Details:

- Replace approximately 1,380 linear feet of drainage between Malbone Channel and intersection of Hillside Avenue and Bedlow Avenue;
- Existing 12-, 15-, and 18- inch pipe on Malbone Road proposed increase to either 18-inch or 24-inch depending on the segment;
- Existing 36-inch pipe on Bedlow Avenue, Cummings Road, and Malbone Road proposed increase to 60-inch;
- Proposed 24-inch influent connections from Eisenhower Street, Dexter Street and Dudley Avenue to 1.0 MG detention pond at Miantonomi Memorial Park;

- Proposed 6-inch effluent connection from detention pond to Admiral Kalbfus Road;
- Existing 12-inch pipe on Bedlow Avenue and Smith Avenue proposed increase to 48-inch and slope reversed towards Malbone Road;
- New 48-inch pipe along Smith Avenue to Malbone Road; and
- Proposed 1.2 MG detection pond at Malbone Channel outlet has a 35-foot long weir set 1-foot below the top of the channel sidewall.

Advantages:

- Replacement of drainage pipe and structures within existing trench;
- Provides green infrastructure approach for storm water attenuation and infiltration;
- Increases hydraulic capacity to convey the design storm event to the Malbone Channel without street flooding;
- Reduces gutter flow below existing inlet capacity for portions of Hillside Avenue;
- Reduced quantity of drainage pipe replacement compared to Option 1 and 3;
- Smaller Malbone Channel detention pond than Option 3.
- Malbone Channel detention pond maintains headwater depth and peak flow at or below existing conditions for the channel outlet; and
- Conventional materials and methods of construction.

Disadvantages:

- Local traffic impacts;
- Construction disturbances to residential areas;
- Potential utility conflicts related to increased pipe size and trench width;
- Modification to Miantonomi Memorial Park;
- Larger detention pond footprint than Option 3, 1 acre 3-foot deep pond;
- Potential for unsuitable subsurface conditions at Miantonomi Park; and
- Potential for easements for Malbone Channel Detention Pond siting; and
- Public safety concerns with detention ponds.

Planning Level Cost Estimate:

The planning level cost estimates for the four proposed drainage system improvements are summarized in Table 7 below.

Table 7 – Summary of Planning Level Cost Estimates

	Option 1	**Option 2**	**Option 3**	**Option 4**
Base - Pipe and Manholes	$1,979,000.00	$2,079,000.00	$1,359,000.00	$1,934,000.00
Detention Basin Appurtenances	$ -	$ -	$178,000.00	$178,000.00
20% of Base	$396,000.00	$416,000.00	$272,000.00	$387,000.00
Construction Sub-Total	**$2,375,000.00**	**$2,495,000.00**	**$1,809,000.00**	**$2,499,000.00**
Contingency 15% of Construction	$356,000.00	$374,000.00	$271,000.00	$375,000.00
Engineering Services 15% of Construction	$356,000.00	$374,000.00	$271,000.00	$375,000.00
Total Project Cost Estimate	**$3,087,000.00**	**$3,243,000.00**	**$2,351,000.00**	**$3,249,000.00**

- Planning level cost estimates developed from bid results for several recent public works projects in New England region.

- Detention Basin cost estimate developed from EPA Guidance Fact Sheet on Dry Detention Basins.[1]
- Base price includes costs for furnishing and installing the various sized drainage pipe and manhole structures required for each mitigation alternative.
- Appurtenances were assumed to be 20% of the base drainage pipe and manhole construction costs. Appurtenances include items such as surface restoration, paving, additional backfill materials, traffic controls, erosion controls, etc.
- Planning level estimate assumes suitable subsurface conditions for conventional means and methods of drainage system construction.

Items for Further Consideration

The following is a list of issues for the City to take into consideration while reviewing the study results and when considering any future drainage infrastructure design in the study area. The list includes issues for further research that could potentially impact selection or design of a mitigation alternative, key assumptions relevant to the study, and acknowledgement of various issues outside of the scope of this study. Issues related to land ownership and utility constructability are outlined in the supplemental information memo provided as Attachment 3.

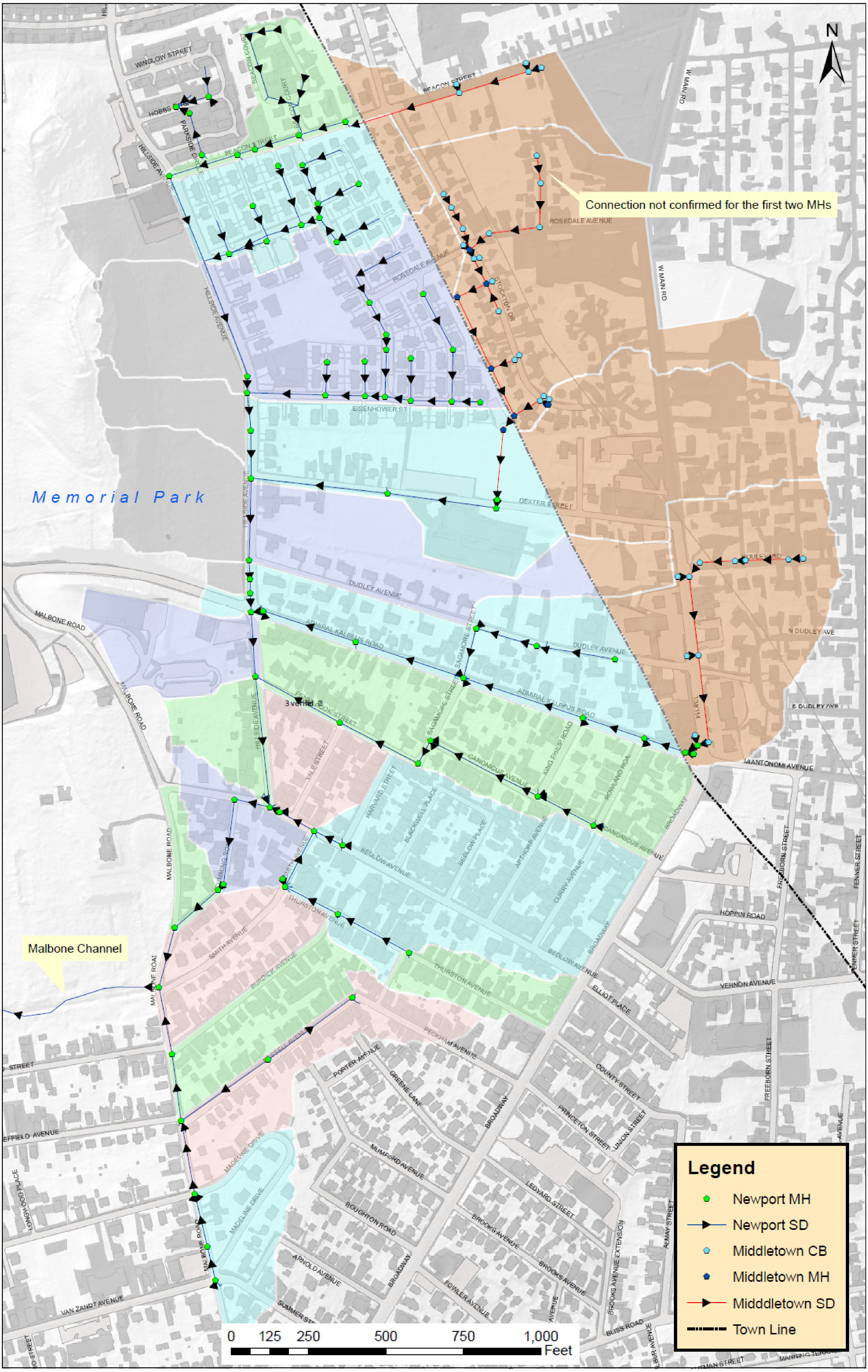
1. Catch Basin Modifications – Add additional catch basins where required to provide adequate inlet capacity for the peak surface runoff for streets such as Bedlow Avenue, where peak surface runoff exceeds the existing inlet capacity. Modify or replace existing catch basins to increase inlet capacity (e.g. increase throat size; add grates in front of curb inlets).
2. Miantonomi Memorial Park – If green infrastructure option selected, detention basin design would require researching the existing land use covenants for the park and investigation of the subsurface soil and groundwater conditions.
3. Drainage Swale Inspection and Maintenance - CH2M HILL visually observed the existing conditions of the City and State drainage swales downstream of the Malbone Channel from Halsey Street to the rotary at Admiral Kalbfus Road and JT Connell Road. Increased maintenance and cleaning of the swales should be considered due to the quantity of silt, vegetation, and trash observed in the City and State swales. Several photographs taken during the limited walking survey of the drainage system are provided in Attachment 1.
4. Drain Pipe Inspection and Maintenance - The CCTV Inspection and Cleaning Report for 48-inch drain pipe from Malbone Channel outlet to the swale behind Newport DPW Yard at 70 Halsey Street indicated a significant amount of accumulated sediment within the drain line and at its outlet. The frequency of inspection and maintenance should be increased due to the observed sedimentation. The potential for erosion of the earthern headwall at the drain outlet should be evaluated further and consideration should be given to stabilizing this slope temporarily until a permanent concrete headwall could be installed.
5. Malbone Channel – Determine the nature and extent of any drainage easement(s) related to the Malbone Channel between Malbone Road and Halsey Street. The costs associated with any land acquisition required for channel modifications or additional drainage pipe infrastructure would have to be evaluated further.
6. Evaluation of downstream impacts – Although this study addressed the drainage infrastructure in the Hillside Avenue-Bedlow Avenue area, future assessments should include inspection and analysis of drainage system infrastructure (including City, State, and Navy) downstream of the Malbone Channel to Newport Harbor to identify the need for additional improvements.

[1] http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=67

7. Climate Change Risk and Mitigation – Potential impacts from increased storm return frequency and sea level rise could negatively impact the City's ability to effectively collect and convey storm water.

Attachment 1

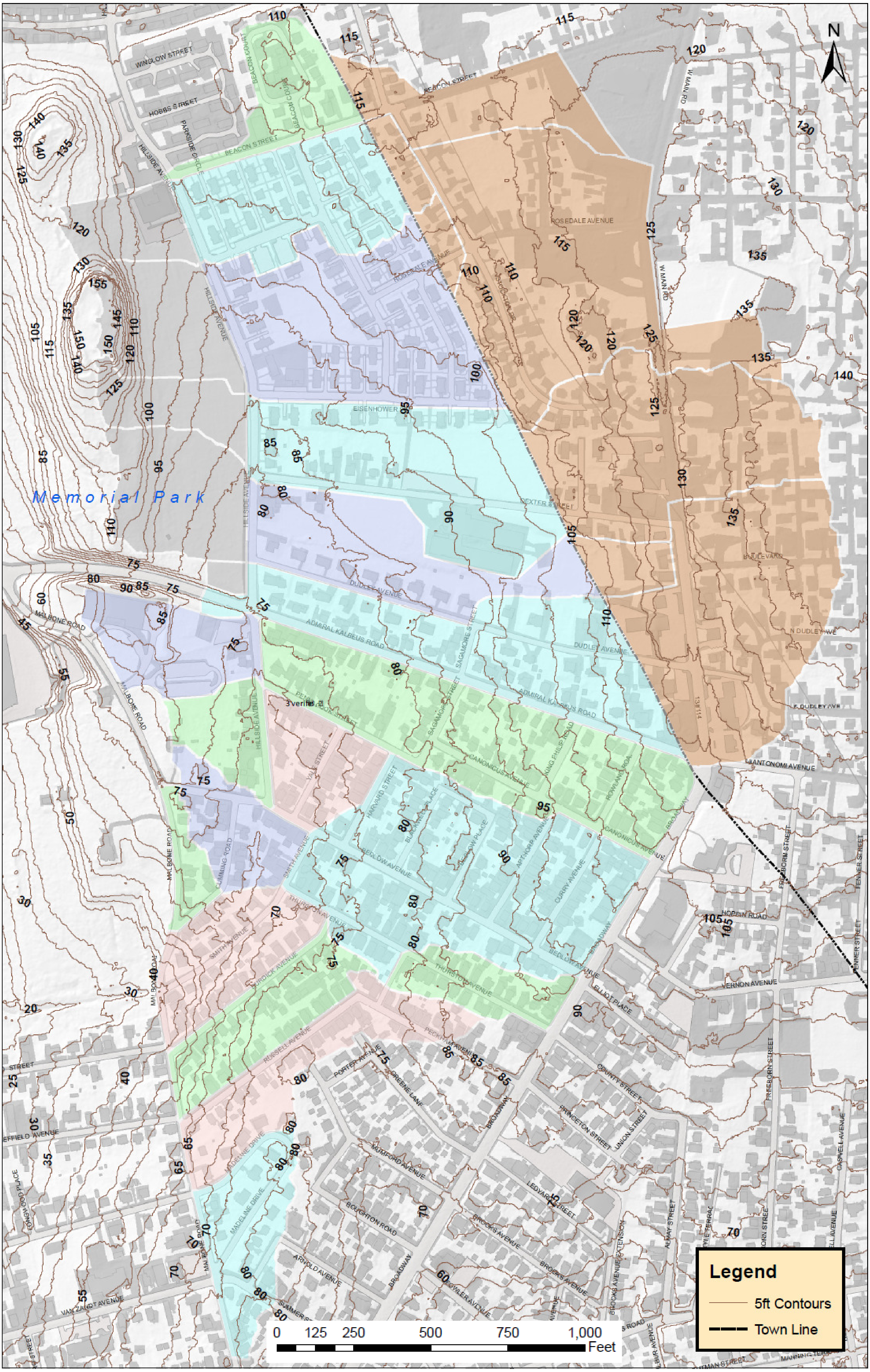
Field Maps



CH2MHILL.

ATTACHMENT 1: FIGURE 1 - Middletown Connections & Catchments Delineation

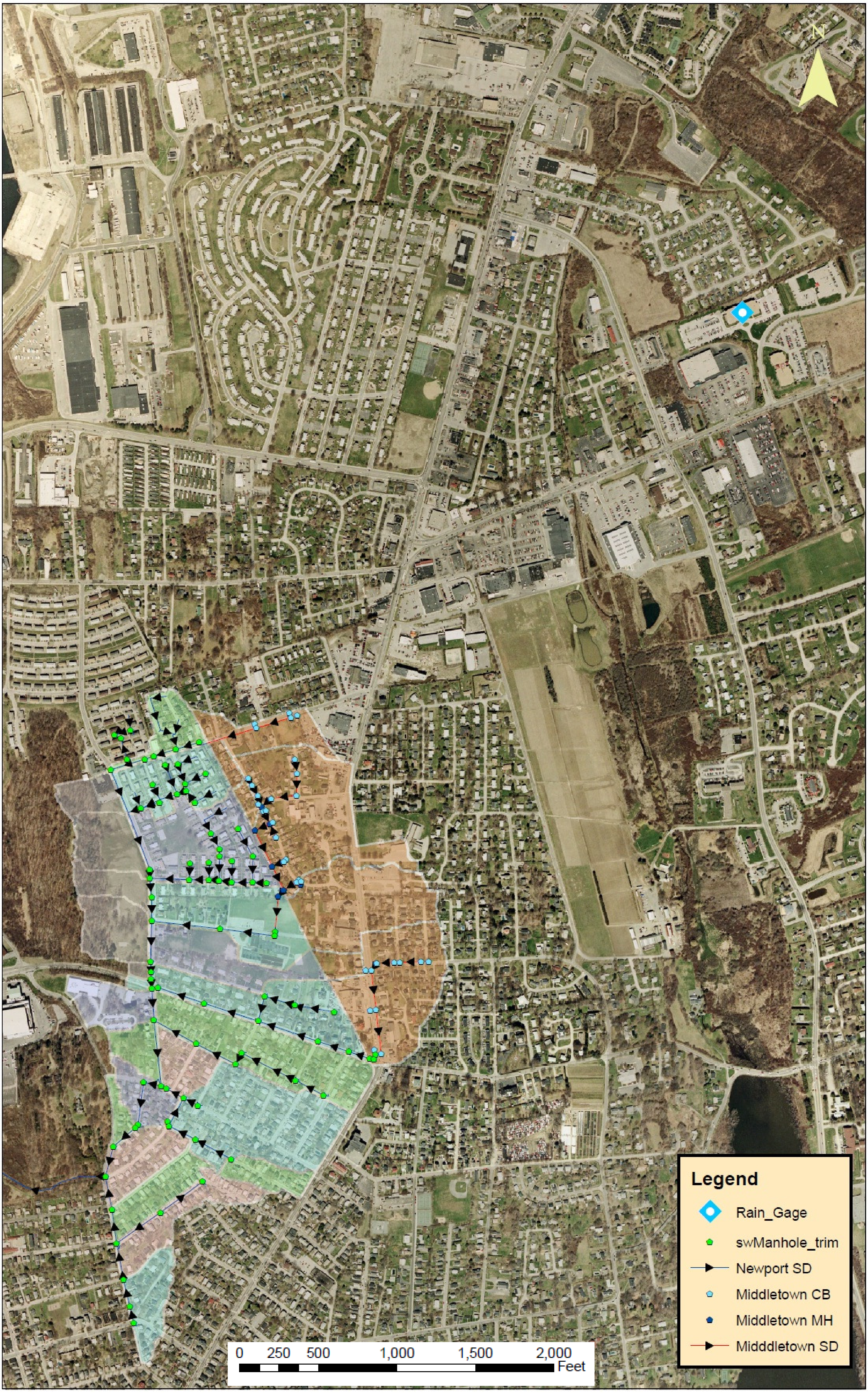
MALBONE ROAD DRAINAGE STUDY, CITY OF NEWPORT



CH2MHILL.

ATTACHMENT 1: FIGURE 2 - Topography

MALBONE ROAD DRAINAGE STUDY, CITY OF NEWPORT



CH2MHILL.

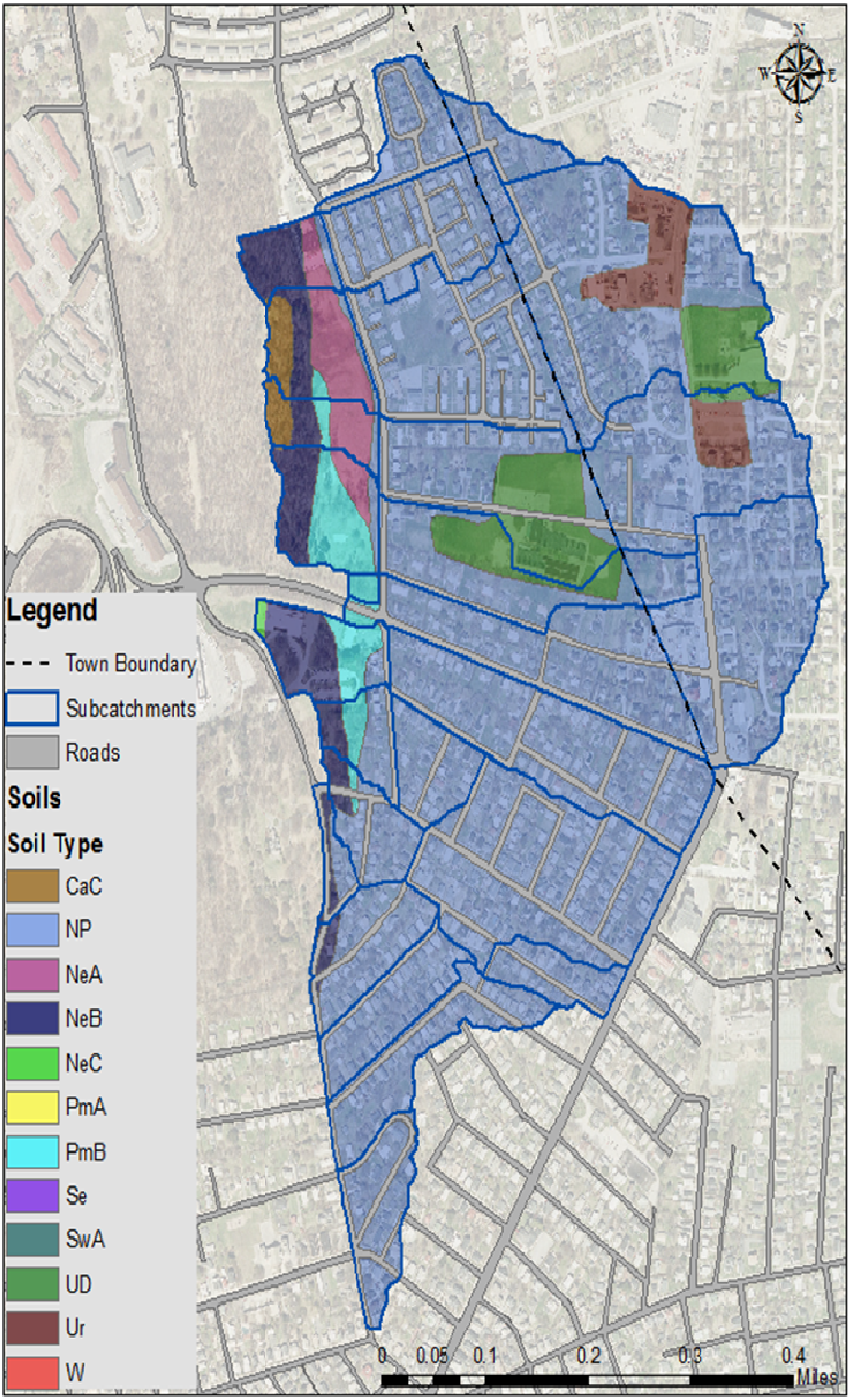
ATTACHMENT 1: FIGURE 3 - Rain Gage Location

MALBONE ROAD DRAINAGE STUDY, CITY OF NEWPORT

CH2MHILL.

ATTACHMENT 1: FIGURE 4—3D WATERSHED MAP

MALBONE ROAD DRAINAGE STUDY , CITY OF NEWPORT



CH2MHILL.

ATTACHMENT 1: FIGURE 5—SOIL CLASSIFICATION MAP

MALBONE ROAD DRAINAGE STUDY, CITY OF NEWPORT

Photo 1: Malbone Channel - looking west from Malbone Rd.

Photo 2: Malbone Channel - Looking west at culvert approx. mid-point of channel.

Photo 3: Double-Barrel Culvert under RI 138/138A/238 – Looking west at City Drainage Swale from rear of DPW Yard.

Photo 4: Outlet of Double-Barrel Culvert under RI 138/138A/238 - Looking east from rear of 111 JT Connell Road.

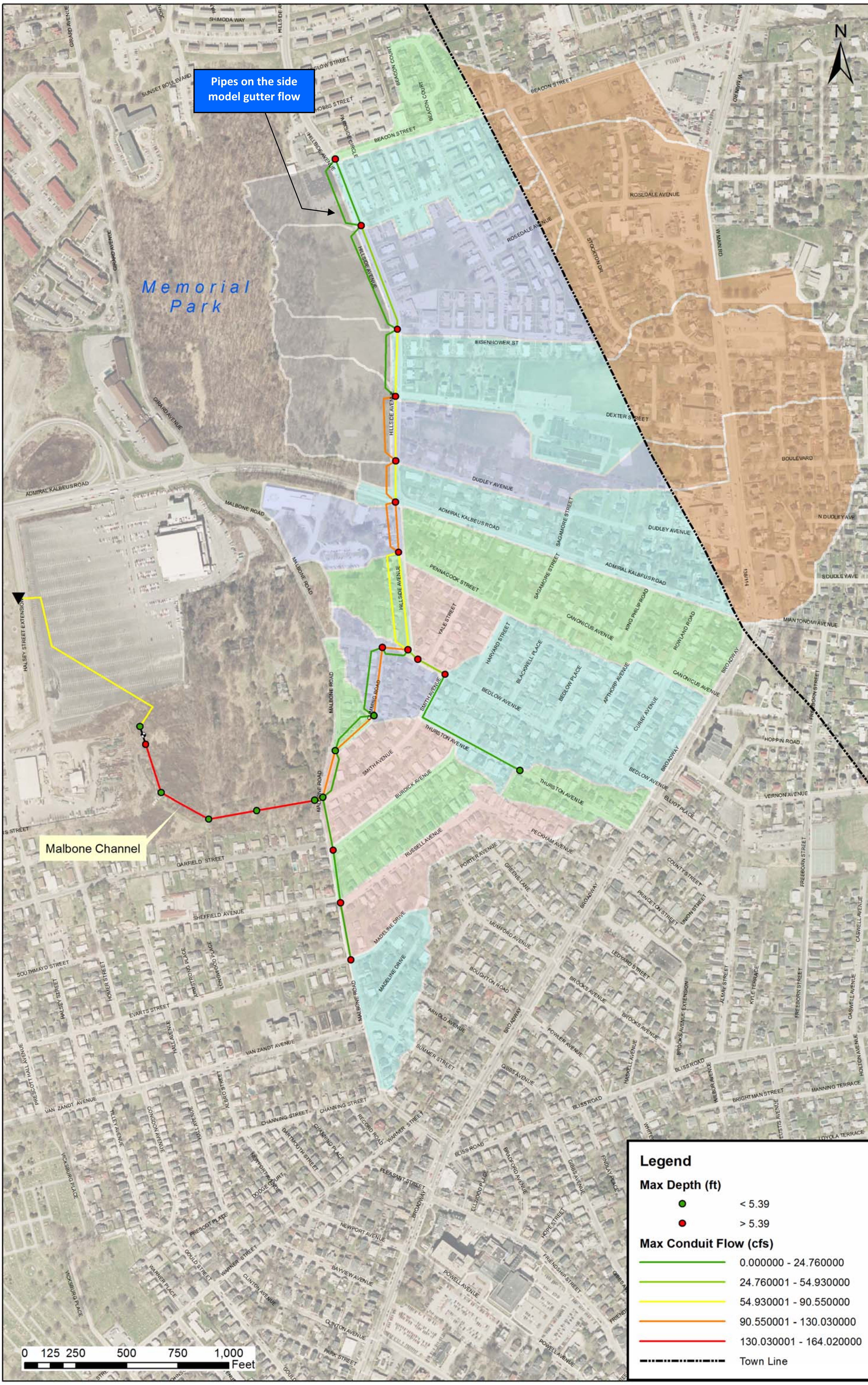
Photo 5: Drainage swale at rear of 111 JT Connell Rd. - Looking north towards rotary.

Photo 6: Drainage swale at rear of 111 JT Connell Rd. - Looking north towards rotary.

Photo 7: Drainage swale at Kalbus Way/JT Connell Rotary - Looking south from commercial plaza northeast of rotary.

Attachment 2

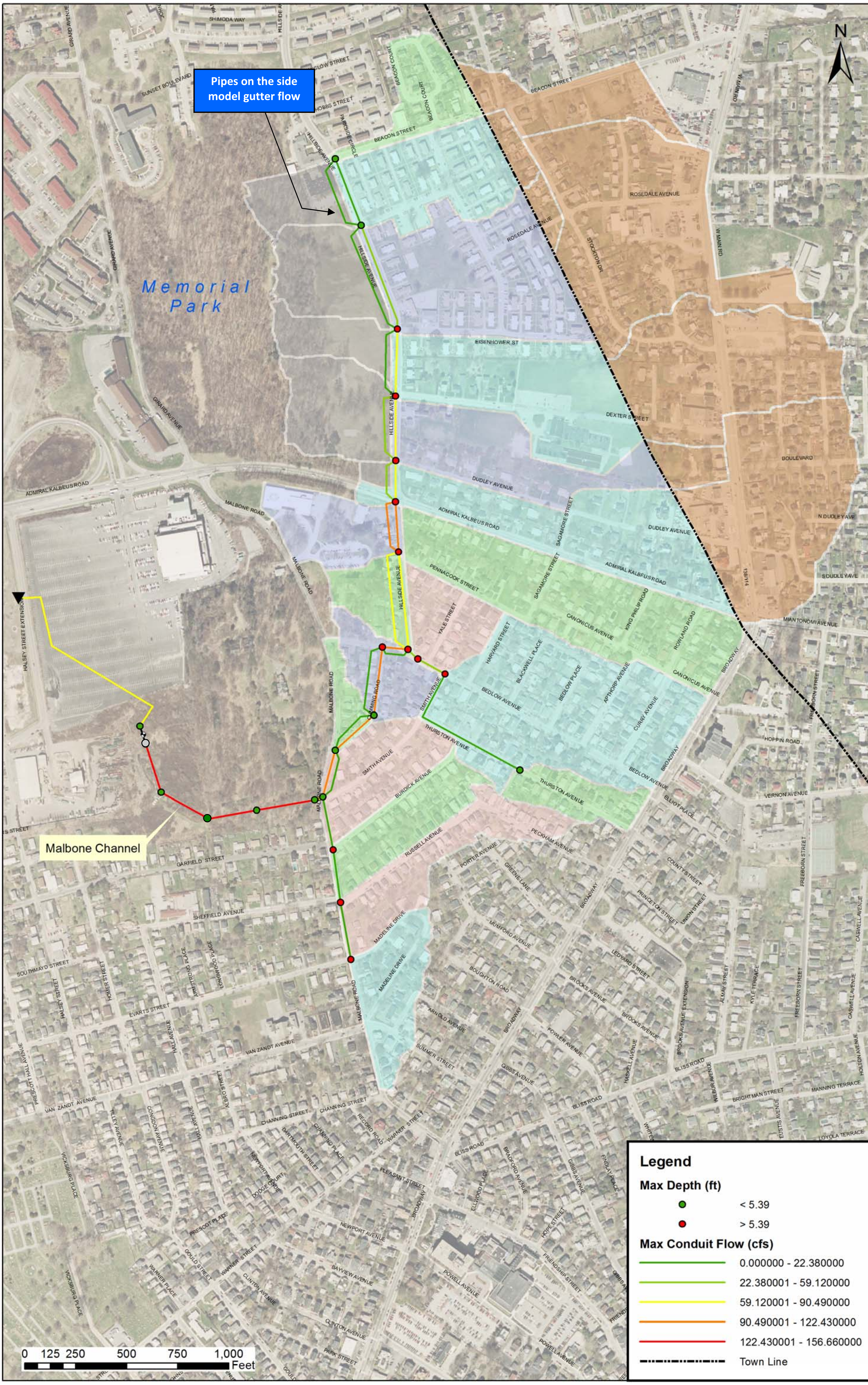
H/H Model Figures and Tables



CH2MHILL.

ATTACHMENT 2: FIGURE 1—MODEL SCHEMATIC

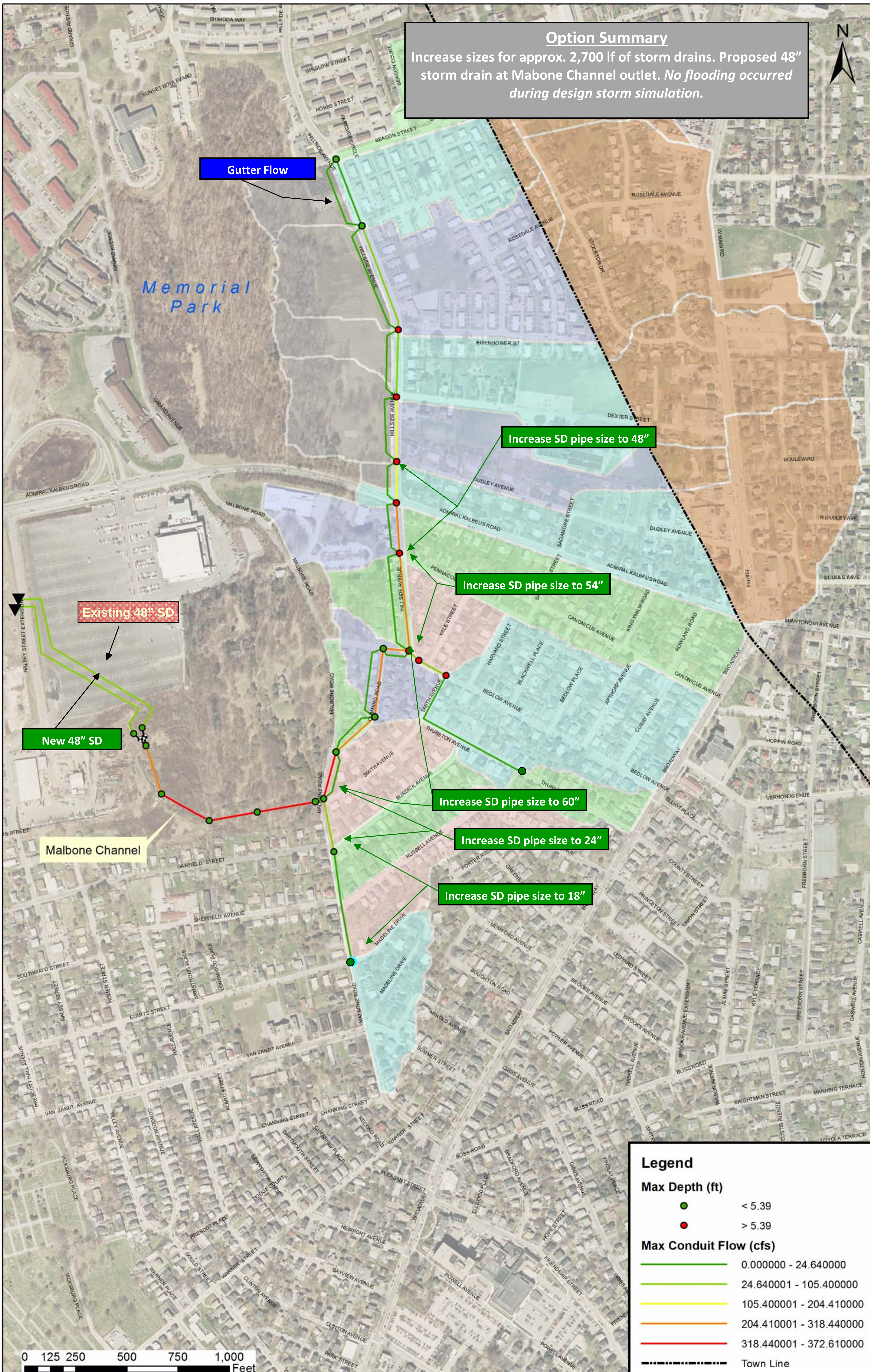
EXISTING CONDITIONS—JULY 28, 2012 STORM EVENT



CH2MHILL

ATTACHMENT 2: FIGURE 2—MODEL SCHEMATIC

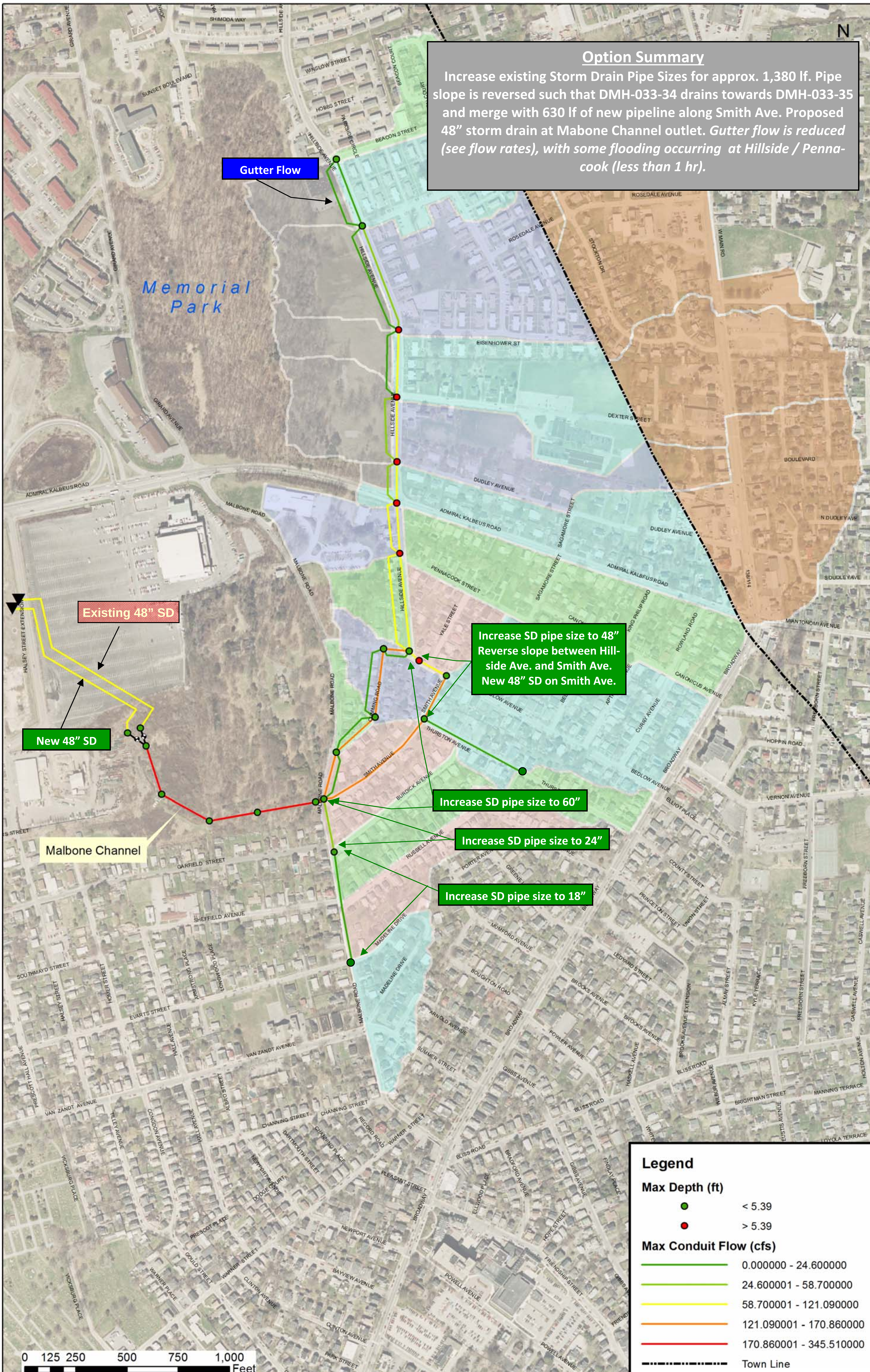
EXISTING CONDITIONS—10 YEAR 6-HOUR DESIGN STORM



CH2MHILL.

ATTACHMENT 2: FIGURE 3—MODEL SCHEMATIC

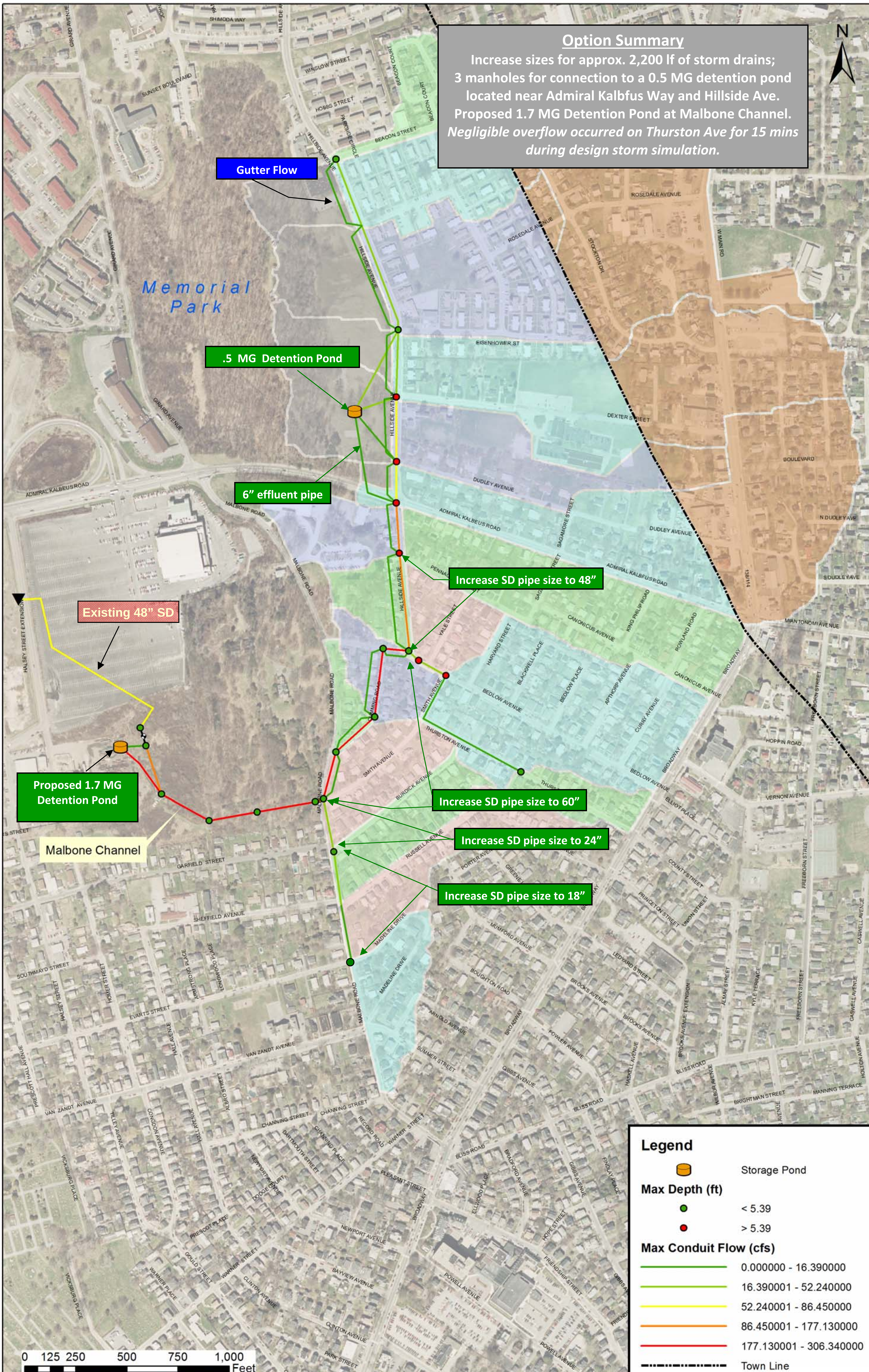
OPTION 1—GRAY CONVEYANCE #1



ATTACHMENT 2: FIGURE 4—MODEL SCHEMATIC

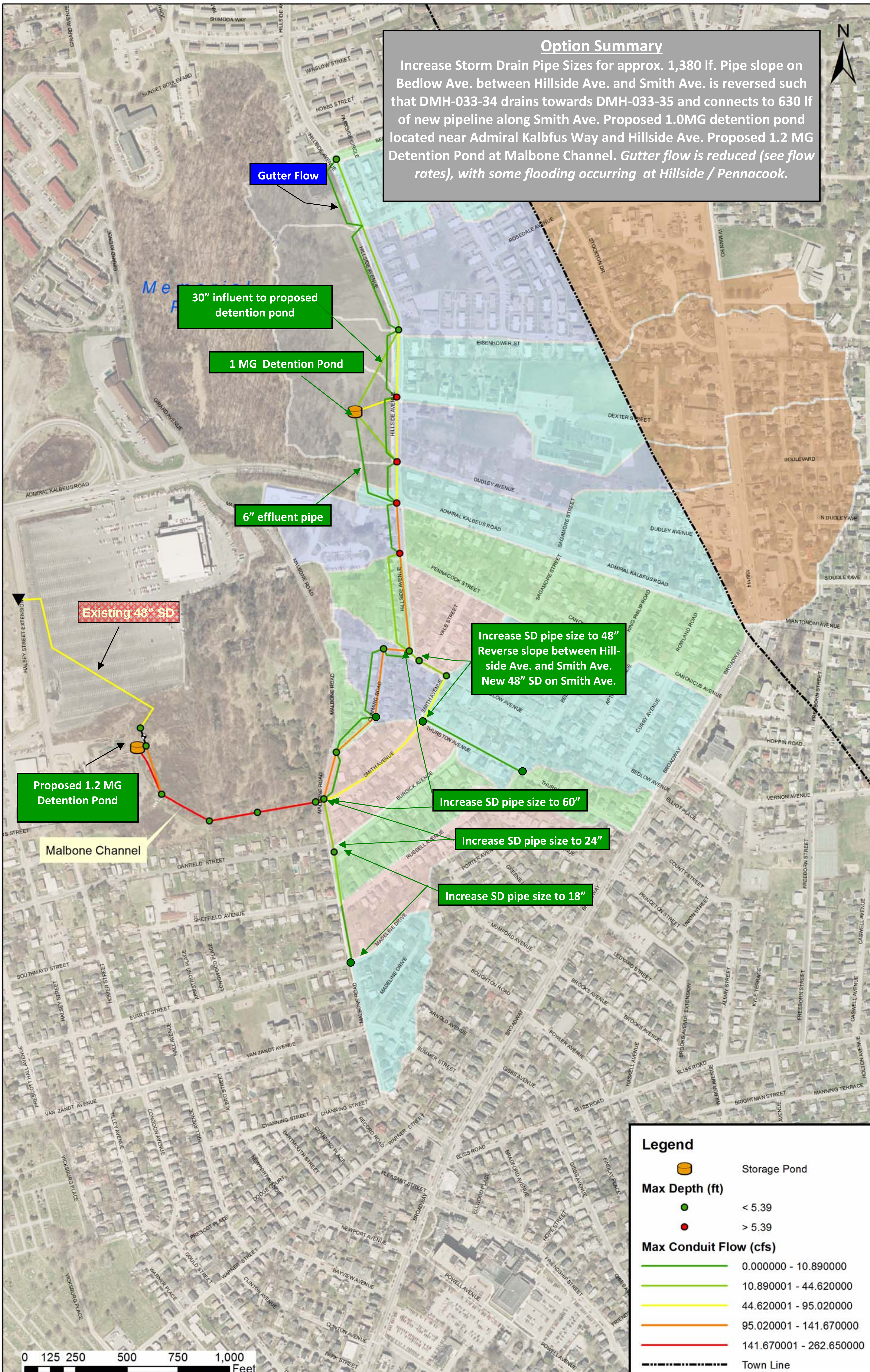
OPTION 2—GRAY CONVEYANCE #2

CH2MHILL.



ATTACHMENT 2: FIGURE 5—MODEL SCHEMATIC

OPTION 3—GREEN INFRASTRUCTURE #1



CH2MHILL.

ATTACHMENT 2: FIGURE 6—MODEL SCHEMATIC

OPTION 4—GREEN INFRASTRUCTURE #2

ATTACHMENT 2
MALBONE ROAD DRAINAGE STUDY

TABLE 2
SUMMARY OF DRAINAGE ANALYSIS AND FLOOD ASSESSMENT RESULTS
EXISTING CONDITIONS WITH FOUR MITIGATION ALTERNATIVES

Location	Gutter Flow ID	Node ID	Existing Condition				Option 1				Option 2				Option 3				Option 4			
			Flood			Duration (Hr)	Flood			Duration (Hr)	Flood			Duration (Hr)	Flood			Duration (Hr)	Flood			Duration (Hr)
			Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)	
Hillside Ave.	Gutter1	DMH-016-21	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0
Hillside Ave.	Gutter3	DMH-021-45	18	0	0	0.1	0	0	0	0	18	0	0	0.1	0.0	0.0	0.0	0	0	0	0	0
Hillside Ave.	Gutter5	DMH-027-11	58,806	0	58,806	0.6	0	0	0	0	57,922	0	57,922	0.6	0.0	0.0	0.0	0	0	0	0	0
Adm. Kalbus Way	Gutter6	DMH-027-14	0	0	0	0	0	0	0	0	108,286	0	108,286	0.7	0.0	0.0	0.0	0	0	0	0	0
Hillside Ave.	Gutter4	DMH-027-7	49,959	43	50,002	0.5	0	0	0	0	49,241	0	49,241	0.5	0.0	0.0	0.0	0	0	0	0	0
Bedlow Ave.		DMH-033-35		1,324	1,324	0.7		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Cummings Rd.	Gutter10	DMH-033-37	120,595	0	120,595	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0
Hillside Ave.	Gutter7	DMH-033-38	285,601	81,994	367,596	1.2	0	0	0	0	154,705	21,875	176,580	0.8	0.0	0.0	0.0	0	18,293	0	18,293	0.5
Bedlow Ave.	Gutter8	DMH-033-45	0	31,296	31,296	0.7	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0
Bedlow Ave.		DMH-033-47		276,927	276,927	1.2		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Thurston Ave.		DMH-039-26		1,188	1,188	0.3		0	0	0		0	0	0		509.3	509.3	0.2		0	0	0
Malbone Rd.		DMH-039-34		1,638	1,638	0.3		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Malbone Rd.		DMH-039-41		8,527	8,527	0.4		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Malbone Rd.	Gutter11	DMH-039-42	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0
Malbone Rd.		DMH-039-43		0	0	0		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Malbone Rd.		DMH-046-61		3,050	3,050	0.3		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Hillside Ave.	Gutter2	Kennedy_MH	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0
Cummings Rd.	Gutter9	Cummings_MH	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0
Malbone Channel		Culvert_Outlet		0	0	0		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Smith Ave.		Smith_Ave_NEWMH		0	0	0		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Malbone Channel		MalboneChannel1		0	0	0		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Malbone Channel		MalboneChannel2		0	0	0		0	0	0		0	0	0		0.0	0.0	0		0	0	0
Malbone Channel		MalboneChannel3		0	0	0		0	0	0		0	0	0		0.0	0.0	0		0	0	0
		Total			920,948				0				392,028				509				18,293	

Note:
1 The absence of flood conditions, gutter or curb overflow, is indicated by a zero value in the table. Positive values indicate gutter flow and/or curb overflow were simulated by the H/H model at that gutter section or manhole node.
2 Design Storm is Type III 10-Year 6-Hour Storm

ATTACHMENT 2
MALBONE ROAD DRAINAGE STUDY

TABLE 1
SUMMARY OF DRAINAGE ANALYSIS AND FLOOD ASSESSMENT RESULTS
EXISTING CONDITIONS SUMMER 2012 STORM EVENTS AND DESIGN STORM

Location	Gutter Flow ID	Node ID	July 28th Storm				August 10th Storm				August 15th Storm				Design Storm			
			Flood			Duration (Hr)	Flood			Duration (Hr)	Flood			Duration (Hr)	Flood			Duration (Hr)
			Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)		Gutter Flow (cf)	Curb Overflow (cf)	Total (cf)	
Hillside Ave.	**Gutter1**	**DMH-016-21**	18,337	0	18,337	**0.4**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Hillside Ave.	**Gutter3**	**DMH-021-45**	83,857	0	0	**0.6**	0	0	0	**0**	80	0	80	**0.1**	18	0	0	**0.1**
Hillside Ave.	**Gutter5**	**DMH-027-11**	290,475	81,578	372,054	**1**	10,245	0	10,245	**0.3**	37,683	0	37,683	**0.3**	58,839	0	58,839	**0.6**
Adm. Kalbus Way	**Gutter6**	**DMH-027-14**	446,146	30,356	476,502	**1.3**	24,668	0	24,668	**0.3**	65,130	0	65,130	**0.3**	120,652	0	120,652	**0.7**
Hillside Ave.	**Gutter4**	**DMH-027-7**	243,659	64,780	308,438	**0.7**	7,796	0	7,796	**0.3**	31,364	0	31,364	**0.3**	49,971	0	49,971	**0.5**
Bedlow Ave.		**DMH-033-35**	0	45,433	45,433	**0.5**	0	0	0	**0**	0	2,506	2,506	**0.2**	0	1,336	1,336	**0.2**
Cummings Rd.	**Gutter10**	**DMH-033-37**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Hillside Ave.	**Gutter7**	**DMH-033-38**	551,378	341,481	892,859	**2**	85,587	9,919	95,506	**0.5**	125,279	49,524	174,802	**0.5**	286,433	81,911	368,344	**1.2**
Bedlow Ave.	**Gutter8**	**DMH-033-45**	0	75,017	75,017	**1.3**	0	10,376	10,376	**0.5**	0	22,338	22,338	**0.3**	0	31,246	31,246	**0.7**
Bedlow Ave.		**DMH-033-47**	0	505,018	505,018	**2**	0	90,342	90,342	**0.5**	0	103,304	103,304	**0.5**	0	278,046	278,046	**1.2**
Thurston Ave.		**DMH-039-26**	0	9,757	9,757	**0.5**	0	0	0	**0**	0	1,123	1,123	**0.2**	0	1,189	1,189	**0.3**
Malbone Rd.		**DMH-039-34**	0	18,159	18,159	**0.5**	0	0	0	**0**	0	1,588	1,588	**0.2**	0	1,640	1,640	**0.3**
Malbone Rd.		**DMH-039-41**	0	25,982	25,982	**0.5**	0	2,367	2,367	**0.2**	0	6,958	6,958	**0.3**	0	9,119	9,119	**0.4**
Malbone Rd.	**Gutter11**	**DMH-039-42**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Malbone Rd.		**DMH-039-43**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Malbone Rd.		**DMH-046-61**	0	17,615	17,615	**0.5**	0	212	212	**0.1**	0	2,545	2,545	**0.3**	0	3,050	3,050	**0.3**
Hillside Ave.	**Gutter2**	**Kennedy_MH**	8,990	0	8,990	**0.3**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Cummings Rd.	**Gutter9**	**Cummings_MH**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Malbone Channel		**Culvert_Outlet**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Smith Ave.		**Smith_Ave_NEWMH**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Malbone Channel		**MalboneChannel1**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Malbone Channel		**MalboneChannel2**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Malbone Channel		**MalboneChannel3**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
		Total			**2,774,160**				**241,512**				**449,422**				**923,431**	

Note:

1 The absence of flood conditions, gutter or curb overflow, is indicated by a zero value in the table. Positive values indicate gutter flow and/or curb overflow were simulated by the H/H model at that gutter section or manhole node.

2 Design Storm is Type III 10-Year 6-Hour Storm

3 July 28th Storm = 10-Year Return Frequency

4 August 10th Storm = Less than 1-Year Return Frequency

5 August 15th Storm = 2-Year Return Frequency

Attachment 3

Supplemental Information

Land Ownership

Utility Constructability Review

DRAINAGE INVESTIGATION AND FLOODING ANALYSIS FOR MALBONE ROAD – SUPPLEMENTAL INFORMATION

PREPARED FOR:	Julia Forgue, P.E. Director of Utilities City of Newport
COPY TO:	Rob Shultz/NEWPORT Peter von Zweck/CH2M HILL
PREPARED BY:	Eric Kelley/BOS
DATE:	April 8, 2013
PROJECT NUMBER:	401892.DS

This supplemental information provides responses to several of the City's comments on the Technical Memorandum prepared for the Malbone Road Drainage Investigation and Flood Analysis. The City provided comments to CH2M HILL on March 25, 2013.

Land Ownership Along Malbone Channel

CH2M HILL reviewed the available City of Newport Assessor's Database information for six parcels located along the extent of the Malbone Channel between Malbone Road and Halsey Street Extension. The parcels are depicted in Figure 1 and property data is provided in Table 1. Potential sites for the proposed storm water detention ponds as well as some parcel dimensions are shown in Figure 1.

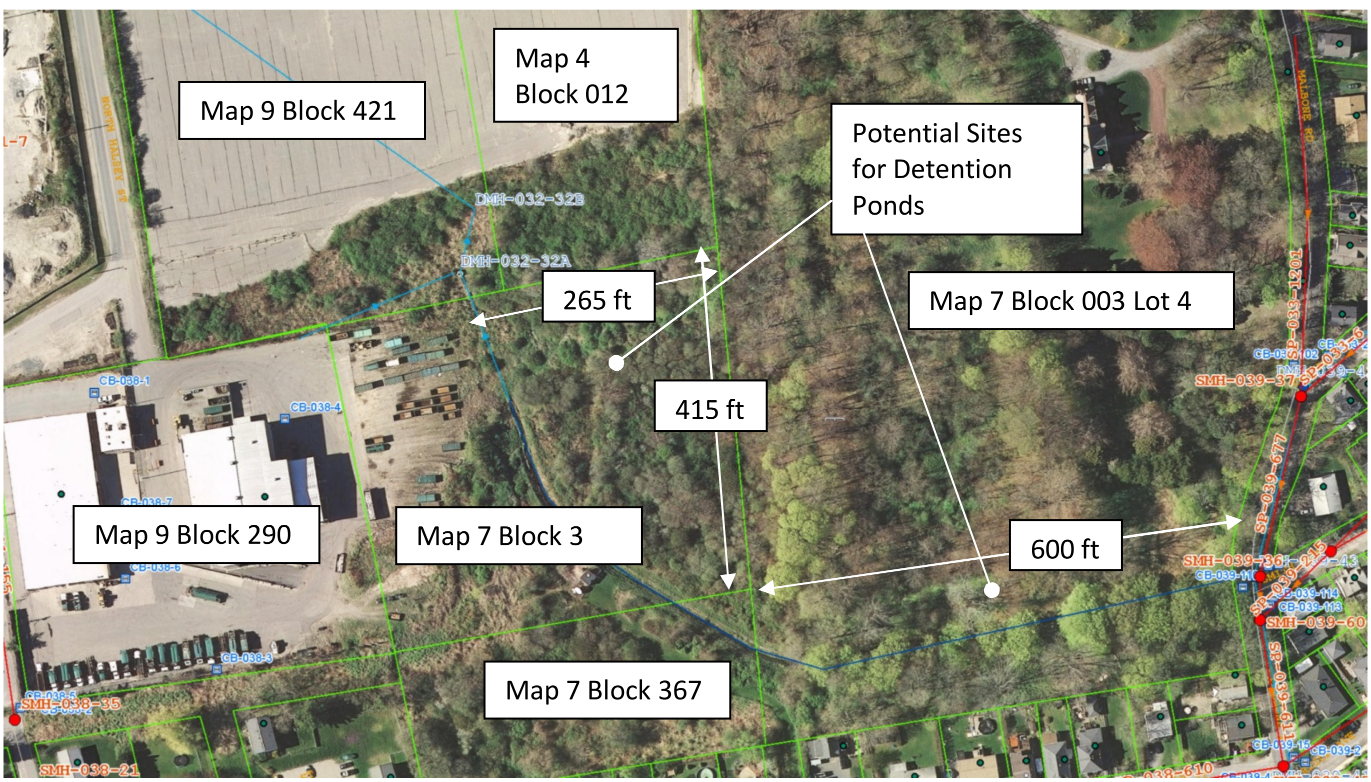


Figure 1 - Malbone Channel Parcels

Table 1 – Summary of Parcel Data

Parcel ID	***Address***	***Owner***	***Size / Description***
Map 7 Block 367	Rutgers St.	Safeway Systems (Waste Mgmt.)	2.20 Acre Vacant land
Map 7 Block 003	Rutgers St.	Safeway Systems (Waste Mgmt.)	4.13 Acre Partially Vacant land
Map 9 Block 290	65 Halsey St.	D&L Disposal Systems (Waste Mgmt.)	3.61 Acre Transfer Station
Map 7 Block 003 Lot 4	Malbone Road	Malbone Trust	17.00 Acre Malbone House
Map 9 Block 421	150 Admiral Kalbfus Rd.	Newport Jai Alai, LLC	5.77 Acre Parking Lot
Map 4 Block 012	150 Admiral Kalbfus Rd.	Newport Jai Alai, LLC	13.27 Acre Casino

Mitigation Options 3 and 4 include 1.2 million gallon and 1.7 million gallon stormwater detention ponds, respectively at the downstream end of the Malbone Channel. The proposed ponds have a surface area of 1 acre and 1.5 acre, respectively. A typical design guideline for detention basins is for their length to width ration to be a minimum of 3 to 1. Therefore, the ponds would be a minimum of 360 feet long by 120 feet wide and 440 feet long by 147 feet wide, respectively. Ideally these ponds would be oriented parallel to the channel so as to allow for gravity flow with an inlet and outlet connection to the channel. The footprint of the smaller pond could be accommodated adjacent to the channel on both the Malbone House parcel and the Safeway System's parcel that extends across the channel (Map 7 Block 003). The larger pond's footprint could be accommodated on the Malbone House parcel, but if sited on the Safeway Systems parcel (Map 7 Block 003) a portion of it would potentially extend onto one of the abutting parcels. The Safeway Systems parcel that extends parallel to Garfield Street could accommodate the smaller pond, but may not be well suited for siting the detention pond due to access to the radio station antenna site and neighboring residential properties. The undeveloped southern portions of the Newport Grand Casino parcels could be accommodate a portion of the detention ponds, but the ponds would likely have to extend onto abutting parcels. The Newport Grand Casino parcels also may not be well suited for the detention ponds due to the historical use of the site as a landfill. Information available through the Assessor's Database does not confirm if a drainage easement exists for the Malbone Channel between Malbone Road and Halsey Street.

Utility Constructability Review

CH2M HILL staff reviewed the available GIS data for municipal storm drainage, water, and sanitary sewer for those streets with proposed drainage improvements. Table 2 summarizes potential constructability concerns related to utility crossings and traffic.

Table 2 – Constructability Concerns

Roadway	Segment		Length (approx)	Existing Storm Pipe Dia.	Max. Prop. Storm Pipe Dia.	Potential Utility Conflicts	Road Width (approx)	ROW Width (approx)	Comments
	From	To	(ft)	(in.)	(in.)	Water/ Sewer	(ft.)	(ft.)	
Hillside Ave	Dudley Avenue	Admiral Kalbfus	200	36	48		30	50	Potential utility crossings at Kalbfus. Storm under west gutter, sewer at CL. Water east of sewer.
Hillside Ave	Admiral Kalbfus	Pennacook St	300	36	48		30	50	Potential utility crossings at Kalbfus. Storm under west gutter, sewer at CL. Water east of sewer.
Hillside Ave	Pennacook St	Bedlow Ave	450	36	54		30	50	Potential utility crossings at Pennacook & Bedlow
Bedlow	Hillside Ave	Cummings Rd	130	36	60	Water, Sewer	30	50	Numerous crossings at intersection of Bedlow & Hillside. Sewer, water.
Cummings Rd	Bedlow Ave	Malbone Rd	580	36	60	Water, Sewer	20	40	Narrow roadway. Several houses constructed right at property line. Potential conflicts with water and sewer due to road width.
Malbone Rd	Cummings Rd	Smith Ave (headwall)	240	36	60	Water, Sewer	25	45	Narrow roadway, higher traffic volume. Shallow construction at Smith Street. Waterline crosses over existing twin 30" outfalls according to GIS data. 60" installation may require relocation of water main.
Bedlow Ave	Hillside Ave	Smith Ave	200	18	48	Water, Sewer	30	45	Storm crosses diagonally under existing water and sewer for a major portion of this segment. Several crossings.
Smith Ave	Bedlow Ave	Thurston Ave	240	12	48	Sewer	25	40	Sewer runs parallel for a portion of this segment at less than 5' west. Water, sewer crossings at Thurston.
Smith Ave	Thurston Ave	Malbone Rd (headwall)	615	none	48	Water, Sewer	25	40	Sewer crosses Smith several times over length of road. Potential water conflicts at Malbone.

This review was based on utility data provided in the City's GIS and our observations of the subject area made during the field investigations. As shown in Table 2, construction of the proposed drainage improvements between Hillside Avenue and Malbone Road would present challenges related to utility crossings, street crossings, width of roadways, and traffic. Additional review would be necessary for other potential conflicts with other buried utilities (e.g. gas, communications) not present in the City's GIS database. The alignment of the existing utilities would have to be confirmed prior to design of the storm drainage improvements to further evaluate potential utility conflicts. The design would have to provide for the temporary relocation of affected utilities and the alignment of those utilities would have to be adjusted as necessary to permit the excavation and installation of the storm drain. The utility crossings, street crossings, and traffic accommodations would be challenges that could be addressed during the design and construction of the drainage improvements.