1987

Occurrence and distribution of shell in the vicinity of Parker's Rock, Pocomoke Sound

Carl H. Hobbs III

REPORT

to

Virginia Marine Resources Commission

concerning

OCCURRENCE AND DISTRIBUTION OF SHELL IN THE VICINITY OF PARKER'S ROCK, POCOMOKE SOUND

by

Carl H. Hobbs, III

Virginia Institute of Marine Science
College of William and Mary
School of Marine Science
Gloucester Point, Virginia 23062

September 1987

INTRODUCTION

This is a summary report on the investigation of the occurrence and distribution of shell in the vicinity of Parker's Rock, Pocomoke Sound. The investigation was performed by the Virginia Institute of Marine Science at the request and with the financial support of the Virginia Marine Resources Commission. The site (Figure 1) was selected, primarily, at the direction of the Commission, acting on the recommendation of its shell-dredging contractor and, secondarily, with supporting reconnaissance seismic data from VIMS.

METHODS

There were two distinct phases to the project's field work. The first was a detailed 3.5 kHz, seismic survey (Figure 2) of the study area. The second phase was the acquisition of a suite of eleven cores (Figure 1, Tables 1 and 2). The seismic data were used to assist in determining the specific locations at which cores would be taken and, following analysis of the individual cores, to provide some degree of correlation across the study area.

After returning to the laboratory, the cores were cut, logged (described) and sampled. Portions of the cores that contained more than a few shells were removed from the core and placed in separate containers for analysis. The analysis consisted of sieving each sample through 19 mm and 4 mm sieves, determining the volume of shell by displacement in water for each fraction, drying and weighing each fraction, and estimating the "loose packed" volume of each larger than 19 mm sample. These and other calculated data are presented in Tables 3, 4, 5, and 6.

In general, the material held on the 19 mm sieve consisted of intact half-shells and large fragments, and the material passing the 19 mm but held on the 4 mm sieve of small shell-hash. These samples have been kept and are available for inspection. The material passing the 4 mm sieve has been discarded. All the shells sampled were contained in a matrix of mud.

Table 3 describes the size and setting of each sample — the depth in the core of the top of the segment sampled (hence the thickness of overburden), the depth of the bottom of the sample section, by subtraction the length of the sampled segment, and the volume of the sample given a 3 inch inside diameter of the core tube.

Table 4 presents the weight of each sample fraction, the volumes determined both by measurement of displaced water and by estimation of bulk volume in a large, graduated beaker (the later for the greater than 19 mm fraction only), and the calculated density of each sample. The density was calculated as a check on the weight and displacement-volume measurements. Only one of the densities, that of a sample of the finer fraction, is suspect, the remainder are within the range of shell material.

The calculations of the volume-percent shell (Table 5) within the collected samples yielded results that were surprisingly low, ranging down from 11.3% for the combined fractions. These numbers, however, refer only to the volume of the shell material and not to the volume displaced by the loosely packed shell forms.

The percent shell bulk volume, which was calculated only for the greater than 19 mm fractions, is an attempt to estimate how the shell might pack in large quantities. Those numbers are somewhat larger, ranging from 6 to 16 percent by volume. However, it is evident that this still is not a good measure of the quantity of shell as it would be used in shell-seeding/repletion; the relatively small size of the sample, the nature of "packing" in a small rigid container and so on did not lend confidence the use of volume percent as means to measure the quantity of shell available in the study area for use in the repletion program.

Because of the difficulty with the volume-percent calculations, the weight of the shell in the sample is a better starting point for determining the quantity of shell available for use. Using the volume of the sampled section of the core and the weights of the shell in each sample-fraction (Table 4), it is relatively easy to calculate the weight of shell per cubic yard of material in the shell-bearing layer (Table 5). However as the thickness of the shell zone varies from location to location, it is better to normalize the pounds per cubic yard measure by dividing the thickness of the layer and to present the weight of shell per square yard of bottom (Table 6 and Figure 4). These calculations are presented only for the larger size-fraction as it is the intact half-shells that are of interest to the repletion program. These numbers then can be advanced and summed over the study area to estimate the quantity of shell that is available.

However, as shell repletion work usually is done by volume, it is desirable to obtain volumetric data. In an attempt to develop useful volumetric data, we weighed five-gallon buckets filled with loose shell. The average weight of five gallons of shell was determined to be 28 pounds. It should be noted that this figure is based on a limited number of samples and is subject to variation. The 28 pounds per five gallons of shell extends to 1,084 pounds per cubic yard. Rounding this to 1,000 pounds per cubic yard, we have a reasonable working number.

Hence using the pounds of shell per square yard of bottom and the pounds per cubic yard of shell data, it is now possible to develop an estimate of the quantity of shell available in the area. Although the bushel is the traditional unit of measure in shell work, the data here will be presented in both cubic yards and bushels. The size of a bushel, the number of cubic inches that define the measure, varies from application to application or state to state, thus the use of the more widely understood cubic yard. The Virginia bushel used here is 3003.9 cubic inches. Table 6 and Figure 5 present the number of cubic yards and bushels of shell per square yard of bottom.

Finally, by estimating the area of bottom for each concentration of shell, it is possible to develop figures for the total volume of shell potentially available to the repletion program.

RESULTS

The calculations and estimations indicate that there are approximately 233,250 cubic yards of shell (3,620,000 Virginia bushels at 15.5 bushels per cubic yard) under an area of approximately 1,200,000 square yards. This gives an average yield of about 0.2 cubic yards (3 bushels) of shell for each square yard of surface material disturbed. Figure 5 presents the number of cubic yards of shell per square yard of surface at each of the core sites and the area containing the deposit. Figure 3 shows the depth of the overburden at each site.

SUMMARY AND CONCLUSIONS

The deposit of oyster shell in the vicinity of Parker's Rock, Pocomoke Sound, is relatively low density and widely distributed. Most of the deposit is near the surface, there being little overburden, with the overlying material usually being mud. Should the engineering and economic considerations, which are not addressed by this report, prove the deposit suitable for exploitation, the Parker's Rock deposit should satisfy the repletion program for approximately three years at recent rates of utilization.

It is necessary to reiterate that the above figures are based on various estimates and assumptions, and they include a potential for a wide range of error. The validity of the numbers and hence the methods will not be known if or until tested by actual dredging. The method does appear quite useful in providing a preliminary quantification of the resource. Coring is both the most expensive and most important individual aspect of the work. A denser grid of cores would provide more conclusive evidence concerning the areal distribution and the thickness of the shell zone. The subbottom profiling does provide an indication of the areal distribution, but as with any form of remote sensing, its utility is enhanced by ground truth.

The subbottom profiling and more traditional probing both appear to be good methods to use in reconnaissance surveys. Indeed when used independently as in the Parker's Rock area, they provide reasonable confirmation of each other. If it were possible to employ only one method for reconnaissance survey, the choice might well be dictated by personal experience and preference; however, it should be noted that the subbottom profiling does provide a continuous record that can be interpreted by any number of individuals and does not rely solely upon the subjective judgements of one person.

TABLE 1

LOCATION OF CORES

Core	Loran		Latitude	Longitude
1	27243.0	41890.4	37°47.6472'	75°51.6943'
2	27243.0	41888.9	37°47.5257'	75°51.7543'
3	27242.9	41887.0	37°47.3708'	75°51.8088'
4	27243.1	41885.1	37°47.2215'	75°51.9264'
5	27243.0	41884.0	37°47.1302'	75°51.9489'
6	27242.2	41883.0	37°47.0304'	75°51.8207'
7	27245.5	41886.2	37°47.3673'	75°52.3865'
8	27245.1	41887.1	37°47.4307'	75°52.2665'
9	27243.9	41889.0	37°47.5555'	75°51.9392'
10	27242.0	41889.1	37°47.5186'	75°51.5364'
11	27241.1	41888.0	37°47.4081'	75°51.3913'

Latitude and longitude calculated from Loran data.

TABLE 2

PENETRATION AND RECOVERY

Core	Penetration Feet	Recovery Feet
1	38'0"	37'3"
2	25'0"	18'0"
3	29'0"	25'9"
4	40'0"	40'0"
5	40'0"	38'0"
6	40'0"	34'0"
7	36'0"	33'0"
8	40'0"	40'0"
9	29'0"	24'10"
10	36'0"	35'0"
11	33'0"	33'0"

TABLE 3

POSITION OF SAMPLES WITHIN CORES

Core	Sample #	Top of Layer	Bottom of Layer	Length (in)	Volume (in^3)
1	47	13'8"	16'3"	31	219.1
2	2-1	1'8"	2'8"	12	84.8
3	28	0	5'9"	69	487.7
	23	5'9"	8'3"	30	212.1
4	27	0	8'0"	96	678.6
5	32	0	8'0"	96	678.6
7	33	5'0"	7'8"	32	226.2
	4	12'0"	15'6"	42	296.9
8	5	0	10'0"	120	848.2
9	3	3'2"	4'10"	20	141.4

TABLE 4

WEIGHT AND VOLUME OF SHELLS WITHIN SAMPLES

Core	Sample #		Weight g	In Water Volume cm^3	g/cm^3	Loose Volume cm^3
1	47	>19 mm	155.84	70.0	2.2	300
		> 4 mm	153.80	75.0	2.1	
2	2-1	>19 mm	110.50	40.5	2.7	100
		> 4 mm	203.44	83.0	2.5	
3	28	>19 mm	262.66	125.0	2.1	500
		> 4 mm	935.91	395.0	2.4	
	23	>19 mm	277.37	123.0	2.3	500
		> 4 mm	304.63	121.0	2.5	
4	27	>19 mm	692.24	300.0	2.3	1100
		> 4 mm	963.14	400.0	2.4	
5	32	>19 mm	598.53	275.0	2.2	1150
		> 4 mm	949.79	383.0	2.5	
7	33	>19 mm	339.60	158.0	2.1	600
		> 4 mm	201.65	100.0	2.0	
	4	>19 mm	444.28	210.0	2.1	800
		> 4 mm	779.84	340.0	2.3	
8	5	>19 mm	629.92	270.0	2.3	1100
		> 4 mm	571.79	235.0	2.4	
9	3	>19 mm	152.28	70.0	2.2	250
		> 4 mm	132.78	75.0	1.7	

TABLE 5

CALCULATED VALUES

Core	Sample #		lbs Shell per yd^3 of Bottom		% Shell Displaced Volume		% Shell Bulk
1	47	19 mm	73	145	1.9	4.0	8.4
		4 mm	72		2.1		
2	2-1	19 mm	134	380	2.9	8.9	7.2
		4 mm	246		6.0		
3	28	19 mm	55	252	1.6	6.5	6.3
		4 mm	197		4.9		
	23	19 mm	134	281	3.5	7.0	14.4
		4 mm	147		3.5		
4	27	19 mm	105	251	2.7	6.3	9.9
		4 mm	146		3.6		
5	32	19 mm	91	235	2.5	5.9	10.3
		4 mm	144		3.4		
7	33	19 mm	154	246	4.3	7.0	16.2
		4 mm	92		2.7		
	4	19 mm	154	324	4.3	11.3	16.4
		4 mm	270		7.0		
8	4	19 mm	76	145	1.9	3.6	7.9
		4 mm	69		1.7		
9	3	19 mm	111	208	3.0	6.2	10.8
		4 mm	97		3.2		

TABLE 6

QUANTITY OF SHELL > 19 MM PER SQUARE YARD OF BOTTOM

Core	Pounds of shell per yd^3	Yd^3 of Shell per yd^2	Bushels per yd^2
1	63	0.063	1.0
2	45	0.045	0.7
3	217	0.217	3.4
4	279	0.279	4.3
5	241	0.241	3.7
7	317	0.317	5.1
8	254	0.254	3.9
9	62	0.062	0.09

Figure 1. Location map showing Watts Island, Parker's Rock oyster ground, the shell area described by the dredging contractor, and the sites of the eleven cores.

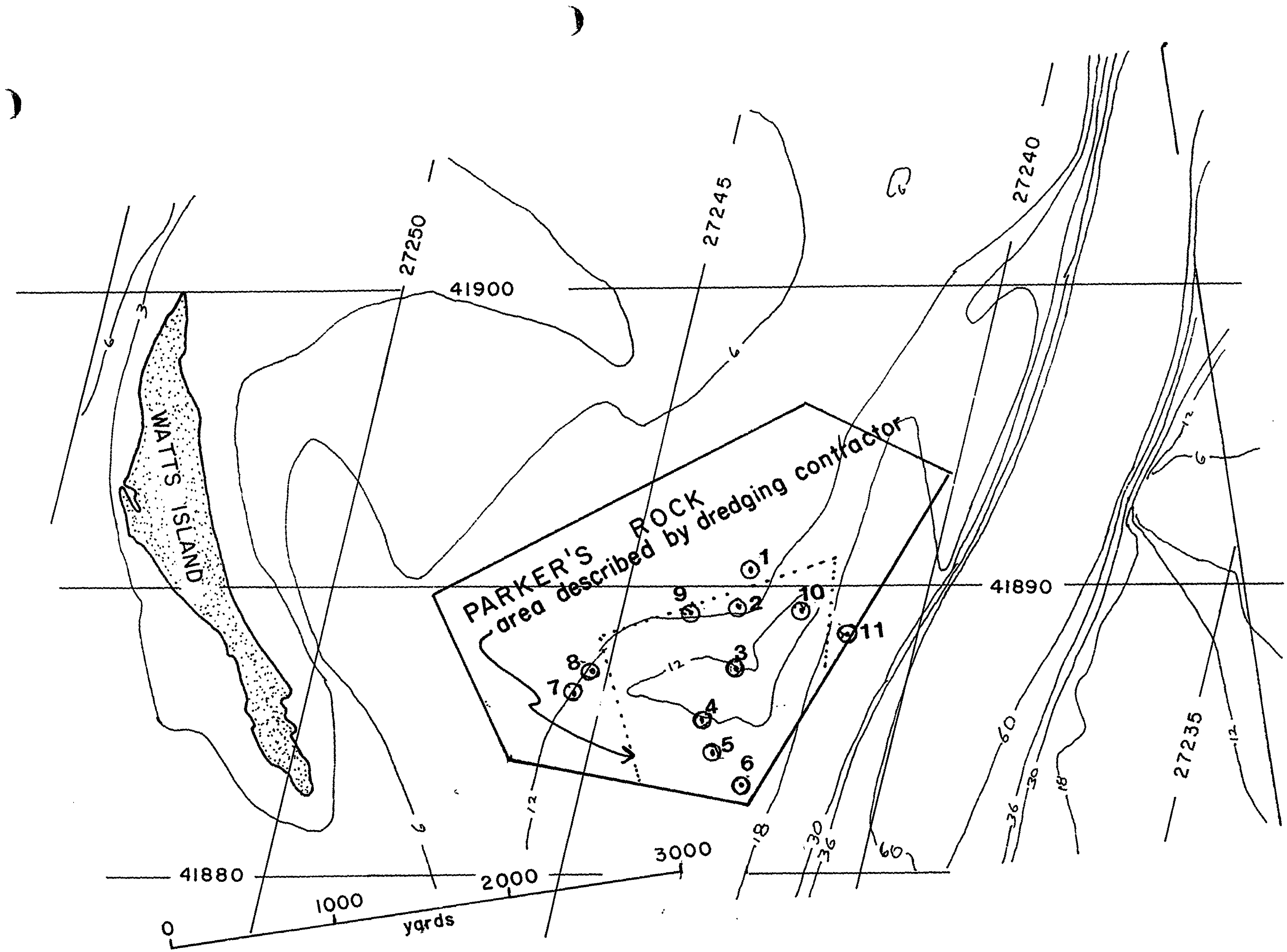

WATTS ISLAND
PARKER'S ROCK
area described by dredging contractor
27250
27245
27240
27235
41900
41890
41880
1
2
3
4
5
6
7
8
9
10
11
0
1000
2000
3000
yards

Figure 2. The detailed seismic grid shown over both LORAN and latitude-longitude grids.

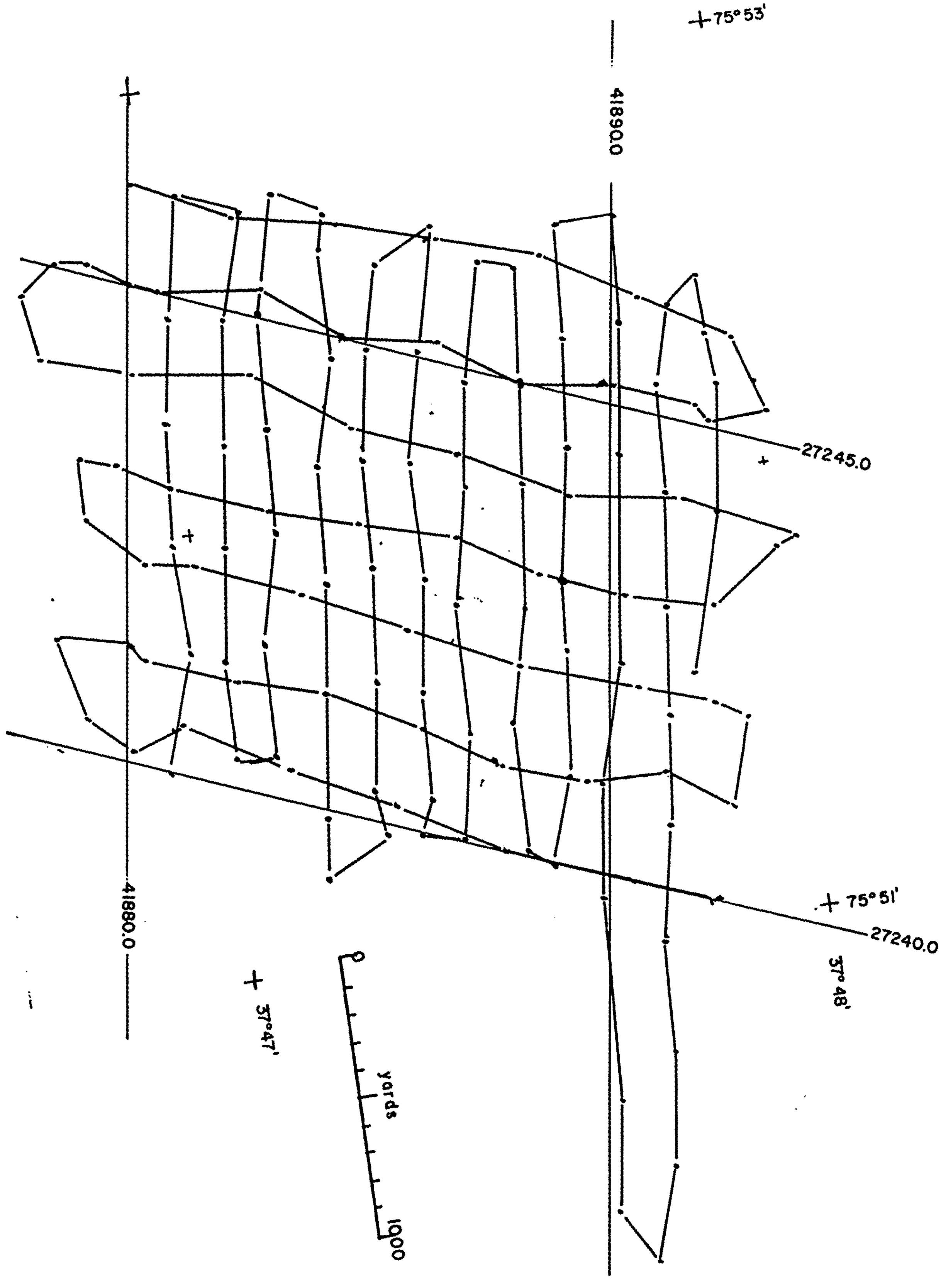

75°53'
41890.0
27245.0
75°51'
27240.0
37°48'
41880.0
37°47'
0
yards
1000

Figure 3. A map showing the amount of overburden above the shell zone in each core.

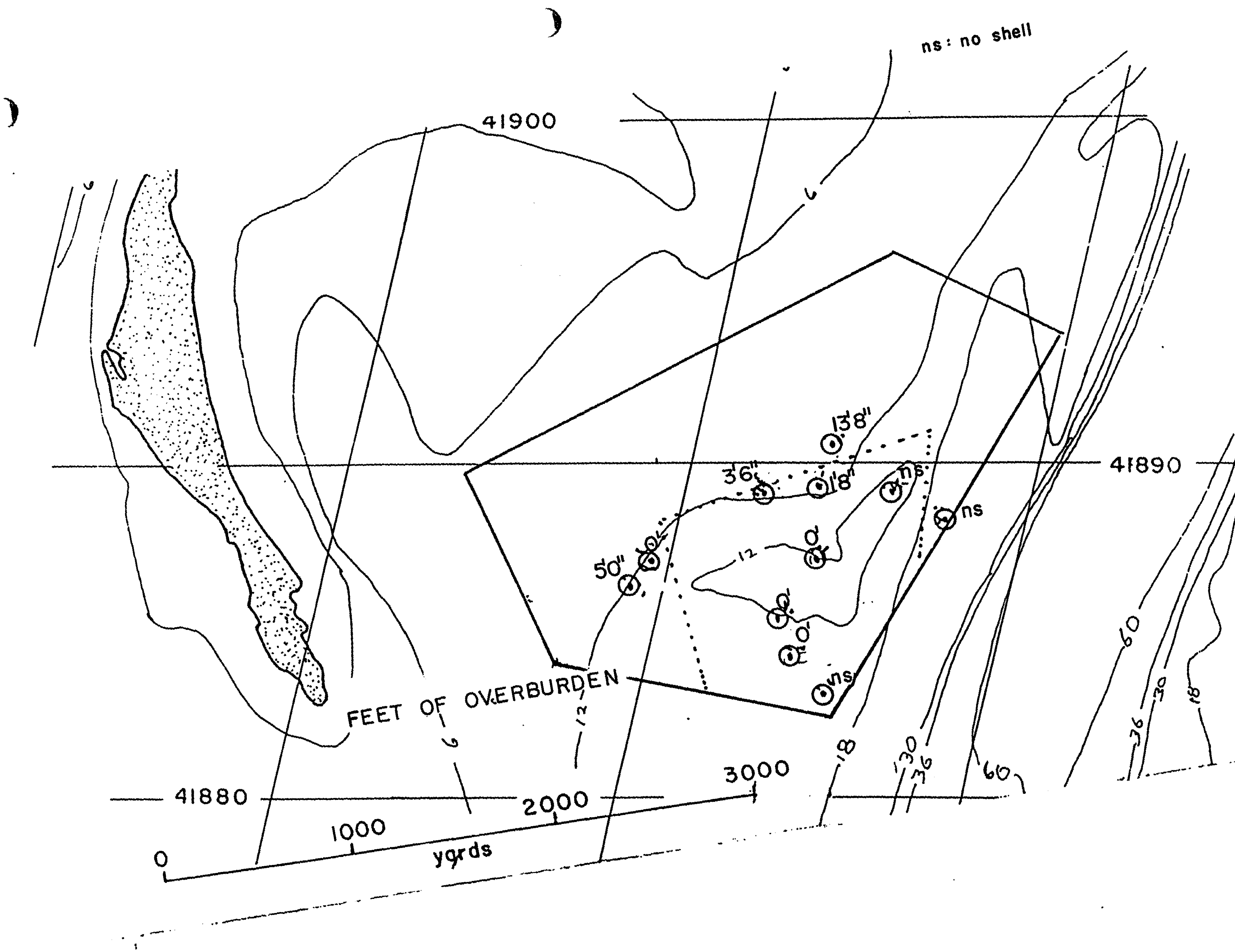
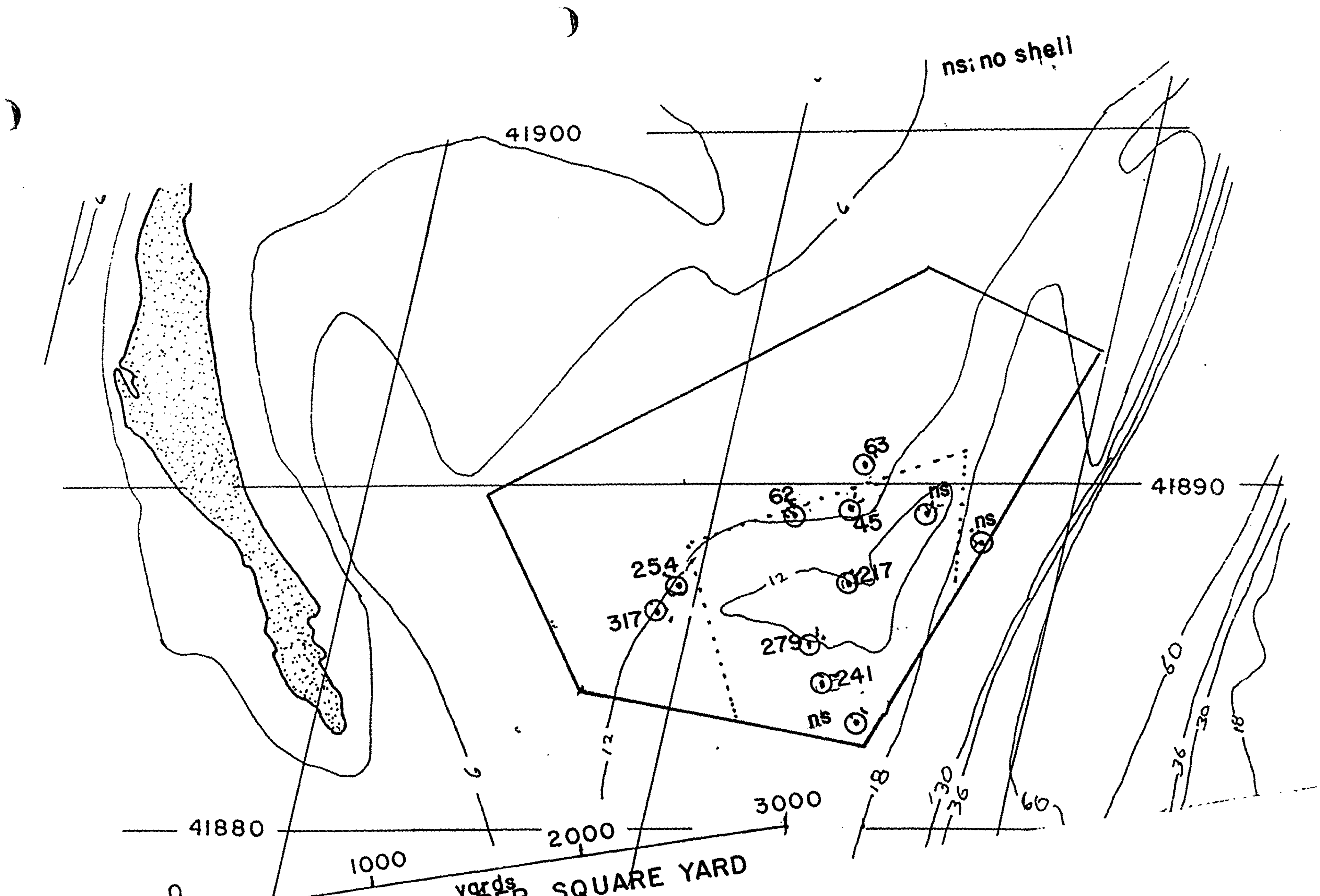
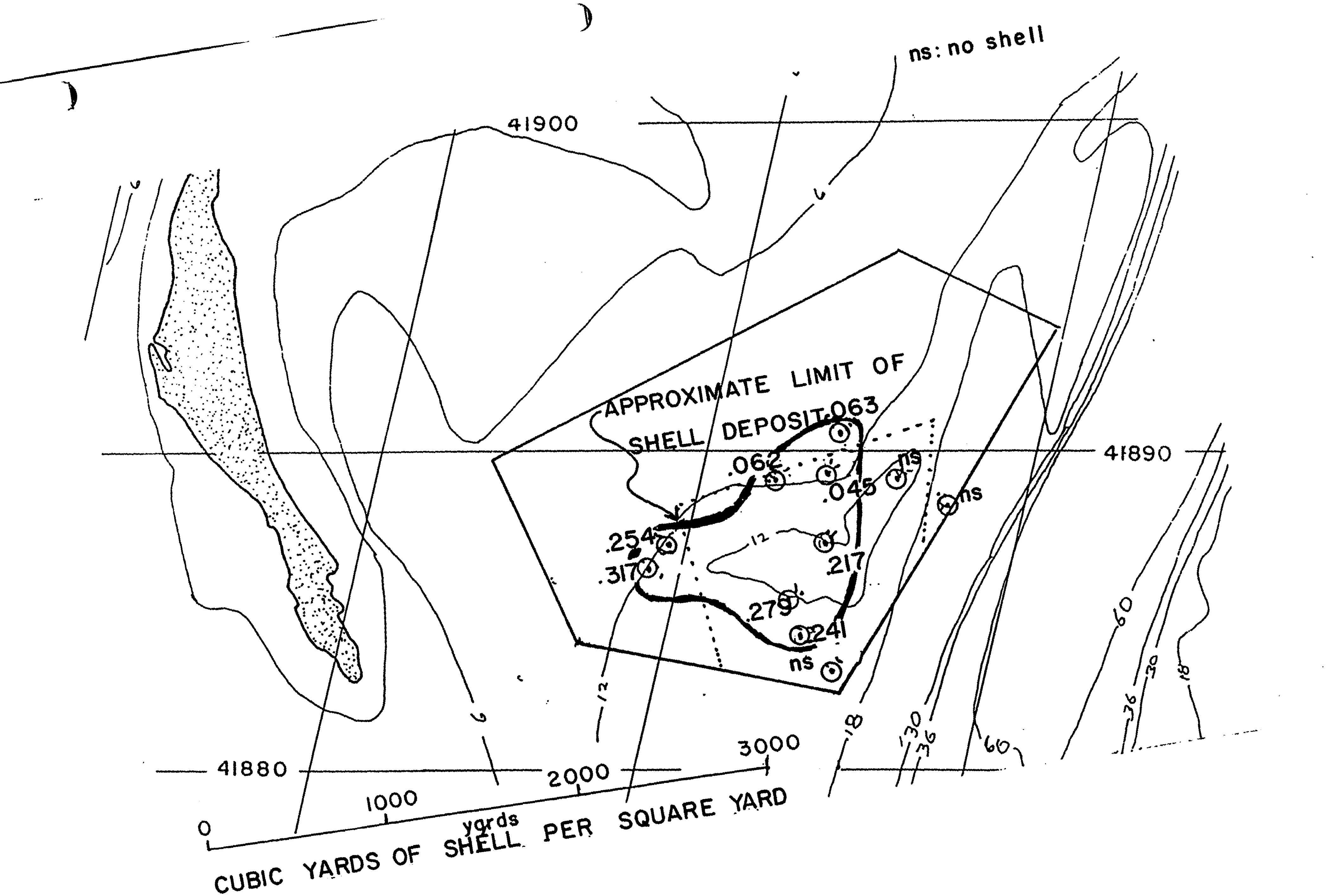

ns: no shell
41900
41890
41880
FEET OF OVERBURDEN
13'8"
36"
18"
ns
ns
50"
0'
0'
0'
ns
0
1000
2000
3000
yards
6
12
18
30
36
60

Figure 4. A map showing the pounds of shell per square yard of bottom potentially available at each core.



POUNDS of SHELL PER SQUARE YARD

Figure 5. A map showing the approximate limits of the deposit of shell and the cubic yards of shell potentially available for dredging at each core.


ns: no shell
41900
41890
41880
APPROXIMATE LIMIT OF SHELL DEPOSIT
.063
.062
.045
ns
ns
.254
.317
.217
.279
.241
ns
12
6
18
30
36
60
0
1000
2000
3000
yards
CUBIC YARDS OF SHELL PER SQUARE YARD