

**TOWN OF
MILLIS, MASSACHUSETTS**

**SEWER SYSTEM
FEASIBILITY STUDY**

FOR

SERVICE AREA C

**Prepared by:
GCG ASSOCIATES, INC.
226 Lowell St. Wilmington, MA 01887**

MARCH 2014

(Revised March 18, 2014)

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Phone: (978) 657-9714

Fax: (978) 657-7915

March 13, 2014

Mr. Charles Aspinwall
Town Hall
900 Main Street
Millis, MA 02054

RE: Sewer System Feasibility Study
Area C

Dear Mr. Aspinwall:

Our office has completed a feasibility study to provide sewer service to Area C as shown on the enclosed plans and detailed in this report. Area C was divided into 4 service areas which were labeled "Base", "North", "South" and "West" as requested by the Town. The designated areas were serviced by a combination of gravity sewer systems, municipal pump stations and force mains, or low-pressure sewer systems with individual private grinder pumps. Often one or a combination of these methods was utilized. Preliminary design schematics are based upon a review of the Town Assessor's Maps and GIS Data, USGS Maps and the recent Village Street survey plans prepared by BSC Group. A detailed survey was not conducted. This report is divided into sections according to each of the service areas. Each section includes a brief description, sewer schematic plans, soil analysis, and detailed construction cost estimate and wastewater flow and betterment analysis for each service area.

Our office reviewed the soils present within each service area to determine the suitability for residential septic systems. Soil maps developed by the United States Department of Agriculture and Soil Conservation Service were overlaid onto the Town Assessor Maps to determine the approximate location of the soils.

The hydrological group for a soil, as determined by the "Soil Survey of Norfolk and Suffolk Counties, Massachusetts" - published by the National Cooperative Soil Survey, was used to determine the suitability of the soils within each service area. The hydrological group is useful in estimating the permeability of a soil and may be used as a preliminary means to determine the suitability of soils for septic systems. The four hydrological soil groups are:

Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands and gravelly sands. These soils have a high rate of permeability.

Group B: Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of permeability.

Group C: Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of permeability.

Group D: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, and soils that have clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of permeability.

The soils in hydrological group D are unacceptable for residential septic systems. The soils contain silts or clays and the infiltration rate is expected to exceed the maximum percolation rates allowed by DEP. Soils found in hydrological group B and C are mostly unacceptable with but exceptions require further field investigations to determine the percolation rates and other physical characteristics. Soils found in the hydrological group A are acceptable. See the following sections for location and description of the soils present within each area.

Construction prices for sewer installation were developed from projects recently bid by this office and used to develop the detailed cost estimates for each service area. The ledge quantity used for these estimates was assumed for comparison purposes and was based upon past sewer projects of similar size in Millis constructed by this office, but further subsurface investigations are necessary for more accurate estimates. The low pressure sewer systems do not include the cost for grinder pumps or emergency generators and ends at the Town property line. The sewer construction generally consists of the sewer system installation, 2" trench paving to be weathered through the winter months or a predetermined period of time, followed by reclaim and grading of the roads, installation of a new binder and top course of pavement and cleanup.

The "Base", "North" and "South" service areas require a sewage pump station located at the intersection of Village and Pleasant Streets, which discharges by force main and new sanitary sewer to the existing gravity sewer on Village Street at the intersection of Pine House Road, which flows to the sewage pump station located at the intersection of Village Street and Norfolk Road. The "North" and "South" service areas are considered additions to the "Base" service area and do not include the pump station cost when reviewed individually in the following report

sections. The following table provides further cost comparisons for the various combinations of the service areas sharing the cost of the pump station.

The “Base”, “North” and “South” service areas also include low pressure sewers which require a grinder pump system and emergency standby generator to connect into piping located within the streets in front of the property owners. The cost of the piping within the streets is included in the following cost estimates but cost of the pump system and generator is not. The cost is estimated to be upwards of \$7,500 depending on the system chosen. The Town should decide how best to handle this cost due a number of considerations.

The “West” service area does not require a pump station and flows by gravity along Village Street to the existing gravity sewer at Tara Terrace and flows to the treatment plant in Medway. If the “West” service area is constructed prior to or with the “Base” service area, the force main from the proposed sewage pump station at the intersection of Pleasant Street and Village Street would be revised in location to discharge through the “West” service area to save the cost of double pumping wastewater flows.

We have summarized the results of the feasibility study in the table on the next page. We trust this information is sufficient for your current needs and welcome the opportunity to meet with you to discuss this report in detail. Please call if you have questions or if additional information is needed.

If you require additional information or have any questions, please call.

Respectfully Submitted,
GCG ASSOCIATES, INC.

Michael J. Carter

Michael J. Carter, P.E.

MARCH 2014

SEWER SYSTEM FEASIBILITY STUDY
 AREA C
 SUMMARY TABLE

MILLIS, MA

AREA C SERVICE AREA	TOTAL CONSTRUCTION/CONTINGENCIES COST (\$)	TOTAL ENGINEERING COST (\$)	TOTAL PROJECT COST (\$)	20% TOTAL CONSTRUCTION COST (\$)	TOTAL BETTERMENT UNITS	BETTERMENT UNIT COST (\$)	80% BETTERMENT UNIT COST (\$)	TOTAL SEWAGE FLOW (GPD)	SEPTIC IMPROVEMENT
BASE	2,245,595	175,000	2,420,595	484,119	72	33,619	26,896	23,540	
NORTH	1,096,508	130,000	1,226,508	245,302	46	26,663	21,331	15,730	
COMBINED BASE AND NORTH	3,342,103	305,000	3,647,103	729,421	118	30,908	24,726	39,270	
SOUTH	674,575	120,000	794,575	158,915	30	26,486	21,189	10,340	
COMBINED BASE AND SOUTH	2,920,170	295,000	3,215,170	643,034	102	31,521	25,217	33,880	
COMBINED BASE, NORTH AND SOUTH	3,950,678	425,000	4,375,678	875,136	148	29,565	23,652	49,610	
WEST	1,325,995	130,000	1,455,995	291,199	74	19,676	15,740	28,380	
* North Service Area Construction Cost Revised March 18, 2014									

Appendix A

“Base” Service Area

- **Description**
- **Reduced Service Area Plan**
- **Soil Survey**
- **Wastewater Flow and
Betterment Analysis**
- **Detailed Construction
Estimate**

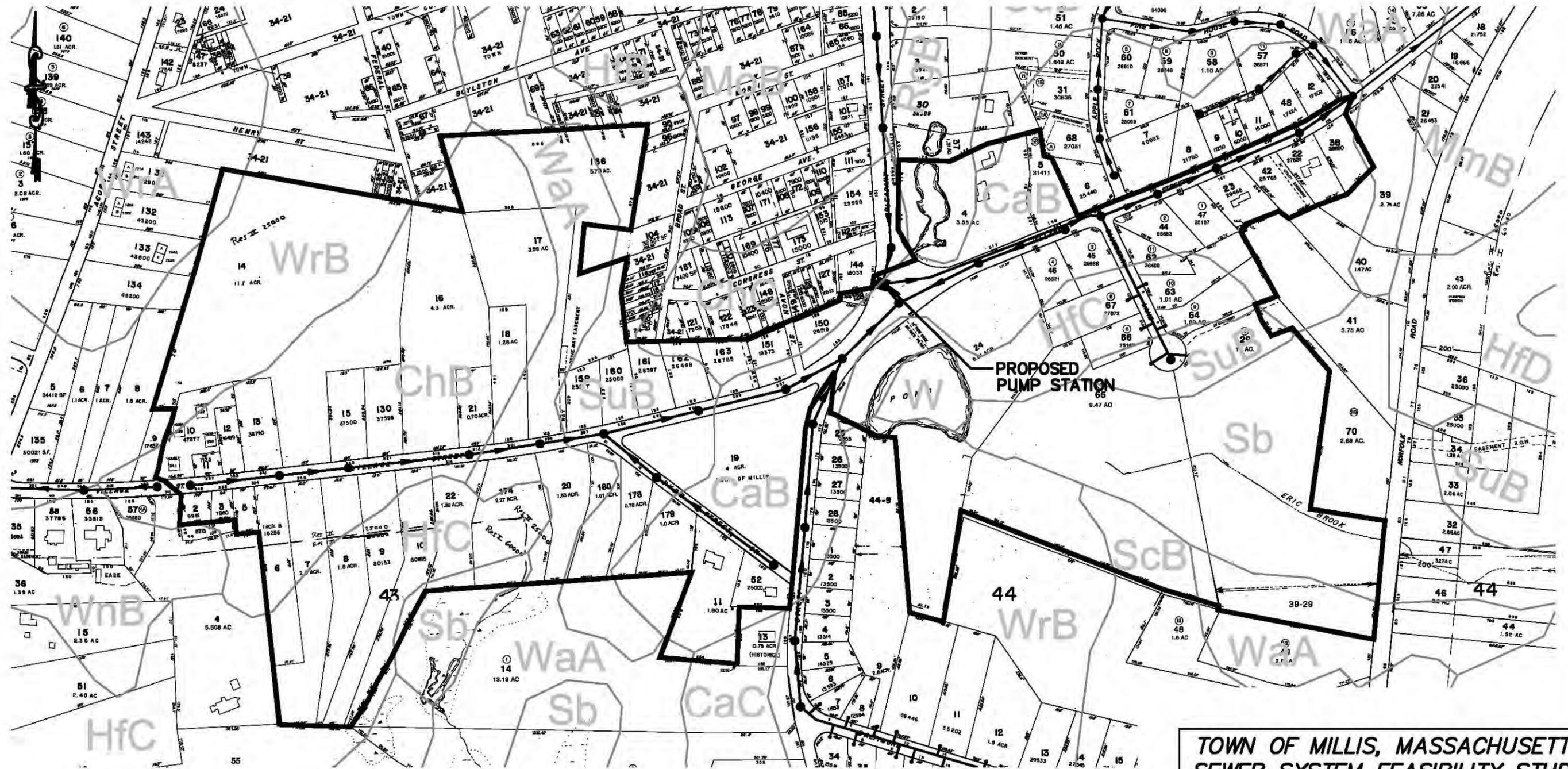
BASE

The "Base" service area consists of installing a gravity sewer system on Village Street from the existing gravity sewer system on Village Street at the intersection of Pine House Road west on Village Street to beyond and including Dyer Street to a high point located in front of #341/342 Village Street. Extending the gravity sewer further on Village Street to the intersection of Acorn Street would require a depth of approximately 32 feet at this highpoint and is better serviced in the "West" service area discussed later. A low pressure sewer system is utilized to service Blueberry Lane, which discharges into the gravity system at the intersection with Village Street. A grinder pump is required to connect into the low pressure system

A municipal sewage pump station is necessary at the intersection of Pleasant Street and Village Street and requires approximately 800 linear feet of forced main piping which discharges to a new gravity sewer at the intersection of Blueberry Lane and Village Street, which flows by gravity east along Village Street to the existing sewage pump station located at the intersection of Norfolk Road and Village Street. The existing pump station will require upgrading to handle the additional wastewater flow, which is expected to be either shimming or changing of the impellers for the pumps.

The soils found within the service area vary in their suitability for residential septic systems. The soils in hydrological group D are unacceptable for residential septic systems. The soils contain silts or clays and the infiltration rate is expected to exceed the maximum percolation rates allowed by DEP. Soils found in hydrological group B and C are mostly unacceptable with but exceptions requiring further field investigations to determine the percolation rates and other physical characteristics. Soils found in the hydrological group A are acceptable. See the following plan showing the proposed sewer system and location of soils found within the service area and attached soil descriptions.

A potential of 72 units with an estimated wastewater flow of 23,540 gallons per day would be served by this system according to the uniform method adopted by the Town and as calculated on the attached betterment and flow analysis. The sewer system consists of approximately 4,800 linear feet of gravity sewer and 26 manholes. The low-pressure portion of the sewer system consists of approximately 530 linear feet of low pressure main and 6 services. We have estimated the cost to construct this sewer to be \$2,245,595 and an engineering cost of \$175,000. If the Town supplies the grinder pump systems and emergency generators to the property owners on Blueberry Lane than an additional cost would be required depending on the system chosen. See the following detailed construction cost estimate which includes the cost of the municipal pump station and a separate sidewalk/drainage improvement estimate for Village Street



**TOWN OF MILLIS, MASSACHUSETTS
SEWER SYSTEM FEASIBILITY STUDY**

**AREA "C"
BASE SERVICE AREA**

GCG ASSOCIATES, INC.

WILMINGTON MASSACHUSETTS

SCALE: 1" = 350' DATE: MARCH 6, 2014

JOB NO. \ FILE NAME: 1414_AREA_C.dwg	DESIGNED BY: JTC DRAWN BY: JTC CHECKED BY: JTC	PLAN NO. 1 OF 1
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- MANHOLE
- PROPOSED SEWER
- - - - EXISTING SEWER
- SERVICE AREA LIMIT
- SOIL TYPE LIMIT
- SOIL CLASSIFICATION

XyZ

Area C Base Service Area Soil Survey

Service Area	Soil Type	Hydrological Group		
Base Area	HfC - Hinckley Sandy Loam, 8 to 15% slopes	A		
	CaB - Canton Fine Sandy Loam, 3 to 8% slopes CaC - Canton Fine Sandy Loam, 8 to 15% slopes ScB - Scio Very Fine Sandy Loam, 2 to 5% slopes SuB - Sudbury Fine Sandy Loam, 2 to 8% slopes	B		
		ChB - Charlton-Hollis-Rock Outcrop Complex, 3 to 8% ChC - Charlton-Hollis-Rock Outcrop Complex, 8 to 15% RgB - Ridgebury Fine Sandy Loam Stony 2 to 8% slopes WaA - Walpole Sandy Loam, 0 to 5% slopes WrA - Woodbridge Fine Sandy Loam, 0 to 3% slopes WrB - Woodbridge Fine Sandy Loam, 3 to 8% slopes	C	
			Sb - Scarboro and Birdsall, nearly level	D
			W - Surface Water	None

WASTEWATER FLOW AND BETTERMENT ANALYSIS - BASE SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments	
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)
341, 339, 337, 335 Village Street		40	10	R-S	0.57	125	200	1.08	162.53	300	4	20	2200	No	0	0	2200	4	Multi-House, All single family
335 Village Street		40	11	R-S	0.57	125	200	0.16	95	75	1	5	550	No	0	0	550	3	3 Family
333 Village Street		40	12	R-S	0.57	125	200	0.38	75	219.93	1	5	550	No	0	0	550	2	2 Family
331 Village Street		40	13	R-S	0.57	125	200	0.89	129.3	300	1	6	660	No	0	0	660	6	6 Apartment Units
No Adress		40	14	R-S	0.57	125	200	11.7	157	300	1	3	330	Yes	3	1320	1320	3	Cul-de-sac with 3 lots, Displace house
323 Village Street		40	15	R-S	0.57	125	200	0.86	125	300.04	1	4	440	No	0	0	440	2	2 Family
321 Village Street		40	130	R-S	0.57	125	200	0.86	125	300.04	1	3	330	No	0	0	330	2	2 Family
315 Village Street		40	16	R-S	0.57	125	200	4.3	188.28	800	1	4	440	No	0	0	440	2	2 Family
313 Village Street		40	21	R-S	0.57	125	200	0.7	119.7	260.24	1	3	330	No	0	0	330	1	Existing House
301 Village Street		40	18	R-S	0.57	125	200	1.28	125	445	1	3	330	No	0	0	330	1	Existing House
299 Village Street		40	17	R-S	0.57	125	200	3.59	128	760	1	3	330	No	0	0	330	1	Cannot reach with cul-de-sac, 20' driveway ease. to lot 166
No Adress		40	166	R-S	0.57	125	200	5.7	0	720	0	0	0	Yes	1	440	440	1	No Frontage, Drive Ease through Lot 17
297 Village Street		40	159	R-S	0.57	125	200	0.58	125	200	1	3	330	No	0	0	330	1	Existing House
295 Village Street		40	160	R-S	0.57	125	200	0.57	125	220	1	3	330	No	0	0	330	1	Existing House
293 Village Street		40	161	R-S	0.57	125	200	0.65	125	227	1	4	440	No	0	0	440	1	Existing House
291 Village Street		40	162	R-S	0.57	125	200	0.61	125	200	1	3	330	No	0	0	330	1	Existing House
289 Village Street		40	163	R-S	0.57	125	200	0.66	155	152	1	3	330	No	0	0	330	1	Existing House, Ease to Lot 122
287 Village Street		40	151	R-S	0.57	125	200	0.44	128	152	1	3	330	No	0	0	330	1	Existing House
285 Village Street		40	150	R-S	0.57	125	200	0.71	298	120	1	3	330	No	0	0	330	1	Existing House
No Adress	Town	40	128	R-S	0.57	125	200	0.06	54.65	102	0	0	0	No	0	0	0	0	Town Land
17 Dyer Street		40	179	R-S	0.57	125	200	0.99	183.64	188.54	1	3	330	No	0	0	330	1	Existing House
19 Dyer Street		40	178	R-S	0.57	125	200	0.78	125	318.25	1	3	330	No	0	0	330	1	Existing House
21 Dyer Street		40	180	R-S	0.57	125	200	1.01	125	400	1	3	330	No	0	0	330	1	Existing House
304 Village Street		40	20	R-S	0.57	125	200	1.53	188	420	1	4	440	No	0	0	440	1	Existing House, Wetlands
No Adress		40	174	R-S	0.57	125	200	2.27	163.3	420	0	0	0	Yes	1	440	440	1	Potential for new house
314 Village Street		40	22	R-S	0.57	125	200	1.39	189.35	410	1	2	220	No	0	0	330	1	Existing House
No Adress	Town	40	19	R-S	0.57	125	200	4	660	300	0	0	0	No	0	0	0	0	Town Land
342 Village Street		43	2	R-S	0.57	125	200	0.23	100	100	1	3	330	No	0	0	330	1	Existing House
338 Village Street		43	3	R-S	0.57	125	200	0.18	68	100	1	3	330	No	0	0	330	1	Existing House
334 Village Street		43	5	R-S	0.57	125	200	0.37	75	150	1	0	0	No	0	0	0	1	Existing Church
334 Village Street		43	6	R-S	0.57	125	200	1	97.61	600	1	3	330	No	0	0	330	1	Existing House
330 Village Street		43	7	R-S	0.57	125	200	2.3	125	796	1	3	330	No	0	0	330	1	Existing House
328 Village Street		43	8	R-S	0.57	125	200	1.8	125	830	1	4	440	No	0	0	440	1	Existing House
322, 320 Village Street		43	9	R-S	0.57	125	200	1.84	125	870	1	5	550	No	0	0	550	2	2 Family
318, 316 Village Street		43	10	R-S	0.57	125	200	1.85	125	891	1	4	440	No	0	0	440	2	2 Family
15 Dyer Street		43	11	R-S	0.57	125	200	1.79	192	367	1	3	330	No	0	0	330	1	Existing House
183 Pleasant Street		43	52	R-S	0.57	125	200	0.57	77	192	1	2	220	No	0	0	220	1	Existing House

WASTEWATER FLOW AND BETTERMENT ANALYSIS - BASE SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments		
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)	
266 Village Street		39	24	R-S	0.57	125	200	6.51	861.47	325.6	1	3	330	Yes	1	440	770	2	Potential to displace existing house and make 2 lots	
261 Village Street		39	4	R-S	0.57	125	200	3.55	317	330	1	3	330	No	0	0	330	1	Pond prohibits dividing lot	
257 Village Street		39	5	R-S	0.57	125	200	0.75	140	318	1	3	330	No	0	0	330	1	Existing House	
260 Village Street		39	46	R-S	0.57	125	200	0.6	125	200	0	0	0	Yes	1	440	440	1	Potential for new house	
258 Village Street		39	45	R-S	0.57	125	200	0.69	125	200	1	4	440	No	0	0	440	1	Existing House	
2 Blueberry Lane		39	67	R-S	0.57	125	200	0.86	125	293.38	0	0	0	Yes	1	440	440	1	Potential for new house	
4 Blueberry Lane		39	66	R-S	0.57	125	200	0.58	101.45	200	0	0	0	Yes	1	440	440	1	Potential for new house	
No Address		39	65	R-S	0.57	125	200	9.47	125	685	0	0	0	Yes	1	440	440	1	Wetlands	
7 Blueberry Lane		39	29	R-S	0.57	125	200	11	125	269	1	4	440	No	0	0	440	1	Wetlands	
5 Blueberry Lane		39	64	R-S	0.57	125	200	1.09	101.46	379	1	4	440	No	0	0	440	1	Existing House	
3 Blueberry Lane		39	63	R-S	0.57	125	200	1.01	125.6	379	1	4	440	No	0	0	440	1	Existing House	
1 Blueberry Lane		39	62	R-S	0.57	125	200	0.61	184.52	207	1	4	440	No	0	0	440	1	Existing House	
246 Village Street		39	44	R-S	0.57	125	200	0.61	164.79	208	1	4	440	No	0	0	440	1	Existing House	
244 Village Street		39	47	R-S	0.57	125	200	0.58	125	213	1	4	440	No	0	0	440	1	Existing House	
242 Village Street		39	23	R-S	0.57	125	200	0.68	157	200	1	3	330	No	0	0	330	1	Existing House	
240 Village Street		39	42	R-S	0.57	125	200	0.59	128.83	227.83	1	4	440	No	0	0	440	1	Existing House, 24' Utility Easement	
238 Village Street		39	22	R-S	0.57	125	200	0.63	138.35	227.83	1	3	330	No	0	0	330	1	Existing House	
236 Village Street		39	38	R-S	0.57	125	200	0.061	125	200	1	3	330	No	0	0	330	1	Existing House	
											Existing Buildings		Potential Development		Sewage	Betterment				
Average Lot Size:								1.81	Totals:			50	176	19360	Yes	10	4400	23540	72	
Assumptions																				
New House Design Flow				440 gpd (4 bedrooms)																
Existing House Design Flow				110 gpd/bedroom (330 gpd min value)																

VILLAGE STREET - PINE HOUSE ROAD TO #341 VILLAGE STREET AND DYER STREET

AREA C - BASE-72 Units		Engineers Estimate		
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	4800	100.00	480,000.00
6" SEWER SERVICE PIPE	EA.	66	1,500.00	99,000.00
LOW PRESSURE SEWER PIPE	L.F.	530	50.00	26,500.00
LOW PRESSURE SEWER SERVICE	EA.	6	1,000.00	6,000.00
4' DIA. SEWER MANHOLE FRAME AND COVER	EA.	26	3,800.00	98,800.00
8" MANHOLE DROP INLET	V.F.	25	400.00	10,400.00
6" SERVICE CHIMNEYS	V.F.	100	100.00	2,500.00
PUMP STATION & FM PIPING	L.S.	1	350,000.00	10,000.00
UPGRADING NORFOLK ROAD PUMP STATION	L.S.	1	5,000.00	350,000.00
ROCK EXCAVATION	C.Y.	500	100.00	50,000.00
GENERAL EXCAV.	C.Y.	300	15.00	4,500.00
GRAVEL BORROW	C.Y.	200	25.00	5,000.00
RECLAIM/FINE GRADE	S.Y.	18900	6.50	122,850.00
2" TRENCH PAVING	L.F.	6450	12.00	77,400.00
2 1/2" BASE COURSE	TON	2800	95.00	266,000.00
1 1/2" TOP COURSE	TON	1700	95.00	161,500.00
BASE COURSE(HAND)	TON	150	160.00	24,000.00
TOP COURSE(HAND)	TON	100	160.00	16,000.00
CONCRETE SIDEWALK R/R	SY	50	60.00	3,000.00
TRAFFIC SYSTEM	L.S.	1	5,000.00	5,000.00
CONCRETE	C.Y.	10	100.00	1,000.00
POLICE	HR	2000	50.00	100,000.00
LOAM & SEED	S.Y.	2900	10.00	29,000.00
MOBILIZATION	L.S.	1	50,000.00	50,000.00
MISC. WORK	L.S.	1	30,000.00	30,000.00
EROSIN CONTROL	EA.	800	10.00	8,000.00
TOTAL		84 work days		2,041,450.00
10% CONTINGENCIES				\$204,145.00
DESIGN				\$75,000.00
INSPECTION				\$100,000.00
TOTAL SEWER PROJECT COST				2,420,595.00
20% Town Cost				484,119.00
80% Resident Cost				1,936,476.00
Betterment Cost per Unit		72 Units		\$26,895.50
SIDEWALK/DRAINAGE IMPROVEMENTS				
5' WIDE R/R BITUMINOUS SIDEWALK-873'	S.Y.	485	30.00	14,550.00
5' WIDE NEW BITUMINOUS SIDEWALK-1250'	S.Y.	700	34.00	23,800.00
18" HDPE DRAIN PIPE & HEADWALLS	L.S.	1	12,000.00	12,000.00
12" HDPE DRAIN PIPE & CATCHBASIN	L.S.	1	7,500.00	7,500.00
TOTAL				57,850.00
10% CONTINGENCIES				\$5,785.00
DESIGN				\$3,000.00
INSPECTION				\$5,000.00
TOTAL SIDEWALK/DRAINAGE ESTIMATE				71,635.00

Appendix B

“North” Service Area

- **Description**
- **Reduced Service Area Plan**
- **Soil Survey**
- **Wastewater Flow and
Betterment Analysis**
- **Detailed Construction
Estimate**

NORTH

The “North” service area consists of installing a gravity sewer system on Pleasant Street from the proposed sewage pump station at the intersection with Village Street to and including Spencer Street to #70 Spencer Street. A low pressure sewer system is utilized to continue on Spencer Street to approximately #51 Spencer Street. A grinder pump is required to connect into the low pressure system beyond #70 Spencer Street.

The “North” service area is considered an addition to the “Base” service area and requires the municipal sewage pump station at the intersection of Pleasant Street. The existing pump station at Norfolk Road may need modifications to handle additional flow.

The soils found within the service area vary in their suitability for residential septic systems. The soils in hydrological group D are unacceptable for residential septic systems. The soils contain silts or clays and the infiltration rate is expected to exceed the maximum percolation rates allowed by DEP. Soils found in hydrological group B and C are mostly unacceptable with but exceptions requiring further field investigations to determine the percolation rates and other physical characteristics. Soils found in the hydrological group A are acceptable. See the following plan showing the proposed sewer system and location of soils found within the service area and attached soil descriptions.

A potential of 46 units with an estimated wastewater flow of 15,730 gallons per day would be served by this system according to the uniform method adopted by the Town and as calculated on the attached betterment and flow analysis. The sewer system consists of approximately 2,800 linear feet of gravity sewer and 16 manholes. The low-pressure portion of the sewer system consists of approximately 610 linear feet of low pressure main and 10 services. We have estimated the cost to construct this sewer to be \$1,096,508 and an engineering cost of \$130,000. If the Town supplies the grinder pump systems and emergency generators to the property owners on Spencer Street than an additional cost would be required depending on the system chosen. See the following detailed construction cost estimate which does not include the cost of the municipal pump station considered in the “Base” service area.



- MANHOLE
- PROPOSED SEWER
- - - EXISTING SEWER
- SERVICE AREA LIMIT
- SOIL TYPE LIMIT
- XyZ SOIL CLASSIFICATION

**TOWN OF MILLIS, MASSACHUSETTS
SEWER SYSTEM FEASIBILITY STUDY**

**AREA "C"
NORTH SERVICE AREA**

GCG ASSOCIATES, INC.
WILMINGTON MASSACHUSETTS

SCALE: 1" = 350' DATE: MARCH 6, 2014

JOB NO. \ FILE NAME: 1414_AREA_C.dwg	DESIGNED BY: JTC DRAWN BY: JTC CHECKED BY: JTC	PLAN NO. 1 OF 1
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Area C North Service Area Soil Survey

Service Area	Soil Type	Hydrological Group
North Area	None	A
	CaB - Canton Fine Sandy Loam, 3 to 8% slopes SuB - Sudbury Fine Sandy Loam, 2 to 8% slopes	B
	ChC - Charlton-Hollis-Rock Outcrop Complex, 8 to 15% MoB - Montauk fine sandy loam, 3 to 8% slopes Ra - Raynham Silt Loam, nearly level RdA - Ridgebury Fine Sandy Loam, 0 to 5% slopes RgB - Ridgebury Fine Sandy Loam Stony 2 to 8% slopes WrA - Woodbridge Fine Sandy Loam, 0 to 3% slopes WrB - Woodbridge Fine Sandy Loam, 3 to 8% slopes	C
	Sb - Scarboro and Birdsall, nearly level WhA - Whitman Fine Sandy loam, 0 to 5% slopes	D
	Ua - Udorthents, Sandy - surface material removed	None

WASTEWATER FLOW AND BETTERMENT ANALYSIS - NORTH SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments	
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)
110 Pleasant Street		35	18	R-S	0.57	125	200	3.54	267.9	430	1	3	330	No	0	0	330	1	Existing House, Wetlands prevent division
No Adress		35	27	R-S	0.57	125	200	0.85	80	335	0	0	0	Yes	1	440	440	1	Potential for new house, Wetlands
Wilson Boulevard	Town	35	26	R-S	0.57	125	200	0.06	40	120	0	0	0	No	0	0	0	0	Town Land
Wilson Boulevard		35	32	R-S	0.57	125	200	1.42	170	325	0	0	0	Yes	1	440	440	1	Potential for new house, Wetlands
No Adress		35	36	R-S	0.57	125	200	0.96	84	396	0	0	0	Yes	1	440	440	1	Potential for new house, Wetlands
132 Pleasant Street		39	1	R-S	0.57	125	200	0.59	125	195.74	1	4	440	No	0	0	440	1	Existing House
136 Pleasant Street		39	2	R-S	0.57	125	200	0.58	125	195.74	1	4	440	No	0	0	440	1	Existing House
138 Pleasant Street		39	3	R-S	0.57	125	200	0.6	125	191.88	1	3	330	No	0	0	330	1	Existing House
140 Pleasant Street		39	30	R-S	0.57	125	200	1.2	125	390	1	3	330	No	0	0	330	1	Existing House
50 Spencer Street		34	109	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	1.98	125	300	1	4	440	No	0	0	440	1	Existing House, Slope Easement
54, 56 Spencer Street		34	105	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.43	125	150	2	4	440	No	0	0	440	2	2 Condos
58, 60 Spencer Street		34	104	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	1.04	125	316	2	6	660	No	0	0	660	2	2 Condos, Wetlands
62, 64 Spencer Street		34	103	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.89	125	289	2	6	660	No	0	0	660	2	2 Condos, Wetlands
66, 68 Spencer Street		34	102	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.72	125	268	2	4	440	No	0	0	440	2	2 Condos, Wetlands

WASTEWATER FLOW AND BETTERMENT ANALYSIS - NORTH SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments	
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)
70 Spencer Street		34	95	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.61	125	250	1	3	330	No	0	0	330	1	Existing House, Wetlands
72 Spencer Street		34	96	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.67	125	219	1	4	440	No	0	0	440	1	Existing House, Wetlands
74 Spencer Street		34	97	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.69	171	194.46	1	4	440	No	0	0	440	1	Existing House, Wetlands
76 Spencer Street		34	34-37	R-S	0.57	125	200	0.68	181.53	126.29	1	3	330	No	0	0	330	1	Existing House, Wetlands
No Adress	Town	34	38	R-S	0.57	125	200	0.11	40.34	113.25	0	0	0	No	0	0	0	0	Town Land
105 Pleasant Street	Town	34	39	R-S	0.57	125	200	0.18	80.77	87.71	0	0	0	No	0	0	0	0	Town Land
107 Pleasant Street		34	40	R-S	0.57	125	200	0.34	273.42	48	1	6	660	No	0	0	660	1	3 Family
51 Spencer Street		34	4	R-S	0.57	125	200	4	170	695	1	3	330	No	0	0	330	1	Lot too narrow to subdivide, Wetlands
53 Spencer Street		34	65	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.36	100	156	1	3	330	No	0	0	330	1	Existing House
55, 57 Spencer Street		34	99	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.52	125	212	2	4	440	No	0	0	440	2	2 Condos

WASTEWATER FLOW AND BETTERMENT ANALYSIS - NORTH SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments	
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)
59, 61 Spencer Street		34	98	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.52	125	192	2	4	440	No	0	0	440	2	2 Condos
63, 65 Spencer Street		34	92	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.53	126	204	2	4	440	No	0	0	440	2	2 Condos, Utility Easement
No Adress		34	7	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	8.31	50	825	0	0	0	Yes	2	880	880	2	Wetlands limit potential development
69 Spencer Street		34	93	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.63	125	204	1	4	440	No	0	0	440	1	Existing House, Utility Easement
71 Spencer Street		34	94	R-V	1 Family - 0.34 2 Family - 0.43 Multi Family - 5.0	1 Family - 100 2 Family - 125 Multi Family - 250	1 Family - 150 2 Family - 150 Multi Family - 400	0.62	125	204	1	4	440	No	0	0	440	1	Existing House
73 Spencer Street		34	14	R-S	0.57	125	200	3.8	131.68	1358	1	3	330	No	0	0	330	1	Existing House, Lot too narrow to subdivide
No Adress		34	31	R-S	0.57	125	200	0.06	20	144	0	0	0	No	0	0	0	0	Lot too small to build, Wetlands
No Adress		34	32	R-S	0.57	125	200	0.12	44.34	129	0	0	0	No	0	0	0	0	Lot too small to build, Wetlands
85 Spencer Street		34	75	R-S	0.57	125	200	0.35	121.02	127	1	3	330	No	0	0	330	1	Existing House, Wetlands
No Adress	Town	34	33	R-S	0.57	125	200	0.12	40.48	137.3	0	0	0	No	0	0	0	0	Town Land
No Adress	Town	34	41	R-S	0.57	125	200	0.11	40.88	133.34	0	0	0	No	0	0	0	0	Town Land
89 Spencer Street		34	78	R-S	0.57	125	200	0.62	213.07	124	1	4	440	No	0	0	440	1	Existing House
115 Pleasant Street		34	57	I-P	1	200	250	1.35	200	269	1	0	0	No	0	0	0	1	Electric Equipment Factory MDL-96

WASTEWATER FLOW AND BETTERMENT ANALYSIS - NORTH SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments			
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)		
No Adress		34	68	R-S	0.57	125	200	0.31	62	260	0	0	0	No	0	0	0	0	Insufecient frontage to build		
No Adress		40	53	R-S	0.57	125	200	1.8	164.16	137.35	0	0	0	Yes	1	440	440	1	Potential for new house		
127 Pleasant Street		40	54	R-S	0.57	125	200	0.31	102.58	135.23	1	3	330	No	0	0	330	1	Existing House		
No Adress		40	83	R-S	0.57	125	200	0.16	61.56	130.87	0	0	0	No	0	0	0	0	Lot too small to build		
No Adress		40	84	R-S	0.57	125	200	0.12	41.52	130.87	0	0	0	No	0	0	0	0	Lot too small to build		
No Adress	Town	40	85	R-S	0.57	125	200	0.12	41.52	130.92	0	0	0	No	0	0	0	0	Town Land		
No Adress	Town	40	86	R-S	0.57	125	200	0.12	41.52	130.92	0	0	0	No	0	0	0	0	Town Land		
3 Morris Street		40	164-165	R-S	0.57	125	200	0.32	41.52	130.92	1	3	330	No	0	0	330	1	Existing House		
141 Pleasant Street		40	157-158	R-S	0.57	125	200	0.64	145.32	127	1	3	330	No	0	0	330	1	Existing House		
143 Pleasant Street		40	101	R-S	0.57	125	200	0.25	83.04	127	1	4	440	No	0	0	440	1	Existing House		
No Adress		40	155-156	R-S	0.57	125	200	0.15	41.52	127	1	3	330	No	0	0	330	1	Existing House		
No Adress	Town	40	111	R-S	0.57	125	200	0.18	81.52	127	0	0	0	No	0	0	0	0	Town Land		
151 Pleasant Street		40	153-154	R-S	0.57	125	200	0.67	187	187	1	3	330	No	0	0	330	1	Existing House		
No Adress	Town	40	112	R-S	0.57	125	200	0.09	20.76	127	0	0	0	No	0	0	0	0	Town Land		
155 Pleasant Street		40	144	R-S	0.57	125	200	0.37	151	102	1	3	330	No	0	0	330	1	Existing House		
											Existing Buildings		Potential Development		Sewage	Betterment					
Average Lot Size:								0.88	Totals:			40	119	13090	Yes	6	2640	15730	46		
Assumptions																					
New House Design Flow				440 gpd (4 bedrooms)																	
Existing House Design Flow				110 gpd/bedroom (330 gpd min value)																	

VILLAGE STREET - PLEASANT/VILLAGE STREET PUMP STATION TO SPENCER STREET

AREA C -NORTH-46 Units		Engineers Estimate		
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	2800	100.00	280,000.00
6" SEWER SERVICE PIPE	EA.	36	1,500.00	54,000.00
LOW PRESSURE SEWER PIPE	L.F.	610	50.00	30,500.00
LOW PRESSURE SEWER SERVICE	EA.	10	1,000.00	10,000.00
4' DIA. SEWER MANHOLE	EA.	16	3,800.00	60,800.00
FRAME AND COVER	EA.	16	400.00	6,400.00
8" MANHOLE DROP INLET	V.F.	10	100.00	1,000.00
6" SERVICE CHIMNEYS	V.F.	50	100.00	5,000.00
PUMP STATION & FM PIPING	L.S.	0	350,000.00	0.00
UPGRADING NORFOLK ROAD PUMP STATION	L.S.	1	5,000.00	5,000.00
ROCK EXCAVATION	C.Y.	500	100.00	50,000.00
GENERAL EXCAV.	C.Y.	250	15.00	3,750.00
GRAVEL BORROW	C.Y.	150	25.00	3,750.00
RECLAIM/FINE GRADE	S.Y.	7650	6.50	49,725.00
2" TRENCH PAVING	L.F.	4000	12.00	48,000.00
2 1/2" BASE COURSE	TON	1150	95.00	109,250.00
1 1/2" TOP COURSE	TON	750	95.00	71,250.00
BASE COURSE(HAND)	TON	115	160.00	18,400.00
TOP COURSE(HAND)	TON	75	160.00	12,000.00
CONCRETE SIDEWALK R/R	SY	0	60.00	0.00
TRAFFIC SYSTEM	L.S.	1	5,000.00	5,000.00
CONCRETE	C.Y.	10	100.00	1,000.00
POLICE	HR	1500	50.00	75,000.00
LOAM & SEED	S.Y.	1900	10.00	19,000.00
MOBILIZATION	L.S.	1	50,000.00	50,000.00
MISC. WORK	L.S.	1	20,000.00	20,000.00
EROSIN CONTROL	EA.	800	10.00	8,000.00
TOTAL		63 work days		996,825.00
10% CONTINGENCIES				\$99,682.50
DESIGN				\$55,000.00
INSPECTION				\$75,000.00
TOTAL ESTIMATE				1,226,507.50
20% Town Cost				245,301.50
80% Resident Cost				981,206.00
Betterment Cost per Unit		46 Units		\$21,330.57

* Construction Cost Revised March 18, 2014

Appendix C

“South” Service Area

- **Description**
- **Reduced Service Area Plan**
- **Soil Survey**
- **Wastewater Flow and Betterment Analysis**
- **Detailed Construction Estimate**

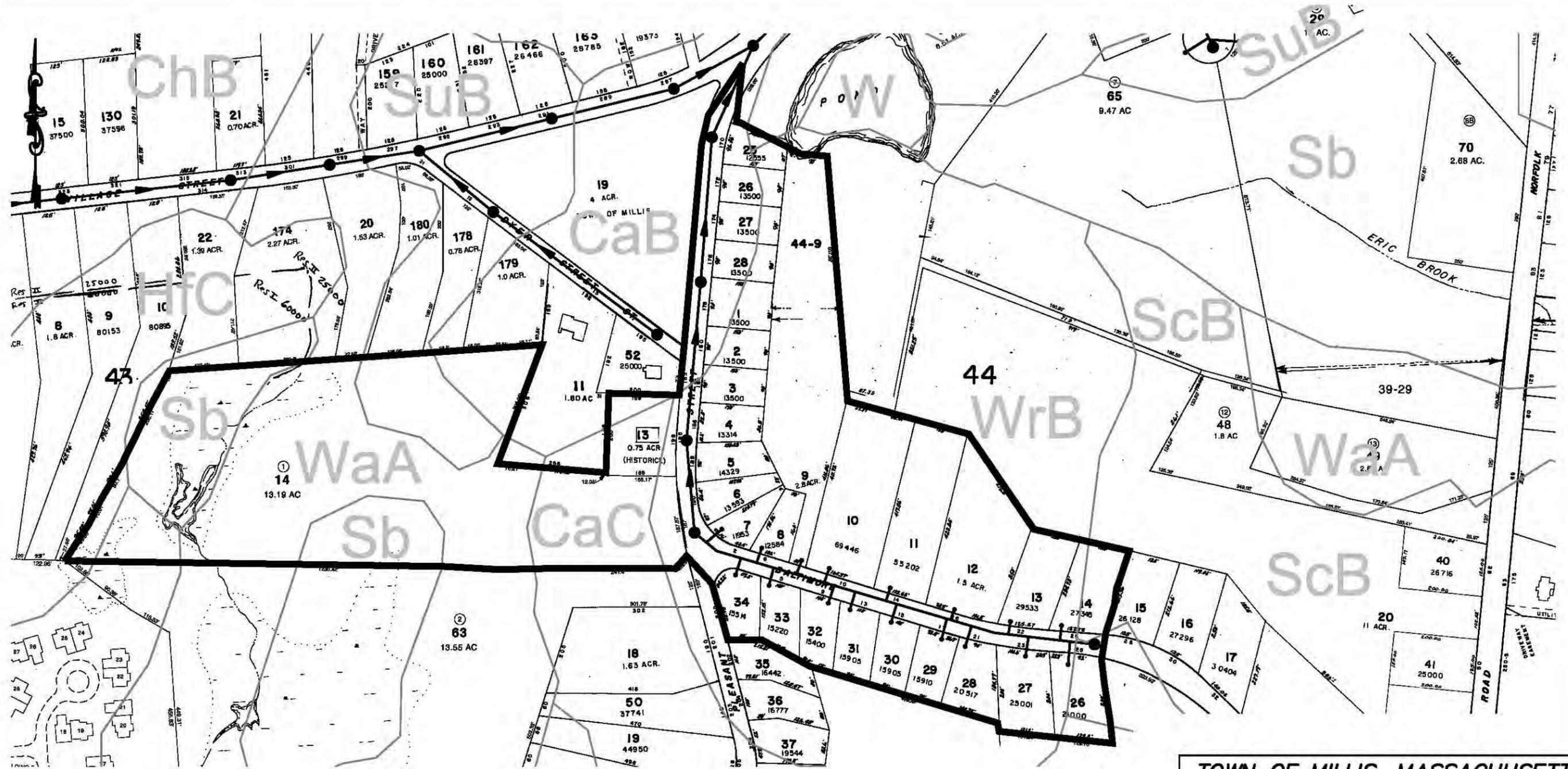
SOUTH

The “South” service area consists of installing a gravity sewer system on Pleasant Street from the proposed sewage pump station at the intersection with Village Street to the intersection of Baltimore Street. A low pressure sewer system is utilized to continue on Baltimore Street to approximately #26 Spencer Street. A grinder pump is required to connect into the low pressure system beyond #190 Pleasant Street.

The “South” service area is considered an addition to the “Base” service area and requires the municipal sewage pump station at the intersection of Pleasant Street. The existing pump station at Norfolk Road may need modifications to handle additional flow.

The soils found within the service area vary in their suitability for residential septic systems. The soils in hydrological group D are unacceptable for residential septic systems. The soils contain silts or clays and the infiltration rate is expected to exceed the maximum percolation rates allowed by DEP. Soils found in hydrological group B and C are mostly unacceptable with but exceptions requiring further field investigations to determine the percolation rates and other physical characteristics. Soils found in the hydrological group A are acceptable. See the following plan showing the proposed sewer system and location of soils found within the service area and attached soil descriptions.

A potential of 30 units with an estimated wastewater flow of 10,340 gallons per day would be served by this system according to the uniform method adopted by the Town and as calculated on the attached betterment and flow analysis. The sewer system consists of approximately 1,125 linear feet of gravity sewer and 7 manholes. The low-pressure portion of the sewer system consists of approximately 1,000 linear feet of low pressure main and 17 services. We have estimated the cost to construct this sewer to be \$674,575 and an engineering cost of \$120,000. If the Town supplies the grinder pump systems and emergency generators to the property owners on Baltimore Street than an additional cost would be required depending on the system chosen. See the following detailed construction cost estimate which does not include the cost of the municipal pump station considered in the “Base” service area.



**TOWN OF MILLIS, MASSACHUSETTS
SEWER SYSTEM FEASIBILITY STUDY**

**AREA "C"
SOUTH SERVICE AREA**

GCG ASSOCIATES, INC.
WILMINGTON MASSACHUSETTS

SCALE: 1" = 250' DATE: MARCH 6, 2014

JOB NO. \ FILE NAME: 1414_AREA_C.dwg	DESIGNED BY: JTC DRAWN BY: JTC CHECKED BY: JTC	PLAN NO. 1 OF 1
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- MANHOLE
- PROPOSED SEWER
- - - - EXISTING SEWER
- SERVICE AREA LIMIT
- SOIL TYPE LIMIT
- SOIL CLASSIFICATION

XyZ

Area C South Service Area Soil Survey

Service Area	Soil Type	Hydrological Group
South Area	HfC - Hinckley Sandy Loam, 8 to 15% slopes MmB - Merrimac Fine Sandy Loam, 3 to 8% slopes	A
	CaB - Canton Fine Sandy Loam, 3 to 8% slopes CaC - Canton Fine Sandy Loam, 8 to 15% slopes ScB - Scio Very Fine Sandy Loam, 2 to 5% slopes SuB - Sudbury Fine Sandy Loam, 2 to 8% slopes	B
	ChC - Charlton-Hollis-Rock Outcrop Complex, 8 to 15% MoB - Montauk fine sandy loam, 3 to 8% slopes Ra - Raynham Silt Loam, nearly level RdA - Ridgebury Fine Sandy Loam, 0 to 5% slopes RgB - Ridgebury Fine Sandy Loam Stony 2 to 8% slopes WaA - Walpole Sandy Loam, 0 to 5% slopes WrA - Woodbridge Fine Sandy Loam, 0 to 3% slopes WrB - Woodbridge Fine Sandy Loam, 3 to 8% slopes	C
	Sa - Saco Silt Loam, nearly level Sb - Scarboro and Birdsall, nearly level	D
	WhA - Whitman Fine Sandy loam, 0 to 5% slopes Ua - Udorthents, Sandy - surface material removed	None

WASTEWATER FLOW AND BETTERMENT ANALYSIS - SOUTH SERVICE AREA

Address	Owner	Map No.	Lot	ZONING BYLAW			Actual Lot Size			Existing Houses			Additional Development Potential	Vacant Land		Total Sewage Flow (gpd)	Total Betterment Units	Comments		
				Zoning District	Min. Lot Size (acres)	Min. Lot Frontage (ft)	Min. Lot Depth (ft)	Actual Lot Size (acres)	Actual Frontage (ft)	Actual Depth (ft)	# of Ex. Houses	# of Bedrooms		Sewage Flow (gpd)	Estimated Potential Houses				Sewage Flow (gpd)	
170 Pleasant Street		39	25	R-S	0.57	125	200	0.29	96.36	140.24	1	3	330	No	0	0	330	1	Existing House	
172 Pleasant Street		39	26	R-S	0.57	125	200	0.31	90	150	1	3	330	No	0	0	330	1	Existing House	
174 Pleasant Street		39	27	R-S	0.57	125	200	0.31	90	150	1	3	330	No	0	0	330	1	Existing House	
176 Pleasant Street		39	28	R-S	0.57	125	200	0.31	90	150	1	3	330	No	0	0	330	1	Existing House	
185 Pleasant Street	Town	43	13	R-S	0.57	125	200	0.75	198	165	1	0	0	No	0	0	0	0	Town Land, Historical Building	
187 Pleasant Street		43	14	R-S	0.57	125	200	13.19	187.87	1320	1	3	330	Yes	2	880	880	2	Potential for Cul-de-sac with 2 lots, displace existing house	
178 Pleasant Street		44	1	R-S	0.57	125	200	0.31	90	150	1	3	330	No	0	0	330	1	Existing House	
180 Pleasant Street		44	2	R-S	0.57	125	200	0.31	90	150	1	3	330	No	0	0	330	1	Existing House	
184 Pleasant Street		44	3	R-S	0.57	125	200	0.31	90	150	1	3	330	No	0	0	330	1	Existing House	
186 Pleasant Street		44	4	R-S	0.57	125	200	0.31	95	150	1	3	330	No	0	0	330	1	Existing House	
188 Pleasant Street		44	5	R-S	0.57	125	200	0.33	95	150.43	1	3	330	No	0	0	330	1	Existing House	
190 Pleasant Street		44	6	R-S	0.57	125	200	0.31	95.4	187.45	1	3	330	No	0	0	330	1	Existing House	
2 Baltimore Street		44	7	R-S	0.57	125	200	0.27	119.56	170.36	1	3	330	No	0	0	330	1	Existing House	
6 Baltimore Street		44	8	R-S	0.57	125	200	0.29	102	166	1	3	330	No	0	0	330	1	Existing House	
No Adress	Town	44	9	R-S	0.57	125	200	2.8	40	411.86	0	0	0	No	0	0	0	0	Town Land	
8 Baltimore Street		44	10	R-S	0.57	125	200	1.59	165.57	411.92	1	4	440	No	0	0	440	1	Existing House	
14 Baltimore Street		44	11	R-S	0.57	125	200	1.27	132.65	417.36	1	3	330	No	0	0	330	1	Existing House	
16 Baltimore Street		44	12	R-S	0.57	125	200	1.5	180	250	1	9	990	No	0	0	990	3	3 Family	
22 Baltimore Street		44	13	R-S	0.57	125	200	0.68	125.57	234.73	1	3	330	No	0	0	330	1	Existing House	
26 Baltimore Street		44	14	R-S	0.57	125	200	0.63	127.72	213.56	1	3	330	No	0	0	330	1	Existing House	
25 Baltimore Street		44	26	R-S	0.57	125	200	0.57	124.9	200	1	4	440	No	0	0	440	1	Existing House	
23 Baltimore Street		44	27	R-S	0.57	125	200	0.57	125.1	200	1	3	330	No	0	0	330	1	Existing House	
21 Baltimore Street		44	28	R-S	0.57	125	200	0.47	90	184.79	1	3	330	No	0	0	330	1	Existing House	
17 Baltimore Street		44	29	R-S	0.57	125	200	0.37	100.01	175	1	3	330	No	0	0	330	1	Existing House	
15 Baltimore Street		44	30	R-S	0.57	125	200	0.37	100	175	1	3	330	No	0	0	330	1	Existing House	
13 Baltimore Street		44	31	R-S	0.57	125	200	0.37	100	175	1	3	330	No	0	0	330	1	Existing House	
9 Baltimore Street		44	32	R-S	0.57	125	200	0.35	100	175	1	3	330	No	0	0	330	1	Existing House	
5 Baltimore Street		44	33	R-S	0.57	125	200	0.35	100	175	1	3	330	No	0	0	330	1	Existing House	
200 Pleasant Street		44	34	R-S	0.57	125	200	0.36	118.95	80	1	3	330	No	0	0	330	1	Existing House	
											Existing Buildings			Potential Development			Sewage	Betterment		
								Average Lot Size:	1.03		Totals:	28	89	9790	Yes	2	880	10340	30	
Assumptions																				
New House Design Flow				440 gpd (4 bedrooms)																
Existing House Design Flow				110 gpd/bedroom (330 gpd min value)																

AREA C
SEWER EXTENSION
SOUTH

PLEASANT STREET - VILLAGE STREET TO/AND BALTIMORE STREET

AREA C -SOUTH-30 Units		Engineers Estimate		
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	1125	100.00	112,500.00
6" SEWER SERVICE PIPE	EA.	13	1,500.00	19,500.00
LOW PRESSURE SEWER PIPE	L.F.	1000	50.00	50,000.00
LOW PRESSURE SEWER SERVICE	EA.	17	1,000.00	17,000.00
4' DIA. SEWER MANHOLE FRAME AND COVER	EA.	7	3,800.00	26,600.00
8" MANHOLE DROP INLET	EA.	7	400.00	2,800.00
6" SERVICE CHIMNEYS	V.F.	10	100.00	1,000.00
	V.F.	25	100.00	2,500.00
PUMP STATION & FM PIPING	L.S.	0	350,000.00	0.00
UPGRADING NORFOLK ROAD PUMP STATION	L.S.	1	5,000.00	5,000.00
ROCK EXCAVATION	C.Y.	500	100.00	50,000.00
GENERAL EXCAV.	C.Y.	200	15.00	3,000.00
GRAVEL BORROW	C.Y.	100	25.00	2,500.00
RECLAIM/FINE GRADE	S.Y.	600	6.50	3,900.00
2" TRENCH PAVING	L.F.	2600	12.00	31,200.00
2 1/2" BASE COURSE	TON	900	95.00	85,500.00
1 1/2" TOP COURSE	TON	550	95.00	52,250.00
BASE COURSE(HAND)	TON	30	160.00	4,800.00
TOP COURSE(HAND)	TON	20	160.00	3,200.00
CONCRETE SIDEWALK R/R	SY	0	60.00	0.00
TRAFFIC SYSTEM	L.S.	1	5,000.00	5,000.00
CONCRETE	C.Y.	10	100.00	1,000.00
POLICE	HR	1100	50.00	55,000.00
LOAM & SEED	S.Y.	1200	10.00	12,000.00
MOBILIZATION	L.S.	1	50,000.00	50,000.00
MISC. WORK	L.S.	1	15,000.00	15,000.00
EROSIN CONTROL	EA.	200	10.00	2,000.00
TOTAL		45 work days		613,250.00
10% CONTINGENCIES				\$61,325.00
DESIGN				\$50,000.00
INSPECTION				\$70,000.00
TOTAL ESTIMATE				794,575.00
20% Town Cost				158,915.00
80% Resident Cost				635,660.00
Betterment Cost per Unit		30 Units		\$21,188.67

Appendix D

“West” Service Area

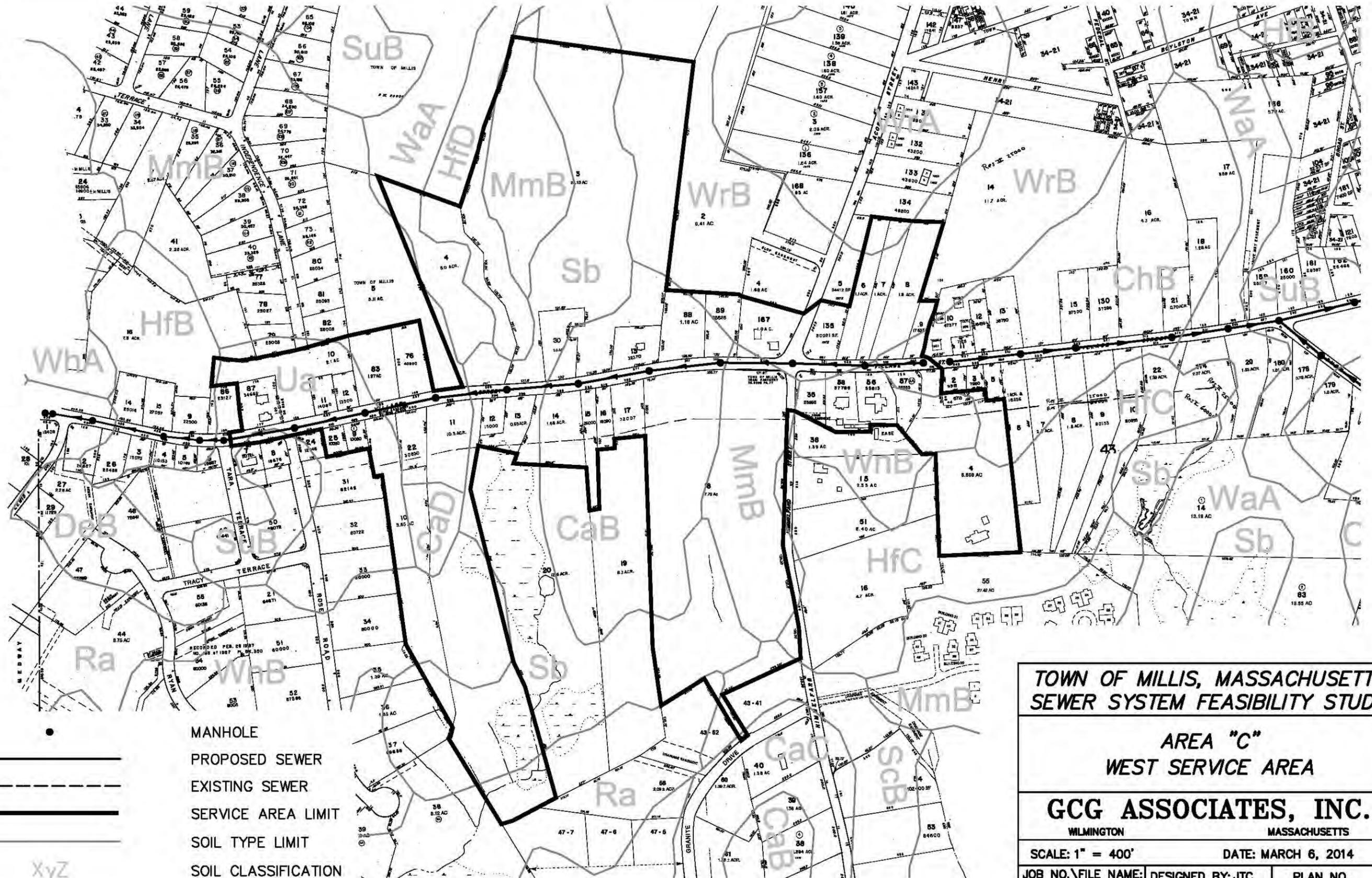
- **Description**
- **Reduced Service Area Plan**
- **Soil Survey**
- **Wastewater Flow and
Betterment Analysis**
- **Detailed Construction
Estimate**

WEST

The “West” service area consists of installing a gravity sewer system on Village Street from the existing gravity sewer at the intersection of Tara Terrace east to beyond Acorn Street to the high point at #348 Village Street and the border western border of the “Base” service area. The “West” service area is considered an addition to the “Base” service area, but does not require the municipal sewage pump station at the intersection of Pleasant Street and would not share the station cost.

The soils found within the service area vary in their suitability for residential septic systems. The soils in hydrological group D are unacceptable for residential septic systems. The soils contain silts or clays and the infiltration rate is expected to exceed the maximum percolation rates allowed by DEP. Soils found in hydrological group B and C are mostly unacceptable with but exceptions requiring further field investigations to determine the percolation rates and other physical characteristics. Soils found in the hydrological group A are acceptable. See the following plan showing the proposed sewer system and location of soils found within the service area and attached soil descriptions.

A potential of 74 units with an estimated wastewater flow of 28,380 gallons per day would be served by this system according to the uniform method adopted by the Town and as calculated on the attached betterment and flow analysis. The sewer system consists of approximately 3,000 linear feet of gravity sewer and 16 manholes. We have estimated the cost to construct this sewer to be \$1,325,995 and an engineering cost of \$130,000.



**TOWN OF MILLIS, MASSACHUSETTS
SEWER SYSTEM FEASIBILITY STUDY**

**AREA "C"
WEST SERVICE AREA**

GCG ASSOCIATES, INC.

WILMINGTON MASSACHUSETTS

SCALE: 1" = 400' DATE: MARCH 6, 2014

JOB NO./FILE NAME:
1414_AREA_C.dwg

DESIGNED BY: JTC
DRAWN BY: JTC
CHECKED BY: JTC

PLAN NO.
1 OF 1

Area C West Service Area Soil Survey

Service Area	Soil Type	Hydrological Group
West Area	HfB - Hinckley Sandy Loam, 3 to 8% slopes HfC - Hinckley Sandy Loam, 8 to 15% slopes HfD - Hinckley Sandy Loam, 15 to 35% slopes MmB - Merrimac Fine Sandy Loam, 3 to 8% slopes WnB – Winsor Loamy Sand, 3 to 8% slopes	A
	CaB - Canton Fine Sandy Loam, 3 to 8% slopes CaC - Canton Fine Sandy Loam, 8 to 15% slopes CaD – Canton Fine Sandy Loam, 15 to 35% slopes ScB - Scio Very Fine Sandy Loam, 2 to 5% slopes SuB - Sudbury Fine Sandy Loam, 2 to 8% slopes	B
	ChB - Charlton-Hollis-Rock Outcrop Complex, 3 to 8% Ra - Raynham Silt Loam, nearly level WaA - Walpole Sandy Loam, 0 to 5% slopes WrA - Woodbridge Fine Sandy Loam, 0 to 3% slopes WrB - Woodbridge Fine Sandy Loam, 3 to 8% slopes	C
	Sb - Scarboro and Birdsall, nearly level WhA - Whitman Fine Sandy loam, 0 to 5% slopes	D
	Ua - Udorthents, Sandy - surface material removed	None

AREA C
SEWER EXTENSION
WEST

VILLAGE STREET - TARA TERRACE TO #348 VILLAGE STREET

AREA C -WEST-74 Units		Engineers Estimate		
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	3000	125.00	375,000.00
6" SEWER SERVICE PIPE	EA.	74	1,500.00	111,000.00
LOW PRESSURE SEWER PIPE	L.F.	0	50.00	0.00
LOW PRESSURE SEWER SERVICE	EA.	0	1,000.00	0.00
4' DIA. SEWER MANHOLE FRAME AND COVER	EA.	16	3,800.00	60,800.00
8" MANHOLE DROP INLET	V.F.	10	400.00	6,400.00
6" SERVICE CHIMNEYS	V.F.	100	100.00	1,000.00
ROCK EXCAVATION	C.Y.	500	100.00	50,000.00
GENERAL EXCAV.	C.Y.	300	15.00	4,500.00
GRAVEL BORROW	C.Y.	200	25.00	5,000.00
RECLAIM/FINE GRADE	S.Y.	9700	6.50	63,050.00
2" TRENCH PAVING	L.F.	4100	12.00	49,200.00
2 1/2" BASE COURSE	TON	1450	95.00	137,750.00
1 1/2" TOP COURSE	TON	950	95.00	90,250.00
BASE COURSE(HAND)	TON	150	160.00	24,000.00
TOP COURSE(HAND)	TON	100	160.00	16,000.00
CONCRETE SIDEWALK R/R	SY	125	60.00	7,500.00
TRAFFIC SYSTEM	L.S.	1	5,000.00	5,000.00
CONCRETE	C.Y.	10	100.00	1,000.00
POLICE	HR	1800	50.00	90,000.00
LOAM & SEED	S.Y.	2000	10.00	20,000.00
MOBILIZATION	L.S.	1	50,000.00	50,000.00
MISC. WORK	L.S.	1	20,000.00	20,000.00
EROSIN CONTROL	EA.	800	10.00	8,000.00
TOTAL		75 work days		1,205,450.00
10% CONTINGENCIES				\$120,545.00
DESIGN				\$45,000.00
INSPECTION				\$85,000.00
TOTAL ESTIMATE				1,455,995.00
20% Town Cost				291,199.00
80% Resident Cost				1,164,796.00
Betterment Cost per Unit		74	Units	\$15,740.49

Appendix E

**Combined Service Area
Detailed Construction
Estimates**

AREA C
SEWER EXTENSION
BASE AND NORTH COMBINED

VILLAGE, DYER, PLEASANT, SPENCER AND BALTIMORE STREETS

AREA C -BASE-NORTH-118 Units		Engineers Estimate		
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	7600	100.00	760,000.00
6" SEWER SERVICE PIPE	EA.	102	1,500.00	153,000.00
LOW PRESSURE SEWER PIPE	L.F.	1140	50.00	57,000.00
LOW PRESSURE SEWER SERVICE	EA.	16	1,000.00	16,000.00
4' DIA. SEWER MANHOLE FRAME AND COVER	EA.	42	3,800.00	159,600.00
8" MANHOLE DROP INLET	V.F.	35	400.00	16,800.00
6" SERVICE CHIMNEYS	V.F.	150	100.00	3,500.00
PUMP STATION & FM PIPING	L.S.	1	350,000.00	15,000.00
UPGRADING NORFOLK ROAD PUMP STATION	L.S.	1	5,000.00	350,000.00
ROCK EXCAVATION	C.Y.	1000	100.00	100,000.00
GENERAL EXCAV.	C.Y.	550	15.00	8,250.00
GRAVEL BORROW	C.Y.	350	25.00	8,750.00
RECLAIM/FINE GRADE	S.Y.	26550	6.50	172,575.00
2" TRENCH PAVING	L.F.	10450	12.00	125,400.00
2 1/2" BASE COURSE	TON	3950	95.00	375,250.00
1 1/2" TOP COURSE	TON	2450	95.00	232,750.00
BASE COURSE(HAND)	TON	265	160.00	42,400.00
TOP COURSE(HAND)	TON	175	160.00	28,000.00
CONCRETE SIDEWALK R/R	SY	50	60.00	3,000.00
TRAFFIC SYSTEM	L.S.	1	10,000.00	10,000.00
CONCRETE	C.Y.	20	100.00	2,000.00
POLICE	HR	3500	50.00	175,000.00
LOAM & SEED	S.Y.	4800	10.00	48,000.00
MOBILIZATION	L.S.	1	100,000.00	100,000.00
MISC. WORK	L.S.	1	50,000.00	50,000.00
		0		
EROSIN CONTROL	EA.	1600	10.00	16,000.00
TOTAL		147 work days		3,033,275.00
10% CONTINGENCIES				\$303,327.50
DESIGN				130,000.00
INSPECTION				175,000.00
TOTAL ESTIMATE				3,641,602.50
20% Town Cost				728,320.50
80% Resident Cost				2,913,282.00
Betterment Cost per Unit		118 Units		\$24,688.83

* North Service Area Construction Cost Revised March 18, 2014

AREA C
SEWER EXTENSION
BASE AND SOUTH COMBINED

VILLAGE, DYER, PLEASANT, SPENCER AND BALTIMORE STREETS

AREA C -BASE-SOUTH-102 Units		Engineers Estimate		
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	5925	100.00	592,500.00
6" SEWER SERVICE PIPE	EA.	79	1,500.00	118,500.00
LOW PRESSURE SEWER PIPE	L.F.	1530	50.00	76,500.00
LOW PRESSURE SEWER SERVICE	EA.	23	1,000.00	23,000.00
4' DIA. SEWER MANHOLE	EA.	33	3,800.00	125,400.00
FRAME AND COVER	EA.	33	400.00	13,200.00
8" MANHOLE DROP INLET	V.F.	35	100.00	3,500.00
6" SERVICE CHIMNEYS	V.F.	125	100.00	12,500.00
PUMP STATION & FM PIPING	L.S.	1	350,000.00	350,000.00
UPGRADING NORFOLK ROAD PUMP STATION	L.S.	1	5,000.00	5,000.00
ROCK EXCAVATION	C.Y.	1000	100.00	100,000.00
GENERAL EXCAV.	C.Y.	500	15.00	7,500.00
GRAVEL BORROW	C.Y.	300	25.00	7,500.00
RECLAIM/FINE GRADE	S.Y.	19500	6.50	126,750.00
2" TRENCH PAVING	L.F.	9050	12.00	108,600.00
2 1/2" BASE COURSE	TON	3700	95.00	351,500.00
1 1/2" TOP COURSE	TON	2250	95.00	213,750.00
BASE COURSE(HAND)	TON	180	160.00	28,800.00
TOP COURSE(HAND)	TON	120	160.00	19,200.00
CONCRETE SIDEWALK R/R	SY	50	60.00	3,000.00
TRAFFIC SYSTEM	L.S.	1	10,000.00	10,000.00
CONCRETE	C.Y.	20	100.00	2,000.00
POLICE	HR	3100	50.00	155,000.00
LOAM & SEED	S.Y.	4100	10.00	41,000.00
MOBILIZATION	L.S.	1	100,000.00	100,000.00
MISC. WORK	L.S.	1	45,000.00	45,000.00
		0		
EROSIN CONTROL	EA.	1000	10.00	10,000.00
TOTAL		129 work days		2,649,700.00
10% CONTINGENCIES				\$264,970.00
DESIGN				125,000.00
INSPECTION				170,000.00
TOTAL ESTIMATE				3,209,670.00
20% Town Cost				641,934.00
80% Resident Cost				2,567,736.00
Betterment Cost per Unit		102 Units		\$25,173.88

AREA C
SEWER EXTENSION
BASE, NORTH, SOUTH COMBINED

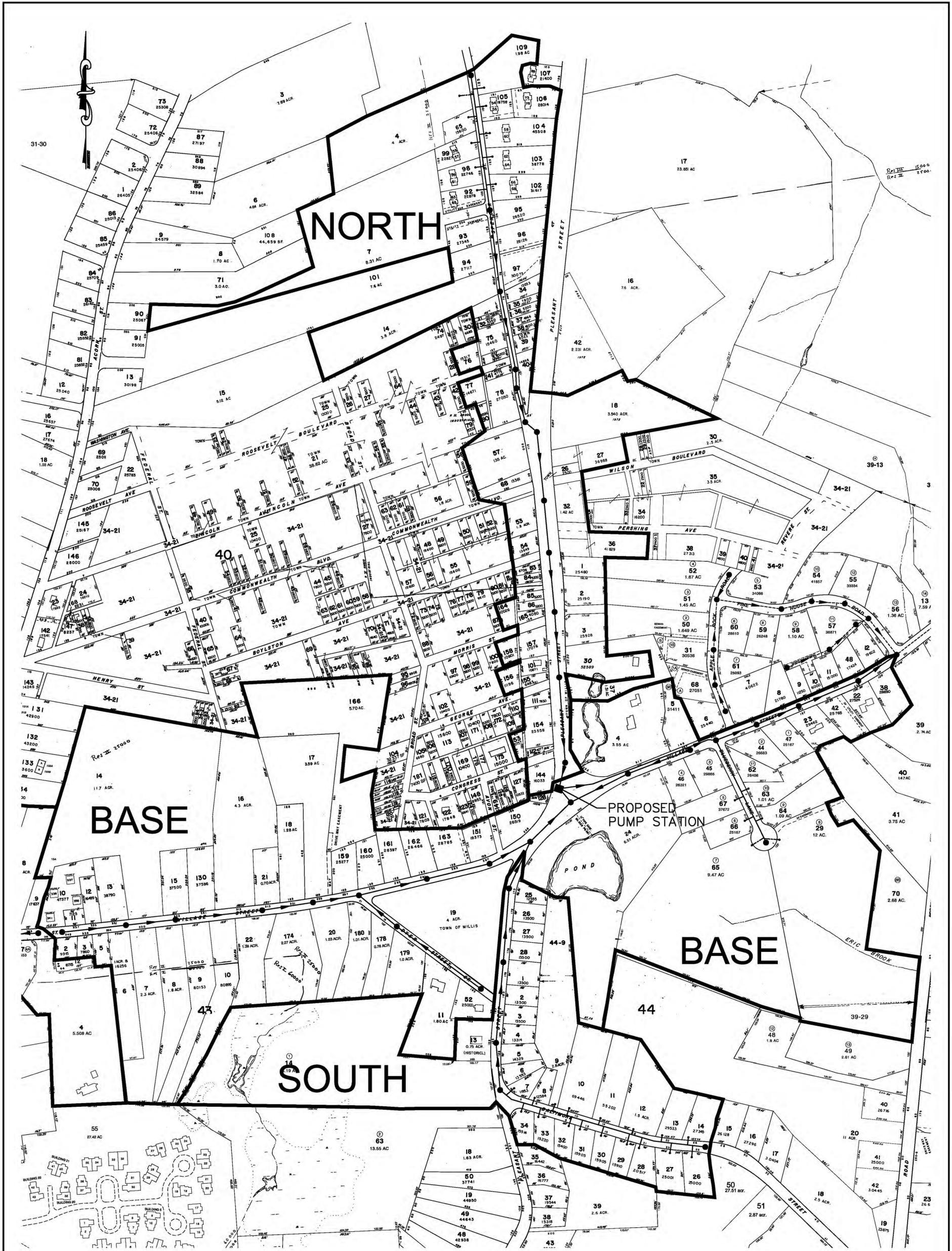
VILLAGE, DYER, PLEASANT, SPENCER AND BALTIMORE STREETS

AREA C -BASE-NORTH-SOUTH-148 Units			Engineers Estimate	
Item Descript.	Units	Quan.	Unit Cost (\$)	Total Cost (\$)
8" SEWER MAIN PIPE	L.F.	8725	100.00	872,500.00
6" SEWER SERVICE PIPE	EA.	115	1,500.00	172,500.00
LOW PRESSURE SEWER PIPE	L.F.	2140	50.00	107,000.00
LOW PRESSURE SEWER SERVICE	EA.	33	1,000.00	33,000.00
4' DIA. SEWER MANHOLE FRAME AND COVER	EA.	49	3,800.00	186,200.00
8" MANHOLE DROP INLET	V.F.	45	100.00	4,500.00
6" SERVICE CHIMNEYS	V.F.	175	100.00	17,500.00
PUMP STATION & FM PIPING	L.S.	1	350,000.00	350,000.00
UPGRADING NORFOLK ROAD PUMP STATION	L.S.	1	5,000.00	5,000.00
ROCK EXCAVATION	C.Y.	1500	100.00	150,000.00
GENERAL EXCAV.	C.Y.	750	15.00	11,250.00
GRAVEL BORROW	C.Y.	450	25.00	11,250.00
RECLAIM/FINE GRADE	S.Y.	27150	6.50	176,475.00
2" TRENCH PAVING	L.F.	13050	12.00	156,600.00
2 1/2" BASE COURSE	TON	4850	95.00	460,750.00
1 1/2" TOP COURSE	TON	3000	95.00	285,000.00
BASE COURSE(HAND)	TON	295	160.00	47,200.00
TOP COURSE(HAND)	TON	195	160.00	31,200.00
CONCRETE SIDEWALK R/R	SY	50	60.00	3,000.00
TRAFFIC SYSTEM	L.S.	1	15,000.00	15,000.00
CONCRETE	C.Y.	30	100.00	3,000.00
POLICE	HR	4600	50.00	230,000.00
LOAM & SEED	S.Y.	6000	10.00	60,000.00
MOBILIZATION	L.S.	1	100,000.00	100,000.00
MISC. WORK	L.S.	1	65,000.00	65,000.00
		0		
EROSIN CONTROL	EA.	1800	10.00	18,000.00
TOTAL		192 work days		3,591,525.00
10% CONTINGENCIES				\$359,152.50
DESIGN				180,000.00
INSPECTION				245,000.00
TOTAL ESTIMATE				4,375,677.50
20% Town Cost				875,135.50
80% Resident Cost				3,500,542.00
Betterment Cost per Unit		148 Units		\$23,652.31

* North Service Area Construction Cost Revised March 18, 2014

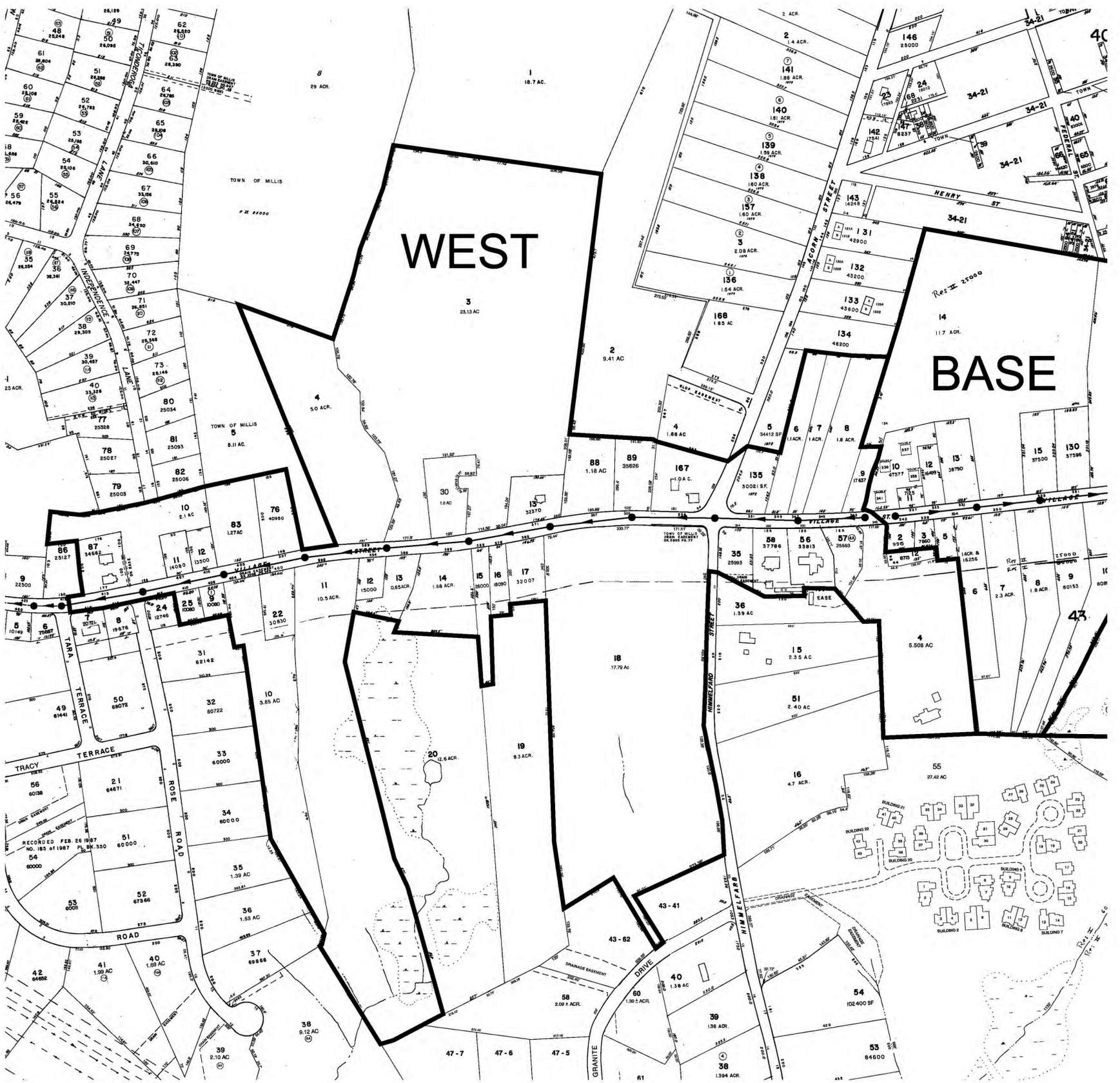
Appendix F

**Full Size Plans of All Service
Areas**



TOWN OF MILLIS, MASSACHUSETTS SEWER SYSTEM FEASIBILITY STUDY		
SEWER AREA "C"—BASE—NORTH—SOUTH SEWER SCHEMATIC DESIGN		
GCG ASSOCIATES, INC.		
WILMINGTON		MASSACHUSETTS
SCALE: 1" = 200'		DATE: MARCH 6, 2014
JOB NO. \FILE NAME: 1414_AREA_C.dwg	DESIGNED BY: JTC DRAWN BY: JTC CHECKED BY: JTC	PLAN NO. 1 of 2

● MANHOLE
 — PROPOSED SEWER
 - - - EXISTING SEWER
 ——— SERVICE AREA LIMIT



- MANHOLE
- PROPOSED SEWER
- - - EXISTING SEWER
- ▬ SERVICE AREA LIMIT

TOWN OF MILLIS, MASSACHUSETTS SEWER SYSTEM FEASIBILITY STUDY	
SEWER AREA "C" WEST SEWER SCHEMATIC DESIGN	
GCG ASSOCIATES, INC. WILMINGTON MASSACHUSETTS	
SCALE: 1" = 200'	DATE: MARCH 6, 2014
JOB NO. \FILE NAME: 1414_AREA_C.dwg	DESIGNED BY: JTC DRAWN BY: JTC CHECKED BY: JTC
PLAN NO. 2 OF 2	