MICROBIAL SURVEY DATA AND RESULTS

Big Heart 3-D Prospect
Osage County, Oklahoma

U. S. Department of Energy
BDM-Oklahoma, Inc.
DLB Oil and Gas, Inc.

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Summary and Conclusions

Nine hundred twenty-two (922) soil samples were collected for the Microbial Oil Survey Technique (MOST) to evaluate the hydrocarbon microseepage potential of DLB Oil and Gas, Inc.'s Big Heart 3-D Seismic Program in Osage County, Oklahoma. The survey was initiated by Geo-Microbial Technologies, Inc. (GMT) and the Department of Energy in order to compare tested surface geochemical techniques with geophysical data. The samples for this reconnaissance exploration survey were collected in a 440' grid pattern along 3-D seismic traverses. Large, continuous clusters of samples with elevated microbial populations indicate significant hydrocarbon microseepage is present within the survey area. The northern half of the survey area has the most significant continuous trends of anomalous hydrocarbon microseepage. The strongest microseepage signature occurs in a roughly NW-SE trend in the central portions of traverses R-25 to R-35. Except for one narrow trend of elevated microbial populations in the southern most portion the survey area along traverse R-85, the southern half of the survey area contains only small and scattered trends of elevated hydrocarbon microseepage. In addition, continuous trends of low microbial populations occur between many of the trends of elevated microbial activity.

The hydrocarbon microseepage patterns within the survey area target reservoirs with probable sinuous depositional features. These could be either primary depositional features or post depositional secondary alterations which develop sinuous permeability patterns within a reservoir. Considering the usual reservoir types within the Osage County sedimentary column, these microbial patterns help target specific reservoirs which have geologic environments of deposition or alteration which fit the identified microseepage trends. The abandoned Bartlesville field in the south-central portion of the survey area between traverses R-67 and R-79 has a generally low microbial signature as expected with older, unpressured reservoirs.

The microbial average for the combined surveys is 49 with a standard deviation of 23. Tables, lineplots, histograms, and maps reveal the microbial interpretation of the survey area. This stand alone report utilizes available microbial and basic well log information only. Correlation of the microbial signatures with 3-D seismic and geologic data is strongly recommended. No comparison with geophysical or other geochemical methodologies was available at the time of this submission.

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Introduction

The Microbial Oil Survey Technique (MOST) is based on the presence of hydrocarbon microseeps above buried hydrocarbon accumulations. The microseeps are detected by observing the concentrations and distributions of hydrocarbon-indicating microorganisms found in shallow soils. There is a direct, positive relationship between the hydrocarbon concentrations in the soils and these microbial populations. This relationship between increased hydrocarbon concentrations and increased hydrocarbon-indicating microorganism populations is easily measurable and distinctly reproducible. High microbial population distributions are therefore reliable indicators of hydrocarbon gas migration.

The specific suite of microorganisms are measured from shallow soil samples collected from a depth of approximately 8 inches (20cm). The soils are analyzed by microbiological screening techniques for hydrocarbon-indicating microbes. The process used in this survey screened for only those microorganisms which indicate the presence of light hydrocarbons, particularly butane.

Sample patterns and sample density for this reconnaissance microbial survey in Osage County, Oklahoma were selected by BDM-Oklahoma to define the hydrocarbon microseepage potential of the area targeted for closely spaced 3-D seismic surveys. More detailed infill surveys of higher priority acreage or prospects may be completed in a similar manner to more accurately identify drilling targets. The predictive value of this technology has been demonstrated by extensive field surveys. Microbial surveys are highly effective when used in conjunction with geological and geophysical data.

Survey Method and Data Analysis

The nine hundred twenty-two (922) shallow soil samples were collected by GMT personnel. The samples were collected from a depth of approximately 8 inches (20cm) every 440 feet along designated seismic traverses, R-1 through R-91. The sampling pattern was selected by BDM-Oklahoma to fit the DLB 3-D seismic grid. The samples were collected between October 9 to the 14, 1996, by a three person crew. On average one crew member could collect 100 samples per day. The samples were processed at GMT's laboratory in Ochelata, Oklahoma the day following each collection day. Four pages of photographs display particular survey features.

In processing the samples, twenty-five (25) gms of the collected soil were analyzed from each sample location. The 25 gms of soil were diluted and plated three times with agar gel and n-butanol. The butanol is the only utilizable organic carbon source for the microorganisms. Only those microorganisms already capable of light hydrocarbon metabolism survive in this selective growth medium. After one week of incubation, the microorganisms grow into colonies visible to the naked

eye. These colonies were counted and the Microbial Value for each sample was calculated as the average of the three agar plates.

Table 1 lists both the Microbial and Statistical Microbial Values for each sample. The Statistical Microbial Value for each sample is calculated by averaging the two adjacent sample point values in a weighted five point moving average smoothing function. This standard methodology reduces noise in the data and helps delineate clusters of both anomalously high and low values.

Map 1 indicates the sample locations for each station and designates which traverses are plotted as microbial profiles. Map 1.1 outlines the T-23-N and R-9-E survey area on a USGS topo sheet. Map 2 plots the Microbial Values and Map 3 the Statistical Microbial Values in bubble map format. The bubble maps use proportional symbols where the size of the circle is determined by the value of the sample at that location. The breaks in bubble size are determined by natural trend reversals or other breaks within frequency distribution data. Map 2.1 is the contour representation of the Microbial values and Map 3.1 is the contour representation of the Statistical Microbial Values. A clear overlay of the production wells is used for Map 2 and 3, while the wells are plotted directly on contour Maps 2.1 and 3.1. Page size maps are included for easy reference. Maps which should match the seismic project scale are contained in the report pocket.

The Microbial Values and Statistical Microbial Values are plotted as Microbial Lineplots (Figures 1 - 14). These representative profiles effectively demonstrate the variation in microbial values displayed in the prospect. The statistically smoothed data is shown as the connected black diamonds on the lineplots. The groupings of both high value and low value samples are displayed in profile and thus relative comparisons of values can be made directly to 2-D seismic and geologic profiles.

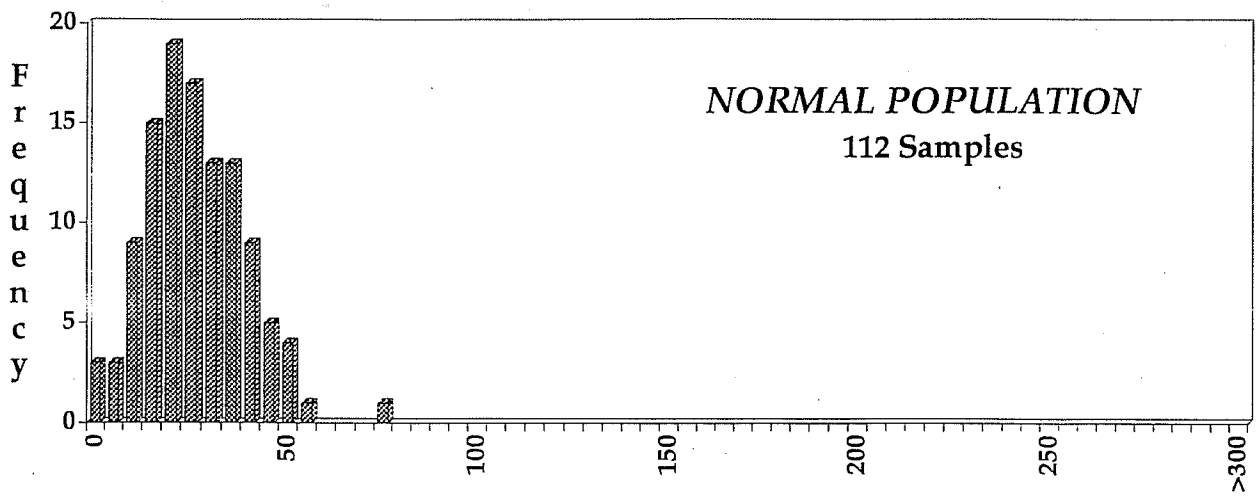
Figure 15 displays the frequency distribution histogram of the Microbial Values for the survey. These indicate the magnitude and skewness of the data sets present over the prospect area. A histogram's skewness and mean can indicate the relative potential of the prospect area. A non-productive survey area is usually represented by a histogram of normal frequency distribution, i.e., a normal bell-shaped curve. When the frequency distribution indicates dual populations, or more commonly is skewed to the right, then the histogram represents an area with an anomalous hydrocarbon microseepage population. Examples of actual survey data of all three distribution types are shown on Figure A. A right-hand skewed histogram has higher Microbial Values and a higher Microbial Value mean than a non-productive, normal frequency distribution.

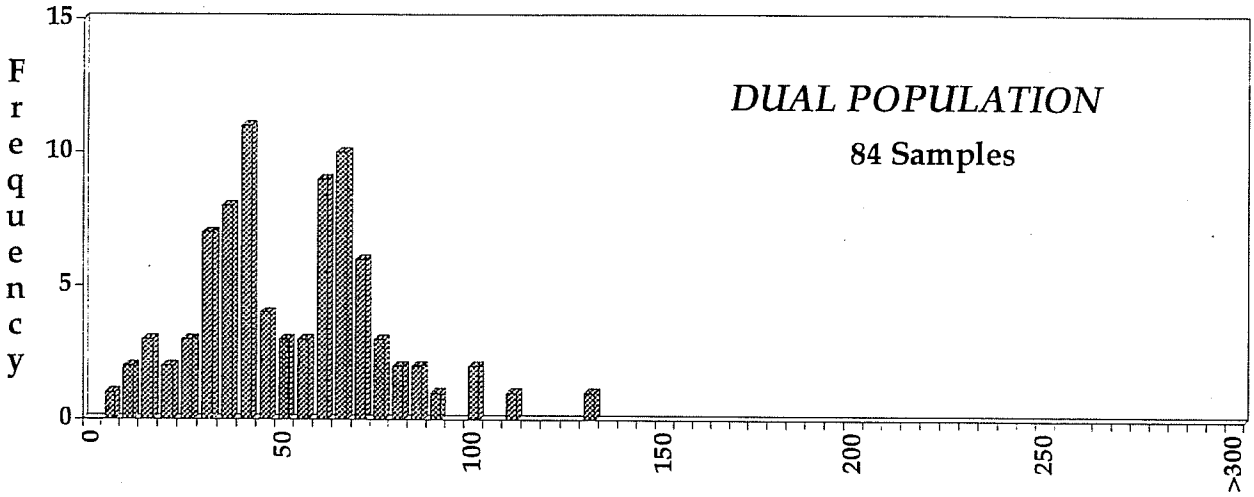
Discussion

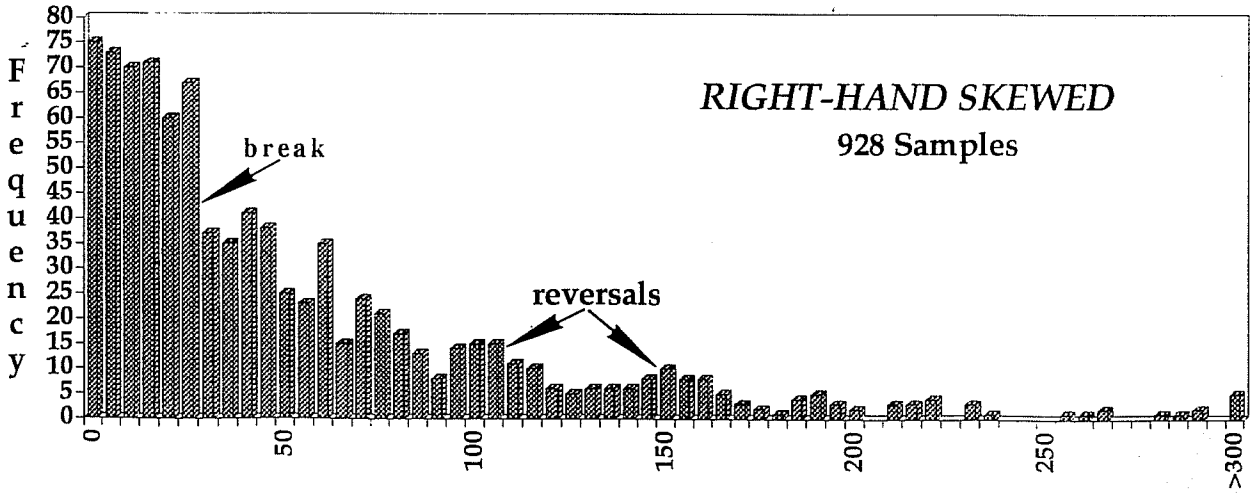
The 922 microbial soil samples were collected in conjunction with DLB's 3-D seismic evaluation of the Big Heart Prospect. BDM-Oklahoma collected additional

Figure A

Frequency Distribution Histogram







Geo-Microbial Technologies, Inc.

geochemical samples. All samples were collected in a 440 feet reconnaissance grid pattern along seismic traverses selected by BDM-Oklahoma. Extensive GMT experience in Osage County has previously utilized a minimum spacing of 330 feet for geochemical sampling, but comparison with the detailed seismic portion of DLB's program dictated a wider than recommended sampling pattern. Microbial samples were collected by GMT personnel who averaged 100 samples per day per person. Collection materials included a shovel, sample envelopes, cloth carrying bag or day pack, map, marker, and compass. No disturbance of the environment, livestock, fences, or ongoing seismic operations occurred.

Large, sinuous clusters of samples with elevated microbial populations indicate significant hydrocarbon microseepage is present within the survey area. In particular, the northern half of the area contains the largest significant indication of continuous trends of anomalous hydrocarbon microseepage. This signature occurs in a roughly NW-SE trend in the central portions of traverses R-25 through R-35. This anomaly is approximately $^1/_2$ square mile in size and is bounded on the east and south by low microbial values. Some extension of the microseepage signature appears to reach north and west. A narrow cluster of elevated microbial populations aligns east-west directly on-line with traverse R-85 in the southern portion the survey area. Except for its western end, this anomaly follows along a section road and may reflect some unobserved cultural influence. Repetitive sampling is recommended to confirm this signature. The rest of the southern half of the prospect contains only small and isolated trends of elevated hydrocarbon microseepage.

The area of abandoned producing wells in the south-central portion of the survey area may strongly affect the microbial activity adjacent to the producing wells. This 10 well Bartlesville field has an average well depth of 2551 feet. It appears as if 10 dry holes were also drilled while determining the limits to the field. The pattern of reduced microbial counts adjacent to oil and gas wells is common for older producing areas. It has been observed that over some well drained gas reservoirs, the microbial values have been found to even be anomalously low. This phenomenon of apparent *microseepage shutdown* over producing fields is thought to be due to a change in the drive mechanism controlling microseepage. When a well is brought into production, the drive changes from a vertically migrating buoyancy force to horizontal gas streaming to pressure sinks created around producing wells. When this occurs, microseepage ends and microbial populations decline rapidly. This change in drive mechanism and microbial population densities can be used to define reservoir drainage direction, radius and heterogeneities around existing wells in producing fields. Obviously, in *undrilled* areas this phenomenon will not occur and there will be a direct relationship between high microbial populations, microseepage and potential reservoirs.

Throughout the survey area there are continuous clusters of samples with *low* microbial populations which occur between many of the elevated microbial population trends. The microbial contour maps highlight these areas in blue.

These sinuous, low trends may indicate some geologic environment which has no effective porosity to accumulate hydrocarbons. The presence of a clay plug (i.e., the last active channel within the area which filled with clay and organics) is a geologic example of such an environment which would have low porosity.

Because of the nature of Osage County depositional history and trapping there is significant probability that more than one reservoir is contributing to the microbial population signatures. However, considering the sinuous, channel-like nature of the microbial signatures, there is also the possibility that one reservoir from a particular geologic environment is dominating the hydrocarbon microseepage signature. To explain these high and low microbial patterns, the targeted reservoirs would have to have been deposited or altered within a geological environment which develops porosity channels which accumulate or divert hydrocarbons. These could be either primary depositional feature or post depositional secondary alterations with will develop these permeability patterns within the reservoir. Considering all the reservoir types within the Osage County sedimentary column, these microbial patterns can help target specific reservoir types which have geologic environments of deposition or alteration which will fit the microseepage trends.

Reflecting the rich exploration history of Osage County, over a dozen other wells have been drilled within the survey area. These wells help bracket the depth of potential reservoirs which may contain hydrocarbon accumulations contributing to the hydrocarbon microseepage signatures. Review of any available logs from these wells will help determine the potential reservoirs. A dry hole in an area of elevated microbial populations either indicates the well was not drilled deep enough or misinterpretation of the logs bypassed potential production. Significantly, the largest microbial anomaly remains untested by the drill bit.

Experience in Osage County and surrounding areas show that surface fault traces or projections of subsurface faults can sometimes be detected at the surface by microbial sampling. Since faults are often high permeability conduits, they may have relatively high volumes of light hydrocarbons migrating along the fault plane. The anomalous concentrations of light hydrocarbon gases associated with faults will therefore escape to the surface in a relatively narrow band. The typical microbial fault signature is an alignment of high, usually stand alone, microbial samples across several traverses. Besides cultural influence, the strong alignment of high values along traverse R-85 could be fault related. Careful observation of alignments of elevated values on the Microbial Value bubble map (Map 2) may indicate possible fault signatures. Comparison of these microbial alignments with 3-D geophysical data is important.

The frequency distribution histogram (Figure 15) has several breaks in trends of the data, potentially demonstrating multiple populations within the data set. An anomalous break occurs at the reversal in trend at 75 counts. A possible anomalous group indicated by the subtle reversal in declining trend occurs at 60 counts. An

additional reversal in trend occurs at 50 counts. The significance of this population can be determined by detailed geologic mapping. Background values appear to be less than 50 counts.

Additional and detailed infill microbial sampling is warranted adjacent to the regions of elevated microbial activity surrounding well locations to determine the extent and direction of the identified hydrocarbon microseepage. These areas should be re-sampled several times following the initiation of new production to determine the extent of reservoir drainage by any particular well. It is strongly suggested that the microbial data be used in conjunction with geologic interpretation of the 3-D seismic information to determine the best locations for drilling.

The approximately six square mile area consisted of mostly rolling grasslands, rocky and wooded hillsides, and some agricultural flood plains near occasional creeks.

Using a reconnaissance sample density, microbial samples were collected every 440 feet along geophysical traverses. The GMT crew worked east and west from a strategic north-south road.

Seismic markers were used when available, but after one day of sampling the GMT crew surpassed the seismic surveyed area. Subsequent microbial samples were collected using GMT's own GPS, compass, pacing and marker methodology.

For this survey and terrain a microbial sampler could collect approximately 100 samples per day. Seismic trucks advance in the northwest portion of the survey area.

Portions of the wooded area and creek topography revealed rock outcrops. Samples were collected from adjacent soil areas.

Seismic traverse required vehicles which cut through trees and across small creeks. Microbial sampling requires only foot travel with no disturbance of the environment, livestock, or fences.

Microbial collection procedures include digging a hole 8 inches (20 cm) deep with a shovel and selecting a handful of soil. Other materials required are paper sample envelopes and a cloth carrying bag.

A view of a typical grassland soil profile. All field observations are noted for final interpretations.

Table 1

Microbial Survey

DOE / BDM / DLB

Big Heart Prospect
Osage County, OK

Collection Date: October 8-14, 1996
Processing Date: October 9-15, 1996

922 Samples

Survey Microbial Average = 49
Survey Standard Deviation = 23

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	1	171	73	53
10/8/96	1	175	31	44
10/8/96	1	179	51	46
10/8/96	1	183	63	56
10/8/96	1	187	42	52
10/8/96	1	191	57	58
10/8/96	1	195	81	64
10/8/96	1	199	67	62
10/8/96	1	203	25	42
10/8/96	1	207	43	43
10/8/96	1	211	54	53
10/8/96	1	215	54	60
10/8/96	1	219	83	71
10/8/96	1	223	97	71
10/8/96	1	227	37	51
10/8/96	1	231	66	53
10/8/96	1	235	28	40
10/8/96	1	239	49	48
10/8/96	1	243	53	60
10/8/96	1	247	47	50
10/8/96	1	251	74	61
10/8/96	1	255	69	61
10/8/96	3	171	18	34
10/8/96	3	175	35	34
10/8/96	3	179	21	39
10/8/96	3	183	86	57
10/8/96	3	187	63	53
10/8/96	3	191	47	59

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	3	195	50	62
10/8/96	3	199	100	66
10/8/96	3	203	33	47
10/8/96	3	207	30	45
10/8/96	3	211	64	56
10/8/96	3	215	74	61
10/8/96	3	219	57	65
10/8/96	3	223	48	56
10/8/96	3	227	39	41
10/8/96	3	231	34	44
10/8/96	3	235	36	40
10/8/96	3	239	42	52
10/8/96	3	243	104	72
10/8/96	3	247	35	49
10/8/96	3	251	42	52
10/8/96	3	255	50	55
10/8/96	5	171	26	32
10/8/96	5	175	34	29
10/8/96	5	179	30	32
10/8/96	5	183	15	44
10/8/96	5	187	46	45
10/8/96	5	191	79	59
10/8/96	5	195	78	63
10/8/96	5	199	42	62
10/8/96	5	203	61	51
10/8/96	5	207	35	43
10/8/96	5	211	49	54
10/8/96	5	215	34	57
10/8/96	5	219	88	67
10/8/96	5	223	54	55
10/8/96	5	227	43	47
10/8/96	5	231	46	48
10/8/96	5	235	31	46
10/8/96	5	239	68	59
10/8/96	5	243	114	77
10/8/96	5	247	29	56
10/8/96	5	251	55	53
10/8/96	5	255	59	60
10/8/96	7	171	32	31
10/8/96	7	175	16	30
10/8/96	7	179	43	35
10/8/96	7	183	49	48
10/8/96	7	187	23	40
10/8/96	7	191	45	47
10/8/96	7	195	44	53
10/8/96	7	199	70	62

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	7	203	74	60
10/8/96	7	207	55	60
10/8/96	7	211	73	71
10/8/96	7	215	106	73
10/8/96	7	219	66	68
10/8/96	7	223	36	53
10/8/96	7	227	50	51
10/8/96	7	231	61	54
10/8/96	7	235	60	53
10/8/96	7	239	51	58
10/8/96	7	243	65	68
10/8/96	7	247	89	67
10/8/96	7	251	36	61
10/8/96	7	255	112	74
10/8/96	9	171	15	31
10/8/96	9	175	26	33
10/8/96	9	179	37	41
10/8/96	9	183	96	59
10/8/96	9	187	30	47
10/8/96	9	191	46	48
10/8/96	9	195	45	51
10/8/96	9	199	60	52
10/8/96	9	203	36	50
10/8/96	9	207	60	57
10/8/96	9	211	65	63
10/8/96	9	215	51	64
10/8/96	9	219	70	62
10/8/96	9	223	63	57
10/8/96	9	227	54	58
10/8/96	9	231	64	57
10/8/96	9	235	33	50
10/8/96	9	239	53	51
10/8/96	9	243	34	55
10/8/96	9	247	70	61
10/8/96	9	251	52	51
10/8/96	9	255	39	55
10/8/96	11	171	57	50
10/8/96	11	175	45	43
10/8/96	11	179	40	46
10/8/96	11	183	61	60
10/8/96	11	187	85	56
10/8/96	11	191	32	49
10/8/96	11	195	65	58
10/8/96	11	199	49	49
10/8/96	11	203	43	51
10/8/96	11	207	67	64

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	11	211	79	64
10/8/96	11	215	55	65
10/8/96	11	219	47	54
10/8/96	11	223	59	54
10/8/96	11	227	65	60
10/8/96	11	231	44	60
10/8/96	11	235	82	62
10/8/96	11	239	64	59
10/8/96	11	243	62	68
10/8/96	11	247	81	68
10/8/96	11	251	73	58
10/8/96	11	255	44	56
10/8/96	13	171	63	54
10/8/96	13	175	42	42
10/8/96	13	179	32	40
10/8/96	13	183	37	49
10/8/96	13	187	33	49
10/8/96	13	191	49	47
10/8/96	13	195	82	61
10/8/96	13	199	30	48
10/8/96	13	203	36	49
10/8/96	13	207	81	66
10/8/96	13	211	53	61
10/8/96	13	215	94	67
10/8/96	13	219	28	54
10/8/96	13	223	47	56
10/8/96	13	227	89	64
10/8/96	13	231	94	68
10/8/96	13	235	57	64
10/8/96	13	239	42	55
10/8/96	13	243	98	66
10/8/96	13	247	51	57
10/8/96	13	251	35	52
10/8/96	13	255	65	53
10/8/96	15	171	80	60
10/8/96	15	175	38	47
10/8/96	15	179	55	52
10/8/96	15	183	78	61
10/8/96	15	187	60	61
10/8/96	15	191	41	51
10/8/96	15	195	77	60
10/8/96	15	199	23	51
10/8/96	15	203	75	54
10/8/96	15	207	59	62
10/8/96	15	211	40	56
10/8/96	15	215	67	60

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	15	219	57	56
10/8/96	15	223	37	45
10/8/96	15	227	24	40
10/8/96	15	231	29	44
10/8/96	15	235	43	47
10/8/96	15	239	26	42
10/8/96	15	243	83	55
10/8/96	15	247	31	49
10/8/96	15	251	44	46
10/8/96	15	255	58	51
10/8/96	17	171	32	43
10/8/96	17	175	22	34
10/8/96	17	179	57	46
10/8/96	17	183	69	63
10/8/96	17	187	81	65
10/8/96	17	191	59	60
10/8/96	17	195	48	63
10/8/96	17	199	108	68
10/8/96	17	203	47	63
10/8/96	17	207	83	71
10/8/96	17	211	64	61
10/8/96	17	215	48	64
10/8/96	17	219	96	72
10/8/96	17	223	57	56
10/8/96	17	227	21	49
10/8/96	17	231	73	55
10/8/96	17	235	60	51
10/8/96	17	239	46	44
10/8/96	17	243	4	40
10/8/96	17	247	53	46
10/8/96	17	251	48	41
10/8/96	17	255	37	46
10/8/96	19	171	46	41
10/8/96	19	175	30	28
10/8/96	19	179	12	33
10/8/96	19	183	49	51
10/8/96	19	187	62	55
10/8/96	19	191	54	51
10/8/96	19	195	37	51
10/8/96	19	199	51	53
10/8/96	19	203	30	49
10/8/96	19	207	43	57
10/8/96	19	211	65	59
10/8/96	19	215	49	61
10/8/96	19	219	97	78
10/8/96	19	223	62	62

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	19	227	60	56
10/8/96	19	231	38	49
10/8/96	19	235	55	50
10/8/96	19	239	43	49
10/8/96	19	243	34	43
10/8/96	19	247	73	51
10/8/96	19	251	18	39
10/8/96	19	255	42	42
10/8/96	21	171	37	36
10/8/96	21	175	13	25
10/8/96	21	179	27	34
10/8/96	21	183	67	53
10/8/96	21	187	52	53
10/8/96	21	191	44	51
10/8/96	21	195	66	62
10/8/96	21	199	62	67
10/8/96	21	203	100	72
10/8/96	21	207	108	79
10/8/96	21	211	51	72
10/8/96	21	215	82	70
10/8/96	21	219	86	80
10/8/96	21	223	70	69
10/8/96	21	227	75	68
10/8/96	21	231	51	57
10/8/96	21	235	50	56
10/8/96	21	239	79	61
10/8/96	21	243	49	55
10/8/96	21	247	61	58
10/8/96	21	251	53	49
10/8/96	21	255	50	49
10/8/96	23	171	32	33
10/8/96	23	175	10	23
10/8/96	23	179	36	31
10/8/96	23	183	43	47
10/8/96	23	187	41	48
10/8/96	23	191	47	49
10/8/96	23	195	85	62
10/8/96	23	199	42	52
10/8/96	23	203	49	56
10/8/96	23	207	44	65
10/8/96	23	211	89	66
10/8/96	23	215	57	62
10/8/96	23	219	61	72
10/8/96	23	223	45	61
10/8/96	23	227	75	66
10/8/96	23	231	38	54

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	23	235	52	55
10/8/96	23	239	60	61
10/8/96	23	243	76	62
10/8/96	23	247	32	52
10/8/96	23	251	39	45
10/8/96	23	255	30	43
10/8/96	25	171	44	37
10/8/96	25	175	32	33
10/8/96	25	179	46	40
10/8/96	25	183	79	56
10/8/96	25	187	47	52
10/8/96	25	191	36	49
10/8/96	25	195	57	55
10/8/96	25	199	54	51
10/8/96	25	203	41	56
10/8/96	25	207	60	69
10/8/96	25	211	50	63
10/8/96	25	215	63	67
10/8/96	25	219	91	85
10/8/96	25	223	93	80
10/8/96	25	227	99	82
10/8/96	25	231	88	73
10/8/96	25	235	57	66
10/8/96	25	239	62	68
10/8/96	25	243	95	73
10/8/96	25	247	74	71
10/8/96	25	251	76	71
10/8/96	25	255	90	65
10/8/96	27	171	13	23
10/8/96	27	175	21	21
10/8/96	27	179	0	24
10/8/96	27	183	39	44
10/8/96	27	187	58	50
10/8/96	27	191	57	56
10/8/96	27	195	50	53
10/8/96	27	199	49	56
10/8/96	27	203	51	75
10/8/96	27	207	161	98
10/8/96	27	211	75	82
10/8/96	27	215	52	77
10/8/96	27	219	121	88
10/8/96	27	223	75	73
10/8/96	27	227	54	69
10/8/96	27	231	69	68
10/8/96	27	235	70	66
10/8/96	27	239	86	67

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/8/96	27	243	55	64
10/8/96	27	247	79	67
10/8/96	27	251	67	61
10/8/96	27	255	33	49
10/8/96	29	171	30	28
10/8/96	29	175	28	31
10/8/96	29	179	39	33
10/8/96	29	183	55	52
10/8/96	29	187	68	56
10/8/96	29	191	68	64
10/8/96	29	195	41	55
10/8/96	29	199	61	61
10/8/96	29	203	127	91
10/8/96	29	207	62	96
10/8/96	29	211	81	80
10/8/96	29	215	92	76
10/9/96	29	219	78	79
10/9/96	29	223	53	62
10/9/96	29	227	43	58
10/9/96	29	231	58	56
10/9/96	29	235	62	51
10/9/96	29	239	15	47
10/9/96	29	243	24	41
10/9/96	29	247	64	57
10/9/96	29	251	65	57
10/9/96	29	255	36	52
10/8/96	31	171	6	21
10/8/96	31	175	30	25
10/8/96	31	179	25	28
10/8/96	31	183	47	45
10/8/96	31	187	39	49
10/8/96	31	191	101	68
10/8/96	31	195	52	53
10/8/96	31	199	24	67
10/8/96	31	203	111	100
10/8/96	31	207	155	107
10/8/96	31	211	80	89
10/8/96	31	215	85	78
10/9/96	31	219	77	75
10/9/96	31	223	68	65
10/9/96	31	227	82	65
10/9/96	31	231	75	61
10/9/96	31	235	59	56
10/9/96	31	239	69	60
10/9/96	31	243	40	44
10/9/96	31	247	67	58

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/9/96	31	251	48	59
10/9/96	31	255	65	60
10/9/96	33	171	22	25
10/9/96	33	175	14	24
10/9/96	33	179	11	24
10/9/96	33	183	43	37
10/9/96	33	187	29	38
10/9/96	33	191	68	56
10/9/96	33	195	25	51
10/9/96	33	199	76	77
10/9/96	33	203	141	100
10/9/96	33	207	93	92
10/9/96	33	211	83	74
10/9/96	33	215	43	60
10/9/96	33	219	45	53
10/9/96	33	223	33	42
10/9/96	33	227	44	39
10/9/96	33	231	9	32
10/9/96	33	235	8	31
10/9/96	33	239	83	48
10/9/96	33	243	17	36
10/9/96	33	247	44	50
10/9/96	33	251	69	64
10/9/96	33	255	114	75
10/9/96	35	171	34	36
10/9/96	35	175	34	37
10/9/96	35	179	51	35
10/9/96	35	183	33	37
10/9/96	35	187	28	35
10/9/96	35	191	31	52
10/9/96	35	195	60	57
10/9/96	35	199	148	84
10/9/96	35	203	50	74
10/9/96	35	207	41	63
10/9/96	35	211	44	52
10/9/96	35	215	41	52
10/9/96	35	219	57	53
10/9/96	35	223	33	43
10/9/96	35	227	36	38
10/9/96	35	231	22	34
10/9/96	35	235	38	32
10/9/96	35	239	43	43
10/9/96	35	243	36	36
10/9/96	35	247	31	38
10/9/96	35	251	70	49
10/9/96	35	255	35	50

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/9/96	37	171	46	43
10/9/96	37	175	56	44
10/9/96	37	179	17	36
10/9/96	37	183	31	35
10/9/96	37	187	44	39
10/9/96	37	191	43	47
10/9/96	37	195	43	43
10/9/96	37	199	35	61
10/9/96	37	203	50	56
10/9/96	37	207	69	58
10/9/96	37	211	53	61
10/9/96	37	215	93	67
10/9/96	37	219	59	65
10/9/96	37	223	81	57
10/9/96	37	227	29	41
10/9/96	37	231	53	39
10/9/96	37	235	8	27
10/9/96	37	239	23	32
10/9/96	37	243	35	28
10/9/96	37	247	12	24
10/9/96	37	251	20	32
10/9/96	37	255	30	36
10/9/96	39	171	44	42
10/9/96	39	175	42	49
10/9/96	39	179	50	48
10/9/96	39	183	41	40
10/9/96	39	187	42	46
10/9/96	39	191	66	55
10/9/96	39	195	38	48
10/9/96	39	199	82	64
10/9/96	39	203	58	54
10/9/96	39	207	41	49
10/9/96	39	211	54	57
10/9/96	39	215	55	60
10/9/96	39	219	97	63
10/9/96	39	223	36	50
10/9/96	39	227	32	42
10/9/96	39	231	57	47
10/9/96	39	235	53	41
10/9/96	39	239	45	40
10/9/96	39	243	37	38
10/9/96	39	247	23	32
10/9/96	39	251	33	31
10/9/96	39	255	32	37
10/10/96	41	171	45	44
10/10/96	41	175	78	57

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/10/96	41	179	60	58
10/10/96	41	183	29	43
10/10/96	41	187	63	52
10/10/96	41	191	79	56
10/10/96	41	195	39	44
10/10/96	41	199	57	52
10/10/96	41	203	51	49
10/10/96	41	207	38	44
10/10/96	41	211	63	54
10/10/96	41	215	43	51
10/10/96	41	219	29	49
10/10/96	41	223	45	43
10/10/96	41	227	58	42
10/10/96	41	231	31	42
10/10/96	41	235	30	36
10/10/96	41	239	36	34
10/10/96	41	243	29	38
10/10/96	41	247	49	38
10/10/96	41	251	23	30
10/10/96	41	255	41	46
10/10/96	43	171	6	32
10/10/96	43	175	61	49
10/10/96	43	179	104	61
10/10/96	43	183	23	41
10/10/96	43	187	34	39
10/10/96	43	191	32	36
10/10/96	43	195	22	32
10/10/96	43	199	35	38
10/10/96	43	203	33	38
10/10/96	43	207	14	38
10/10/96	43	211	77	54
10/10/96	43	215	57	53
10/10/96	43	219	54	50
10/10/96	43	223	33	39
10/10/96	43	227	27	39
10/10/96	43	231	53	40
10/10/96	43	235	37	42
10/10/96	43	239	26	40
10/10/96	43	243	82	50
10/10/96	43	247	63	47
10/10/96	43	251	11	37
10/10/96	43	255	69	60
10/10/96	45	171	20	28
10/10/96	45	175	16	30
10/10/96	45	179	33	40
10/10/96	45	183	42	34

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/10/96	45	187	36	33
10/10/96	45	191	12	28
10/10/96	45	195	20	35
10/10/96	45	199	40	39
10/10/96	45	203	53	43
10/10/96	45	207	54	46
10/10/96	45	211	34	49
10/10/96	45	215	65	51
10/10/96	45	219	51	51
10/10/96	45	223	41	42
10/10/96	45	227	52	43
10/10/96	45	231	33	40
10/10/96	45	235	53	41
10/10/96	45	239	24	30
10/10/96	45	243	19	36
10/10/96	45	247	19	36
10/10/96	45	251	35	42
10/10/96	45	255	115	74
10/10/96	47	171	42	37
10/10/96	47	175	15	28
10/10/96	47	179	33	37
10/10/96	47	183	43	39
10/10/96	47	187	27	37
10/10/96	47	191	31	37
10/10/96	47	195	89	52
10/10/96	47	199	42	46
10/10/96	47	203	31	46
10/10/96	47	207	72	45
10/10/96	47	211	33	44
10/10/96	47	215	31	41
10/10/96	47	219	40	45
10/10/96	47	223	25	35
10/10/96	47	227	31	35
10/10/96	47	231	29	35
10/10/96	47	235	42	40
10/10/96	47	239	39	37
10/10/96	47	243	42	45
10/10/96	47	247	28	40
10/10/96	47	251	44	43
10/10/96	47	255	61	60
10/10/96	49	171	72	49
10/10/96	49	175	32	32
10/10/96	49	179	23	36
10/10/96	49	183	35	43
10/10/96	49	187	37	35
10/10/96	49	191	29	36

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/10/96	49	195	48	47
10/10/96	49	199	42	39
10/10/96	49	203	40	42
10/10/96	49	207	16	37
10/10/96	49	211	58	47
10/10/96	49	215	45	48
10/10/96	49	219	88	61
10/10/96	49	223	46	48
10/10/96	49	227	37	45
10/10/96	49	231	47	40
10/10/96	49	235	40	44
10/10/96	49	239	38	46
10/10/96	49	243	86	58
10/10/96	49	247	60	53
10/10/96	49	251	54	50
10/10/96	49	254	43	53
10/10/96	51	171	24	37
10/10/96	51	175	17	31
10/10/96	51	179	65	48
10/10/96	51	183	102	66
10/10/96	51	187	49	50
10/10/96	51	191	54	49
10/10/96	51	195	42	50
10/10/96	51	199	34	41
10/10/96	51	203	78	50
10/10/96	51	207	23	39
10/10/96	51	211	57	48
10/10/96	51	215	38	43
10/10/96	51	219	53	56
10/10/96	51	223	65	50
10/10/96	51	227	49	51
10/10/96	51	231	43	43
10/10/96	51	235	47	43
10/10/96	51	239	50	45
10/10/96	51	243	38	49
10/10/96	51	247	63	51
10/10/96	51	251	48	50
10/10/96	51	254	59	53
10/10/96	53	171	34	36
10/10/96	53	175	20	27
10/10/96	53	179	31	36
10/10/96	53	183	56	51
10/10/96	53	187	32	39
10/10/96	53	191	52	46
10/10/96	53	195	51	46
10/10/96	53	199	33	36

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/10/96	53	203	31	42
10/10/96	53	207	41	36
10/10/96	53	211	42	44
10/10/96	53	215	39	41
10/10/96	53	219	64	51
10/10/96	53	223	27	48
10/10/96	53	227	63	50
10/10/96	53	231	25	36
10/10/96	53	235	26	36
10/10/96	53	239	37	40
10/10/96	53	243	50	41
10/10/96	53	247	38	40
10/10/96	53	251	17	42
10/10/96	53	255	36	42
10/10/96	55	171	49	38
10/10/96	55	175	28	32
10/10/96	55	179	31	36
10/10/96	55	183	57	50
10/10/96	55	187	28	36
10/10/96	55	191	46	45
10/10/96	55	195	63	47
10/10/96	55	199	27	36
10/10/96	55	203	38	44
10/10/96	55	207	45	41
10/10/96	55	211	44	44
10/10/96	55	215	39	39
10/10/96	55	219	36	47
10/10/96	55	223	59	58
10/10/96	55	227	72	57
10/10/96	55	231	42	44
10/10/96	55	235	36	39
10/10/96	55	239	50	40
10/10/96	55	243	10	34
10/10/96	55	247	27	43
10/10/96	55	251	94	61
10/10/96	55	255	66	59
10/10/96	57	171	16	29
10/10/96	57	175	22	28
10/10/96	57	179	32	29
10/10/96	57	183	39	41
10/10/96	57	187	25	29
10/10/96	57	191	39	36
10/10/96	57	195	37	44
10/10/96	57	199	38	39
10/10/96	57	203	59	46
10/10/96	57	207	41	43

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/10/96	57	211	29	41
10/10/96	57	215	27	37
10/10/96	57	219	31	44
10/10/96	57	223	90	63
10/10/96	57	227	44	54
10/10/96	57	231	40	45
10/10/96	57	235	45	41
10/10/96	57	239	39	46
10/10/96	57	243	57	46
10/10/96	57	247	47	50
10/10/96	57	251	79	60
10/10/96	57	255	45	55
10/10/96	59	171	21	32
10/10/96	59	175	46	37
10/10/96	59	179	17	30
10/10/96	59	183	67	41
10/10/96	59	187	16	29
10/10/96	59	191	27	32
10/10/96	59	195	48	41
10/10/96	59	199	24	39
10/10/96	59	203	52	47
10/10/96	59	207	45	51
10/10/96	59	211	81	57
10/10/96	59	215	41	52
10/10/96	59	219	66	58
10/10/96	59	223	92	72
10/10/96	59	227	59	57
10/10/96	59	231	46	50
10/10/96	59	235	40	41
10/10/96	59	239	49	46
10/10/96	59	243	11	40
10/10/96	59	247	58	45
10/10/96	59	251	34	50
10/10/96	59	255	66	57
10/14/96	61	171	65	43
10/14/96	61	175	35	42
10/14/96	61	179	38	32
10/10/96	61	183	23	31
10/10/96	61	187	24	28
10/10/96	61	191	23	35
10/10/96	61	195	69	48
10/10/96	61	199	77	54
10/10/96	61	203	40	51
10/10/96	61	207	66	56
10/10/96	61	211	54	53
10/10/96	61	215	58	48

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/10/96	61	219	32	48
10/10/96	61	223	44	54
10/10/96	61	227	40	45
10/10/96	61	231	55	51
10/10/96	61	235	34	47
10/10/96	61	239	72	61
10/10/96	61	243	90	62
10/10/96	61	247	48	55
10/10/96	61	251	39	49
10/10/96	61	255	62	55
10/14/96	63	171	16	33
10/14/96	63	175	67	42
10/14/96	63	179	15	31
10/10/96	63	183	19	30
10/10/96	63	187	47	30
10/10/96	63	191	34	33
10/10/96	63	195	7	32
10/10/96	63	199	39	39
10/10/96	63	203	30	36
10/10/96	63	207	48	45
10/10/96	63	211	34	45
10/10/96	63	215	42	50
10/10/96	63	219	77	60
10/10/96	63	223	69	57
10/10/96	63	227	40	53
10/10/96	63	231	48	54
10/14/96	65	171	29	32
10/14/96	65	175	16	40
10/14/96	65	179	51	37
10/14/96	65	183	29	28
10/14/96	65	187	12	28
10/14/96	65	191	34	37
10/10/96	65	195	33	36
10/10/96	65	199	43	44
10/10/96	65	203	48	42
10/10/96	65	207	59	49
10/10/96	65	211	49	45
10/10/96	65	215	52	49
10/10/96	65	219	65	58
10/10/96	65	223	37	52
10/10/96	65	227	68	64
10/10/96	65	231	92	67
10/14/96	67	171	29	40
10/14/96	67	175	86	54
10/14/96	67	179	34	47

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/14/96	67	183	28	38
10/14/96	67	187	40	38
10/14/96	67	191	77	56
10/14/96	67	195	56	45
10/14/96	67	199	39	42
10/10/96	67	203	25	31
10/14/96	67	207	8	31
10/10/96	67	211	28	29
10/10/96	67	215	38	38
10/10/96	67	219	54	55
10/10/96	67	223	39	51
10/10/96	67	227	83	62
10/10/96	67	231	47	55
10/14/96	69	171	40	48
10/14/96	69	175	63	56
10/14/96	69	179	93	61
10/14/96	69	183	39	45
10/14/96	69	187	28	36
10/14/96	69	191	53	51
10/14/96	69	195	39	41
10/14/96	69	199	49	50
10/14/96	69	203	40	36
10/14/96	69	207	52	39
10/14/96	69	211	13	28
10/13/96	69	215	29	35
10/10/96	69	219	63	53
10/13/96	69	223	50	53
10/13/96	69	227	69	58
10/13/96	69	231	50	53
10/14/96	71	171	61	52
10/14/96	71	175	31	49
10/14/96	71	179	44	49
10/14/96	71	183	46	43
10/14/96	71	187	25	36
10/14/96	71	191	82	52
10/14/96	71	195	23	42
10/14/96	71	199	50	52
10/14/96	71	203	26	31
10/14/96	71	207	52	38
10/14/96	71	211	21	29
10/14/96	71	215	36	38
10/10/96	71	219	61	52
10/13/96	71	223	80	54
10/13/96	71	227	24	45
10/13/96	71	231	35	46

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/14/96	73	171	69	59
10/14/96	73	175	39	52
10/14/96	73	179	61	53
10/14/96	73	183	39	42
10/14/96	73	187	19	30
10/14/96	73	191	30	39
10/14/96	73	195	41	50
10/14/96	73	199	125	64
10/14/96	73	203	16	36
10/14/96	73	207	31	34
10/14/96	73	211	25	22
10/14/96	73	215	5	30
10/10/96	73	219	45	40
10/13/96	73	223	40	44
10/13/96	73	227	39	41
10/13/96	73	231	66	54
10/14/96	75	171	60	63
10/14/96	75	175	102	59
10/14/96	75	179	36	55
10/14/96	75	183	58	46
10/14/96	75	187	35	34
10/14/96	75	191	0	29
10/14/96	75	195	88	48
10/14/96	75	199	20	42
10/14/96	75	203	25	30
10/14/96	75	207	24	29
10/14/96	75	211	27	28
10/14/96	75	215	66	43
10/10/96	75	219	29	41
10/13/96	75	223	39	42
10/13/96	75	227	29	36
10/13/96	75	231	74	52
10/14/96	77	171	55	54
10/14/96	77	175	13	42
10/14/96	77	179	91	51
10/14/96	77	183	42	43
10/14/96	77	187	43	37
10/14/96	77	191	26	28
10/14/96	77	195	52	44
10/14/96	77	199	35	38
10/14/96	77	203	34	34
10/14/96	77	207	17	26
10/14/96	77	211	11	26
10/14/96	77	215	63	45
10/10/96	77	219	60	47
10/13/96	77	223	37	38

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/13/96	77	227	13	27
10/13/96	77	231	18	32
10/14/96	79	171	70	51
10/14/96	79	175	11	31
10/14/96	79	179	13	26
10/14/96	79	183	18	22
10/14/96	79	187	9	20
10/14/96	79	191	13	18
10/14/96	79	195	24	31
10/14/96	79	199	26	34
10/14/96	79	203	56	42
10/14/96	79	207	28	30
10/14/96	79	211	21	26
10/14/96	79	215	30	36
10/10/96	79	219	36	41
10/13/96	79	223	28	34
10/13/96	79	227	20	32
10/13/96	79	231	24	34
10/14/96	81	171	42	45
10/14/96	81	175	29	31
10/14/96	81	179	5	29
10/14/96	81	183	29	25
10/14/96	81	187	27	27
10/14/96	81	191	30	33
10/14/96	81	195	26	35
10/14/96	81	199	51	47
10/14/96	81	203	56	51
10/14/96	81	207	38	39
10/14/96	81	211	25	34
10/14/96	81	215	34	45
10/10/96	81	219	89	60
10/13/96	81	223	61	53
10/13/96	81	227	77	57
10/13/96	81	231	33	49
10/14/96	83	171	42	48
10/14/96	83	175	61	44
10/14/96	83	179	32	41
10/14/96	83	183	13	27
10/14/96	83	187	28	32
10/14/96	83	191	27	38
10/14/96	83	195	21	37
10/14/96	83	199	70	54
10/14/96	83	203	60	55
10/14/96	83	207	27	44
10/14/96	83	211	32	36

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/14/96	83	215	44	44
10/10/96	83	219	35	49
10/13/96	83	223	39	49
10/13/96	83	227	69	64
10/13/96	83	231	94	71
10/14/96	85	171	70	58
10/14/96	85	175	63	62
10/14/96	85	179	120	73
10/14/96	85	183	48	54
10/14/96	85	187	65	68
10/14/96	85	191	122	74
10/14/96	85	195	85	67
10/14/96	85	199	83	78
10/14/96	85	203	90	74
10/14/96	85	207	96	66
10/14/96	85	211	52	55
10/14/96	85	215	75	61
10/10/96	85	219	52	57
10/13/96	85	223	26	50
10/13/96	85	227	66	65
10/13/96	85	231	86	72
10/14/96	87	171	17	39
10/14/96	87	175	29	39
10/14/96	87	179	73	54
10/14/96	87	183	26	39
10/14/96	87	187	78	53
10/14/96	87	191	24	43
10/14/96	87	195	11	35
10/14/96	87	199	40	44
10/14/96	87	203	37	42
10/14/96	87	207	28	41
10/14/96	87	211	35	43
10/14/96	87	215	73	63
10/10/96	87	219	86	71
10/13/96	87	223	97	69
10/13/96	87	227	69	73
10/13/96	87	231	79	72
10/14/96	89	171	50	47
10/14/96	89	175	42	38
10/14/96	89	179	28	40
10/14/96	89	183	27	32
10/14/96	89	187	43	46
10/14/96	89	191	36	45
10/14/96	89	195	47	45
10/14/96	89	199	67	51

Table 1

Collection Date	Traverse	Sample Number	Microbial Values	Statistical Microbial Values
10/14/96	89	203	48	44
10/14/96	89	207	22	41
10/14/96	89	211	34	40
10/14/96	89	215	50	49
10/10/96	89	219	66	58
10/10/96	89	223	21	52
10/10/96	89	227	80	61
10/10/96	89	231	57	58
10/14/96	91	171	65	49
10/14/96	91	175	23	34
10/14/96	91	179	9	29
10/14/96	91	183	31	33
10/14/96	91	187	53	47
10/14/96	91	191	47	43
10/14/96	91	195	40	40
10/14/96	91	199	33	41
10/14/96	91	203	24	37
10/14/96	91	207	56	42
10/14/96	91	211	42	42
10/14/96	91	215	35	46
10/10/96	91	219	55	54
10/10/96	91	223	62	52
10/10/96	91	227	42	51
10/10/96	91	231	39	47

Figure 1

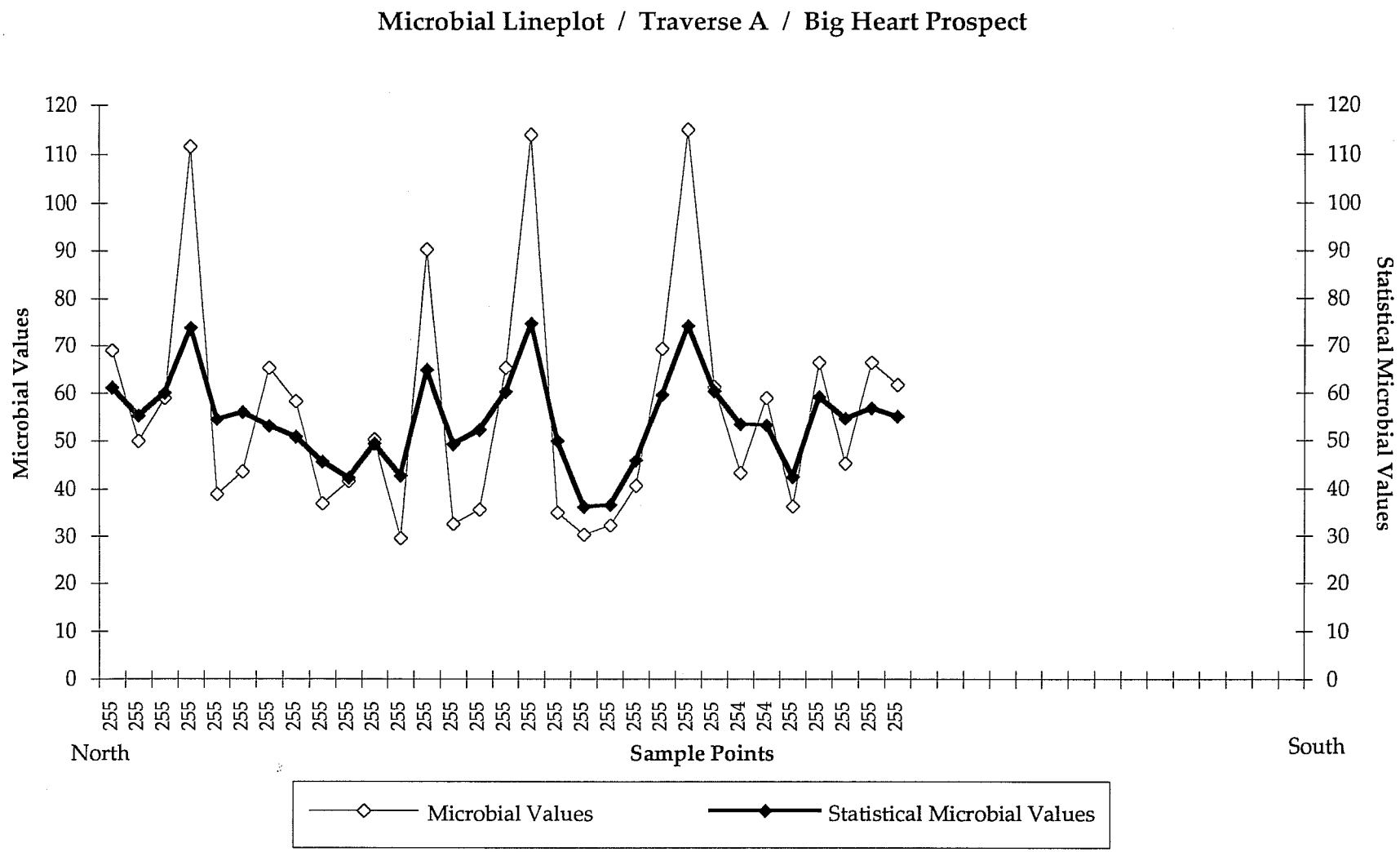

Microbial Lineplot / Traverse A / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 255 254 254 255 255 255 255 255
North
Sample Points
South
Microbial Values
Statistical Microbial Values

Figure 2

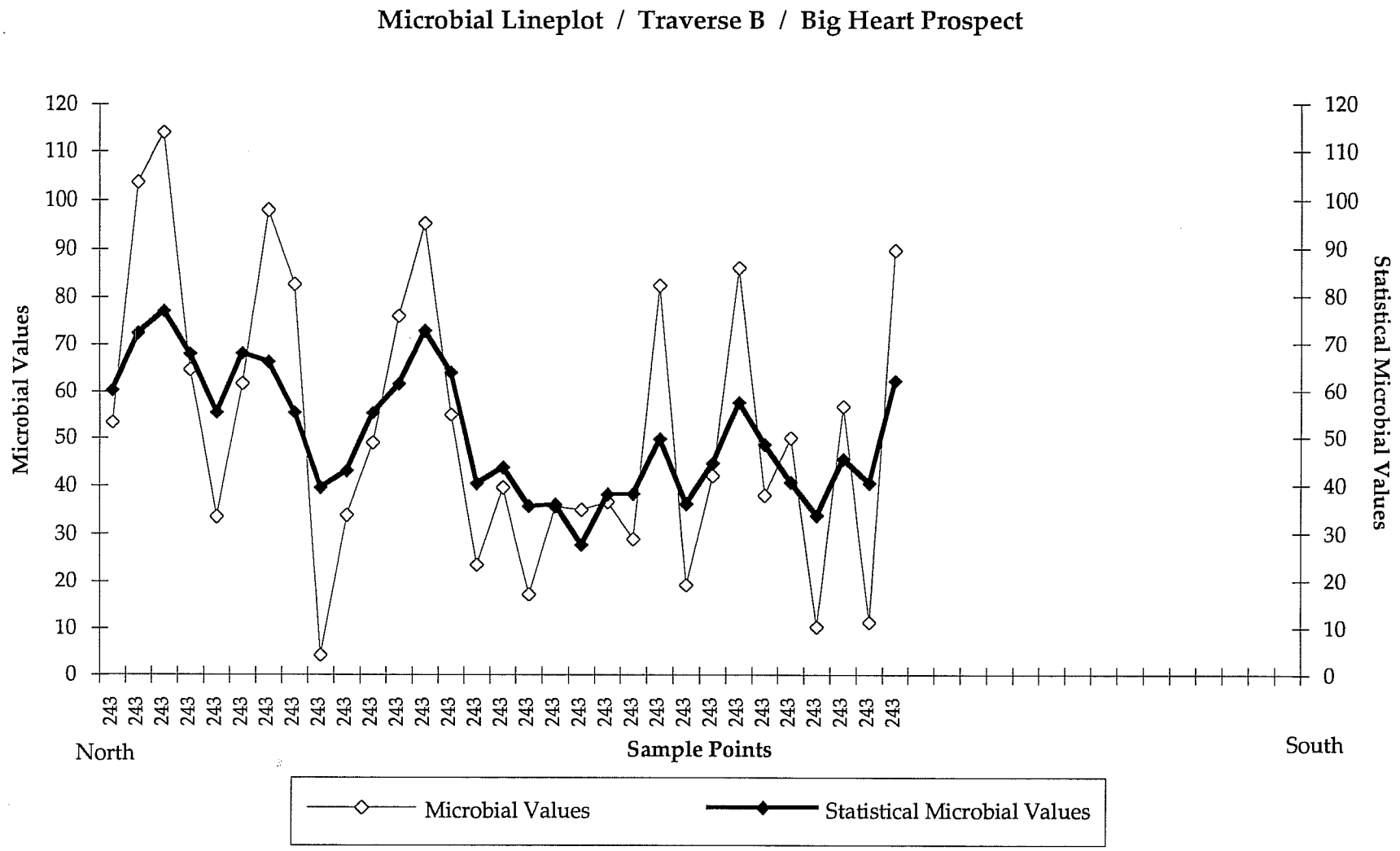

Microbial Lineplot / Traverse B / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
243
North
Sample Points
South
Microbial Values
Statistical Microbial Values

Figure 3

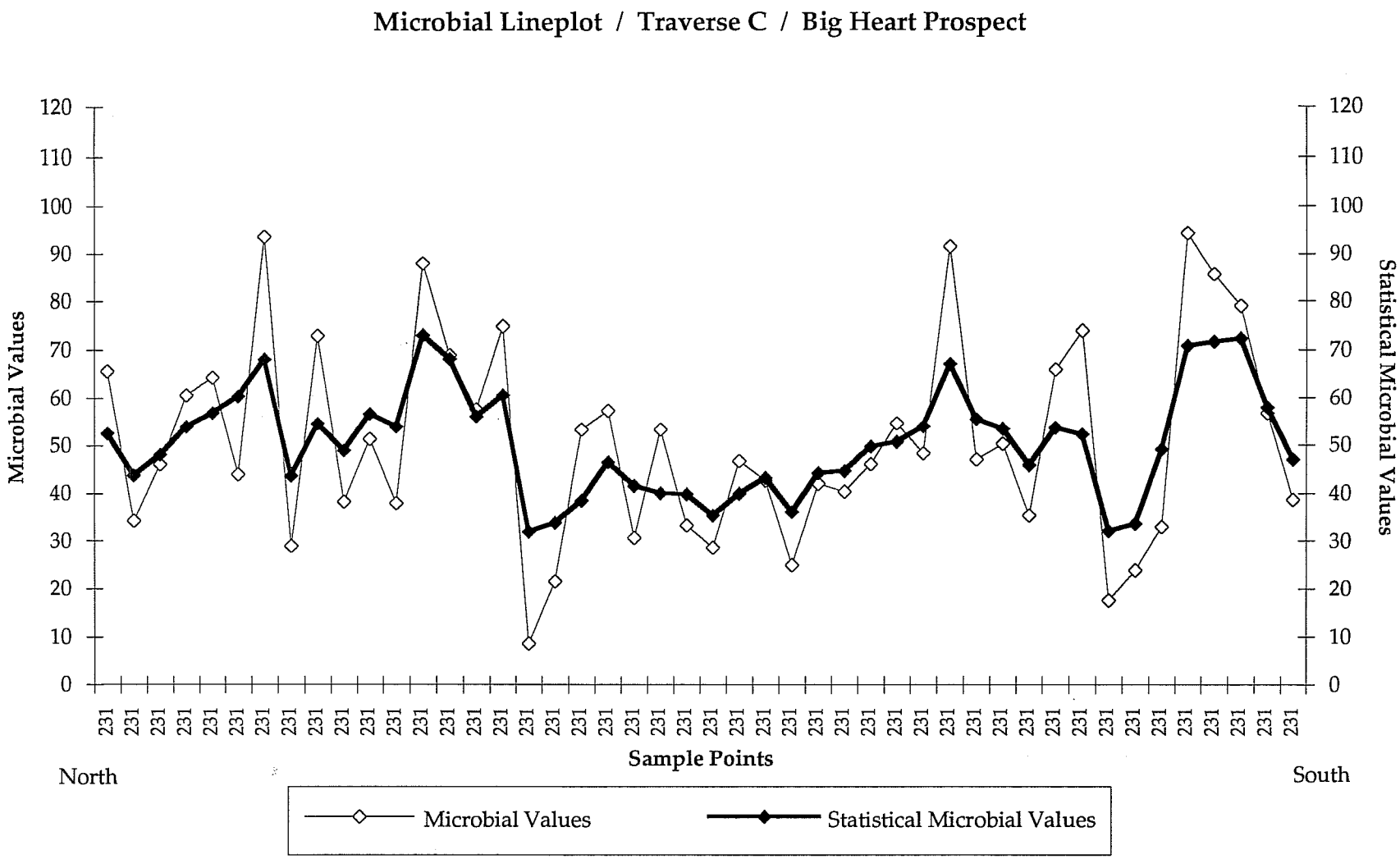

Microbial Lineplot / Traverse C / Big Heart Prospect
Microbial Values
Statistical Microbial Values
Sample Points
North
South
Microbial Values
Statistical Microbial Values

Figure 4

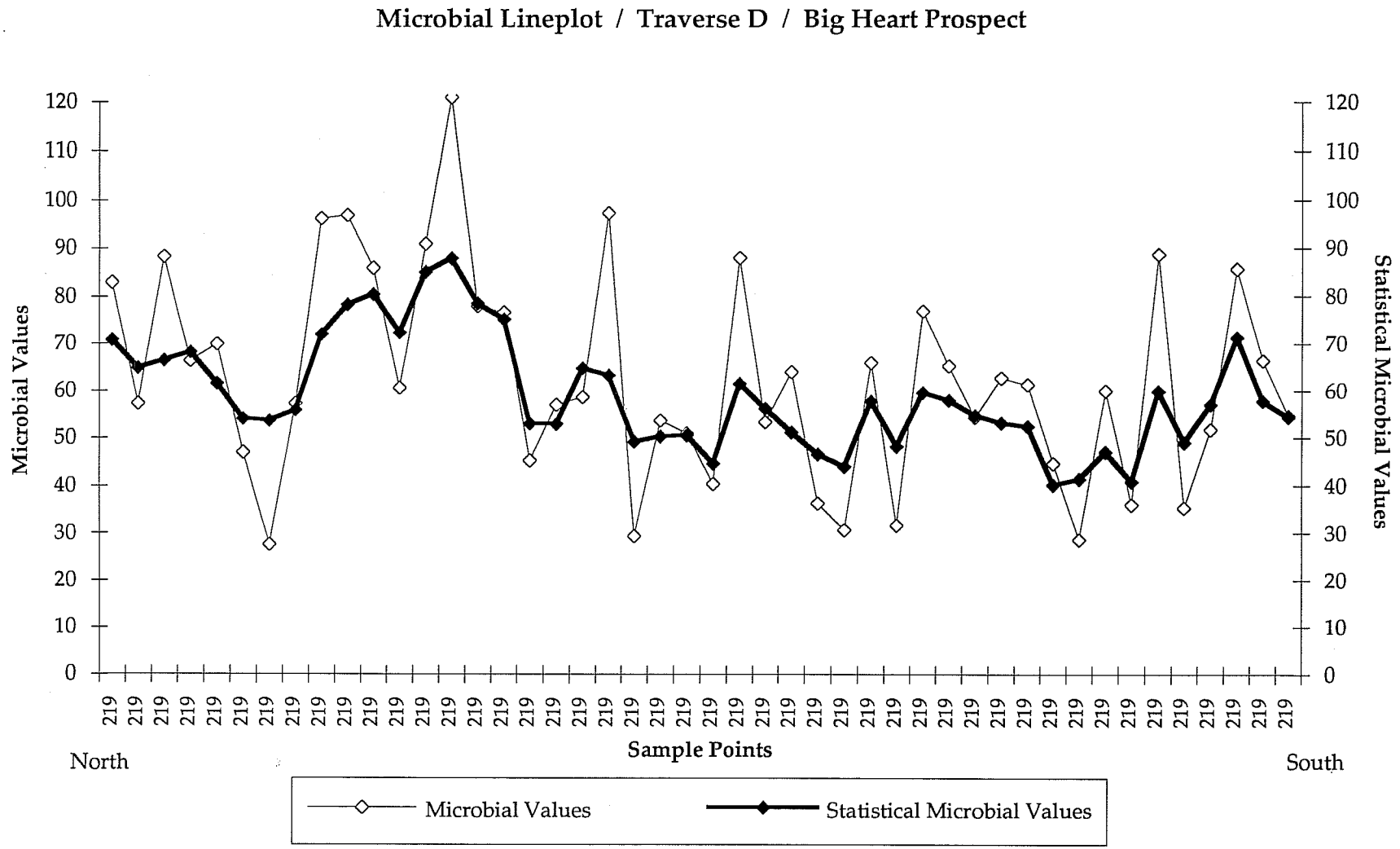

Microbial Lineplot / Traverse D / Big Heart Prospect
Microbial Values
Statistical Microbial Values
Sample Points
North
South
Microbial Values
Statistical Microbial Values

Figure 5

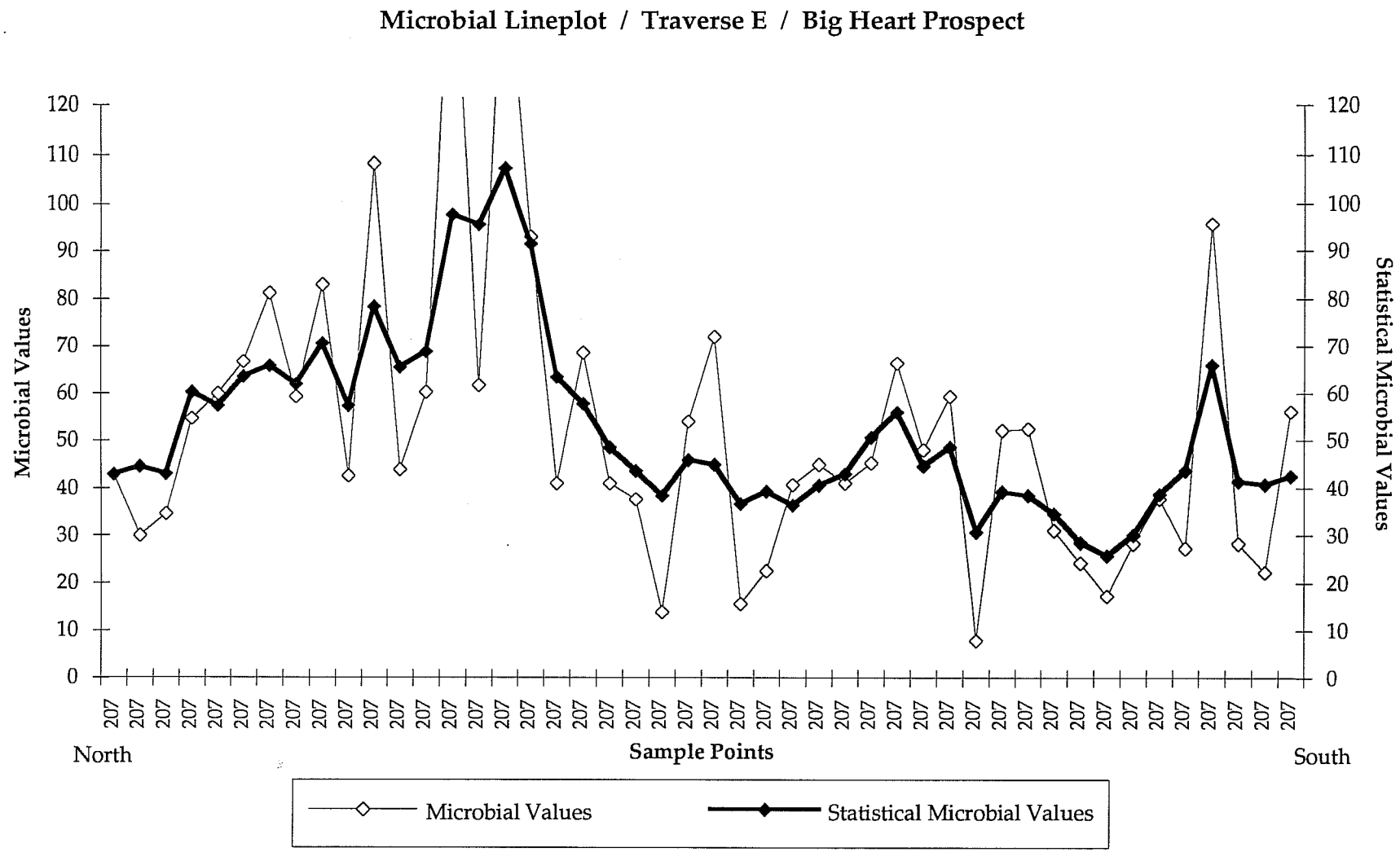

Microbial Lineplot / Traverse E / Big Heart Prospect
Microbial Values
Statistical Microbial Values
0
10
20
30
40
50
60
70
80
90
100
110
120
North
Sample Points
South
Microbial Values
Statistical Microbial Values

Figure 6

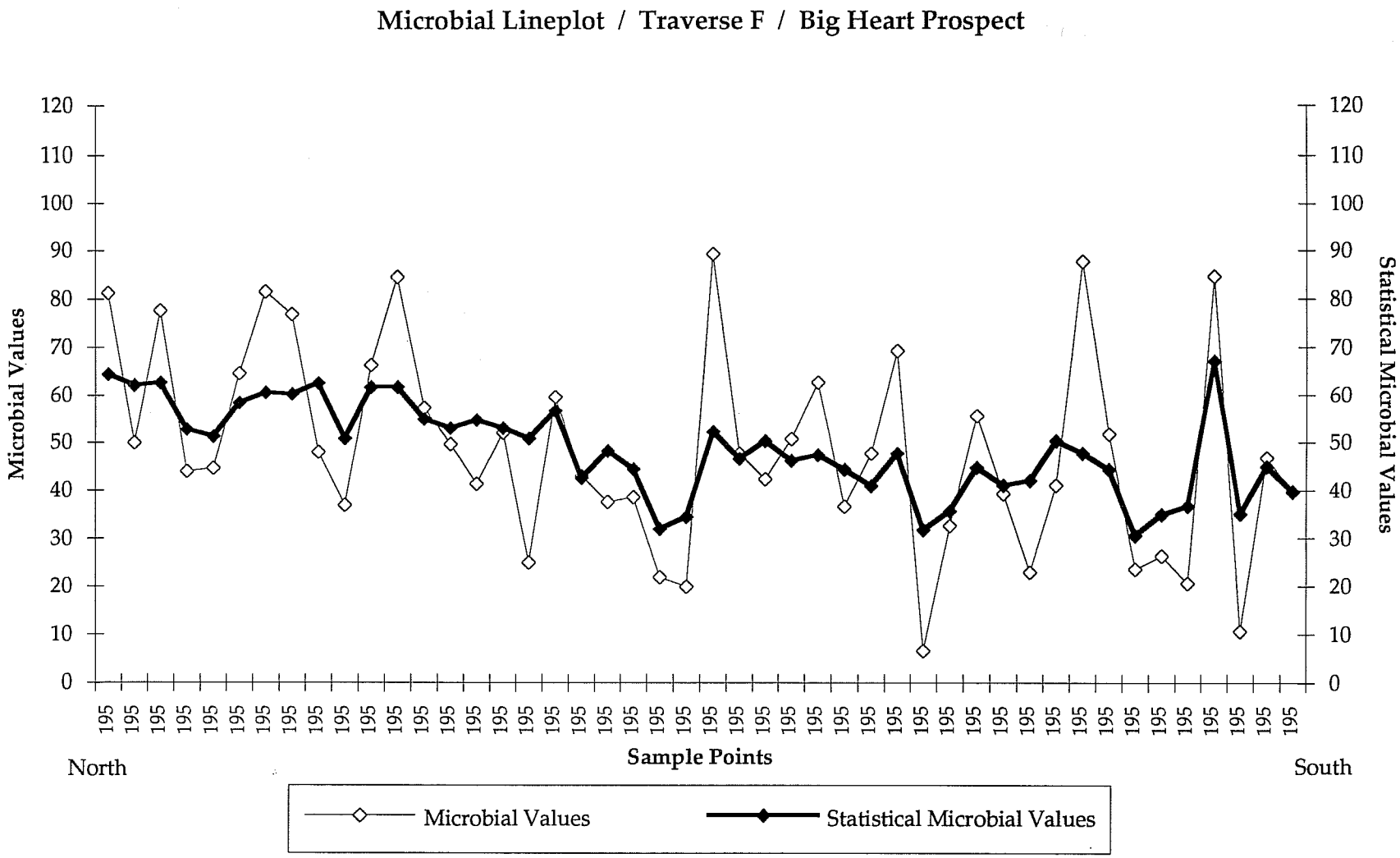

Microbial Lineplot / Traverse F / Big Heart Prospect
Microbial Values
Statistical Microbial Values
Sample Points
North
South
Microbial Values
Statistical Microbial Values

Figure 7

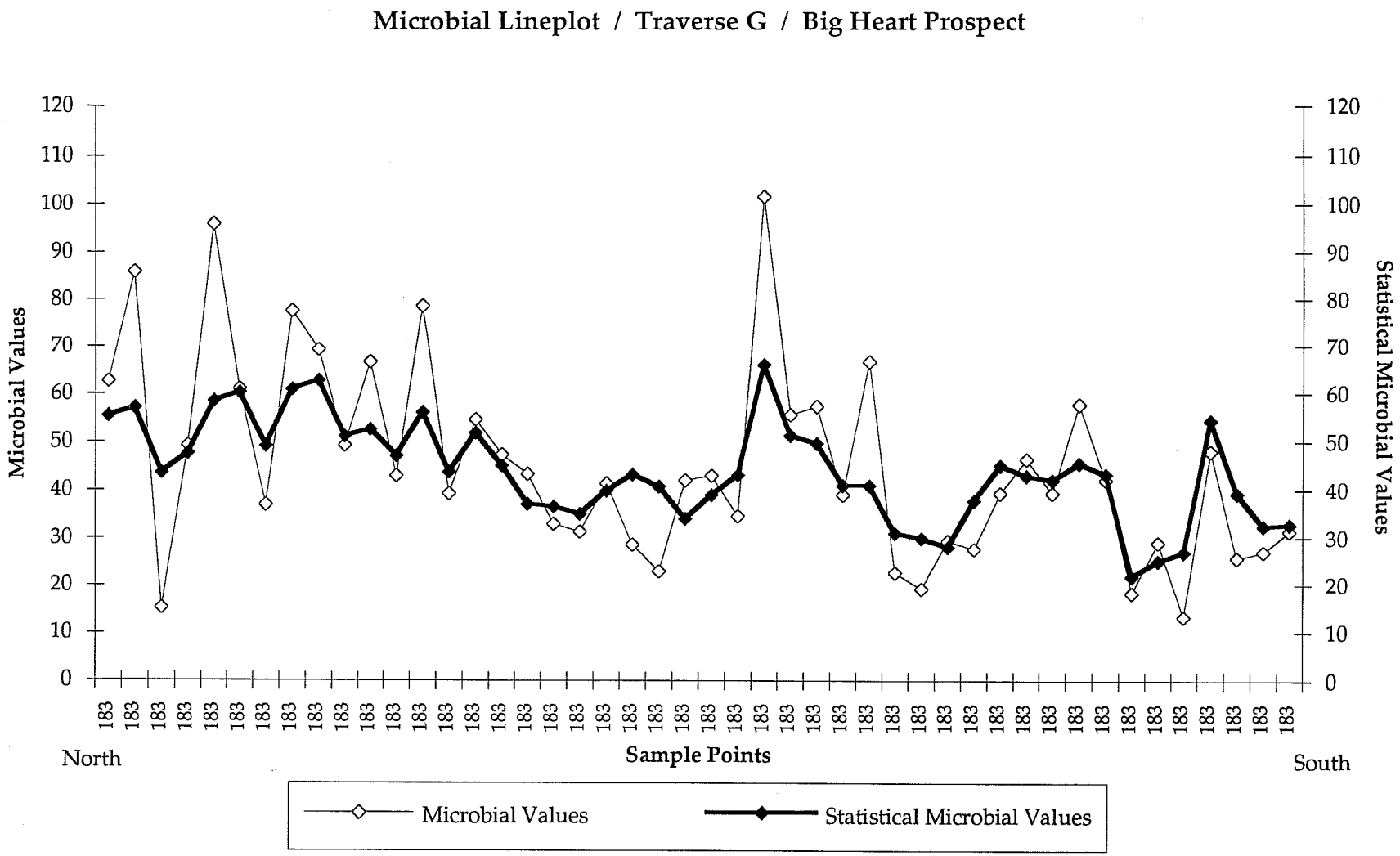

Microbial Lineplot / Traverse G / Big Heart Prospect
Microbial Values
Statistical Microbial Values
Sample Points
North
South
Microbial Values
Statistical Microbial Values

Figure 8

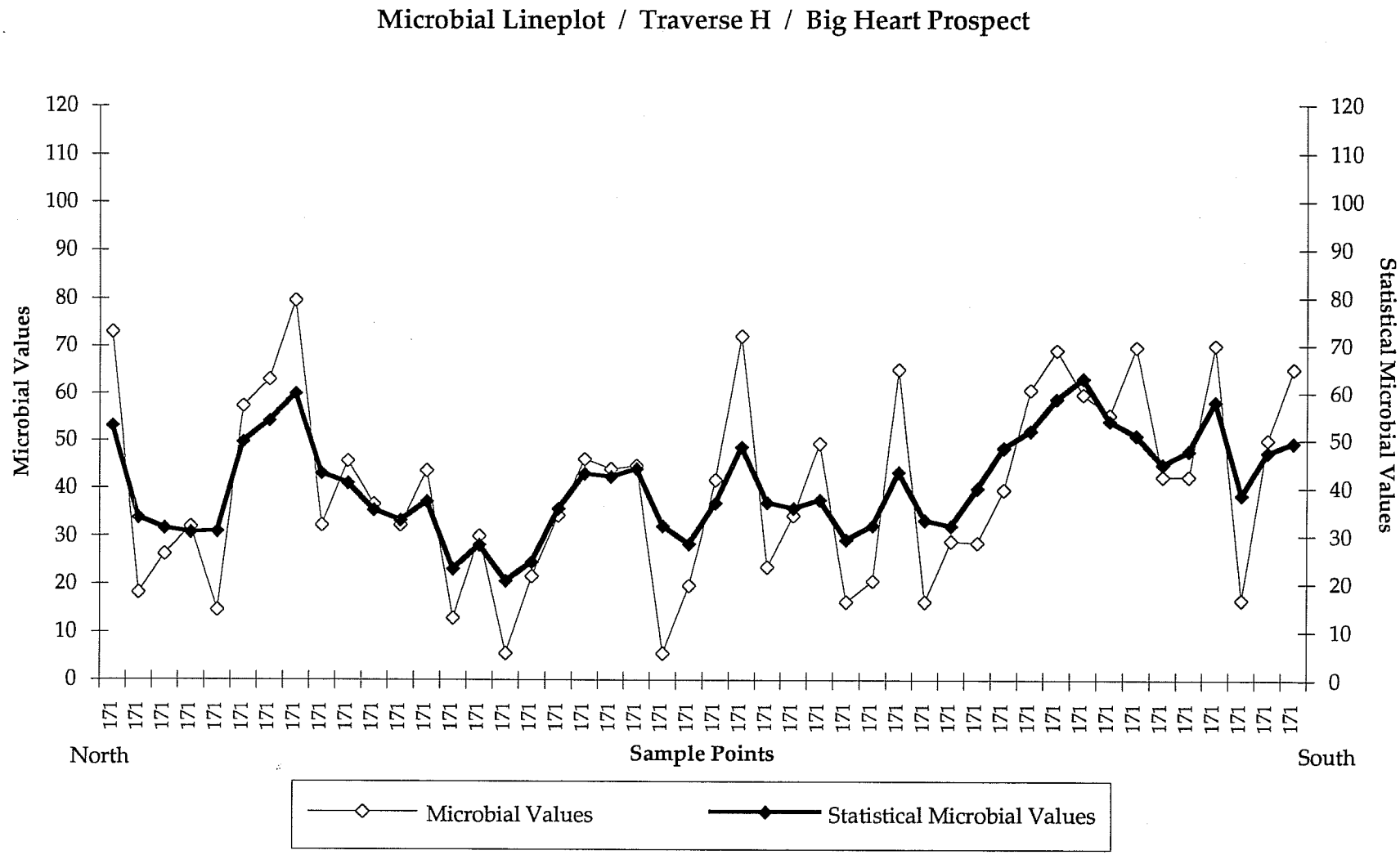

Microbial Lineplot / Traverse H / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
North
Sample Points
South
Microbial Values
Statistical Microbial Values

Figure 9

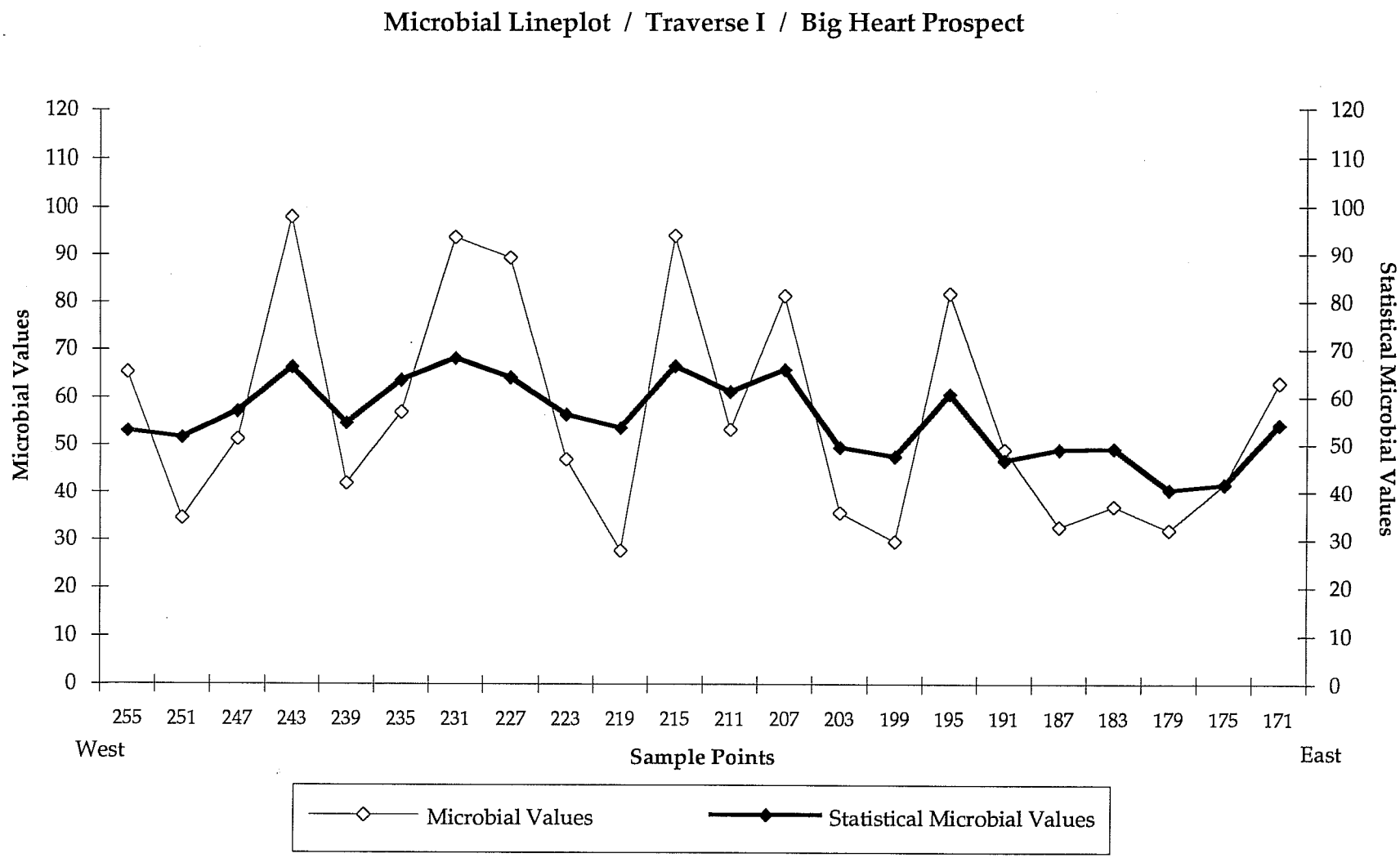

Microbial Lineplot / Traverse I / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 251 247 243 239 235 231 227 223 219 215 211 207 203 199 195 191 187 183 179 175 171
West
Sample Points
East
Microbial Values
Statistical Microbial Values

Figure 10

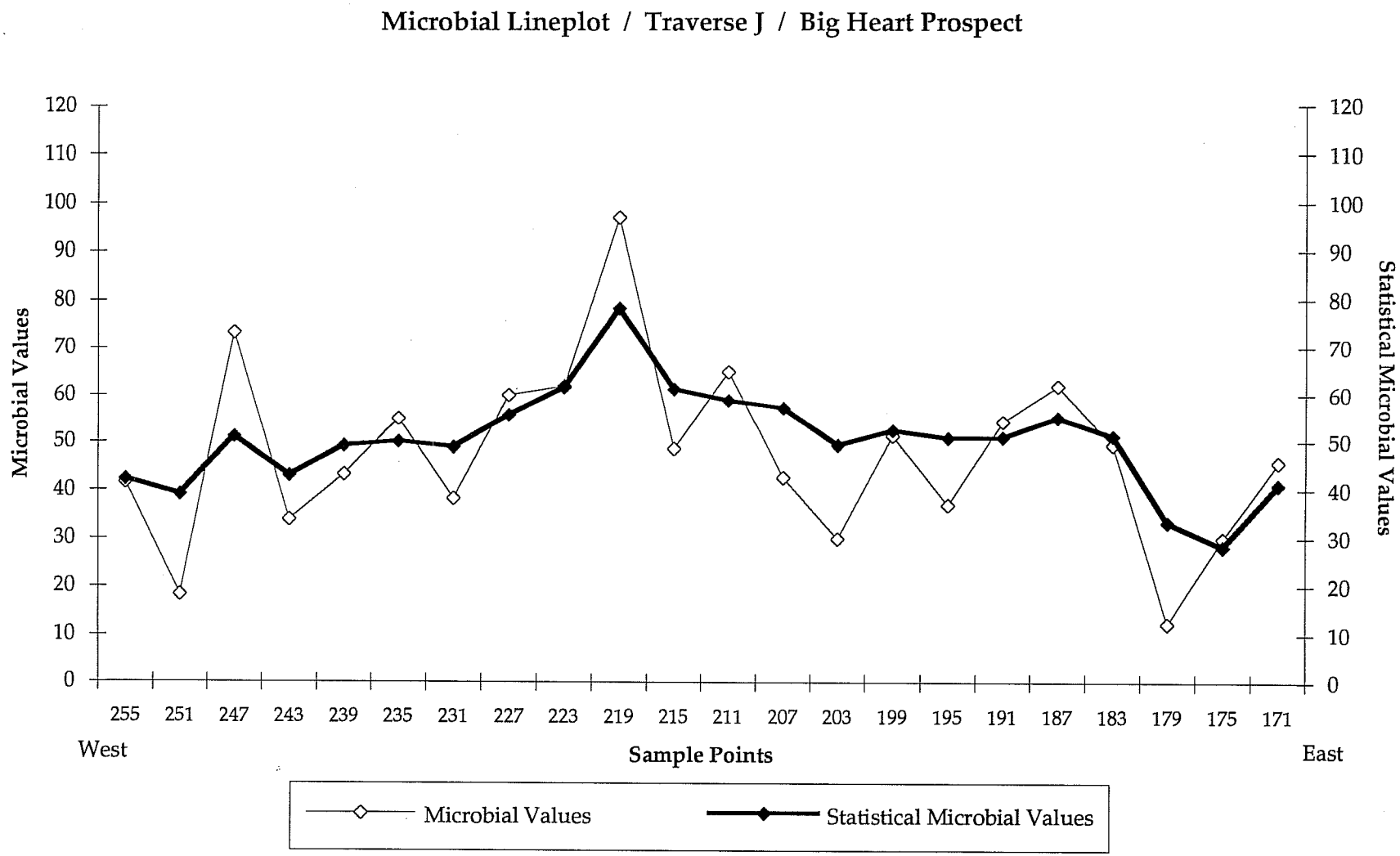

Microbial Lineplot / Traverse J / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 251 247 243 239 235 231 227 223 219 215 211 207 203 199 195 191 187 183 179 175 171
West
Sample Points
East
Microbial Values
Statistical Microbial Values

Figure 11

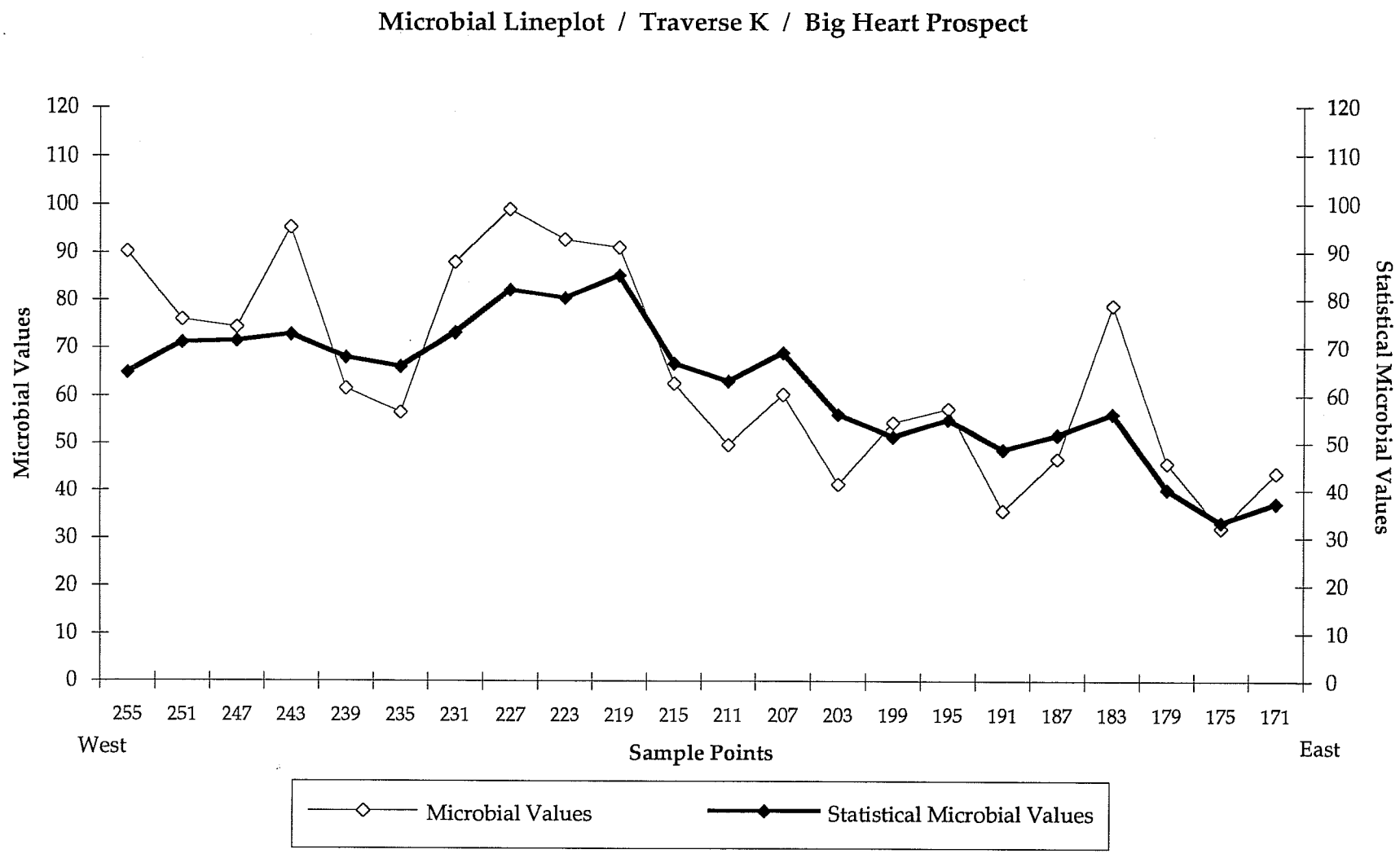

Microbial Lineplot / Traverse K / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 251 247 243 239 235 231 227 223 219 215 211 207 203 199 195 191 187 183 179 175 171
West
Sample Points
East
Microbial Values
Statistical Microbial Values

Figure 12

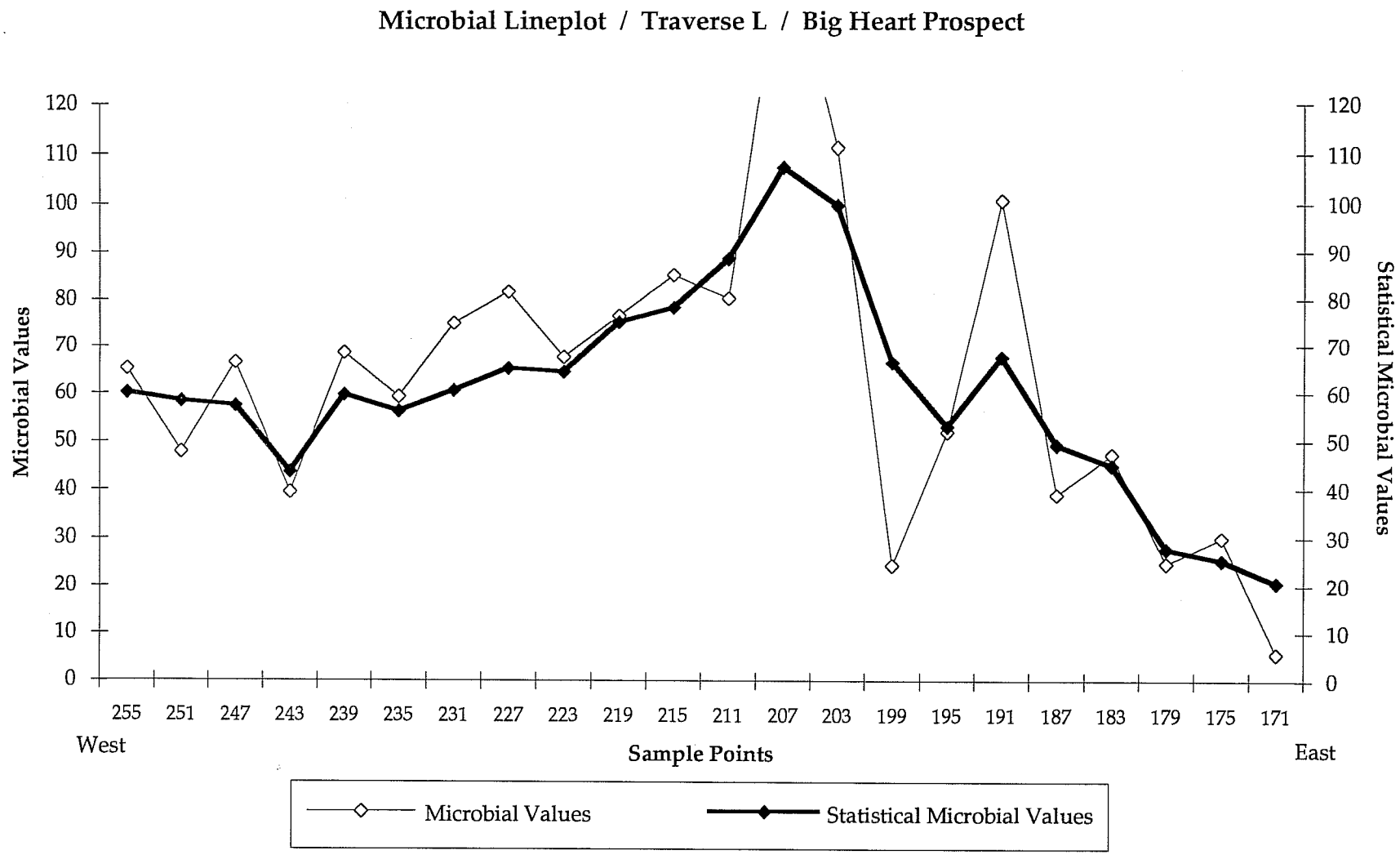

Microbial Lineplot / Traverse L / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 251 247 243 239 235 231 227 223 219 215 211 207 203 199 195 191 187 183 179 175 171
West
Sample Points
East
Microbial Values
Statistical Microbial Values

Figure 13

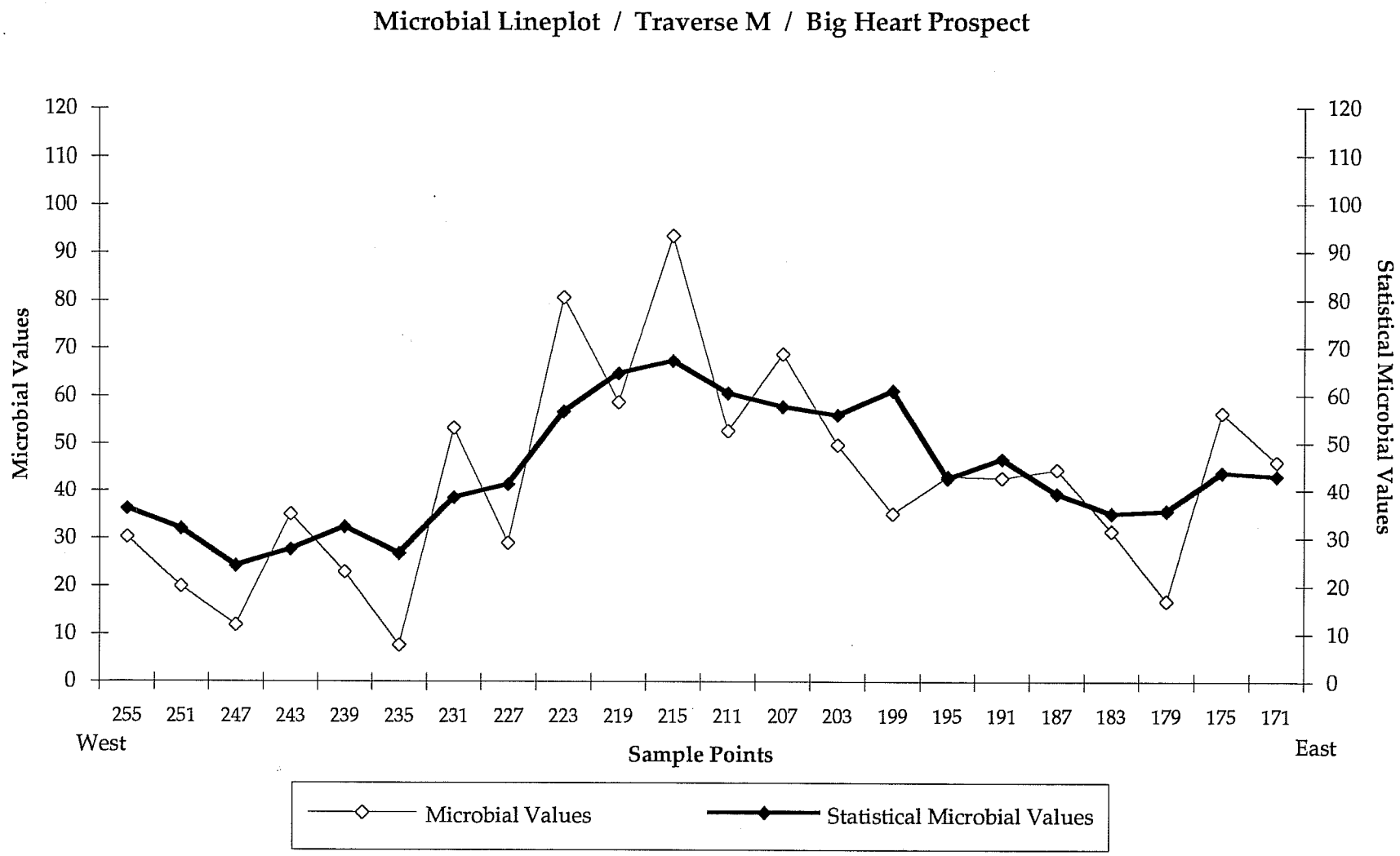

Microbial Lineplot / Traverse M / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 251 247 243 239 235 231 227 223 219 215 211 207 203 199 195 191 187 183 179 175 171
West
East
Sample Points
Microbial Values
Statistical Microbial Values

Figure 14

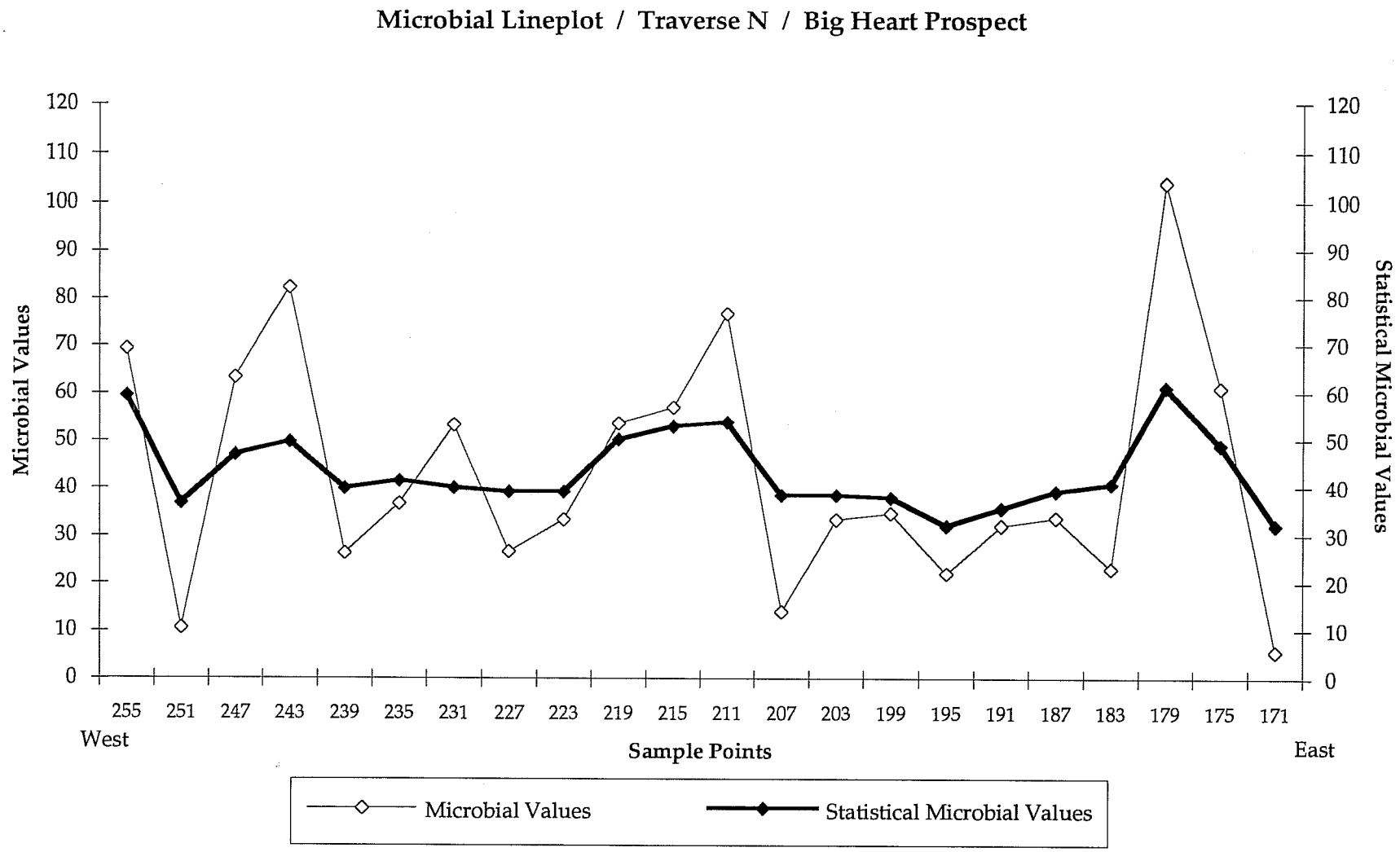
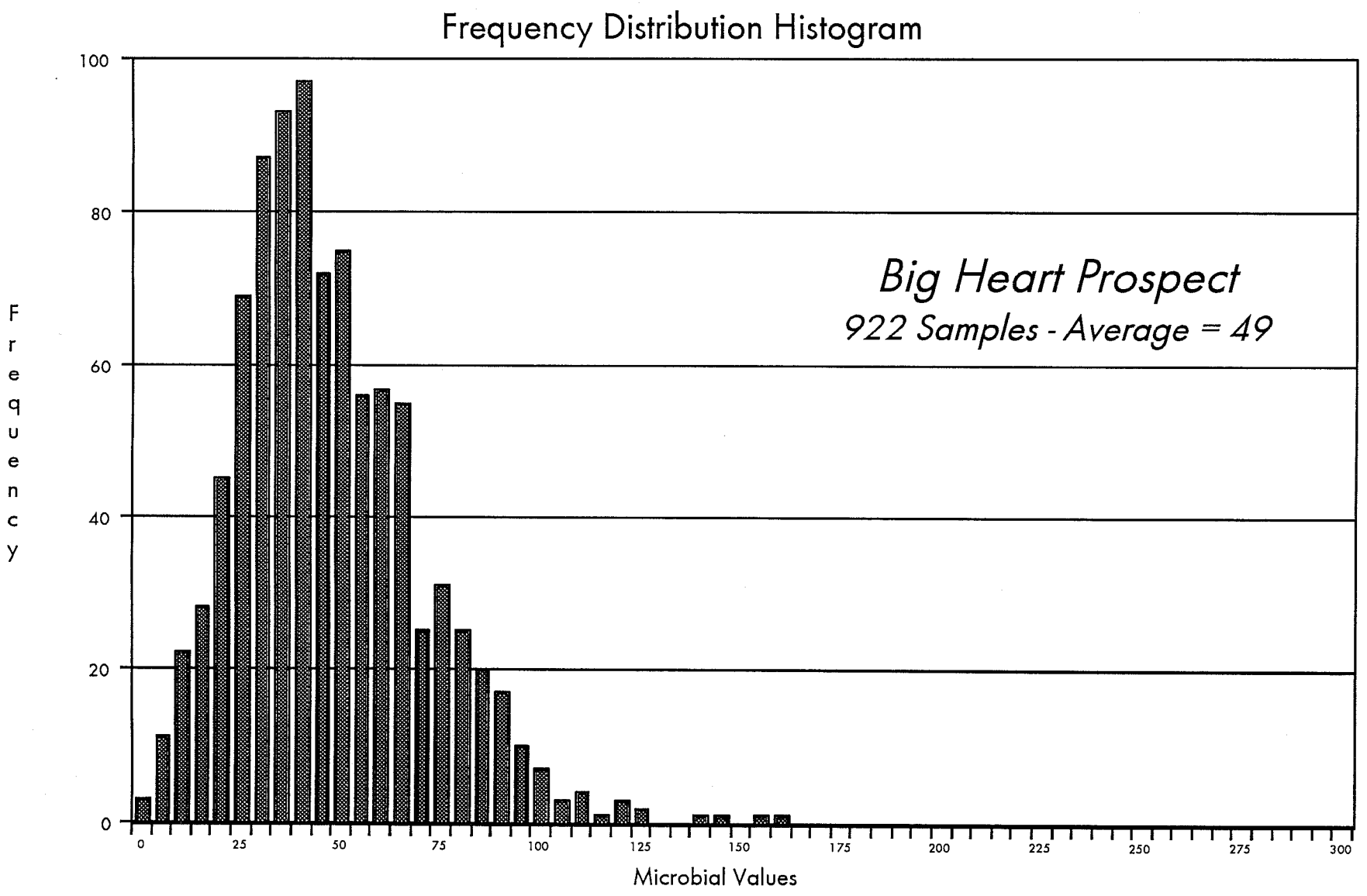

Microbial Lineplot / Traverse N / Big Heart Prospect
Microbial Values
Statistical Microbial Values
120
110
100
90
80
70
60
50
40
30
20
10
0
255 251 247 243 239 235 231 227 223 219 215 211 207 203 199 195 191 187 183 179 175 171
West
East
Sample Points
Microbial Values
Statistical Microbial Values

Figure 15


Frequency Distribution Histogram
Big Heart Prospect
922 Samples - Average = 49
Frequency
100
80
60
40
20
0
0
25
50
75
100
125
150
175
200
225
250
275
300
Microbial Values

MICROBIAL SURVEY

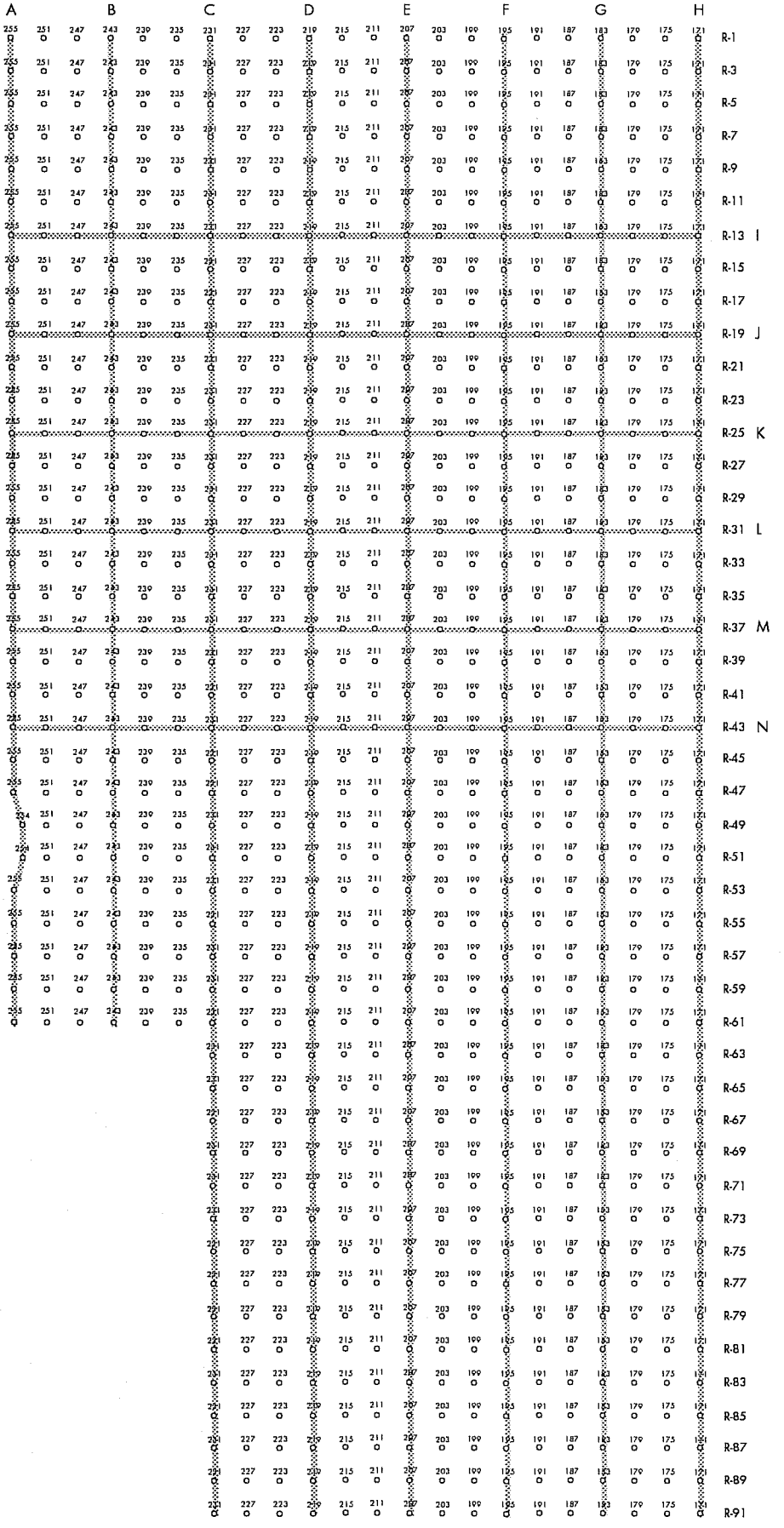
DOE / BDM / DLB

Big Heart Prospect

Osage County
Oklahoma

October 1996

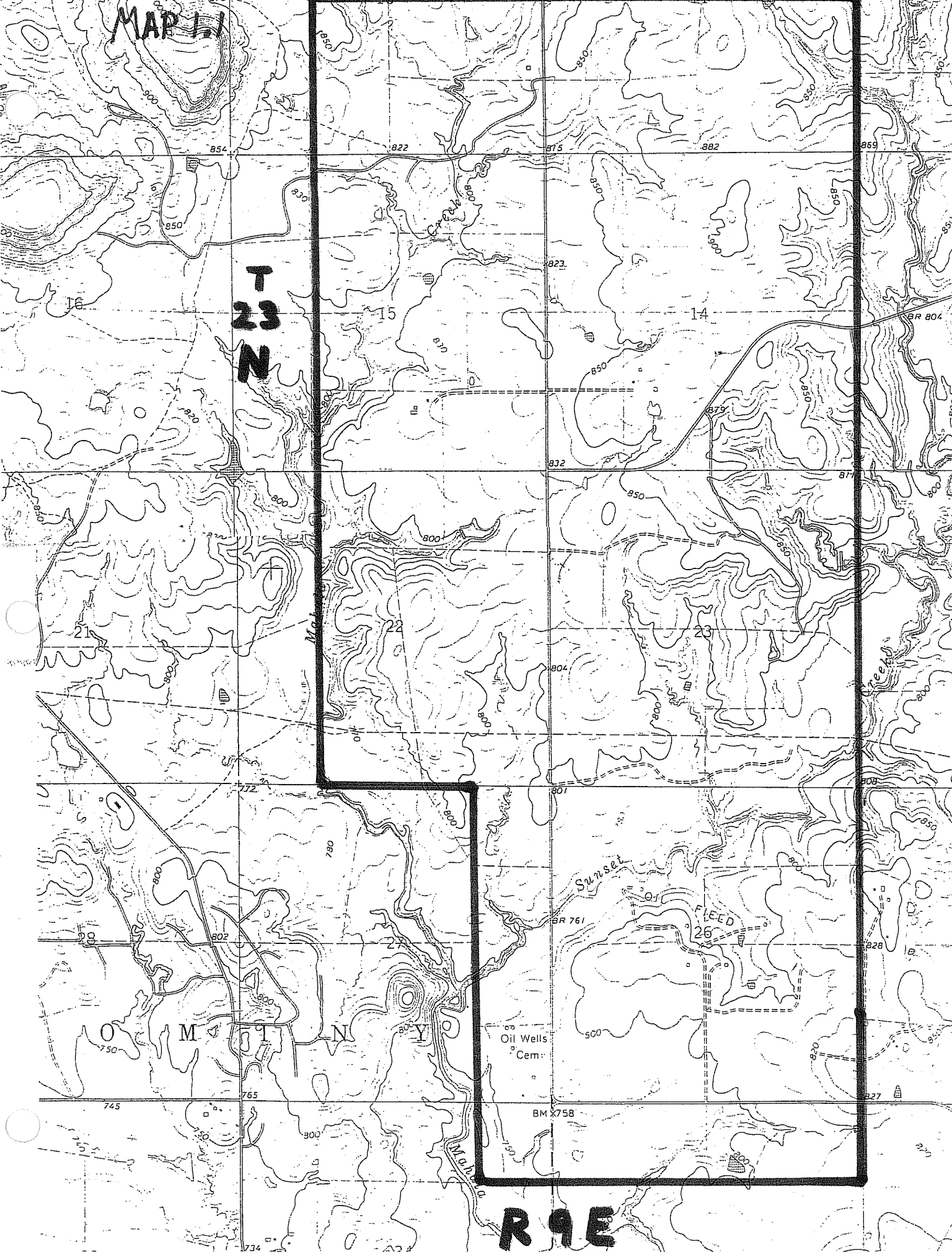
Geo-Microbial Technologies, Inc



Map 1
Sample Points
&
Lineplots

N

Scale: 1" = 880'
(Samples taken at 440' intervals)


MAP 1.1
T
23
N
16
15
14
21
22
23
28
27
26
Creek
Mahala
Sunset
OIL FIELD
BR 804
BR 761
O M I N Y
Oil Wells
Cem
BM 758
R9E

MICROBIAL SURVEY

DOE / BDM / DLB

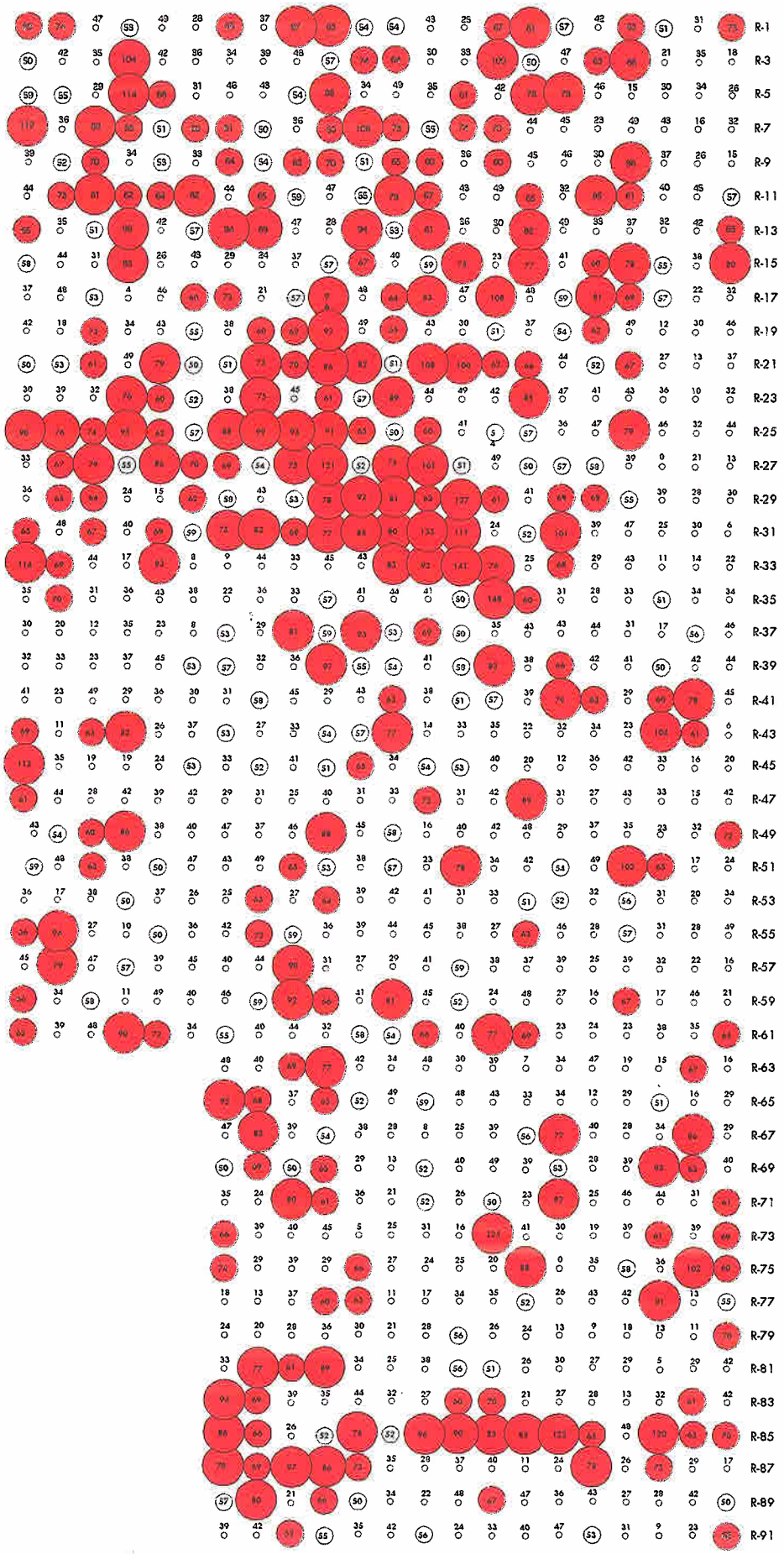
Big Heart Prospect

Osage County

Oklahoma

October 1996

Geo-Microbial Technologies, Inc.



Map 2
Microbial Values

≥75
60-74
50-59
≤49

N

Scale: 1" = 880'
(Samples taken at 440' intervals)

MICROBIAL SURVEY

DOE / BDM / DLB

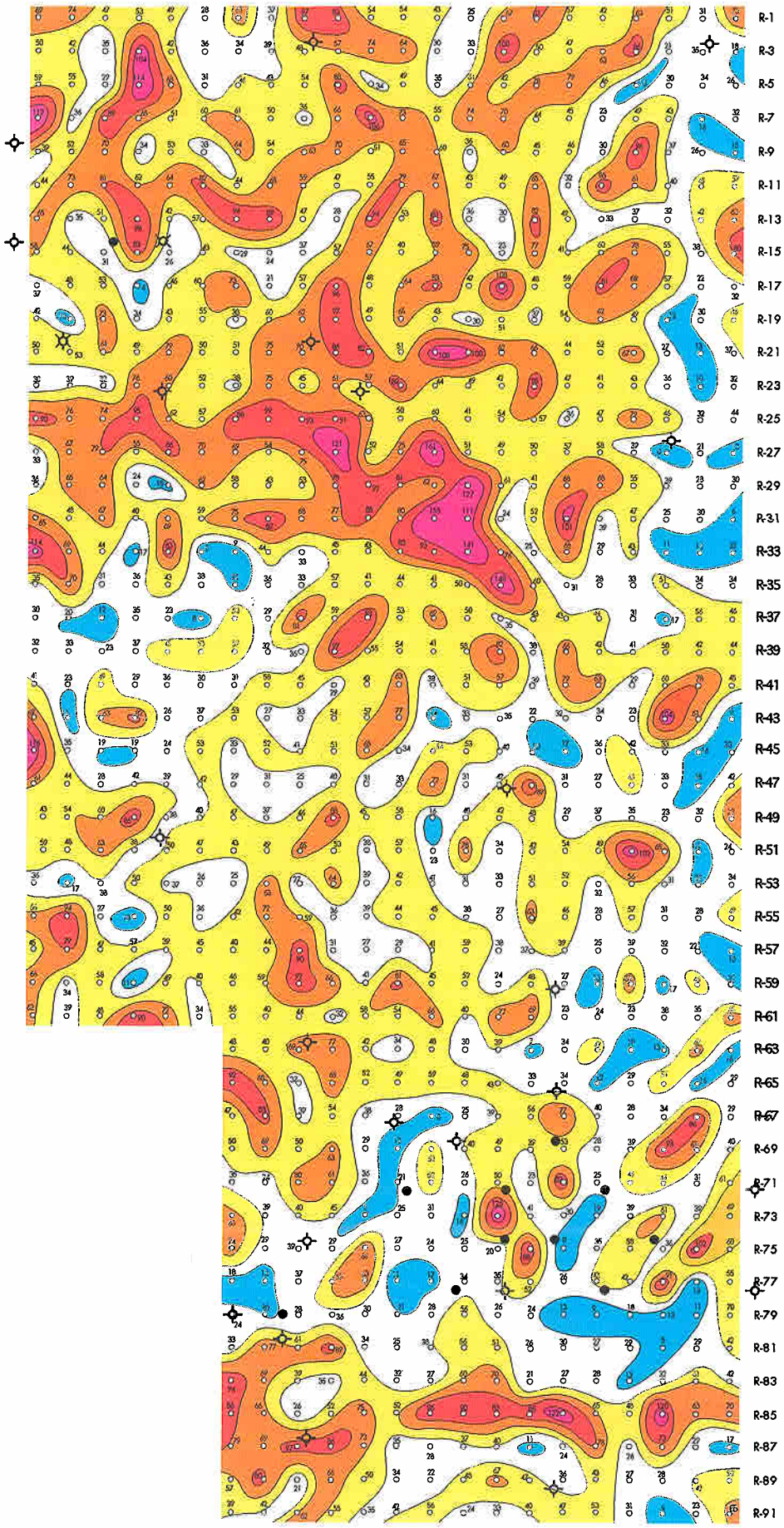
Big Heart Prospect

Osage County

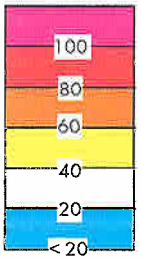
Oklahoma

October 1996

Geo-Microbial Technologies, Inc.



Map 2.1
Raw Microbial Contours
&
Production Sites



N

Scale: 1" = 880'
(Samples taken at 440' intervals)

MICROBIAL SURVEY

DOE / BDM / DLB

Big Heart Prospect

Osage County

Oklahoma

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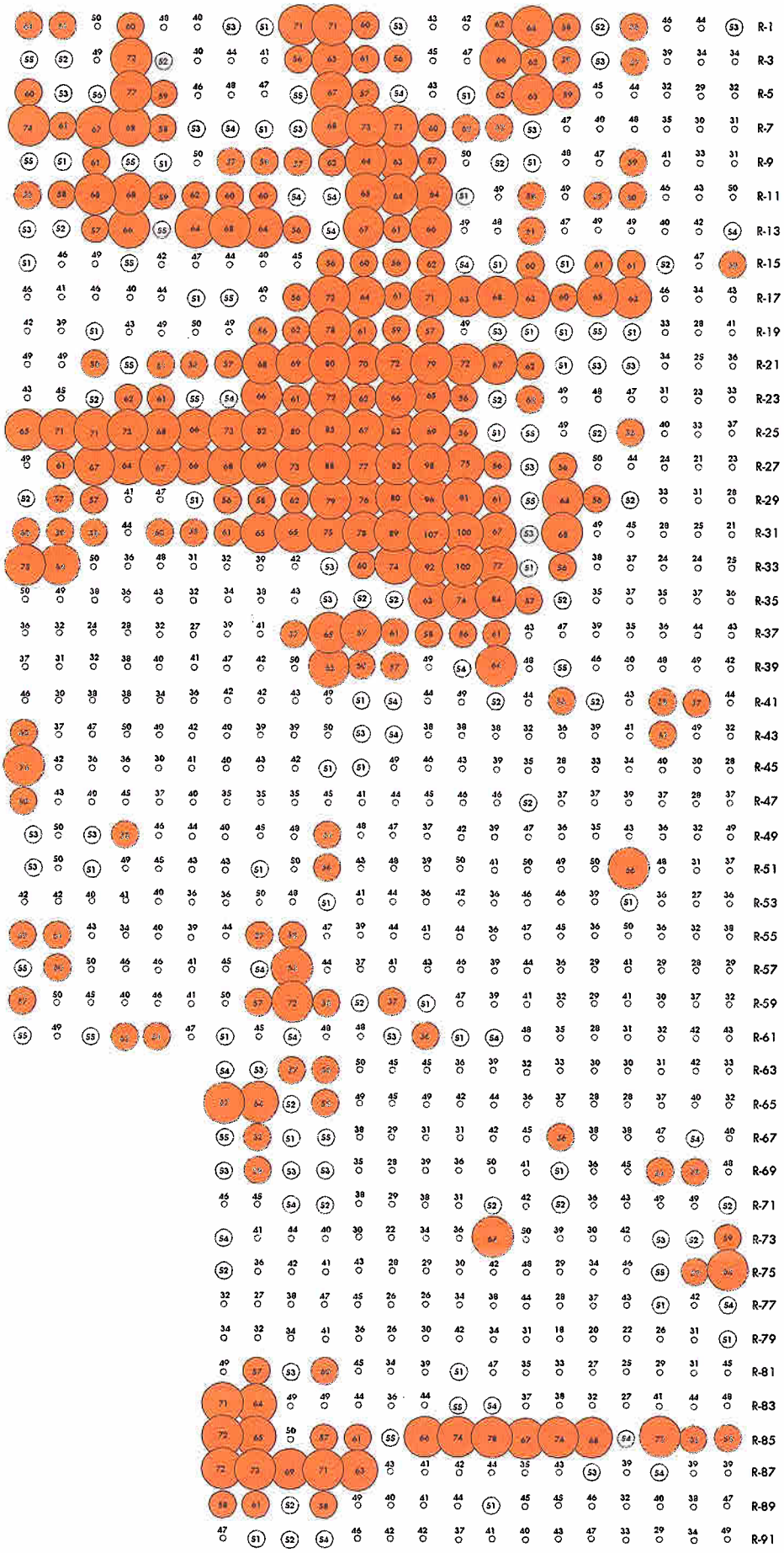


Map 3
Statistical Microbial Values

- ≥ 63
- 56 - 62
- 51 - 55
- ≤ 50

N

Scale: 1" = 880'
(Samples taken at 440' intervals)

MICROBIAL SURVEY

DOE / BDM / DLB

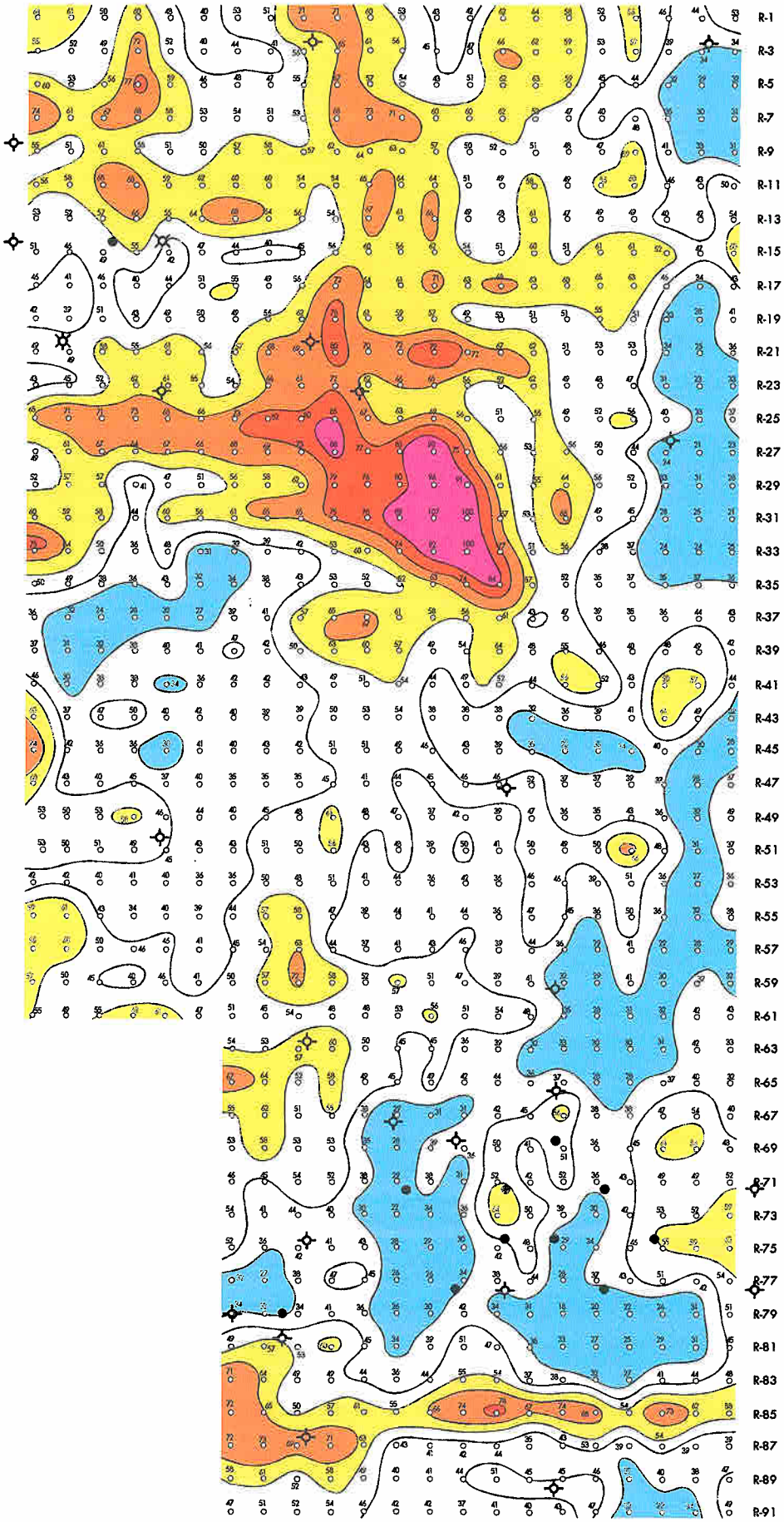
Big Heart Prospect

Osage County

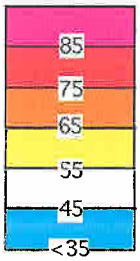
Oklahoma

October 1996

Geo-Microbial Technologies, Inc.



Map 3.1
Microbial Contours
&
Production Sites



Scale: 1" = 880'
(Samples taken at 440' intervals)