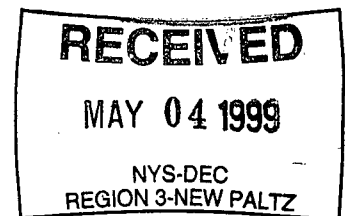
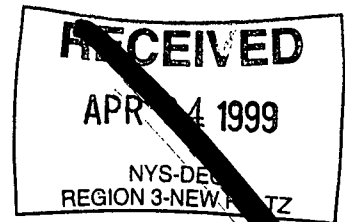


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& LANDSCAPE ARCHITECTS



POST-CLOSURE MONITORING
AND
MAINTENANCE OPERATIONS MANUAL
FOR
THE TOWN OF WOODSTOCK LANDFILL
ULSTER COUNTY, NEW YORK

**POST-CLOSURE MONITORING
AND
MAINTENANCE OPERATIONS MANUAL**

for

**THE TOWN OF WOODSTOCK LANDFILL
Ulster County, New York**

DEC FILE No.56S26

CHA FILE No. 3509.07

December, 1997
Revised April, 1999

Prepared by:

**CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS
& LANDSCAPE ARCHITECTS**

III Winners Circle
Albany, New York 12205

(518) 453-4500

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- Appendix A Town of Woodstock Environmental Monitoring Plan
- Appendix B Standard Operating Procedures
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I. INTRODUCTION

This Post-Closure Monitoring and Maintenance Operations Manual has been prepared for the Town of Woodstock Municipal Landfill by Clough, Harbour & Associates LLP, in accordance with 6 NYCRR Part 360 effective December 31, 1988. This manual describes all aspects of the groundwater, surface water, leachate and gas monitoring programs, as well as the site inspection and maintenance procedures that should be performed after final closure of the landfill. This report is intended to serve as a summary and guide for all monitoring and maintenance at the landfill for a minimum of thirty (30) years.

The list of phone numbers below has been included to serve as a quick reference of Town and area personnel in case of emergency or other inquiries in reference to the Town of Woodstock Landfill.

Town Supervisor.....	(914) 679-8597
Town Clerk.....	(914) 679-2113
Town Highway Superintendent	(914) 679-2805
Fire Department.....	(914) 679-2422
Ambulance.....	(914) 679-2422
Police Department	(914) 679-2422

The Town has proposed the construction of a Town Highway Department facility on an adjacent undeveloped portion of the landfill property. When this facility is complete, any emergencies or other inquiries regarding the landfill may be conveniently reported to the Town Highway Department staff on-site. Inspection and maintenance of the landfill will also be conveniently implemented as needed by Town Highway Department staff from this adjacent location.

II. LANDFILL FACILITY MONITORING PROGRAM

A. MONITORING POINT LOCATIONS

1. Groundwater Monitoring Points:

There are twelve (12) monitoring wells on the landfill site, six of which are to be used for post-closure monitoring. In addition, the water well to be installed to serve the proposed highway garage will be monitored during post closure monitoring. Reference the environmental monitoring plan included in Appendix A for the locations and numbers of the wells to be monitored.

2. Surface Water Monitoring Points:

There is one surface water sampling point proposed for post-closure monitoring at the Woodstock Landfill Site. Reference the environmental monitoring plan in Appendix A for the location and number of this point.

3. Residential Well Sampling Points:

Up to nine residential wells shall be monitored during the post-closure period. The locations and numbers of potential candidate wells are included in the environmental monitoring plan included in Appendix A.

4. Gas Monitoring Points:

Perimeter gas monitoring shall be performed immediately adjacent to the cap, at a spacing of one hundred (100) feet. Gas monitoring shall also be done within the proposed Town Highway Building and in the three proposed gas monitoring wells in the vicinity of this building after construction of these facilities is complete. The locations of the proposed building and gas monitoring wells is included in Appendix C.

B. SAMPLING AND MONITORING SCHEDULE

Groundwater/surface water sampling and analysis will be performed quarterly as required by Part 360 regulations effective December 31, 1988. Sampling and analysis of residential wells and the water well to be installed to serve the proposed highway garage will be performed annually. The parameters to be analyzed for groundwater, surface water and residential sampling are defined in the environmental monitoring plan in Appendix A. Gas monitoring will be performed quarterly.

It is suggested that the above mentioned water sampling and gas monitoring programs be followed for a minimum of five years. However, in accordance with a recent NYSDEC variance, a request for monitoring reduction will be made following the tenth sampling event based on the results of testing previously performed. Sampling and monitoring, however, will continue throughout the 30 year period.

C. GROUNDWATER/SURFACEWATER SAMPLING PROCEDURES

Clough, Harbour & Associates LLP (CHA) has developed standard operating procedures for sampling events. These procedures shall be used for sampling groundwater (including residential wells) and surface water at the landfill. The standard operating procedures are included in Appendix B.

D. GAS MONITORING PROCEDURES

A post-closure gas monitoring program will be initiated to monitor migration of decomposition gases generated within the landfill and to minimize hazards to health, safety, or property. The gas monitoring program will verify that the concentration of methane gas generated by the facility will not exceed 25% of the lower explosive limit of methane gas in all enclosed structures on-site, or the lower explosive limit of methane gas at or beyond the property boundary.

Upon detection of methane gas levels exceeding the above specified limits, the appropriate Town official(s) responsible for landfill closure operations shall immediately take all steps necessary to ensure the safety and protection of health and shall immediately notify the NYS Department of Environmental Conservation.

One of the quarterly gas monitoring events shall be conducted during the winter months when a frost layer exists, when there is the potential for snow cover on the ground, when atmospheric pressure is low, and when wind conditions are at a minimum. These conditions maximize the potential for gas migration from the landfilled area. All gas monitoring events should be conducted on a day when temperatures are above freezing and within the operating range of the gas detection instrument utilized. The atmospheric pressure, temperature, and wind velocity shall be measured and recorded whenever gas readings are taken.

The explosive gas investigation shall utilize a portable gas detection instrument designed to detect the presence combustible decomposition gases in air. The instrument shall be calibrated using methane gas. The perimeter gas readings shall be taken by advancing a probe a minimum of 18 inches into the ground, or to a depth below frost level. Immediately upon extracting the probe from the hole formed, a gas collection tube attached to the gas meter aspirator adapter shall be inserted into the ground. A gas reading shall be taken from the gas detection instrument after aspiration. Should any reading exceed 25% of the lower explosive limit of methane gas, additional readings shall be taken at fifty (50) foot offsets from the original point in a direction away from the waste mass. This shall be done for the purpose of defining the aerial extent of the high concentration of explosive gas.

In addition, gas readings shall be taken inside all enclosed buildings on site. These inside readings shall be taken at floor level, head level, and at the highest extended arm level. A sufficient number of readings shall be taken to provide full coverage of all structures investigated.

Three gas monitoring wells are proposed in the vicinity of the proposed Town Highway Building. Gas concentrations within these wells shall be measured with a portable gas detection instrument. Readings shall be taken by removing the cap from each well and immediately inserting the gas collection tubing of the portable gas detector. Gas level measurements in these wells will be used to evaluate the need for any further gas investigation or remediation at the proposed Town Highway Building beyond that which is included herein.

In addition to the three gas monitoring wells that will be installed in the vicinity of the Highway Building, an explosive gas alarm system will be installed within the highway building. The alarm system will be calibrated to activate if a concentration of 25% of the lower explosive limit of methane is detected within the building. If the alarm does activate at any time, contingency measures as described in Section G of this manual shall be taken.

E. Leachate Monitoring:

The Woodstock landfill closure system includes a contingency leachate collection system. The on-site elements of this system at the start of the post-closure period will consist of deep gas vents that have been designed to function as leachate collection points if conditions after closure warrant their use.

Monitoring of leachate conditions after closure construction shall be conducted on a quarterly basis to help assess the impact of landfill leachate on the surrounding environment, and subsequently determine if the operation of the contingency leachate collection system is necessary. Monitoring shall consist of inspection of the perimeter of the landfill for leachate seeps, and measuring the leachate levels within the deep gas vents/collection points.

It is anticipated that leachate seeps and levels within the landfill will diminish over time. If this trend is not observed, the data gathered during the leachate monitoring will be used in combination with groundwater and surface water monitoring data to evaluate the need for operation of the contingency leachate collection system.

III. SITE MAINTENANCE PROGRAM

A. QUARTERLY INSPECTION

Quarterly inspections of the landfill site should be performed to identify and document any problems that may have developed with time after final closure of the landfill. The inspection should include the inspection of the landfill cover, gas venting, and site drainage control systems. A thorough visual site inspection should also be conducted to identify the presence of any vectors on the site. The following sections of this manual describe in some detail the recommended procedures for inspection of the landfill site.

B. COVER SYSTEM

The Town of Woodstock landfill cover system incorporates a geomembrane barrier. The most likely problems with the landfill cover system that may occur include tearing of the geomembrane, settlement (total and differential) of the landfill, erosion of surface soils on top of the landfill or on side slopes, and loss of vegetative cover on the landfill. In areas where cracks and depressions are discovered in the cover system, the geomembrane should be exposed to determine its integrity. If the geomembrane is damaged, it should be repaired prior to replacing and compacting the cover soils and reseeding.

Areas on top or on the sides of the landfill where erosion of the cover soil is observed should be repaired by replacing the eroded soil and compacting it prior to re-establishing the vegetative cover. Drainage paths should be rerouted to prevent future erosion problems, and hay bale siltation controls should be temporarily installed.

As stated previously, it is likely that the vegetative cover will need periodic maintenance. Bare spots on the top or sideslopes of the landfill should be repaired by re-working the cover soil in these areas, re-seeding, fertilizing and mulching. It should also be noted that periodic mowing of the vegetative cover should be conducted at a minimum rate of four (4) times a year to help maintain the integrity of the cover system. Hand-held or lightweight equipment should be used to avoid the creation of ruts and other subsequent damage to the landfill cover.

C. *GAS VENTING SYSTEM*

Inspection of the gas venting system should include checking the vents for any physical damage, or blockages, and checking the cap adjacent to the vents for any settlement. The inspection should also include a visual inspection of the land and vegetation surrounding the landfill. Stressed vegetation, bubbling of surface water, etc. could indicate a malfunction of the gas venting system that cannot readily be detected upon visual inspection of the venting system itself.

Any physical damage to a gas vent should be repaired by replacement of the damaged part or section. Blockages in a vent should be cleared by use of a snake tool. The tool should be constructed of a non-sparking material.

If there is any evidence of settlement of the cover system directly adjacent to or around a gas vent, the cover soil should be removed and the geomembrane exposed to see if it is still intact. If this layer has been damaged, it should be repaired prior to replacing the cover soils and re-establishing the vegetative cover (i.e., re-seeding, fertilizing and mulching).

There shall be no smoking or use of open flame while working around the gas venting system. Care should be taken to minimize the potential for explosion due to the dangers of the presence of combustible gas.

D. *DRAINAGE SYSTEM*

The drainage system inspection should identify any erosion, siltation, settlement, or restriction to the flow of water in the drainage controls on top of and around the perimeter of the landfill.

All eroded or settled areas should be repaired by replacing and compacting the eroded material or replacing and compacting additional material, followed by reseeding to prevent additional erosion. In areas where drainage ditches are stone or rip-rap lined, additional lining material (e.g., clay, rip rap or stone) may be required. In areas where siltation or some other restriction to the flow of water in the drainage controls has occurred, excess silt or other blockage should be removed and surfaces shall be repaired as necessary to allow the free passage of water.

E. *VECTORS*

A complete visual inspection should be completed during the quarterly landfill site inspections to determine if there is any vector activity at the site. The inspection should note any live vectors, dead vectors, animal tracks, droppings, feeding areas, or dens. If the visual observations determine a substantial degree of vector activity, a professional exterminator should be contacted to develop and implement a plan to control the vector population.

F. *EXISTING STRUCTURES*

Any and all gas vents, monitoring well covers, fences, gates, and any other on-site structures should be checked to insure that they are undamaged and have been secured. Any damaged structures should be repaired using suitable methods based on the nature of the structure and damage. All structures should be resecured immediately. Any on-site facility structure remaining after closure which will be occupied by personnel should be checked for the build-up of methane gas on a **quarterly** basis. Appropriate signs should be placed at the access way to the landfill to indicate that the area is a closed landfill.

G. *GAS CONTINGENCY PLANNING*

If the gas detection alarm system in the proposed Town Highway Building does activate, the following contingency measures will be taken:

- 1.) Evacuate the building immediately and take a head count to insure that all employees have exited the building.
- 2.) Contact the local fire department at (914) 679-2422.
- 3.) Contact the Town Supervisor at (914) 679-8597.
- 4.) When the fire department has determined the building can be entered, windows and doors shall be opened to ventilate the building if possible.
- 5.) Contact the NYSDEC and environmental consultant.
- 6.) Conduct an explosive gas survey of the building, gas monitoring wells, and the surrounding surfacial soils.
- 7.) Check the alarm system to see if calibration is correct and the system is functioning normally.

- 8.) If gas survey results do not reveal elevated gas levels, continue to monitor the gas concentrations on the normal quarterly schedule.
- 9.) If gas survey results show elevated gas levels, evaluate permanent remediation alternatives based on the actual survey results, monitor gas concentrations on a monthly basis, and provide a temporary means of building ventilation until permanent remedial actions are completed.
- 10.) Resume normal quarterly monitoring upon completion of permanent remedial actions.

IV. REPORTING

Quarterly reports will be submitted to the NYSDEC throughout the post-closure monitoring period, detailing the results of all monitoring as well as all site maintenance activities completed. The quarterly reports will contain all data, analyses, and site inspection reports, as well as a brief interpretation regarding the impact of the landfill on the environment based on the quarterly data collected. Copies of quarterly reports will be submitted to the main NYSDEC Office in Albany, New York, and Region 3 offices in New Paltz, New York.

APPENDIX A

**Town of Woodstock Landfill
Environmental Monitoring Plan**

**TOWN OF WOODSTOCK LANDFILL
ENVIRONMENTAL MONITORING PLAN**

CHA Project No. 3509.07.06

January 1996
(Revised April 1999)

Prepared by:

**CLOUGH, HARBOUR & ASSOCIATES LLP
ENGINEERS, SURVEYORS, PLANNERS &
LANDSCAPE ARCHITECTS**

III Winners Circle
Albany, New York 12205
(518) 453-4500

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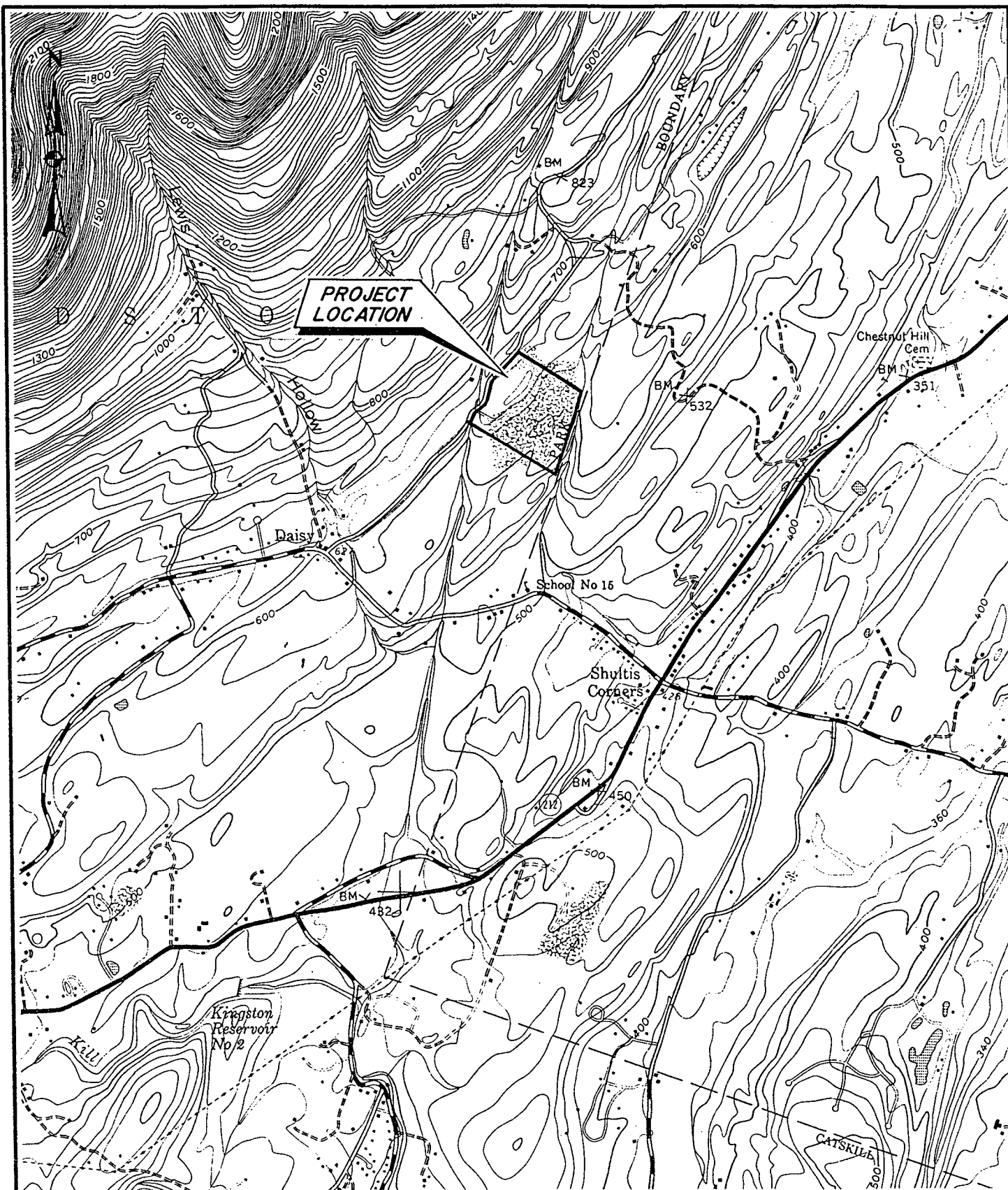
APPENDIX A	Documentation for Monitoring Network Selection
APPENDIX B	Groundwater Velocity Calculations

1.0 INTRODUCTION

This Environmental Monitoring Plan (EMP) describes the environmental monitoring of groundwater and surface water that will be performed at the Town of Woodstock Landfill. The Town of Woodstock Landfill is an unlined landfill located in the Town of Woodstock, Ulster County, New York (Figure 1). The landfill ceased accepting waste in June 1993. The landfill has been closed and capped.

Specifically, the EMP describes the on-site and off-site monitoring network, the schedule for sampling, the analytical parameters to be monitored, and the procedures that will be used in evaluating the analytical data for the landfill. The EMP has been developed in accordance with the applicable version of the New York State Department of Environmental Conservation (NYSDEC) 6 NYCRR Part 360 Solid Waste Management Facilities Regulations.

The EMP consists of three parts; an Existing Water Quality Plan, an Operational Water Quality Plan, and a Contingency Water Quality Plan. Ideally, existing water quality is established prior to the deposition of any waste in a landfill. However, because the Town of Woodstock Landfill existed prior to such regulations, existing water quality was not established and, therefore, this EMP makes alternate provisions to define existing water quality. The EMP does contain an Operational Water Quality Plan to be implemented during the closure and post-closure periods for the landfill.



SOURCE: U.S.G.S. 7.5' Topographic
QUADRANGLE: WOODSTOCK, NY

SCALE: 1"=2000'



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TOWN OF WOODSTOCK LANDFILL
TOWN OF WOODSTOCK, ULSTER COUNTY, NY

SITE LOCATION MAP

FIGURE 1

This EMP also contains a Contingency Water Quality Monitoring Plan to be implemented at times when significant increases are noted in specific water quality monitoring parameters. Further details regarding triggers for initiating Contingency Monitoring are discussed below.

2.0 MONITORING NETWORK

The monitoring network for the Town of Woodstock Landfill has been developed based on the results of previous site investigations which have included an assessment of existing groundwater quality. The permanent monitoring network for the Town of Woodstock Landfill will consist of six (6) bedrock monitoring wells, one (1) surface water seep, and the drinking water well to be installed to serve the highway garage to be constructed on the Town property. Up to nine (9) residential wells will also be sampled on an annual basis for approximately 2 to 3 years. Information regarding these monitoring points is summarized in Table 1.

2.1 GROUNDWATER SAMPLE POINTS

The permanent groundwater monitoring network is designed to evaluate ground water quality in the bedrock aquifer only. Twelve monitoring wells (MW-1D, MW-1S, MW-2D, MW-2S, MW-3D, MW-3S, MW-4D, MW-4S, MW-5D, MW-5S, MW-6S, and MW-7S) were installed during previous site investigations and their locations and depths are based on site hydrogeology. All of the

TABLE 1

**Town of Woodstock Landfill
Environmental Monitoring Plan
Summary of Monitoring Points**

MONITORING POINT	SAMPLING FREQUENCY	SAMPLING PARAMETERS	MEDIA	LOCATION	GEOLOGIC UNIT	TOTAL DEPTH (ft btoc)
MW-1S	Quarterly	1 Baseline/3 Routine	Groundwater	Upgradient	Bedrock	67
MW-4S	Quarterly	1 Baseline/3 Routine	Groundwater	Downgradient	Bedrock	44
MW-4D	Quarterly	1 Baseline/3 Routine	Groundwater	Downgradient	Bedrock	77
MW-5S	Quarterly	1 Baseline/3 Routine	Groundwater	Downgradient	Bedrock	44
MW-6S	Quarterly	1 Baseline/3 Routine	Groundwater	Downgradient	Bedrock	105
MW-7S	Quarterly	1 Baseline/3 Routine	Groundwater	Downgradient	Bedrock	52
LS-2C	Quarterly	1 Baseline/3 Routine	Surface Water	Downgradient	NA	NA
DW-1 ¹	Annually	1 Baseline	Groundwater	Crossgradient	Bedrock	?
RW-A ²	Annually	4	Groundwater	Upgradient	Bedrock	?
RW-B ²	Annually	4	Groundwater	Upgradient	Bedrock	?
RW-C ²	Annually	4	Groundwater	Upgradient	Bedrock	?
RW-2 ³	Annually	4	Groundwater	Downgradient	Bedrock	?
RW-3 ³	Annually	4	Groundwater	Downgradient	Bedrock	?
RW-4 ³	Annually	4	Groundwater	Downgradient	Bedrock	?
RW-5 ³	Annually	4	Groundwater	Downgradient	Bedrock	?
RW-6 ³	Annually	4	Groundwater	Downgradient	Bedrock	?
RW-15 ³	Annually	4	Groundwater	Downgradient	Bedrock	?

- 1 Drinking water well to be installed to serve proposed highway garage.
- 2 To be identified in field and located to the north of the landfill.
- 3 Residential wells previously sampled. Well designations from May 94 Groundwater Sampling Summary Report.
- 4 Reduced parameter list consisting of pH, ammonia, TKN, COD, TDS, alkalinity, chloride, hardness, As, Fe, Pb, and Mn.

monitoring wells are installed in bedrock and range in depth between 27 and 150 feet below grade. The overburden is generally very thin less around the landfill and is unsaturated; therefore no monitoring wells have been installed in the overburden.

The proposed monitoring network will consist of six (6) on-site monitoring wells (MW-1S, MW-4S, MW-4D, MW-5S, MW-6S, and MW-7S) and the drinking water well to be installed to serve the highway garage to be constructed on the Town property. The locations of the monitoring wells are shown in Figure 2.

According to the groundwater contour map for the shallow bedrock aquifer (Figure 3), groundwater flows almost due south across the landfill. Water quality results from MW-1S will be used as an indicator of background groundwater quality for the area. As discussed in the closure plan for the site, the leach field for the highway garage proposed for the site is in proximity to well MW-1S. If future monitoring of this well indicates an impact from the leach field, the well could be replaced in a different location. The proposed location is shown on Figure 2. Alternatively, upgradient monitoring could be terminated. The existing upgradient water quality database would then be used for future upgradient-downgradient water quality comparisons. The appropriate alternative will be selected based upon consultation with the NYSDEC. Monitoring wells MW-4S, MW-4D, MW-5S, MW-6S, and MW-7S will serve as downgradient monitoring points. Although monitoring well MW-4D is installed to a greater depth than its counterpart MW-4S, well MW-4D is likely in the same hydrologic regime as

SCALE:
1"=250 FEET

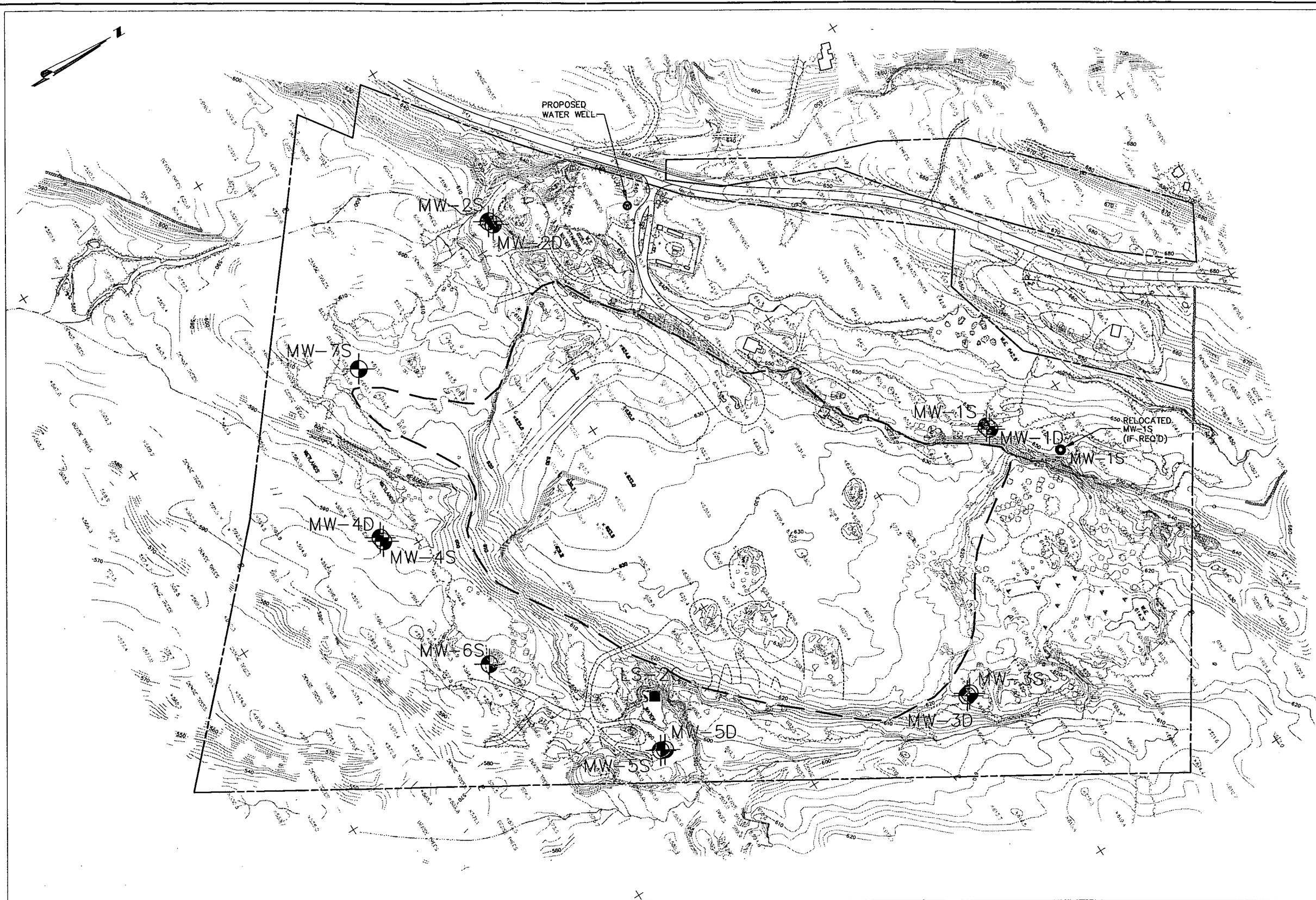
LEGEND

MW-5S
Monitoring Well Location

LS-2C
Surface Water Sampling Location

Property Line

Limit of Waste Line



NOTES:

1. ORIGINAL BASE MAP WAS PREPARED BY DUNN GEOSCIENCE CORPORATION (MAP TITLED, "BASE MAP, TOWN OF WOODSTOCK, WOODSTOCK LANDFILL, DATED NOVEMBER 7, 1990). AREA DISTURBED SINCE 1990 WAS UPDATED BY CLOUGH, HARBOUR IN JULY 1994, FROM MANUAL FIELD SURVEY. TEST PITS WERE LOCATED BY CLOUGH, HARBOUR IN JULY 1994.
2. NORTH ORIENTATION AND VERTICAL DATUM PER DUNN GEOSCIENCE CORP. MAP, REFERENCED IN NOTE 1.



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FIG. NO. 2

DATE: JANUARY, 1996

SITE PLAN

TOWN OF WOODSTOCK LANDFILL
WOODSTOCK, NEW YORK

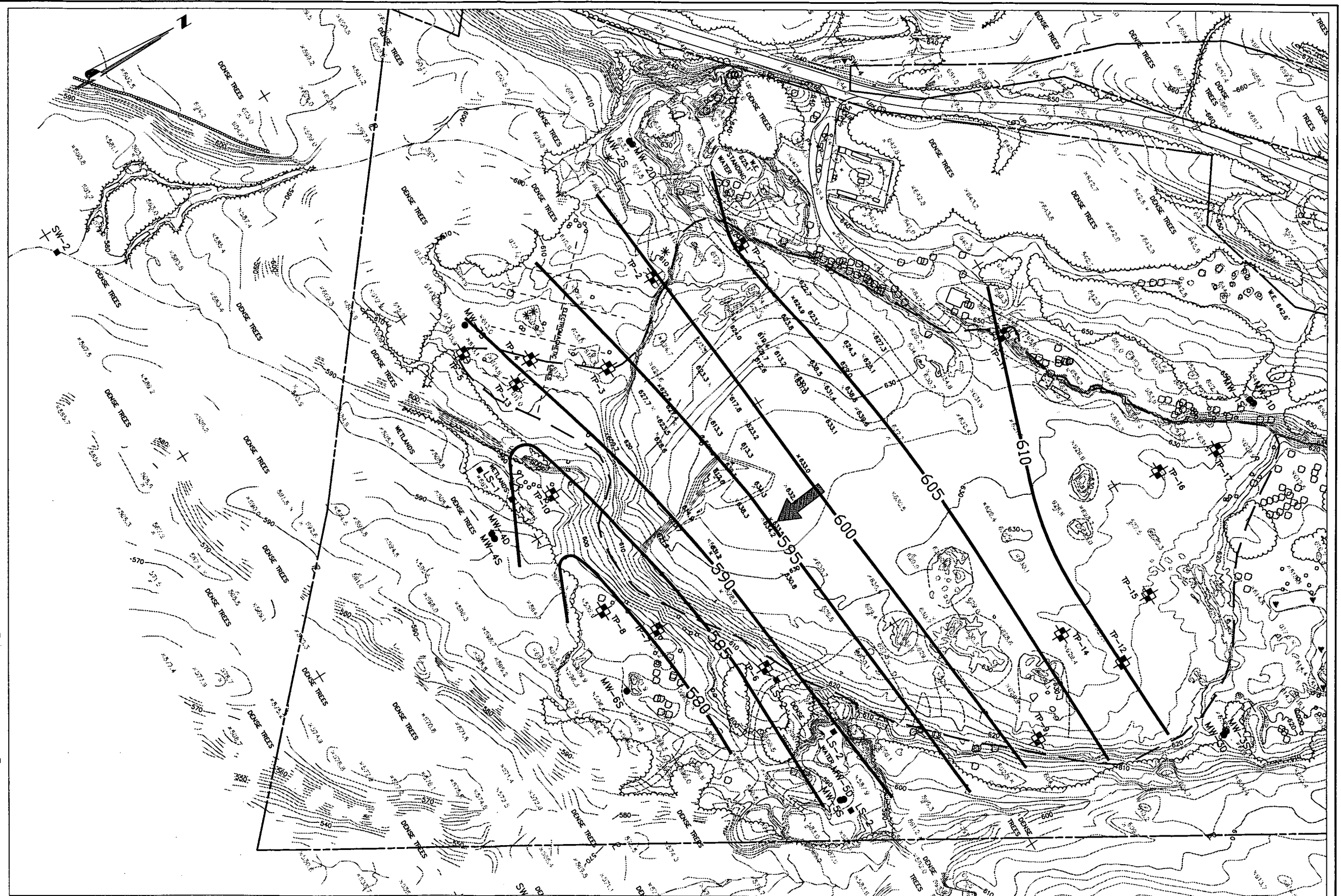
SCALE:
1"=200 FEET

LEGEND

- TP-14 Test Pit Location
- MW-5S Monitoring Well Location
- SW-1 Surface Water Sampling Location
- LS-2 Leachate Sampling Location
- Property Line
- Electromagnetic Line
- Limit of Waste Line
- Groundwater Flow Direction
- Groundwater Contour

NOTES:

1. ORIGINAL BASE MAP WAS PREPARED BY DUNN GEOSCIENCE CORPORATION (MAP TITLED, "BASE MAP, TOWN OF WOODSTOCK, WOODSTOCK LANDFILL, DATED NOVEMBER 7, 1990). AREA DISTURBED SINCE 1990 WAS UPDATED BY CLOUGH, HARBOUR IN JULY 1994, FROM MANUAL FIELD SURVEY. TEST PITS WERE LOCATED BY CLOUGH, HARBOUR IN JULY 1994.
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FIG. NO. 3

DATE: JANUARY, 1996

GROUNDWATER
CONTOUR MAP
TOWN OF WOODSTOCK LANDFILL
WOODSTOCK, NEW YORK

the other wells and therefore results from this well will be comparable to results from the other wells proposed for the monitoring network.

It is important to note that of the ten (10) downgradient monitoring wells that exist on site, the wells proposed as monitoring points were selected because historically they have shown the poorest water quality. Documentation of this finding is included in Appendix A.

2.2 SURFACE WATER SAMPLE POINTS

One surface water sample point, to be designated LS-2C, is proposed for the monitoring network at the landfill. This sampling point represents a seep located along a rock outcrop on the southeastern side of the landfill. The seep is apparently not flowing at all times and therefore a sample may not be collected during all quarterly sampling events.

2.3 LEACHATE SAMPLE POINTS

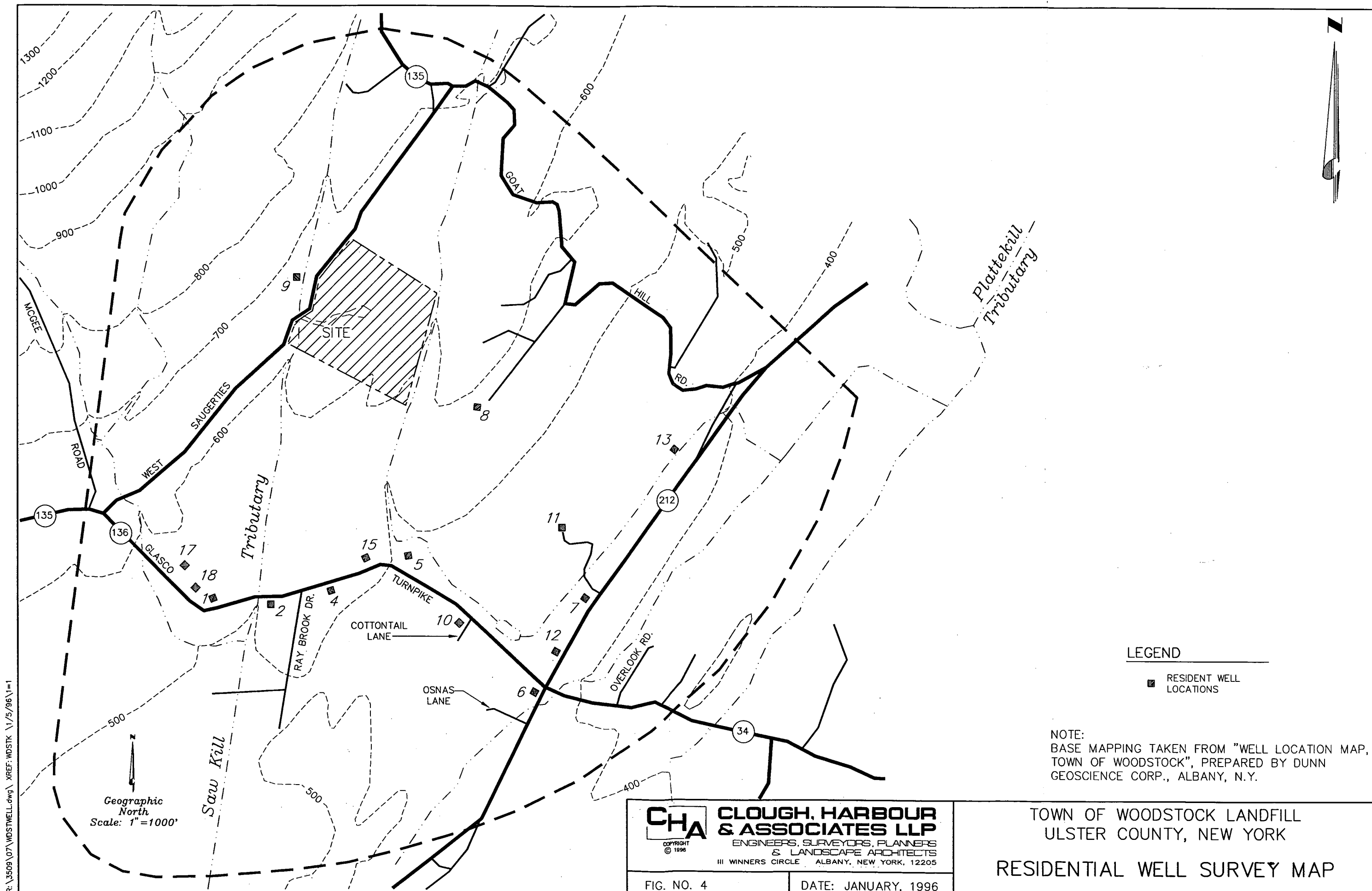
The Town of Woodstock Landfill does not presently have a leachate collection system and the need to install such a system is still under evaluation. If a system is installed, one (1) permanent sampling point will be established within the system.

2.4 RESIDENTIAL WELL SAMPLE POINTS

Sampling of residential homes located near the landfill was conducted in October 1993, May 1997, and February 1998. Results from that testing indicated that several homes contained concentrations of certain inorganic analytes (predominantly iron and manganese) above water quality standards; however, the data does not establish that the landfill is the source for those analytes. Therefore, sampling of residential water wells will not be performed as a permanent element of operational water quality monitoring. However, to aid in developing a better understanding of regional water quality and to ensure protection of the residents located in the vicinity of the landfill, up to nine residential wells will be sampled on an annual basis. The location of the downgradient residential wells to be monitored are depicted on Figure 4. Upgradient residential wells must still be selected but are likely to be located along Goat Hill Road, located north of the landfill.

3.0 EXISTING WATER QUALITY MONITORING

As mentioned in the Introduction, since operation of the Town of Woodstock Landfill began prior to water quality monitoring, pre-existing water quality cannot be established for this landfill. However, in order to evaluate potential changes in water quality over time, existing water quality must be established in some manner. Existing water quality will be defined by the water quality data



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LEGEND

RESIDENT WELL LOCATIONS

NOTE:
BASE MAPPING TAKEN FROM "WELL LOCATION MAP,
TOWN OF WOODSTOCK", PREPARED BY DUNN
GEOSCIENCE CORP., ALBANY, N.Y.

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TOWN OF WOODSTOCK LANDFILL
ULSTER COUNTY, NEW YORK
RESIDENTIAL WELL SURVEY MAP

FIG. NO. 4 DATE: JANUARY, 1996

collected from monitoring well MW-1S. Review of water quality data previously collected from MW-1S indicates this well best represents background water quality. The existing water quality value may change through time as the mean concentration of all parameters measured at the upgradient monitoring point will continually be recalculated as data are collected during each quarterly monitoring event.

4.0 OPERATIONAL WATER QUALITY MONITORING

Operational water quality monitoring will be performed during the closure and post-closure periods of the landfill. The monitoring points used to assess operational water quality will include the six (6) on-site monitoring wells, one (1) surface water sample point, and the drinking water well to be installed to serve the highway garage proposed for the site. Two different categories of analytical parameter scans are to be used in the monitoring program and include routine and baseline scans (defined in Part 360-2.11(c)).

The groundwater samples from the on-site monitoring wells and the surface water sample are to be analyzed on a quarterly basis throughout the year. The water samples will be analyzed for Routine parameters for three quarters and Baseline parameters for one quarter, with the baseline sampling event rotating ahead by one quarter every year.

During quarters that samples are analyzed for routine parameters, the sample from well MW-7S will also be analyzed for volatile organic compounds (using EPA Method 601/602). Monitoring well MW-7S has historically shown volatile organic compounds to be present in all past monitoring events; therefore it is considered important to continue monitoring for these compounds over time.

The water well to be installed to serve the highway garage will be analyzed on an annual basis for baseline scan parameters. The annual sampling of this well will coincide with the baseline scan monitoring well/surface water sampling event.

The groundwater samples from the off-site residential wells will be analyzed for an abbreviated list of parameters on an annual basis. The frequency of sampling has been limited to once per year because of the relationship between the distance the wells are located from the landfill and the estimated groundwater flow velocity (71 feet/year). Documentation for the estimated groundwater flow velocity is included in Appendix B. The abbreviated list of parameters is to include alkalinity, chemical oxygen demand, total dissolved solids, chloride, ammonia, total kjeldahl nitrogen, hardness, arsenic, iron, manganese, and lead. These parameters are being proposed because they are particularly useful indicator parameters of landfill leachate.

For purposes of quality assurance/quality control, a blind duplicate sample will be collected and submitted to the laboratory for analysis of the same parameters as the rest of the samples.

Additionally, for sampling events where samples are analyzed for volatile organic compounds, a trip blank will accompany samples during collection and transport to the laboratory and also be analyzed for volatile organic compounds.

Within 90 days of completing the routine quarterly field sampling activities, a determination will be made as to whether there is contaminant concentrations over existing water quality levels established for each parameter. This determination will be made through comparison of the concentration of each parameter at every monitoring well to the existing groundwater quality value of that parameter. Contamination will be defined by the following two conditions:

1. The ground water quality for any parameter at any monitoring well exceeds the existing water quality value of an established upgradient monitoring point by three standard deviations; or
2. The groundwater quality for any parameter at any monitoring well exceeds the existing water quality and exceeds the water quality standards for the parameter specified in Part 701, 702, 703 of 6 NYCRR.

Based on a recent NYSDEC initiative, the Town of Woodstock will be applying for a variance to reduce the scope of environmental monitoring following the tenth round of monitoring

(or soon thereafter). If approved, the frequency of monitoring well and surface water sampling will be reduced to an annual event for baseline scan parameters.

5.0 CONTINGENCY WATER QUALITY MONITORING

If it is determined that there is contamination for one or more of the routine parameters, at any monitoring well during a field sampling event, excluding the field parameters, then those monitoring points where contamination has been observed will be analyzed for baseline parameters during the next quarterly sampling event. Subsequent sampling for baseline parameters must be conducted semiannually until conditions for curtailing the contingency monitoring are met.

If contamination of any volatile organic compound, cyanide, or toxic metal is found during a baseline sampling event, then those monitoring points where contamination has been observed must be analyzed for expanded parameters during the next quarterly sampling event. Subsequent quarterly sampling events must include an annual analysis of all monitoring points for expanded parameters, and quarterly analyses of the routine parameters, and baseline and expanded parameters previously detected.

Once initiated, Contingency Water Quality Monitoring must continue until the contamination is shown not to be landfill-derived, until the release by the landfill has been remediated, or it is demonstrated to the satisfaction of NYSDEC that such monitoring is not needed to protect public health and the environment.

If at any time, contamination detected by monitoring poses an immediate threat to public health or the environment, then additional measures as part of a corrective action plan may be required by the NYSDEC.

6.0 DATA EVALUATION AND REPORTING

6.1 DATA HANDLING

Once the data is received from the laboratory, the data will be treated in the following manner:

- For parameters not detected above the method detection limit, one-half the value of the detection limit shall be used as the assigned value for that parameter in all calculations.

- In calculating the standard deviation for each parameter, the sample standard deviation, rather than the population standard deviation, shall be calculated until a sufficient amount of data exists (~30 points) to document that the population is normally distributed.
- The results will also be reviewed to identify data outliers. Data for parameters from the upgradient monitoring points that are greater than 3 times the standard deviation of the existing mean for that parameter will be identified as potential outliers.

6.2 DATA INTERPRETATION

The objective of data interpretation is to understand the causes that are associated with observed changes in water quality. Specifically, when observed changes in water quality occur, it is important to determine whether those changes are the result of natural variation, or the result of other causes. This objective may be met by careful integration of the field and laboratory data with geological and hydrogeological data and with other appropriate data. Examples of this analysis include looking for changes in:

- Groundwater flow direction,
- Water table elevation,

- Sources of contamination, and
- Water turbidity.

6.3 DATA REPORTING

Two types of reports summarizing the results of the environmental monitoring shall be submitted to NYSDEC; a quarterly report and an annual report. The quarterly report shall be submitted to the NYSDEC within 90 days of sample collection. The report will include an assessment of water quality and a summary of the planned sampling and analysis for the next quarterly sampling event including any proposed modifications to the program.

The report will include the following tables:

- Analytical results for all monitoring points for the current event and all previous events (including a designation of whether the monitoring point is upgradient or downgradient);
- The mean, standard deviation, and trigger value for each parameter at the upgradient monitoring points;

- Applicable water quality standards; and
- The monitoring points and the parameters where contamination is observed.

The report will also include a site map depicting the location and number of each environmental monitoring point sampled.

An annual report, which will be submitted as part of the fourth quarterly report, will contain a summary of water quality data collected throughout the year with a special note given to changes in water quality which occurred throughout the year.

APPENDIX A

BASIS FOR SELECTION OF MONITORING WELL NETWORK

One objective of a permanent monitoring network is to establish enough monitoring points to provide adequate protection of human health and the environment, but with as few monitoring points as possible; bearing in mind that monitoring will realistically only be performed if it can be afforded by the owner/operator of the monitoring network.

Twelve groundwater monitoring wells currently exist around the Town of Woodstock landfill. Data from October 1993 and June 1995 for selected parameters for every well were averaged. The average concentrations were then ranked from 1 to 12 with 1 being the lowest average concentration and 12 being the highest average concentration for each parameter. The rankings were then summed to determine a total score for each well. The average concentrations and the rankings for each well are presented in the attached table. The wells with the highest rankings include wells MW-7S, MW-5S, MW-4S, and MW-4D. Well MW-6S is located at the median ranking. These wells are all located hydraulically downgradient from the landfill and have therefore been proposed to be part of the permanent monitoring network.

**Town of Woodstock Landfill
Analytical Laboratory Results
Average Concentration**

TEST PARAMETER (mg/l unless otherwise noted)	MW-1S	MW-1D	MW-2S	MW-2D	MW-3S	MW-3D	MW-4S	MW-4D	MW-5S	MW-5D	MW-6S	MW-7S
Turbidity (NTU)	56	124	428	112	39	32	1135	198	89	18	101	92
TDS	111	167	142	109	89	684	335	311	626	628	176	969
COD	30	44	6	7	20	28	243	29	32	24	38	101
Alkalinity	74	120	74	86	60	283	149	144	315	397	86	82
Chloride	1.3	1.6	12	1.7	33	0.37	79	3214	131	89	20	150
TKN	0.76	0.82	0.88	0.63	1.1	0.91	0.52	0.4	1.79	1.07	0.28	11
Ammonia	0.09	0.12	0.04	0.11	0.12	0.21	0.16	0.06	0.18	0.04	0.22	8.8
Phenols	0.003	0.003	0.011	0.016	0.011	0.016	0.016	0.016	0.022	0.011	0.003	0.011
Al	1.7	1.9	5.8	1.5	0.25	0.49	5.9	1.28	0.28	0.13	1.3	0.41
As	0.003	0.005	0.004	0.003	0.004	0.027	0.004	0.004	0.049	0.003	0.015	0.022
Ba	0.168	0.065	0.24	0.052	0.14	0.16	0.42	0.22	0.31	0.38	0.09	1.24
Fe	3.67	4.22	12.33	2.36	1.43	1.07	104	2.81	16.6	1.28	8.91	7.04
Pb	0.004	0.005	0.013	0.003	0.002	0.004	0.016	0.008	0.028	0.002	0.006	0.005
Mg	3.53	0.87	6.8	1.8	2.8	21.4	8.4	4.9	23.3	21	2.5	36.5
Mn	0.553	0.32	4.04	0.089	0.242	1.23	1.76	0.38	5.49	0.69	0.43	3.22
Na	14	54	9	37	5	35	75	61	44	42	48	64
Total VOCs	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL	607 ppb

Ranking of Parameters

TEST PARAMETER (mg/l unless otherwise noted)	MW-1S	MW-1D	MW-2S	MW-2D	MW-3S	MW-3D	MW-4S	MW-4D	MW-5S	MW-5D	MW-6S	MW-7S
Turbidity (NTU)	4	9	11	8	3	2	2	12	10	1	7	6
TDS	3	5	4	2	1	11	8	7	9	10	6	12
COD	7	10	1	2	3	5	12	6	8	4	9	11
Alkalinity	3	6	2	4	1	9	8	7	10	11	5	12
Chloride	1	2	4	3	6	7	9	8	11	10	5	12
TKN	5	6	7	4	10	8	3	2	11	9	1	12
Ammonia	3	5	1	4	5	8	6	2	7	1	9	10
Phenols	1	1	3	4	3	4	4	4	5	3	1	3
Al	9	10	11	8	2	5	12	6	3	1	7	4
As	1	3	2	1	2	6	2	2	7	1	4	5
Ba	6	2	8	1	4	5	11	7	9	10	3	12
Fe	6	7	10	4	3	1	12	5	11	2	9	8
Pb	3	5	8	2	1	3	9	7	10	1	6	5
Mg	5	1	7	2	4	10	8	6	11	9	3	12
Mn	6	3	11	1	2	8	9	4	12	7	5	10
Na	3	9	2	5	1	4	12	10	7	6	8	11
Total VOCs	1	1	1	1	1	1	1	1	1	1	1	2
TOTAL SCORE	67	85	93	56	52	97	128	96	142	87	89	147
RANKING	3	4	7	2	1	9	10	8	11	5	6	12

Rankings are from 1 to 12 with 1 being lowest average concentration per parameter and 12 being highest average concentration.

APPENDIX B

ESTIMATE OF GROUNDWATER FLOW VELOCITY

An estimate of groundwater flow velocity in the bedrock aquifer has been made using the Darcy equation as described below:

$$V = (k * i) / n_e$$

where

V = average linear velocity

k = hydraulic conductivity

i = hydraulic gradient

n_e = effective porosity

Based on straddle packer injection tests performed by Dunn Geoscience Corporation, the average hydraulic conductivity (k) for the bedrock aquifer is 225 ft/yr. Based on the groundwater contour map for the site, the hydraulic gradient (i) between wells MW-1S and MW-5S is 0.032 ft/ft. We have conservatively assumed the effective porosity (n_e) of the fractured rock to be on the order of 1%. The flow velocity is then calculated to be 720 ft/yr. The closest homes to the landfill are located 2,000 feet away. Therefore, there is a travel time of 2.7 years for groundwater leaving the landfill to reach the nearest homes. This estimate is considered to be conservative.

APPENDIX B

Standard Operating Procedures

GROUNDWATER SAMPLING

A. PURPOSE/SCOPE:

To obtain representative ground-water samples from an aquifer.

B. EQUIPMENT/MATERIALS:

Inertial pump, submersible pump, disposable bailers, generator, sample bottles, bailing twine and rope, field analyses meters, sampling gloves, water level meters, filtration system, 2-inch Grundfos Rediflow pump and controller, well sampling forms.

C. PROCEDURE:

1. The wells will be sampled in order from the least contaminated well to the most contaminated well.
2. Using a decontaminated measurement probe, determine the water level in the well; then calculate the fluid volume in the casing.
3. Using a decontaminated surface pump, submersible pump or disposable bailer, purge the well of a minimum of one well volume. Purging will be conducted at the lowest flow rate possible to purge the well within a reasonable time frame and to decrease the potential for elevating the turbidity of the well water. Conductivity, pH, Eh, turbidity, and temperature readings shall be taken and recorded during the well purging. The well will be considered properly purged when a minimum of one well volume has been purged and the conductivity, pH, Eh, turbidity and temperature have stabilized. Turbidity should be below 50 NTU, if possible. Record these readings on the well sampling log.

It is important that none of the sampling equipment (pump, bailer, pump tubing, electrical cords, rope, etc.) come into contact with the ground.

4. Sample collection will be performed utilizing either an inertial pump system, submersible pump or disposable bailer. If the inertial pump system or submersible pump is used, samples will be obtained through the dedicated polyethylene tubing. Should disposable bailers be utilized, the sampling will be performed as follows:

Attach a new bailer line to the disposable bailer equipped with a single check valve. Check the operation of the check valve assembly to confirm free operation. Lower the single check valve bailer slowly into the well until it contacts the water surface. Then lower the bailer just below the water surface with a minimum of disturbance. When filled with groundwater, slowly raise the bailer to the surface. Discharge the first bailer to the ground. Tip the bailer to allow the water to slowly discharge from

the top and to flow gently down the inside of the sample bottle with minimum entry turbulence and aeration.

5. The order in which samples are to be collected is as follows:

volatile organic compounds,
purgable organic carbon,
purgeable organic halogens
total organic halogens
total organic carbon
extractable organic
total metals
dissolved metals
phenols
cyanide
sulfate and chloride
turbidity
nitrate and ammonia
radionuclides.

6. When collecting aliquots for analysis of volatile organic compounds, make absolutely certain that there are no bubbles adhering to the walls or the top of the VOA container.
7. Add appropriate preservatives to samples as described in SOP #605.
8. Label the sample containers with all necessary information and complete all chain-of-custody documents and seals.
9. Place the properly labeled and sealed sample bottles in a cooler with ice and maintain at 4°C for the duration of the sampling and transportation period. Do not allow samples to freeze.

D. QA/QC REQUIREMENTS:

To the extent possible, all samples should be collected using the same type of equipment and in the same manner to ensure comparability of data.

E. SPECIAL CONDITIONS:

Under Step 3, if sample turbidity cannot be reduced below 50 NTU, then the samplers should collect all portions of the sample except for the metals. The samplers should then return within 24 hours and collect a sample for total metals analysis from the top of the water column.

Step 4 can be replaced if purging and sampling is being performed with a Grundfos Rediflow pump. In this case, after well purging was completed, the discharge rate for the pump would

be reduced to approximately 40 ml/minute. Sampling can then proceed as described above.

E. REFERENCES:

None.

SURFACE WATER SAMPLING

A. PURPOSE/SCOPE:

The objective of sampling surface water in various streams, lakes, or ponds on or adjacent to a site is to determine the presence and extent of contamination emanating from the site and to determine the necessity for ecological studies.

B. EQUIPMENT/MATERIALS:

Dedicated sample bottles, glass and/or stainless steel collection vessel/pitcher, Water Quality Measurement Meter (including pH, Eh, dissolved oxygen (DO), temperature, specific conductance), tape measure, stopwatch, Surface Water/Sediment Sampling Log (attached).

C. PROCEDURE:

1. When collecting both water and sediment at the same location, the surface water sample will be collected first, followed by the collection of the sediment sample to agitation of sediments into the water column.
2. The samples will be collected from areas of stream bottom where there is predominantly fine-grained sediment. These areas should also be characterized by a steady, but non-turbulent, flow of water. These criteria are designed to maximize sample quality by maximizing the adsorption of metals and organics in the sediments and the retention of volatile constituents in the water column, respectively. Adjust the field sampling locations to accomodate the above considerations, making sure to measure and record relocation information (e.g., distance from proposed location in what direction), if any, in the field logbook.
3. Once the sampling location has been established, describe the location in terms of water flow rate and descriptive parameters as described below (refer to sampling log):

FLOW RATE - Measure, or estimate if too large to measure, the average stream width and depth. Measure flow velocity three times by measuring off a 10-foot stretch and timing how long is required for a floating object to traverse the 10-foot length. Average the three measurements of stream velocity (add the three and then divide by three) in units of ft/sec. Multiply the average velocity (in feet/sec) by the average stream width (in feet), then multiply by the stream average depth (in feet). The product will be the average flow volume in units of cubic feet/sec.

WATER QUALITY PARAMETERS - Using the collection vessel, transfer the necessary amount of surface water from the water body to a container for field measurements of Eh, pH, specific conductance, turbidity, dissolved oxygen, and temperature. Alternatively, some instruments are equipped with specially designed cups to hold the water or may have submersible probes that are placed into the actual water body itself, etc. Record the field parameter measurements on the log.

DESCRIPTIVE PARAMETERS - Describe the surface water/sediment sampling location by describing both the stream bed and the stream water. Describe the amount of organic material seen in the stream, from toppled trees and branches to fine particles on the bed. Estimate the texture of the stream sediment (% rocks, gravel, sand, silt/clay) and estimate the depth of sediment sample collection. Note the presence of odors, if any. Describe the stream at the sampling location in terms of the percentage of pool (deep, calm, pooled areas), % riffle (shallow, swift-flowing, with the surface broken e.g., tumbling over rocks), and % run (smoothly flowing). The sum of the three types should total 100%. Describe the adjacent banks and surrounding area in terms of amount and type of vegetation, steepness of the banks, rocky versus muddy banks, outcrops, sunny vs. shady, etc.

4. One team member will perform the actual sample collection; he will carefully adopt an optimal sampling position, and once in that position, will not move his feet until all sampling at that locality is concluded in order to minimize agitation of the sediment and water.
5. Stream sediments are to remain undisturbed by the water collection vessel. Should contact with the bottom and resuspension of sediment occur, the sampling team is to halt sampling until the water has cleared. If the water does not clear within a few minutes, the team is to proceed slightly upstream (about 1 meter or just above the disturbed area) and resume the sampling effort.
6. Submerge the open water collection vessel in water with mouth below the water surface. Take care not to collect any floating solids or materials disturbed from the bottom of the water body. In areas of active flow, point bottle mouth upstream. (A stainless steel pitcher may be used to facilitate collection of the portion of the sample for analysis of organics, but should not be used to collect the portion to be analyzed for inorganics).
7. Use the collection vessel to fill all designated sample bottles. Collect the volatile organic fraction first, if it is to be collected. Add appropriate preservatives to samples as given in SOP #605.
8. Label the sample bottles with all necessary information.
9. Place the properly labeled sample bottles in a cooler with ice and maintain at 4°C for the duration of the sampling and transportation period. Do not allow samples

to freeze.

10. Record all sampling information on the log and complete all chain-of-custody documents.

D. QA/QC REQUIREMENTS:

None.

E. SPECIAL CONDITIONS

None.

F. REFERENCES:

Sediment samples are often collected at the same time surface water samples are collected. Refer to SOP #403 for more details regarding sediment sampling.

RESIDENTIAL WELL SAMPLING

A. PURPOSE/SCOPE:

Water samples are collected from residential wells to determine whether contaminants are present in the groundwater. Residential wells are often used in lieu of installing additional monitoring wells as monitoring points.

B. EQUIPMENT/MATERIALS:

pH meter, conductivity meter, temperature meter, turbidity meter, ORP meter, sampling bottles, Home Well Survey Form, Well Sampling Log

C. PROCEDURE:

1. Identify a sample point in the water system where water is not treated or filtered (e.g., example, an outside tap).
2. Flush the domestic water supply system by running one of the system's taps for several minutes.
3. Rinse a clean beaker with well water prior to filling it for field measurements. Measure temperature, pH, conductivity, turbidity, and ORP of the water in beaker. Record measurements on well sampling log.
4. Fill the appropriate sample containers directly from the tap or valve being sampled. Sample containers for volatile organic analysis (VOA) should be carefully filled using a low flow rate. VOA samples must be absolutely free of bubbles.
5. Add appropriate preservatives to samples as described in SOP #605.
6. Label the sample containers with all necessary information and complete all chain-of-custody documents and seals.
7. Place the properly labeled and sealed sample bottles in a cooler with ice and maintain at 4°C for the duration of the sampling and transportation period. Do not allow samples to freeze.
8. Complete the Home Well Survey Form, if not previously completed.

D. QA/QC REQUIREMENTS:

None.

E. SPECIAL CONDITIONS

In most cases, direct sampling of groundwater within a domestic well is not practical due to difficulty in gaining access to the interior of the well casing, and also due to the potential of inadvertently introducing contaminants to the well during sampling. Therefore, sampling of a domestic water supply system at the tap or purge valve nearest to the well head is recommended.

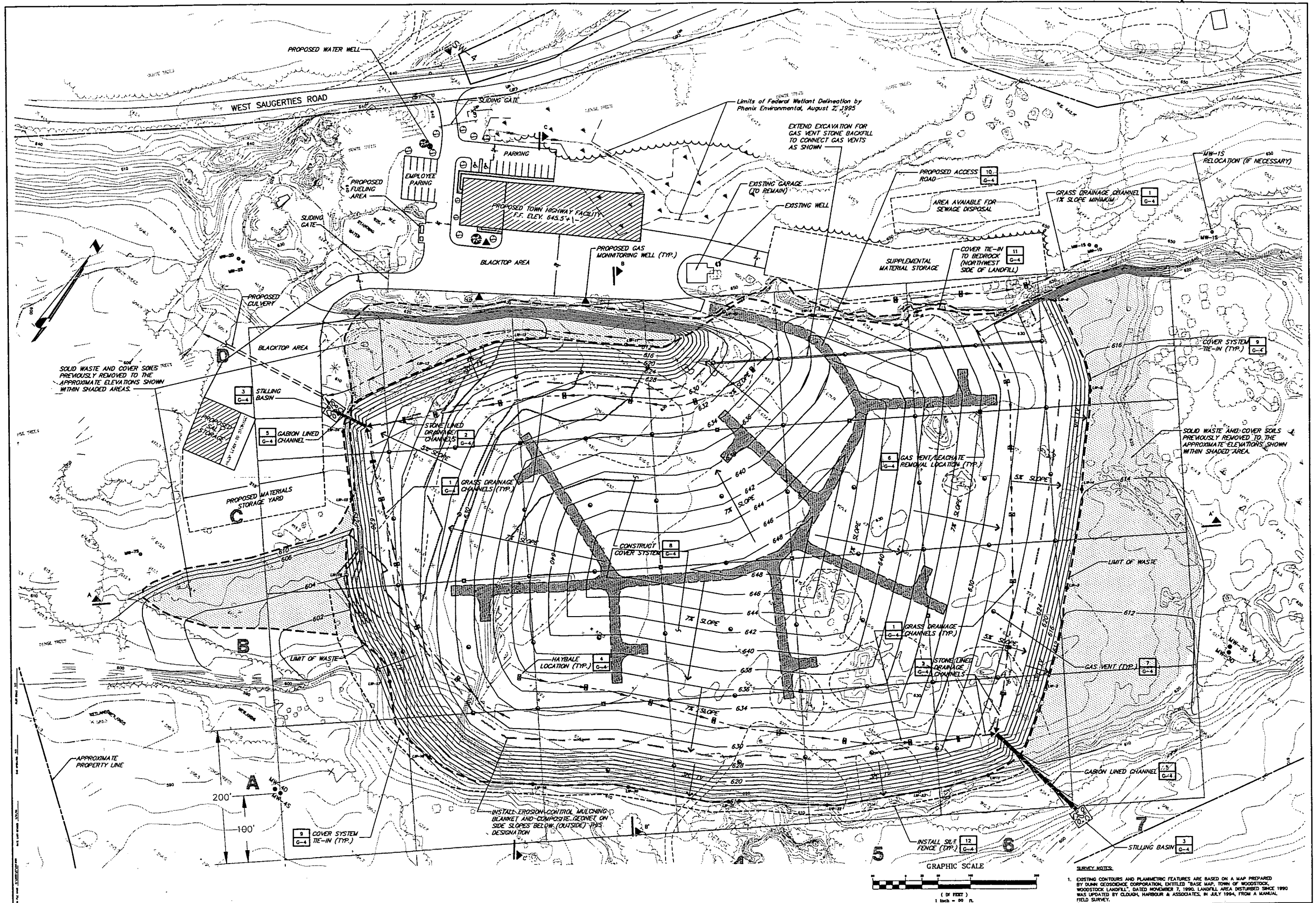
Depending upon the reason for conducting sampling of residential water wells, the State Department of Health should be notified prior to performing any sampling.

F. REFERENCES:

None.

APPENDIX C

Future Site Use Plan



Offices Throughout the Eastern United States



**CLOUGH, HARBOUR
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