LEGEND

- Existing Ground
- Overhead Power Line
- Stream
- Pond
- Existing Residence/Multi-unit Residence
- Existing Mobile Home
- Assessment Monitoring Wells
- SF1 Septic Field Monitoring Wells
- 2 Existing Potable Well/Sampled Well Reference Number
- Spring
- S Spring Used as Potable Water Source

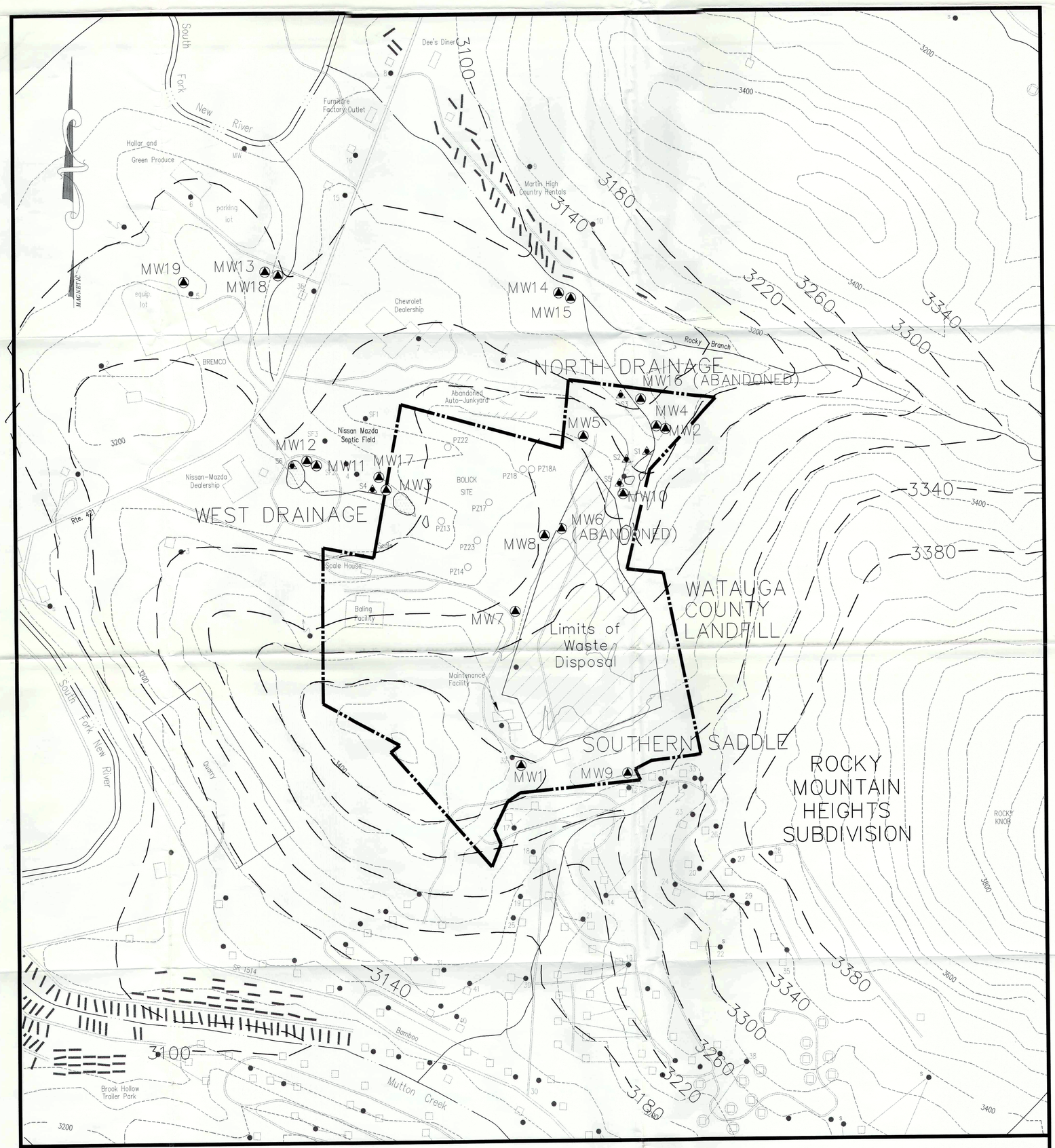
NOTE: Residence and well information is approximate and was obtained from the Appalachian District Health Department and has not been officially verified. Currently, of thirty-eight potable wells sampled, wells No. 4 and 12 have been significantly impacted by VOC's.

VICINITY MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520-14
Scale: 1" = 600'±
Date: 10 JUN 94

FIGURE 1

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA – Nashville, TN



LEGEND

- Stream
- Overhead Power
- Existing Ground
- Pond
- Existing Residence/Multi-unit Residence
- Existing Mobile Home
- Assessment Monitoring Wells
- Surface Water Sampling Locations
- Groundwater Potentiometric Elevation (Inferred from static water level data obtained on April 9-10, 1996)
- SF1 Septic Field Monitoring Wells
- Spring
- S Spring Used as Potable Water Source
- 2 Existing Potable Well/Sampled Well Ref. No.

GROUNDWATER AND SURFACE WATER MONITORING PROGRAM MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

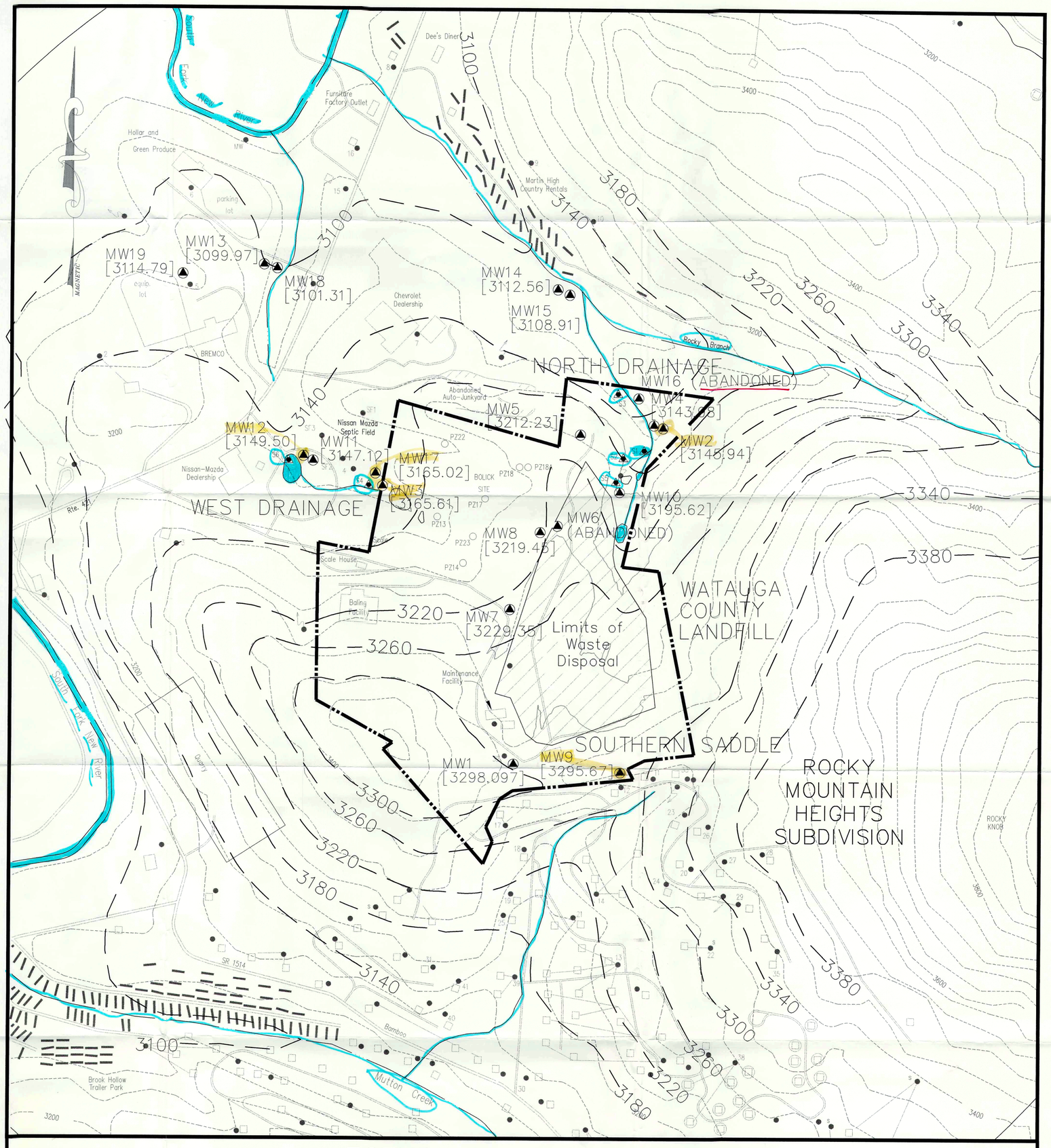
Job No.: 6520-21
Scale: 1" =300'±
Date: 8 APRIL 97

FIGURE 1

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA – Nashville, TN

95-02

6520F.dwg



LEGEND

proposed to monitor

- Stream
- Overhead Power
- 3600 Existing Ground (Elevation in Feet Above MSL)
- Pond
- Existing Residence/Multi-unit Residence
- Existing Mobile Home
- MW8 [3219.45] Assessment Monitoring Wells With Groundwater Elevation in Feet Above MSL
- S5 Surface Water Sampling Locations
- Groundwater Potentiometric Elevation (Inferred from static water level data obtained on January 13, 1998) contour interval 40 feet
- SF1 Septic Field Monitoring Wells
- Spring
- S Spring Used as Potable Water Source
- 2 Existing Potable Well/Sampled Well Ref. No.

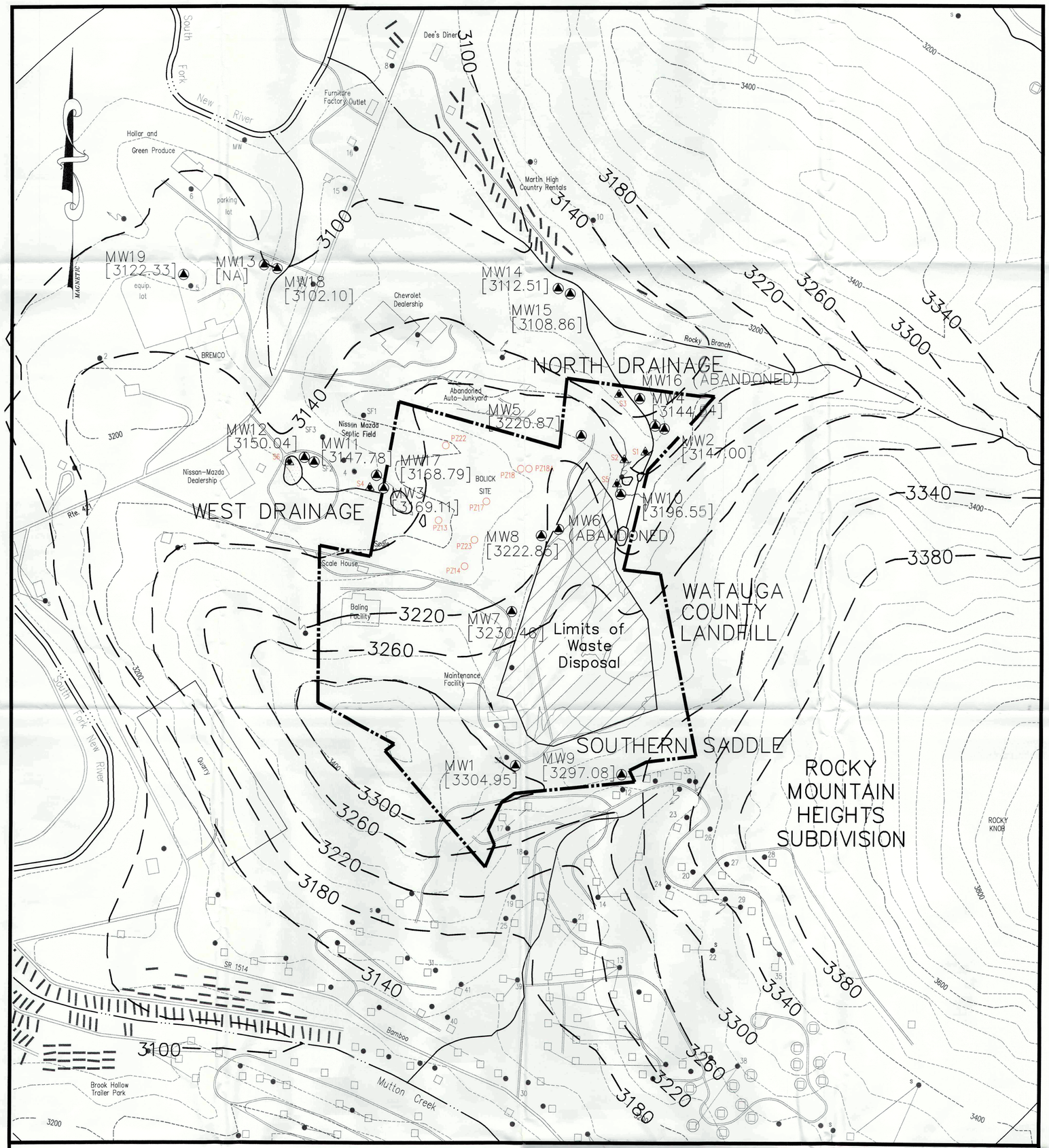
GROUNDWATER AND SURFACE WATER MONITORING PROGRAM MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520-21
Scale: 1" =300'±
Date: 10 MARCH 98

FIGURE 1

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA

6520F.dwg



LEGEND

- Stream
- Overhead Power
- 3600 Existing Ground (Elevation in Feet Above MSL)
- Pond
- Existing Residence/Multi-unit Residence
- Existing Mobile Home
- Assessment Monitoring Wells With Groundwater Elevation in Feet Above MSL
- S5 Surface Water Sampling Locations
- Groundwater Potentiometric Elevation (Inferred from static water level data obtained on June 23, 1998) contour interval 40 feet
- SF1 Septic Field Monitoring Wells
- Spring
- S Spring Used as Potable Water Source
- 2 Existing Potable Well/Sampled Well Ref. No.

GROUNDWATER AND SURFACE WATER MONITORING PROGRAM MAP

WATAUGA COUNTY LANDFILL

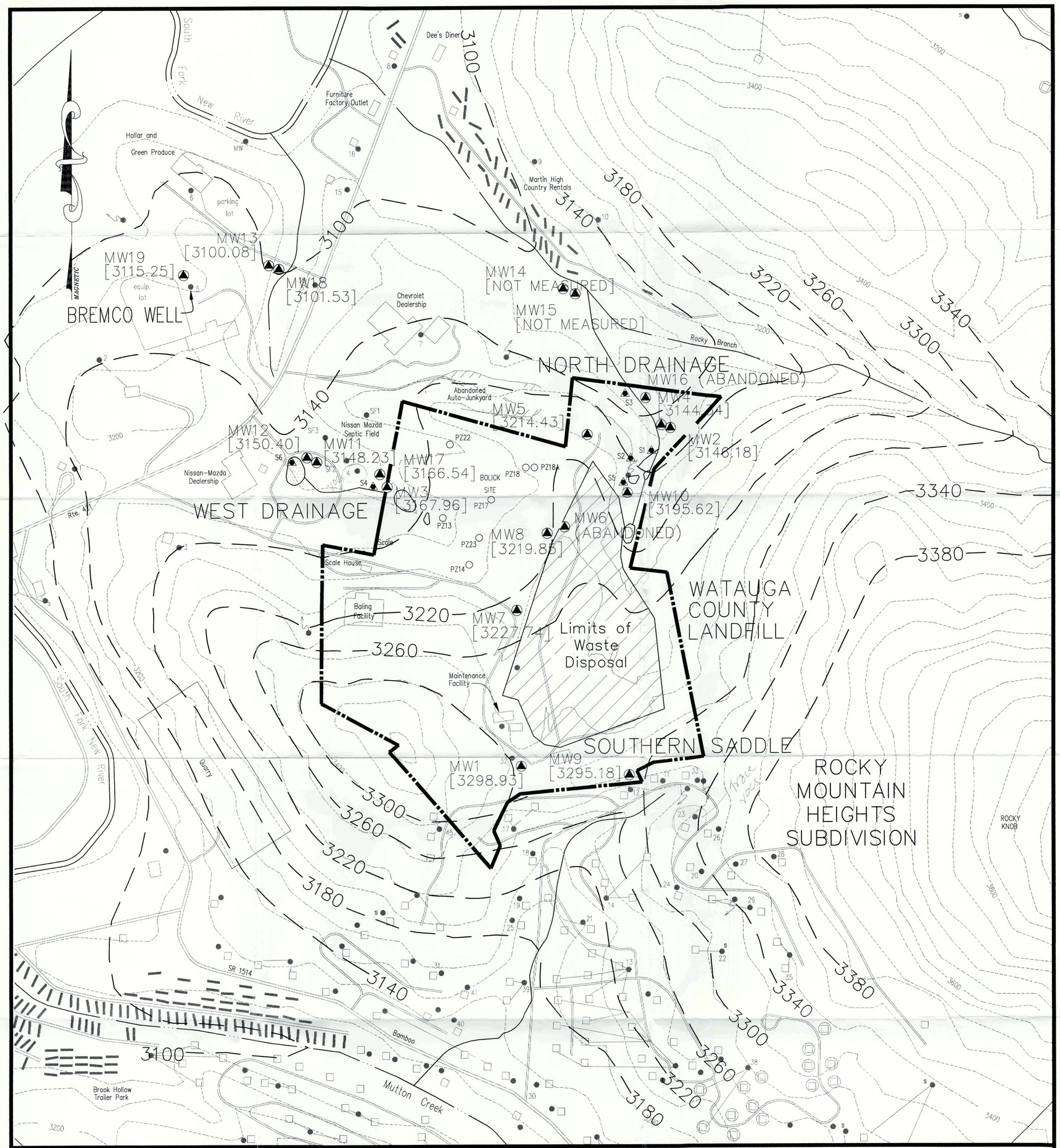
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520-21
Scale: 1" =300'±
Date: 13 AUGUST 98

FIGURE 1

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA

6520F.dwg



LEGEND

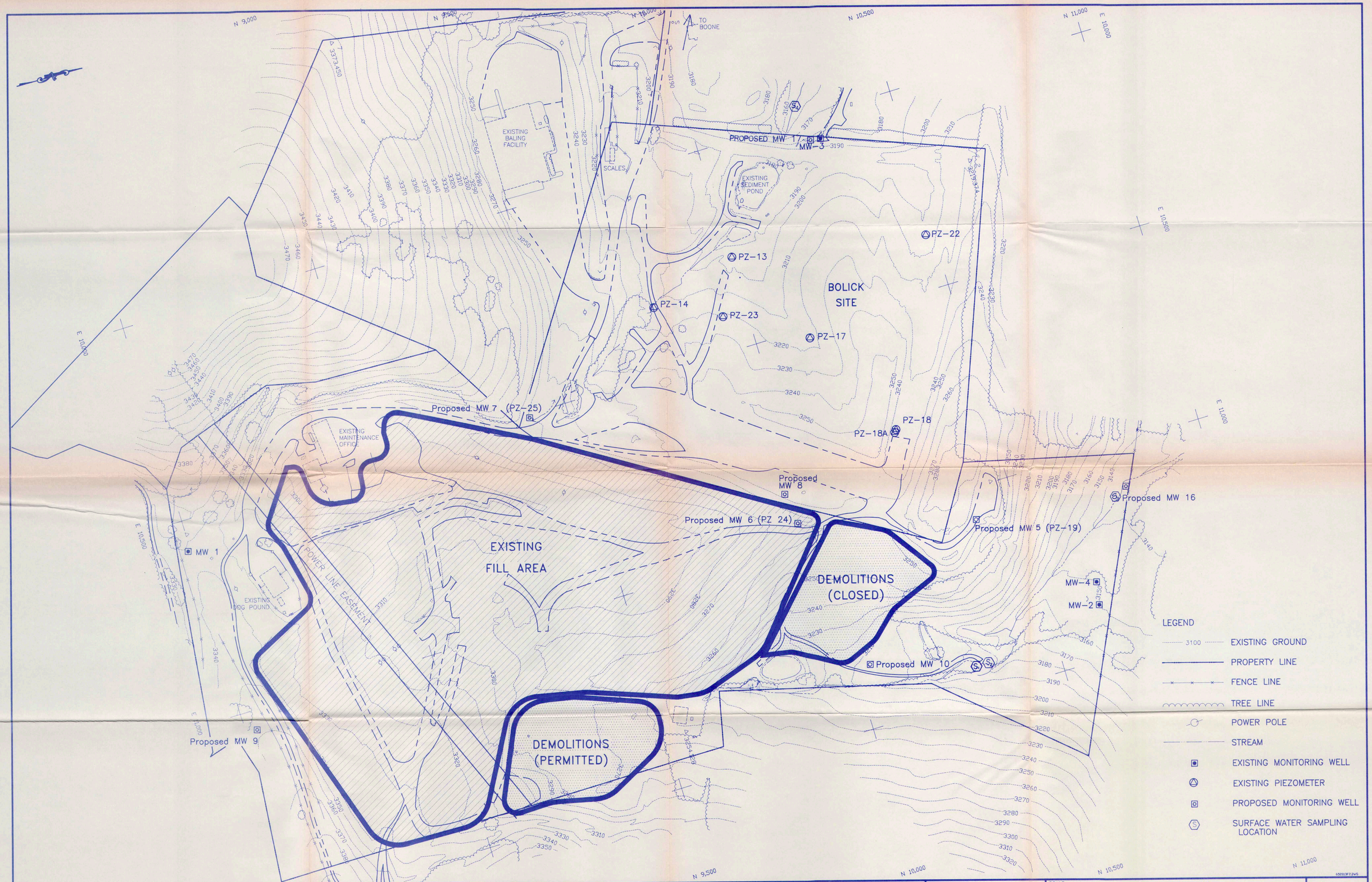
- Stream
- Overhead Power
- 3600 Existing Ground (Elevation in Feet Above MSL)
- Pond
- Existing Residence/Multi-unit Residence
- Existing Mobile Home
- Assessment Monitoring Wells With Groundwater Elevation in Feet Above MSL
- S5 Surface Water Sampling Locations
- 3100 Groundwater Potentiometric Elevation (Inferred from static water level data obtained on January 11, 1999) contour interval 40 feet
- SF1 Septic Field Monitoring Wells
- Spring
- S Spring Used as Potable Water Source
- 2 Existing Potable Well/Sampled Well Ref. No.

GROUNDWATER AND SURFACE WATER MONITORING PROGRAM MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520-21
Scale: 1" =300'±
Date: APRIL 7, 1999

FIGURE 2

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA



Draper Aden Associates
CONSULTING ENGINEERS
BLACKSBURG, VIRGINIA – RICHMOND, VIRGINIA – NASHVILLE, TENNESSEE

DESIGNED:	JES
DRAWN:	ICJ
CHECKED:	JEB
DATE:	8/10/93

SITE MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, VIRGINIA

REVISIONS:

SCALE: 1" = 100', CONTOUR INTERVAL = 10'

PLAN NO. T-6520-13

FIGURE 2

95-02

LEGEND

- Existing Ground
- Overhead Power Line
- Stream
- Pond
- Existing Residence/Multi-unit Residence
- Existing/Proposed Wells
- Existing Mobile Home
- Existing Potable Well/Sampled Well Reference Number
- Spring Used as Potable Water Source

NOTE: Residence and well information is approximate and was obtained from the Appalachian District Health Department and has not been officially verified. Currently, of twenty-nine potable wells sampled, wells No. 4 and 12 have been significantly impacted by VOC's.

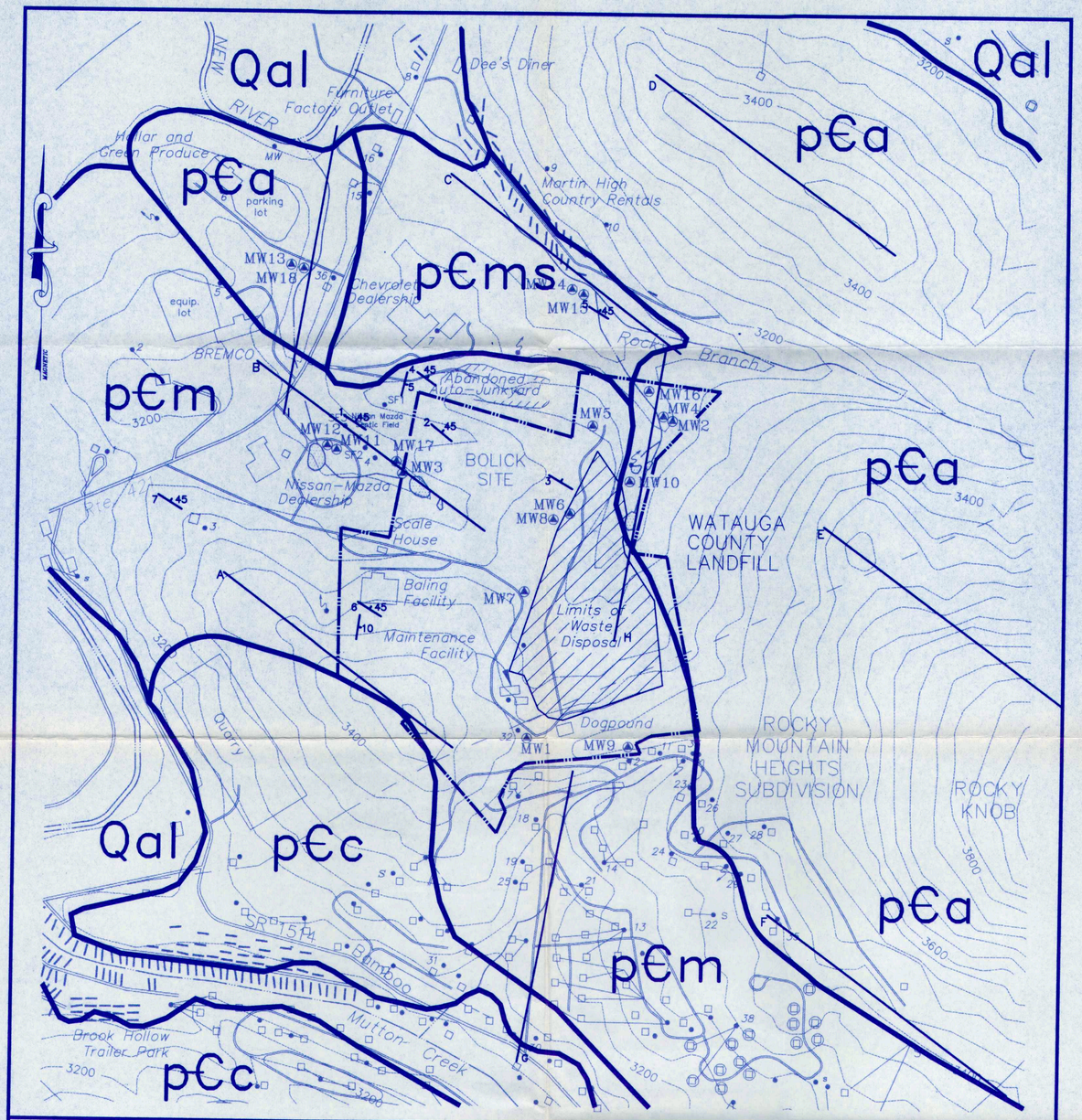
VICINITY MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

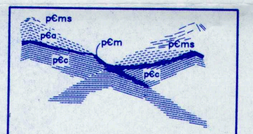
Job No.: 6520-13
Scale: 1" = 600' (Approximate)
Date: 8/10/93

FIGURE 3

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA – Nashville, TN

95-02





N 10° E

Macroscopic Linear Features A–I

A — A N 58° W

1 45 Microscopic Linear Features 1–7 (Layering, Foliation, Joints)

p€ms Lower Precambrian biotite–muscovite schist and gneiss
p€a Lower Precambrian amphibolite and hornblende gneiss
p€m Lower Precambrian "mixed rock" containing interlayered and intergrading amphibolite calc–silicate granofels, biotite–hornblende gneiss, hornblende–epidote–biotite gneiss, biotite–hornblende–plagioclase schist and gneiss, epidote–biotite–plagioclase schist and gneiss, and granite gneiss
p€c Lower Precambrian Cranberry gneiss "layered cataclastic gneiss"
Qal Flood–Plain Alluvium

COMPILED FROM: BRYANT & REED (1970), THE WATAUGA COUNTY SOIL SURVEY (1994), AND FIELD OBSERVATIONS

REVISED GEOLOGY MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520–14
Scale: 1" = 400'±
Date: 10 JUN 94

FIGURE 4

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA – Nashville, TN

LEGEND

- Existing Ground
- Overhead Power Line
- Stream
- Pond
- Existing Residence/Multi-unit Residence
- Assessment Monitoring Wells
- Existing Mobile Home
- Groundwater Potentiometric Elevation
- Septic Field Monitoring Wells
- Spring
- Spring Used as Potable Water Source
- Existing Potable Well/ Sampled Well Ref. No.

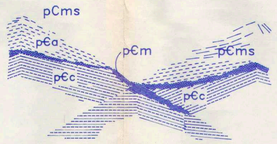
GROUNDWATER POTENTIOMETRIC MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520-14
Scale: 1" = 600'±
Date: 10 JUN 94

FIGURE 5

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA – Nashville, TN

pЄms	Lower Precambrian biotite–muscovite schist and gneiss
pЄa	Lower Precambrian amphibolite and hornblende gneiss
pЄm	Lower Precambrian "mixed rock"
pЄc	Lower Precambrian Cranberry gneiss–"layered cataclastic gneiss"
Qal	Flood–Plain Alluvium



Generalized Cross Section
Depicting Stratigraphic Occurance of
Lower Precambrian "mixed rock" (pЄm)

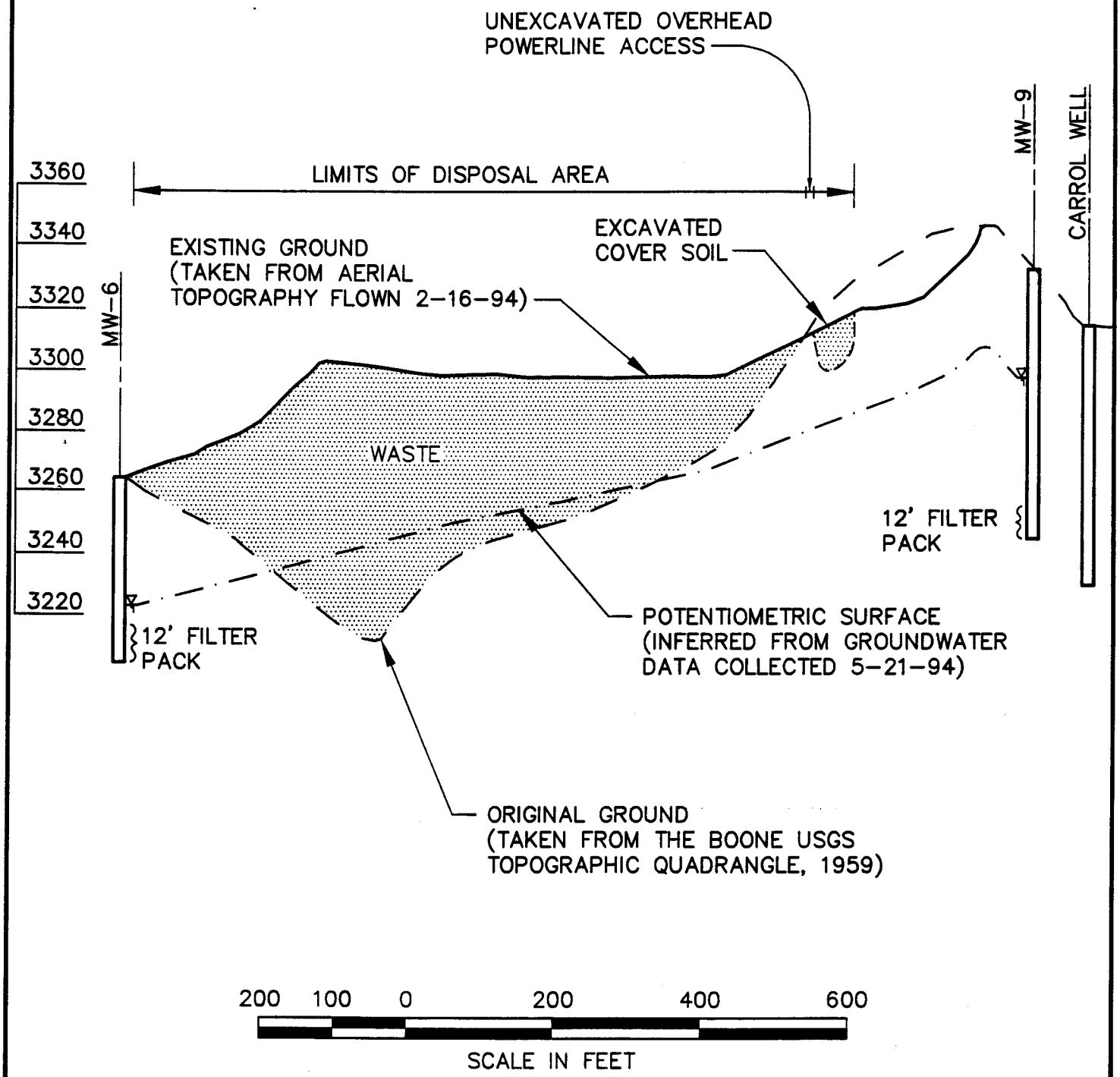
Based on Bryant and Reed, 1970

VICINITY GEOLOGIC MAP &
GEOLOGIC CROSS SECTION
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

Job No.: 6520–13
Scale: 1" = 600' (Approximate)
Date: 8/10/93

FIGURE 5

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, VA – Richmond, VA – Nashville, TN



DISPOSAL AREA CROSS SECTION

WATAUGA COUNTY LANDFILL
WATAUGA COUNTY NORTH CAROLINA

Draper Aden Associates CONSULTING ENGINEERS Blacksburg, Va. – Richmond, Va. – Nashville, Tenn.	JOB No.	DATE:	SCALE:	FIGURE
	6520-14	29 JUN 94	1"=200'	6

All of the components of the mixed rock are of medium metamorphic grade and probably originated through incipient and local feldspathization of rocks similar to the adjacent amphibotite. Most, if not all of the strongly developed layering within the mixed rocks has been produced by shearing of migmatitic layering. The most strikingly layered rocks are the most sheared. Less sheared rocks are generally more granitic and have a migmatitic aspect. The mixed rocks appear to be a gradation zone between migmatitic Cranberry Gneiss and schist, gneiss, and amphibolite, all of which underwent subsequent metamorphism (Bryant and Reed, 1970).

The mapped contact between the "mixed rocks" and the predominantly amphibolitic rocks is located directly beneath the Watauga County Landfill trending along a series of previously documented springs that have subsequently been buried by landfill activities. This contact trends in a northwesterly direction along the central drainage of the Bolick site and trends in a southwesterly direction along the toe of the slope of Rocky Knob, located above the Rocky Heights Subdivision. The contact along the toe of the slope of Rocky Knob is again characterized by a series of springs.

2.6 HYDROGEOLOGY

2.6.1 Surface Water

The Watauga County Landfill site resides within the watershed of the South Fork of the New River. The area of the watershed potentially influenced by the site is comprised of the following three (3) primary drainages:

- the unnamed tributary of Rocky Branch located directly below the surficial drainage of the fill area
- the unnamed drainage located below the Bolick Site and
- the unnamed tributary of Mutton Creek located within the Rocky mountain Heights subdivision

The unnamed tributary of Rocky Branch is the only drainage directly influenced by surface flow from the fill area. The other two drainages may only be influenced by subsurface flow from the fill area.

2.6.2 Groundwater

Two primary aquifer systems exist beneath the Watauga County Landfill property, an unconfined soil aquifer and a fractured bedrock aquifer. Wells installed in the two aquifer systems reveal that the potentiometric surface is similar at variable aquifer depths of groundwater encountered. The shared potentiometric surface suggests that soil and fracture water production zones may be somewhat interconnected by hydraulically conductive fractures, joints, and/or shear zones. The shared potentiometric surface of the soil and fracture aquifer system is presented in Figure 6.

Recharge Sources

The upgradient recharge areas for the site aquifer media are comprised of Rocky Knob (approximate elevation 4000 ft.) to the east of the site and a smaller knob (approximate elevation 3500 ft.) to the southwest. Rocky Knob is the primary recharge source in the vicinity of the site. The Rocky Branch watershed is additionally recharged from the northeast by a northwest trending ridge (approximate elevation 3500 ft.). The approximate elevations of potentiometric surface of the aquifer media in the vicinity of the site range from 3100 ft. to 3305 ft.

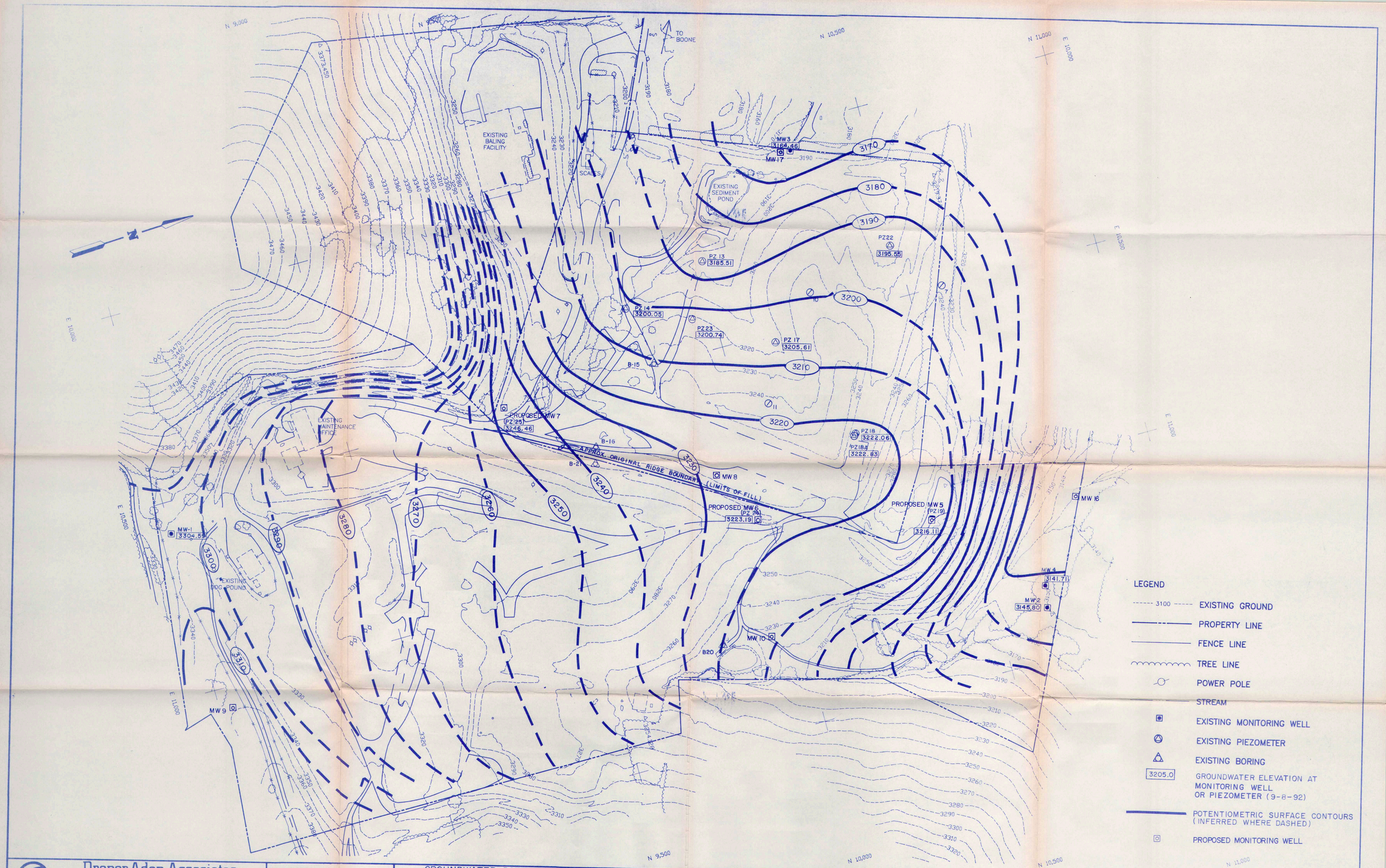
Along the base of Rocky Knob, discharge is expressed at the surface by the presence of springs along a northwest trending contact between the amphibolite/hornblende gneiss bedrock and the zone of "mixed rock" (Figure 5). A series of previously documented springs subsequently covered by landfill activities also follow this trend to the northwest.

Recharge to the springs at the base of Rocky Knob and recharge to the Rocky Mountain Heights subdivision is provided by the substantial upgradient area of Rocky Knob. The primary westward groundwater flow direction from Rocky Knob, and a subjugate topographic and hydraulic divide south of the landfill (Figure 5), likely inhibit flow from the north across the ridge separating the landfill from the Rocky Mountain Heights subdivision.

Per recommendations by the NCDEHNR, additional investigations will include sampling of the spring located at the base of Rocky Knob adjacent to the landfill (as described in Section 5.2 of this Activity Report). The spring to be sampled is located at the head of the drainage adjacent to the Carroll residence well (well reference no. 12) (Figure 5). The Carroll residence well is the only potable well in the Rocky Mountain Heights Subdivision identified as significantly impacted by volatile organic compounds.

The previously documented springs located beneath the landfill may be jointly recharged by both Rocky Knob and by the knob located to the southwest of the site. A spring capture outfall system was installed prior to waste disposal to pipe out the spring groundwater from beneath the waste. As outlined in Appendix I of the Assessment Plan, the spring capture outfall system is currently sampled semiannually as part of the assessment surface water sampling program.

As presented in the disposal area cross section (Figure 6), the potentiometric surface inferred between MW-6 and MW-9 could possibly be influenced by the spring capture outfall which may have failed, resulting in the doming of groundwater within the fill. An overhead power line traverses the upgradient, southern limits of the waste disposal area. An unexcavated area remains within the disposal area to support the transmission lines. Draper Aden Associates proposes to install a piezometer or monitoring well in the unexcavated area near the power line to provide addition potentiometric data and/or groundwater quality data between MW-6 and MW-9 to investigate potential mounding.



Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg · Richmond, Virginia & Nashville, Tennessee

DESIGNED	JES
DRAWN	LHJ
CHECKED	
DATE	8/10/93

GROUNDWATER POTENTIOMETRIC MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

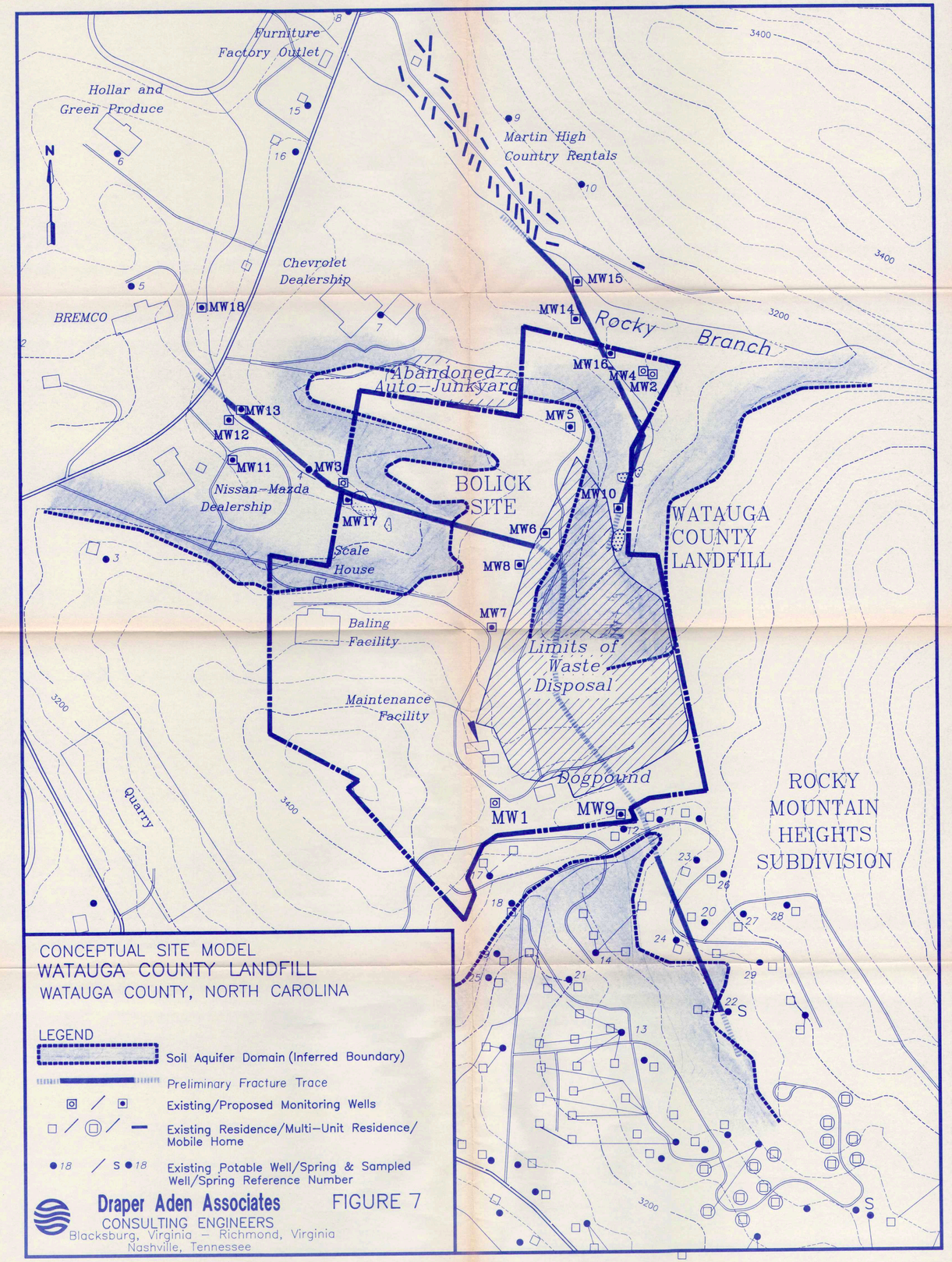
REVISIONS:
12-2-92

SCALE: 1" = 100', CONTOUR INTERVAL = 10'

PLAN № T-6520-13

FIGURE 6

american blueprint of columbia



CONCEPTUAL SITE MODEL
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

LEGEND

- Soil Aquifer Domain (Inferred Boundary)
- Preliminary Fracture Trace
- Existing/Proposed Monitoring Wells
- Existing Residence/Multi-Unit Residence/ Mobile Home
- ●18 / S ●18 Existing Potable Well/Spring & Sampled Well/Spring Reference Number

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg, Virginia – Richmond, Virginia
Nashville, Tennessee

FIGURE 7

TABLE 6

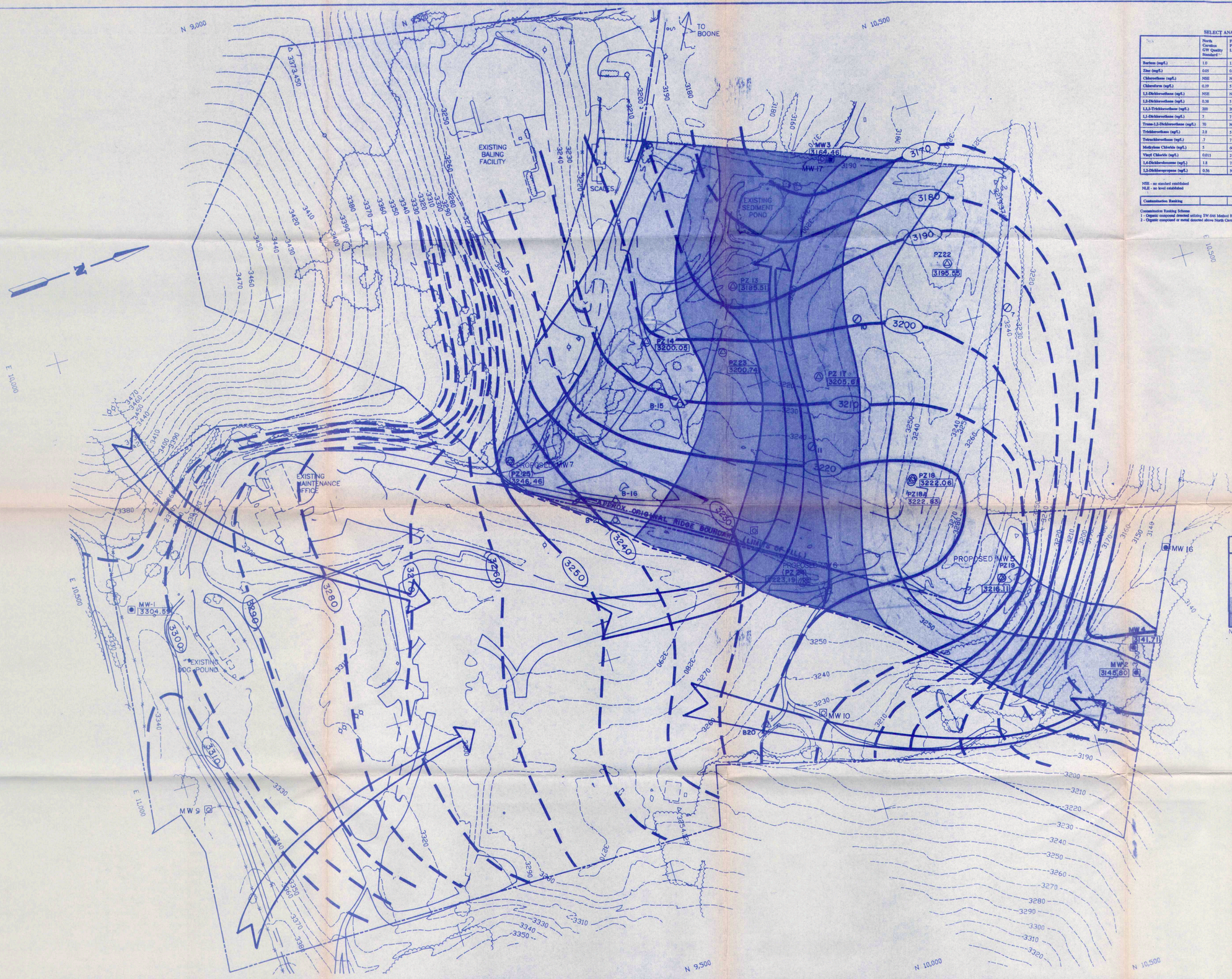
WATAUGA COUNTY LANDFILL

SELECT ANALYTICAL RESULTS OF GROUNDWATER SAMPLING PERFORMED ON NOVEMBER 16-18, 1992

	North Carolina GW Quality Standard [1]	Federal GW Protection Level	MW-1	MW-2	MW-3	MW-4	PZ-13	PZ-14	PZ-17	PZ-18	PZ-18A	PZ-19	PZ-22	PZ-23	PZ-24	PZ-25
Barium (mg/L)	1.0	1.0	0.125	0.141	0.363	0.024	0.568	0.128	2.43	0.140	0.097	0.679	0.075	0.740	0.971	0.310
Zinc (mg/L)	0.05	0.05	0.026	0.024	0.080	0.027	0.088	0.053	0.417	0.032	0.062	0.038	0.038	0.125	0.069	0.029
Chloroethane (ug/L)	NSE	NLE			5		16							8	8	
Chloroform (ug/L)	0.19	5				2			2					3	1	2
1,1-Dichloroethane (ug/L)	NSE	NLE		41	250		270	18	72					83	81	12
1,2-Dichloroethane (ug/L)	0.38	5			1		4									
1,1,1-Trichloroethane (ug/L)	200	200		980	68	6	3		10							1
1,1-Dichloroethene (ug/L)	7	7		110	14		2									
Trans-1,2-Dichloroethene (ug/L)	70	NLE					4								3	
Trichloroethane (ug/L)	2.8	5			23		60	3	6					15	110	2
Tetrachloroethene (ug/L)	7	7		5	39		85	3	10					27	4	
Methylene Chloride (ug/L)	5	600			16		18	13	68	22	13	17	16	24	13	94
Vinyl Chloride (ug/L)	0.015	2			3		18								12	
1,4-Dichlorobenzene (ug/L)	1.8	75					2									
1,2-Dichloropropane (ug/L)	0.56	NLE					3									
Contamination Ranking			0	7	17	3	21	9	14	2	4	2	2	11	15	7

NSE - no standard established
NLE - no level established

Contamination Ranking Scheme
1 - Organic compound detected utilizing SW-846 Method 8010
2 - Organic compound or metal detected above North Carolina Groundwater Quality Standard



KEY

SHADE	WEIGHTED CONTAMINENT VALUES
	< 2
	2 - 4
	5 - 9
	10 - 14
	15 - 21

NOTE: SHADING DOES NOT IMPLY POLLUTANT SPECIFIC CONCENTRATION CONTOUR

LEGEND

- 3100 — EXISTING GROUND
- PROPERTY LINE
- FENCE LINE
- TREE LINE
- POWER POLE
- STREAM
- EXISTING MONITORING WELL / PROPOSED MONITORING WELL
- EXISTING PIEZOMETER
- EXISTING BORING
- 3205.0 — GROUNDWATER ELEVATION AT MONITORING WELL OR PIEZOMETER (9-8-92)
- POTENTIOMETRIC SURFACE CONTOURS (INFERRED WHERE DASHED)
- CONTAMINANT RANKING SCHEME CONTOUR
- PRIMARY FLOW PATH

Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg · Richmond, Virginia & Nashville, Tennessee

DESIGNED JES
DRAWN LHJ
CHECKED
DATE 8/10/92

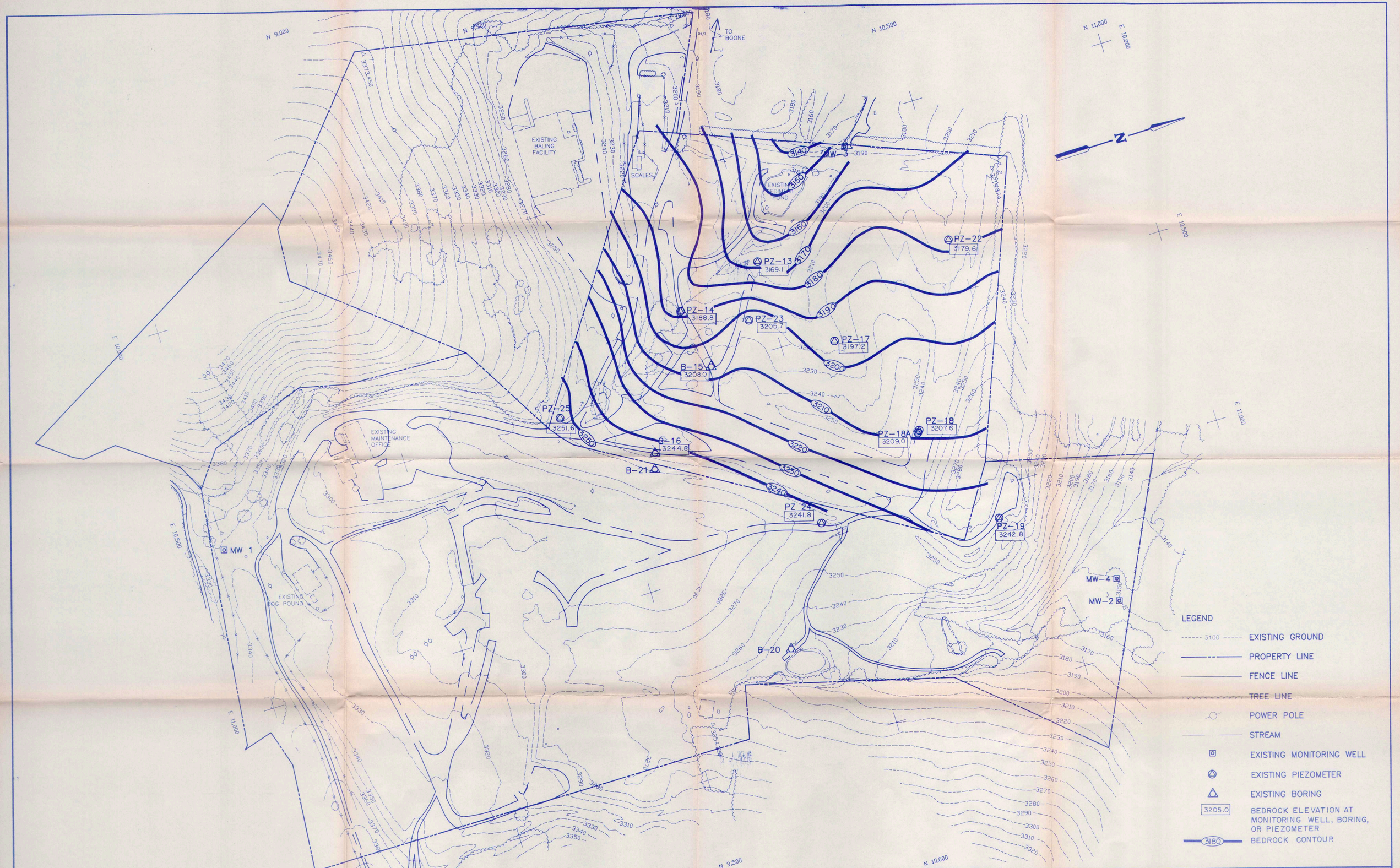
GROUNDWATER CONTAMINENT PLUME MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

REVISIONS:
12-29-92

SCALE: 1" = 100', CONTOUR INTERVAL = 10'

PLAN Nº T-6520-13

FIGURE 8



Draper Aden Associates
CONSULTING ENGINEERS
Blacksburg · Richmond, Virginia & Nashville, Tennessee

DESIGNED JES
DRAWN ICJ
CHECKED
DATE 9/17/92

BEDROCK ELEVATION MAP
WATAUGA COUNTY LANDFILL
WATAUGA COUNTY, NORTH CAROLINA

REVISIONS :

SCALE : 1" = 100', CONTOUR INTERVAL = 10'

PLAN № T-6520-13

FIGURE 9

american blueprint of columbia