UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

POTENTIAL GEOLOGIC HAZARDS AND CONSTRAINTS FOR BLOCKS IN PROPOSED NORTH ATLANTIC OCS OIL AND GAS LEASE SALE 42

OPEN-FILE REPORT 79-1285
1979

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By

Robert W. Hall

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This report has not been edited for conformity with Geological Survey editorial standards or stratigraphic nomenclature.

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ABSTRACT

Analysis of side-scan sonar, 3.5 kHz subbottom profiler, sparker, and fathometer data (approximately 9,900 km) from 206 blocks originally selected for proposed Outer Continental Shelf Lease Sale 42 disclosed potential hazards to oil and gas exploration and development operations. These potential hazards are a shallow gas deposit in one proposed lease sale block and shallow faulting (or possible buried slumping) in 16 proposed lease sale blocks.

Other features considered merely to be developmental constraints can be accommodated by existing standard design and engineering technology. These include sand waves, scour, potentially unstable slopes (due to gradient and/or presence of possible slump-related features), filled channels, shipwrecks, and unidentified bottom objects.

The U. S. Geological Survey has assessed geologic and other natural and manmade potential hazards and constraints which could adversely affect drilling for oil and gas in the 206 blocks originally selected by the Department of the Interior for inclusion in the proposed Federal Outer Continental Shelf (OCS) Lease Sale 42. These blocks are in the Georges Bank region southeast of Cape Cod, Massachusetts (Plate 1 and Fig. 1).

Our judgments concerning potential geologic hazards and constraints are largely based on data collected from high-resolution geophysical (HRG) surveys and certain published documents. Some geologic features and conditions can pose varying degrees of risk to oil and gas exploration and development activities. In this report, these geologic features and conditions are categorized as potential hazards or as constraints.

Hazards are defined as geologic conditions that have a high inherent risk and may be hazardous to oil and gas exploration development operations; not identifying, avoiding, or taking proper engineering precautions against them could have dangerous consequences (Hall and Ensminger, 1979, p. 2). The hazards category includes shallow faults (or possible buried slumps) and shallow gas deposits.

Other aspects of the Atlantic OCS regional geology may have an impact on oil- and gas-related activities but are considered to be merely developmental constraints because, once identified, their adverse effects can be minimized through the use of existing standard design and engineering technology (Hall and Ensminger, 1979, p. 6). These second-order problems include such features as sand waves, scour, potentially unstable slopes, filled channels, shipwrecks, and unidentified bottom objects.

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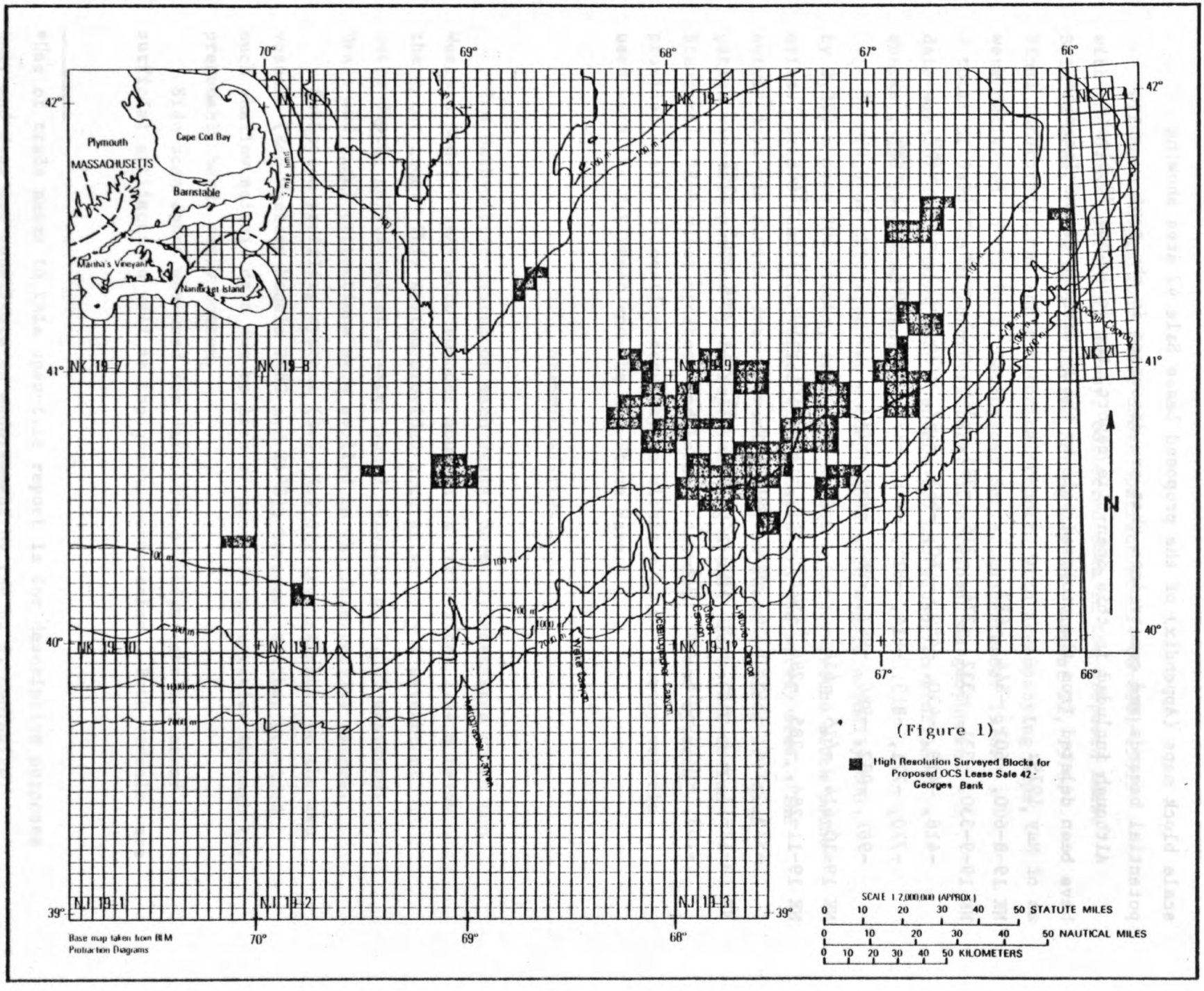

(Figure 1)

High Resolution Surveyed Blocks for Proposed OCS Lease Sale 42 - Georges Bank

This report includes a 1:250,000 scale map (Plate 1) and 1:48,000 scale block maps (Appendix) of the proposed Lease Sale 42 area showing potential hazards and constraints that are discussed in the text.

Although included in this open-file report, the following 78 blocks have been deleted from the proposed sale by the Department of the Interior as of May 1979:

NK 19-8-600, -601, -644, -687,

NK 19-9-330, -331, -332, -374, -375, -385, -386, -415, -416, -417, -418, -419, -430, -459, -460, -461, -462, -724, -725, -768, -769, -770, -771, -813, -814, -815, -856, -899, -900, -942, -943, -944, -981, -982, -986, -987, -988, -989, -990,

NK 19-10-614, -615, -616,

NK 19-11-284, -285, -286, -322, -323, -328, -329, -330, -331, -372, -373, -374, -375, -756, -800, -801 and

NK 19-12-13, -14, -15, -19, -20, -21, -58, -59, -63, -64, -65, -102, -103, -107, -108, and -109.

DATA COLLECTION

Offshore Navigation, Inc., under Contract No. 14-08-0001-15919 with the U. S. Geological Survey, collected data in the proposed Lease Sale 42 area. Data were collected during May 28 - August 22, 1976. Final interpretations and a technical report, with accompanying maps, were delivered to the U. S. Geological Survey in September 1976. A total of 9,907 km of nonproprietary, high-resolution geophysical data was collected using echo sounder, 3.5 kHz subbottom profiler, sparker, and side-scan sonar.

Coverage of this area was accomplished with a grid normally 800 by 3,200 m over 206 blocks, including an 800 m border around block boundaries. Grid orientation varied with location in the survey area. The survey area was divided into 13 work areas, as shown in Plate 1. Navigation was accomplished by Radiopositioning Atomic Clock (RAC-Cesium Standard), DR-Raydist updates, and Loran C/Accufix. These systems provided a stated location accuracy to within $\pm$ 50 m. Survey vessels used were the M/V Draco and the M/V State Wave.

SEISMIC SYSTEMS

The bathymetric system on each vessel normally consisted of an Edo Western Model 4034A* echo sounder mounted on rigid pipes 2.74 m below the water line. This system provided accuracies of $\pm$ 1 percent of water depth, calibrated at a water sound velocity of 1,500 m/second. Draft and tidal corrections were applied in the interpretive stages.

Subbottom profiling systems (3.5-kHz) differed slightly on the two vessels (Edo Western Models 248C and 248E); however, neither provided much shallow seismic data due to lack of acoustic penetration through the presumably hard, sandy bottom.

Side-scan sonar was used for detection of shipwrecks and other surficial artifacts as well as topographic expression. Both vessels were

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*Use of trade names in this open-file report is for descriptive purposes only and does not constitute an endorsement by the U. S. Geological Survey.

equipped with Klein Model 400 side-scan sonar systems. Originally, a 150 m slant range was used; this was later changed to 300 m. Spurious signals received from other systems were a continuous problem, but sea-floor anomalies could still be detected and located. A very small portion of the proposed sale area was not surveyed with side-scan sonar, because the lobster pots there could have snagged the towed transducer.

The seismic system (single channel sparker) utilized Teledyne Model 300 amplifiers, Edo Western Model 550 facsimile recorders, EG&G capacitor banks, C. A. Richards Model 30 sparker cables, and Teledyne Model 20 streamers. All lines were shot with a 2- kj power output at 1-second intervals, using either 1/2- or 1-second sweep rates. Maximum subsurface penetration achieved was 0.7 seconds two-way travel time (approximately 615 m*). Although multiple suppression and other data processing techniques were not used, major deep events were clearly observed in most areas on the analog records.

DATA ANALYSIS AND DATA QUALITY

Initial data analysis was performed by Offshore Navigation, Inc. This included interpretation of all geophysical and side-scan sonar records and preparation of navigation charts, bathymetric charts, shallow structure maps, hazards maps, and maps showing thickness of unconsolidated sediments. All of these charts and maps are at a scale of 1:48,000. They are available for public viewing at the U. S. Geological Survey Office, 1725 K St., N.W., Washington, D. C., or can be purchased from the National Geophysical and Solar-Terrestrial Data

*Throughout this report, subbottom and water depths are calculated using an assumed sound velocity of 1,500 m/sec.

Center (NGSDC) in Boulder, Colorado. In correspondence with NGSDC concerning these data, refer to data set AT15919. Additional data re-interpretation and preparation of the 1:250,000 scale map included in this report were performed by the U. S. Geological Survey. The delineation and mapping of potential hazards and constraints by Offshore Navigation, Inc., and by the Geological Survey were based on reliable data with consideration for equipment limitations, sea state, and geology.

Some of the high-resolution data in the Georges Bank proposed Sale 42 area exhibit seismic blankouts and seismic distortion (Fig. 2). Changes in the reflectivity of the overburden materials or possibly the presence of gassy sediments may blank out the deeper reflectors. Where these seismic blankouts occur there is a disappearance of all coherent data on seismic records and the acoustic stratigraphy below the blankout is not clearly recorded. Similarly, there are areas where the seismic records are distorted by diffracted energy, possibly due to scattering of seismic energy by near-surface boulders or other glaciofluvial deposits. In summary, seismic blankouts and distortions are probably the result of diffraction and changing reflectivity, and result in poorer quality records. Blocks exhibiting seismic blankouts are NK 19-8-600, -643, -644, and NK 19-12-400, 401, -444, and -445. Block NK 19-11-322 contains an area of seismic distortion. These areas are shown on the enclosed summary hazards and constraints map (Plate 1) for completeness, even though they cannot be positively correlated with any identifiable potential hazard or constraint.

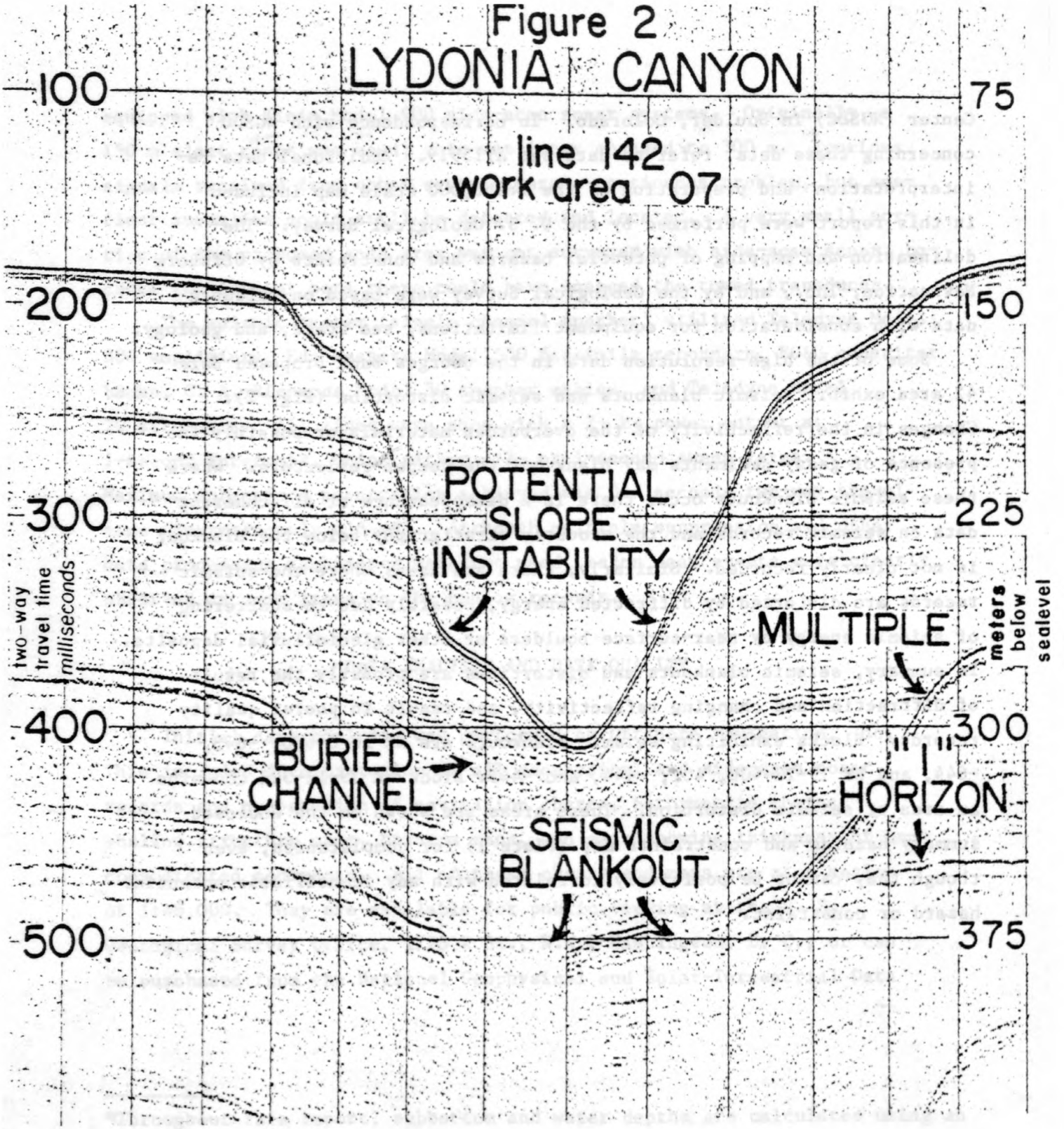

Figure 2- Sparker profile from Lydonia Canyon in Work Area 7. Features of note include zones of potential slope instability on the relatively steep canyon walls, buried channels in the deeper parts of the canyon, seismic blankouts, and the "I" horizon, a regional reflector. Orientation of the line is perpendicular to the axis of the canyon. (See Plate 1, Blocks NK 19-12-445 and -446).

ADDITIONAL STUDIES

Large amounts of other geologic data have also been collected in the Georges Bank vicinity. Two COST wells - G-1 and G-2 - are located in the area (Plate 1); no serious problems or unexpected hazards were encountered during drilling at either the G-1 or G-2 sites (Edvardas Simonis, U. S. Geological Survey, oral commun., 1979). The 1976 Atlantic Margin Coring Project took four cores (6014, 6015, 6016 and 6018) in the region (Plate 1). There are also proprietary data, such as 2,971 short cores on which light hydrocarbon analysis has been performed.

Seismic studies have been conducted along with SCUBA diving and bottom sampling in some sand wave fields. Plate 1 delineates the position of current meters, bottom instrument systems (tripods), and railroad wheels (used as scour indicators) in the area. Plate 1 also gives the positions of two "Texas Tower" offshore radar installations on the Bank. Various studies, such as coring to depths as great as 63 m, were conducted prior to the installation of these towers. Charting (bathymetric) surveys of Georges Bank were conducted by the U. S. Coast and Geodetic Survey during the summers of 1930, 1931, and 1932.

GENERAL GEOLOGIC, METOROLOGIC, AND OCEANOGRAPHIC CONDITIONS AFFECTING GEORGES BANK OCS OIL AND GAS DEVELOPMENT

General Geology

Georges Bank is approximately 150 km wide and 280 km long, and belongs to the chain of banks which stretches from Nantucket Island to the Grand Banks off Nova Scotia. The Bank is the easternmost extension of the U. S. Continental Shelf. The Continental Shelf itself is the seaward extension of Coastal Plain sediments, a gentle, easterly sloping wedge of middle and upper Mesozoic and Cenozoic sediments which have been deposited over Precambrian and Paleozoic crystalline basement and unmetamorphosed Triassic rocks. The Continental Shelf differs from the Coastal Plain in that it has a thicker, more complete Mesozoic section (U. S. Department of the Interior, Bureau of Land Management, 1977, p. 115-116). The shelf-slope boundary in the Georges Bank region is at a depth of 100 to 200 m and is characterized by several submarine canyons, which are themselves relict drainage features. Among these are Hydrographer, Welker, Oceanographer, Lydonia, Gilbert, and Corsair Canyons.

The geologic history of Georges Bank is one of emergence and submergence during glacial periods. Parts of the Bank were glacier covered, and the resulting surficial sediments are derived from glacial tills and are currently being reworked by modern processes. The surficial sediment consists of well-sorted sands composed of quartz and feldspar, with some glauconite, heavy minerals, and rock fragments (U. S. Department of the Interior, Bureau of Land Management, 1977, p. 131). Because of the glacial origin of these sediments, even larger gravel- and boulder-size components may be found.

Borings made in conjunction with the construction of the "Texas tower" radar installations revealed silty-clayey layers up to 15 m thick in the upper 63 m of sediment on Georges Bank, much like some fine textured sediments found in vibracores from Nantucket Shoals (Folger and others, 1978). Lower sea levels resulted in drainage systems (now seen as submarine canyons and filled channels), terminal moraines, and old shorelines (seen

as erosional scarps and terraces or "cuestas"). An abundant sediment supply and vigorous currents have led to several episodes of bedform production on the Bank. Large northwest-trending sand ridges (e.g. Georges Shoal, Cultivator Shoal) dominate the ridge and swale topography on much of the Bank. Superimposed on the ridges (shoals) and swales are well developed, active sand waves of reworked glacial detritus. These are up to 30 m high on Cultivator Shoal on the northern part of the Bank, outside the Proposed Lease Sale 42 area. The proposed sale area is located in the relatively flat eastern and southern portion of Georges Bank, though some extensive sand wave fields are found within the boundaries.

Glacial Erratics

Approximately the top 100 m of sediments on Georges Bank consists of reworked glacial outwash. Tremendous variability in grain size could be expected in such poorly sorted sediment, with the size fraction ranging from silt to boulders. Coarse-grained sediment could facilitate the loss of drilling fluid in "lost circulation" zones, and boulders may present problems during the installation of drive pipe. Glacial erratics are not positively identifiable as such on the geophysical records, although the seismic distortion (apparently point-source diffractions) seen in one block is possible evidence of their existence. Consequently, glacial erratics are not mapped on the enclosed potential hazards and constraints maps but, in light of the genesis of the Georges Bank surficial sediment veneer, may possibly be encountered at any location.

Geopressures

Although little geopressure information is available for the North Atlantic, COST wells B-2 and B-3 (Baltimore Canyon Trough Area), as well as G-1 and G-2, encountered no abnormally high geopressures (Edvardas Simonis, U. S. Geological Survey, oral commun., 1979). Other evidence indicates that abnormally high geopressures on Georges Bank are unlikely. Note should be made, however, of a shallow "bright spot" found in the proposed Lease Sale 42 area (see section titled Shallow Gas). If this bright spot is indeed shallow gas, relatively high pressure might be encountered while drilling through this zone.

Seismicity

Although the East Coast of North America is characterized by relatively low seismicity, earthquakes do occur in the New England area. New York and Massachusetts have experienced numerous shocks, several quite severe. The region is also affected by large earthquakes originating in adjacent Canada, principally in the St. Lawrence Valley and the Laurentian Trough (Coffman and von Hake, 1972). The New England area experiences approximately six earthquakes each year that are strong enough to be felt (approximate intensity, Modified Mercalli, of II to V). Two relatively large earthquakes have occurred in the Northeastern United States in historical times, one located near Cape Ann, Massachusetts, and one located on the Grand Banks. The Cape Ann earthquake, with an estimated Modified Mercalli intensity of VIII, occurred in 1755. The estimated epicenter location was approximately 200 km from the nearest proposed lease sale tract. The 1929 Grand Banks earthquake had a magnitude of 7.2 (Richter Scale) and an estimated Modified Mercalli intensity of X. The epicenter of this earthquake was located about 800 km northeast of Georges Bank. The Bureau of Land Management's Sale 42 Final Environmental Statement, Visual No. 6, indicates a minor earthquake epicenter (Mercalli III-IV) in Block NK 19-10-528, adjacent

to the proposed Sale 42 area. Historical data suggest a relatively low earthquake risk in the immediate Georges Bank area, although a confident prediction of future seismicity is impossible.

The "I" Horizon

Knott and Hoskins (1968) first defined the "I" horizon, a reflector that is regionally persistent and varies in depth from approximately 200 to 560 m beneath the sea floor (Fig. 2). High-resolution geophysical data suggest that this reflector represents the top of relatively indurated sediments, which appear to be competent. The stratigraphy above the "I" level is a complex of Tertiary, Pleistocene and Holocene sediments modified by marine reworking during the sea-level fluctuations related to glacial cycles. The "I" horizon is essentially the acoustic basement for the data collected for the Geological Survey's block-specific hazards investigation.

A series of bar-like features or "bulges" in the "I" horizon have been identified. These may be sand bars within the upper layers of the reflector. These features are mentioned because they are seismic anomalies. They do not appear to present a potential hazard or constraint as such, but they may represent a locally unusual geologic condition. These bar-like features in the "I" horizon are found in the following blocks: NK 19-8-1006, NK 19-12-1, NK 19-12-2, and NK 19-12-323. They are not shown on the enclosed hazards and constraints maps.

Meteorology

The Georges Bank region is subject to both tropical and extratropical storms, though the frequency of tropical storms (hurricanes) is low. Low-pressure centers of extratropical storms enter the Georges Bank region from the west or southwest, whereas tropical storms approach from the south or southwest. Many tropical storms lose strength and assume extratropical storm characteristics in these northern latitudes. Between 1938 and 1963, the Northeastern United States was significantly affected

by only five hurricanes. Extratropical storms, however, are frequent. "Northeasters," for example, with storm surge of 0.6 meter or more occur once or twice a year (U. S. Department of the Interior, Bureau of Land Management, 1977, p. 157-160). Storm-generated wind, surge, waves, and currents pose potential risk to drilling platforms, and wind-generated waves and currents can mobilize bottom sediments causing sand wave migration and scour around bottom-mounted structures. Storm waves in this area can approach 18 m in height.

Currents

Currents on Georges Shoal, which is north of the proposed Sale 42 area, are unusually strong for an area that far from shore and unaffected by a major current. They are predominantly rotary tidal currents, constantly changing direction and making a complete 360 degree rotation in slightly over 12 hours (U. S. Department of the Interior, Bureau of Land Management, 1977). Estimated astronomical tides on Georges Bank and Nantucket Shoals are on the order of 0.6 meter above and below mean sea level. Average flood and ebb tidal currents are greater than 3.7 km/hour across the shoal. Severe storms in the area may produce meteorological tides up to 1.8 m in height.

Four current meters positioned on Georges Bank indicate an overall clockwise gyre over the Bank (Folger and others, 1978). Though not a direct hazard to drilling activities, the current gyre over the Bank may provide for the lengthy entrainment of pollutants spilled in the area. Mean flow along the shelf is westward; pollutants introduced into the water column may eventually be transported with this flow to the New Jersey shelf (Bradford Butman, U. S. Geological Survey, oral commun., 1979).

Shallow Gas Deposit

Shallow gas deposits refer to confined accumulations of gas with possibly higher than ambient pore pressure. When organic material is buried under even a thin layer of sediment, methane gas may be generated by decomposition. This biogenic gas, as well as gas from deeper reservoirs, may migrate into the shallower sediments and become trapped as near-surface gas reservoirs (possibly in shallow fault traps) or in the form of gas-charged sediments. Both types of shallow gas deposits may exist in the Georges Bank region, posing potential hazards, particularly from blowouts and mass movement.

No shallow geologic hazards were present at the COST G-1 and G-2 well sites and gas or oil seeps have not been detected to date in the North Atlantic OCS. In light of this and other evidence, shallow gas is not expected to be a serious hazard for any of the blocks included in the proposed sale area (M. A. Smith, U. S. Geological Survey, written commun., 1977).

A single, shallow high-amplitude seismic reflection (Fig. 3) covering an area 2.6 km long and about 300 m wide at a depth of 60 m below the sea floor and with thickness of approximately 5 m was observed in Block NK 19-11-83 (Plate 1). It is interpreted as a shallow gas deposit. It has some, but not all, of the characteristics of a seismic reflection from gas-charged sediments. There are, however, other nonhazardous geologic conditions which could have caused this high-amplitude reflection.

Shallow Faulting

With the exception of the shelf-edge margin, the survey area is relatively free of shallow faulting. There is no sea-floor displacement associated with any faults seen in the geophysical records.

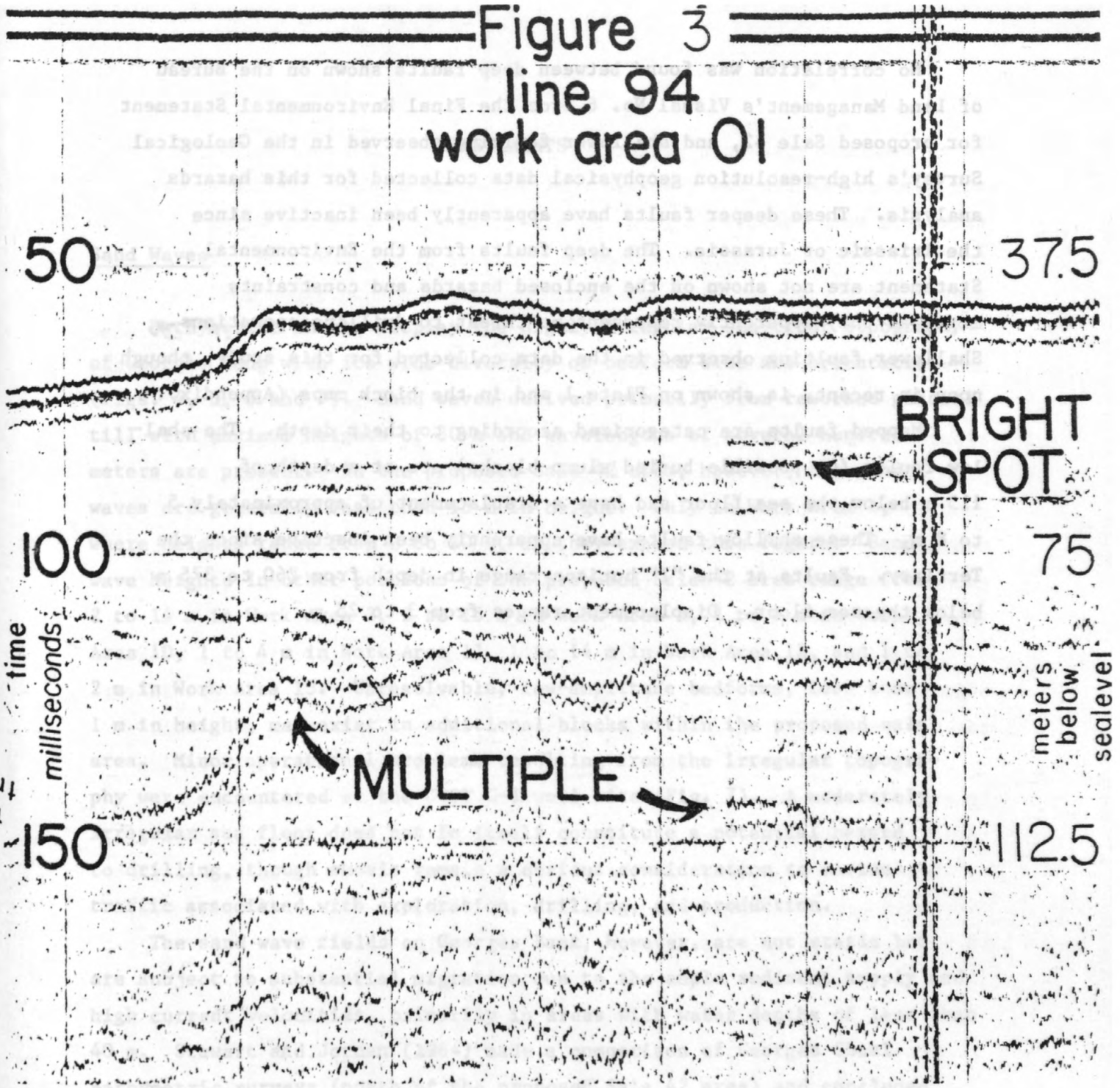

Figure 3- Sparker profile from Work Area 1 showing a high-amplitude reflection (bright spot) possibly indicating a shallow gas deposit. (See Plate 1, Block NK 19-11-83).

No correlation was found between deep faults shown on the Bureau of Land Management's Visual No. 6 from the Final Environmental Statement for proposed Sale 42, and shallower faulting observed in the Geological Survey's high-resolution geophysical data collected for this hazards analysis. These deeper faults have apparently been inactive since the Triassic or Jurassic. The deep faults from the Environmental Statement are not shown on the enclosed hazards and constraints maps, as they apparently represent no threat to drilling operations. Shallower faulting observed in the data collected for this study, though none is recent, is shown on Plate 1 and in the block maps (Appendix).

Mapped faults are categorized according to their depth. The shallow faults (or possible buried slump blocks) are at a depth of 115 m below the sea floor and have a displacement of approximately 5 to 8 m. These shallow faults have apparently been inactive since the Tertiary. Faults at the "I" horizon range in depth from 260 to 375 m below the sea floor. Displacement ranges from 3 to 25 m.

Sand Waves

Bathymetric charts display the highly irregular sea-floor topography of Georges Bank with its wide diversity of bedform size and orientation (Figs. 4, 5, 6 and 7). Sand waves derived primarily from reworked glacial till with maximum heights of 30 m and wavelengths of several hundred meters are present. In the proposed Sale 42 area, however, the sand waves are generally less than 15 m in height. Only in Work Area 1, where heights range from 2 to 20 m, do they exceed this figure. Sand wave heights in other portions of the proposed Sale 42 area range from 2 to 14 m in Work Area 3, 2 to 15 m in Work Area 4, 1 to 2 m in Work Area 10, 1 to 4 m in Work Area 11, 1 to 14 m in Work Area 12, and 1 to 2 m in Work Area 13. Unresolvable, low-amplitude bedforms, less than 1 m in height, may exist in additional blocks within the proposed sale area. Minor operational problems resulting from the irregular topography were encountered at the COST G-1 well site (Fig. 7). A moderately irregular sea floor does not in itself constitute a potential hazard to drilling, though shoals remain a serious consideration to marine traffic associated with exploration, drilling, and production.

The sand wave fields on Georges Bank, however, are not static but are subject to substantial migration due to the ample sediment supply and high current velocities, primarily in areas with water depths of less than 40 m. Stewart and Jordan (1964) made a comparison of Georges Shoal bathymetric surveys (north of the proposed Sale 42 area) and concluded that some of the sand ridges had migrated as much as 300 m westward in a 25 to 28 year period. Sheet flow characterizes the shallower areas; however, the currents are of a rotary tidal nature and there

is no dominant transport direction. Westward-moving waves evidently are responsible for the observed westward ridge migration. The deeper ridges in water depths of 18 to 36 m and trending at right angles to those on top of the shoal show no evidence of migration and are apparently not genetically related to processes now in operation.

General trends and morphology of the proposed Sale 42 sand wave fields have been observed on 3.5-kHz subbottom and side-scan sonar data. Distinct asymmetry exists in many sand waves. Dominant current direction apparently varies from place to place on Georges Bank, possibly as a function of water depth (tidal current vs. wave influence) and local bottom configuration, such as the proximity of linear shoals. This active sediment transport in the proposed sale area requires that bottom-mounted structures be sufficiently engineered to withstand the sand wave migration.

A minor constraint associated with sediment transport is that of abrasion by waterborne sand on bottom-mounted support structures. This constraint can also be mitigated with proper engineering and construction materials.

Capping abandoned wells at the sea floor poses a potential problem in areas characterized by large, migrating sand waves because abandoned capped wells located near the crests of sand waves may become exposed to abrasion and corrosion if the surrounding sand wave migrates. If production eventually takes places on Georges Bank, pipelines will also have to be engineered to withstand the mobile sea floor.

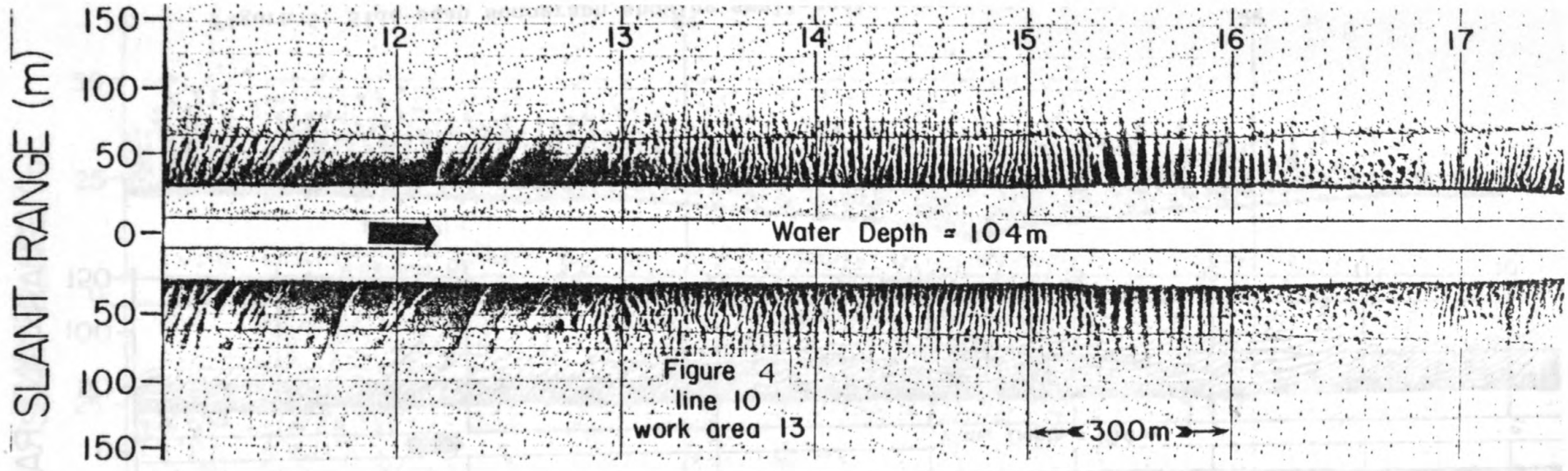

Figure 4- Side-scan sonograph showing small-scale megaripples in Work Area 13. Note the tremendous variability in bedform orientation and size. These megaripples, which are generally less than 1 m high, are probably actively migrating. (See Plate 1, Block 19-9-386).

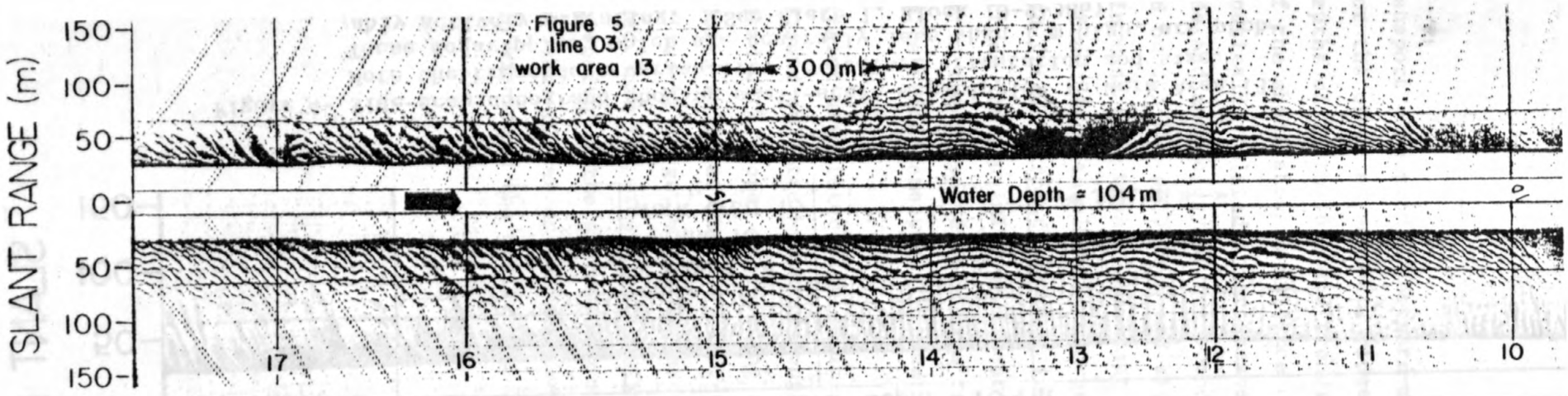

Figure 5- Side-scan sonograph showing small-scale megaripples in Work Area 13. (See Plate 1, Block NK 19-9-385 and -386).

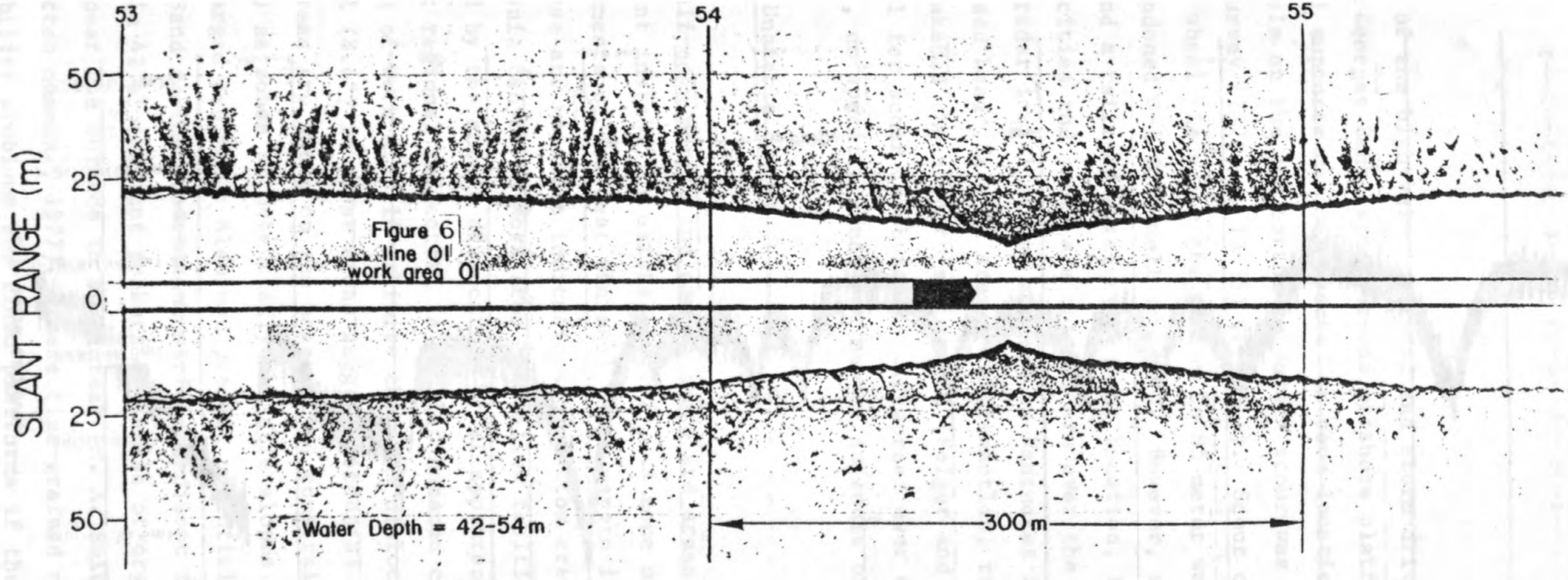

Figure 6- Side-scan sonograph showing a large sand wave near COST well G-1, adjacent to Work Area 1. Smaller scale bedforms can be seen on the flanks of the large sand wave. (See Plate 1, Block 19-11-35).

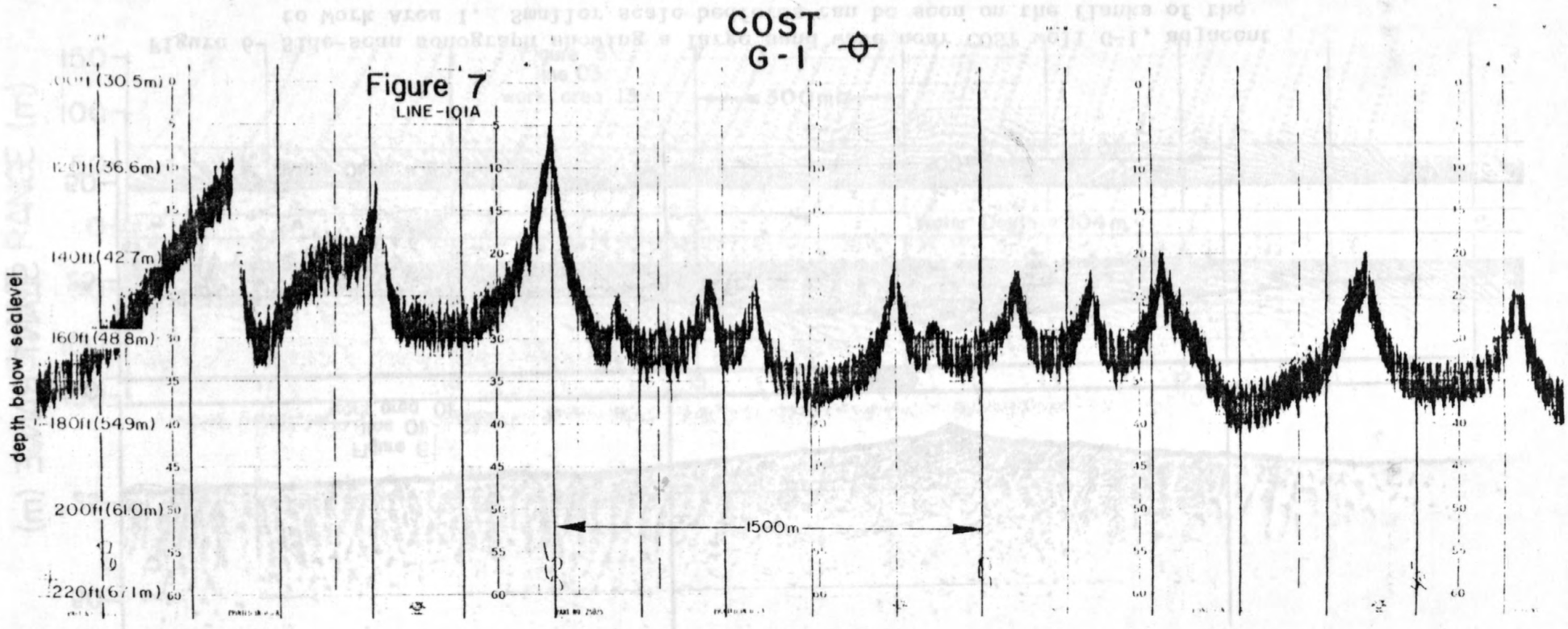

Figure 7- Echo sounder profile showing large sand waves at the COST well G-1 site, adjacent to Work Area 1. These sand waves reach almost 25 m in height. Sand waves within Work Area 1 reach 20 m in height. Vertical exaggeration = 49X. (See Plate 1, Blocks NK 19-11-35 and -79).

Scour

Because of the high-velocity tidal and storm-driven bottom currents prevalent on Georges Bank, scour around offshore platforms' bottom-mounted structural supports can be expected in some locations. The placing of railroad wheels on the sea bottom to detect scour was reported by the U. S. Geological Survey (1976, p. 13-15) (Plate 1). Scour occurred around one railroad wheel placed on the bottom in 85 meter water depths near the abandoned G-1 COST well location. However, scour was not evident around a railroad wheel at another location, indicating that current velocities and scour are not uniform over the Bank. The two Texas Tower radar installations erected on Nantucket Shoals west of the proposed Lease Sale 42 area were dismantled, reportedly because scour had weakened the support structures (Folger and others, 1978). The potential for scour is obviously widespread over Georges Bank. Consequently, no specific areas are mapped as zones of scour.

Potentially Unstable Slopes

The shelf-edge margin and canyon heads are areas where possible slope sediment instability exists (Fig. 2). A zone of crenulations in surface sediments occurs near the shelf-edge margin in Work Areas 10 and 11. These are possible indications of bottom creep. Near the head of Lydonia Canyon in Work Area 7, shallow faulting and/or slumping is indicated by the abrupt dislocation or disappearance of the "I" horizon, a persistent regional reflector. A smaller unnamed canyon in the easternmost section of Work Area 10 exhibits the same dislocation. Slopes as great as 15% (8.6°) in these areas suggest potential slope instability. The above areas are shown on the hazards and constraints maps (Appendix and Plate 1) as zones of potentially unstable slopes.

Gas-charged sediments also can present potential sediment-stability problems. Sand is the predominant surface sediment for most of the proposed Sale 42 blocks, but pockets or lenses of organic-rich silt and clay occur near the surface in some areas (M. A. Smith, U. S. Geological Survey, written commun., 1977). These fine-grained deposits could present stability problems for fixed platforms if they contain abnormal amounts of biogenic gas. Light hydrocarbon gases evolve from the

decomposition of organic material and may contribute to the liquefaction (transformation into a fluid mass) of these layers. A lack of detailed geotechnical studies in the proposed sale area adds to the difficulty of delineating those areas of potential mass sediment instability.

Filled Channels

Buried channels, as seen on high-resolution geophysical profiles, are identified by their irregular erosional contact with the older sediments and the crossbedding or unconformable bedding of the infilling sediments (Figs. 2 and 8). The buried channels, which presumably were cut during a period of lower sea level, were partially obliterated and eventually buried by transgressing seas. Lewis and Sylwester (1976) described the presence of several channel cutting and filling episodes in the Pleistocene sediments of Georges Bank.

Buried channels and other filled depressions are viewed as constraints because large contrasts in bearing capacity can exist between the infilling channel deposits and the surrounding sediments. Bottom-mounted structures straddling the boundary between the two types of sediments could tilt as a result of differential compaction. Similarly, heterogeneous channel fill deposits may display markedly varied bearing capacities over short horizontal or vertical distances. Finally, coarse-grained channel fill deposits can cause "lost-circulation" (drilling fluid loss) during drilling. Distinct buried channels and filled depressions seen on the 3.5 kHz and sparker records are shown on the enclosed maps (Plate 1 and Appendix).

Shipwrecks and Bottom Objects

Both historical data and side-scan sonar data were utilized in locating shipwrecks and other bottom objects which are plotted on the enclosed maps (Appendix and Plate 1). Sunken warships carrying munitions represent the greatest potential hazard. Site-specific surveys before drilling can delineate the position of all such obstacles, allowing them to be avoided. Side-scan sonar sightings that are not identifiable as shipwrecks are mapped as "bottom objects."

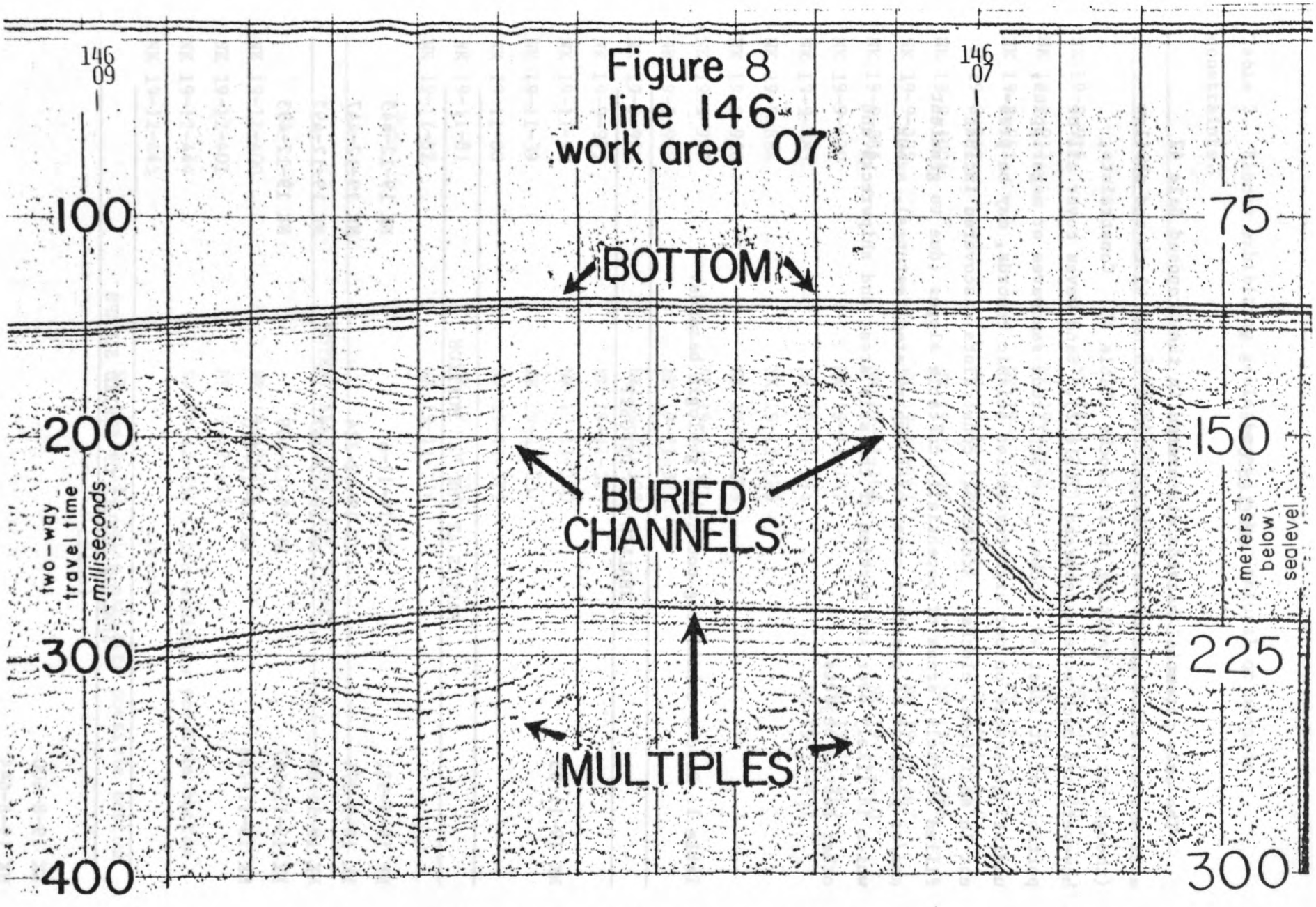

Figure 8- Sparker profile showing filled channels in Work Area 7. These filled channels, representing paleo-drainage features, can be traced over wide areas. (See Plate 1, Blocks NK 19-12-442 and -443).

CONCLUSIONS

The only potential hazards discovered in the proposed Sale 42 area are a shallow gas deposit (bright spot) in one block and shallow (though not recent) faulting in 16 blocks (Table 1). Constraints, however, are much more widespread (Table 2). Sand waves cover all or portions of at least 49 blocks. Low-amplitude sandwaves or megaripples, undistinguishable on our high-resolution seismic records, may be present in additional blocks. Additional constraints discovered include filled channels, areas of potentially unstable slopes (due to gradient and/or presence of possible creep or slump related features), scour which is likely over any portion of the sale area, and shipwrecks and other bottom objects.

Table 1. Blocks exhibiting potential geologic hazards.

SHALLOW GAS DEPOSIT		
NK 19-11-83		
FAULTS AT THE "I" HORIZON		
NK 19-9-932	NK 19-12-6	NK 19-12-445
NK 19-9-974	NK 19-12-324	NK 19-12-447
NK 19-11-84	NK 19-12-367	NK 19-12-492
NK 19-11-167	NK 19-12-409	NK 19-12-493
NK 19-11-756	NK 19-12-410	
SHALLOW FAULTS OR BURIED SLUMPS		
NK 19-8-600		
NK 19-8-644		

Table 2. Blocks exhibiting geologic and other natural or manmade constraints.

SAND WAVES		
NK 19-8-916	NK 19-11-83	NK 19-11-325
NK 19-8-917	NK 19-11-84	NK 19-11-1
NK 19-8-961	NK 19-11-123	NK 19-12-323
NK 19-8-962	NK 19-11-124	NK 19-12-324
NK 19-8-1006	NK 19-11-125	NK 19-12-366
NK 19-9-385	NK 19-11-167	NK 19-12-367
NK 19-9-386	NK 19-11-168	NK 19-12-410
NK 19-9-430	NK 19-11-169	NK 19-12-493
NK 19-9-883	NK 19-11-284	NK 19-12-537
NK 19-9-884	NK 19-11-285	
NK 19-9-926	NK 19-11-286	
NK 19-9-927	NK 19-11-322	
NK 19-9-928	NK 19-11-323	
NK 19-9-970	NK 19-11-328	
NK 19-9-971	NK 19-11-329	
NK 19-11-38	NK 19-11-330	
NK 19-11-39	NK 19-11-331	
NK 19-11-80	NK 19-11-372	
NK 19-11-81	NK 19-11-373	
NK 19-11-82	NK 19-11-374	

POTENTIALLY UNSTABLE SLOPES	
NK 19-12-400	NK 19-12-324
NK 19-12-401	NK 19-12-493
NK 19-12-444	NK 19-12-536 (also exhibits possible bottom creep)
NK 19-12-445	NK 19-12-537 (also exhibits possible bottom creep)

FILLED CHANNELS

NK 19-8-601	NK 19-9-987	NK 19-12-20
NK 19-9-884	NK 19-11-124	NK 19-12-45
NK 19-9-899	NK 19-11-125	NK 19-12-63
NK 19-9-900	NK 19-11-168	NK 19-12-64
NK 19-9-928	NK 19-11-169	NK 19-12-107
NK 19-9-930	NK 19-11-214	NK 19-12-188
NK 19-9-931	NK 19-11-258	NK 19-12-232
NK 19-9 932	NK 19-11-322	NK 19-12-233
NK 19-9-942	NK 19-11-323	NK 19-12-397
NK 19-9-943	NK 19-12-1	NK 19-12-398
NK 19-9-970	NK 19-12-2	NK 19-12-400
NK 19-9-974	NK 19-12-6	NK 19-12-401
NK 19-9-975	NK 19-12-7	NK 19-12-443
NK 19-9-976	NK 19-12-8	NK 19-12-444
NK 19-9-986	NK 19-12-19	NK 19-12-445

SHIPWRECKS

NK 19-8-600	NK 19-9-375	NK 19-11-323
NK 19-8-601	NK 19-9-724	NK 19-12-8
NK 19-8-644	NK 19-9-856	NK 19-12-58
NK 19-8-687	NK 19-9-976	NK 19-12-100
NK 19-9-331	NK 19-11-215	NK 19-12-108
NK 19-9-332	NK 19-11-285	NK 19-12-317

BOTTOM OBJECTS

NK 19-8-601	NK 19-12-108
NK 19-8-687	NK 19-12-409
NK 19-9-944	NK 19-12-447
NK 19-12-58	NK 19-12-492

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APPENDIX

Maps showing potential hazards and constraints for each individual block tentatively selected for the Georges Bank proposed OCS Lease Sale 42.

* Deleted by the Department of the Interior as of May 1979.

EXPLANATION FOR BLOCK MAPS

Proposed Lease Sale 42

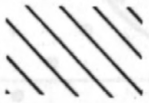
POTENTIAL HAZARDS

Shallow Fault or Slump

Fault at "I" Reflector

Shallow Gas Deposit

CONSTRAINTS



Potentially Unstable Slope

Sand Wave Field

Filled Channel

Bottom Object

Shipwreck

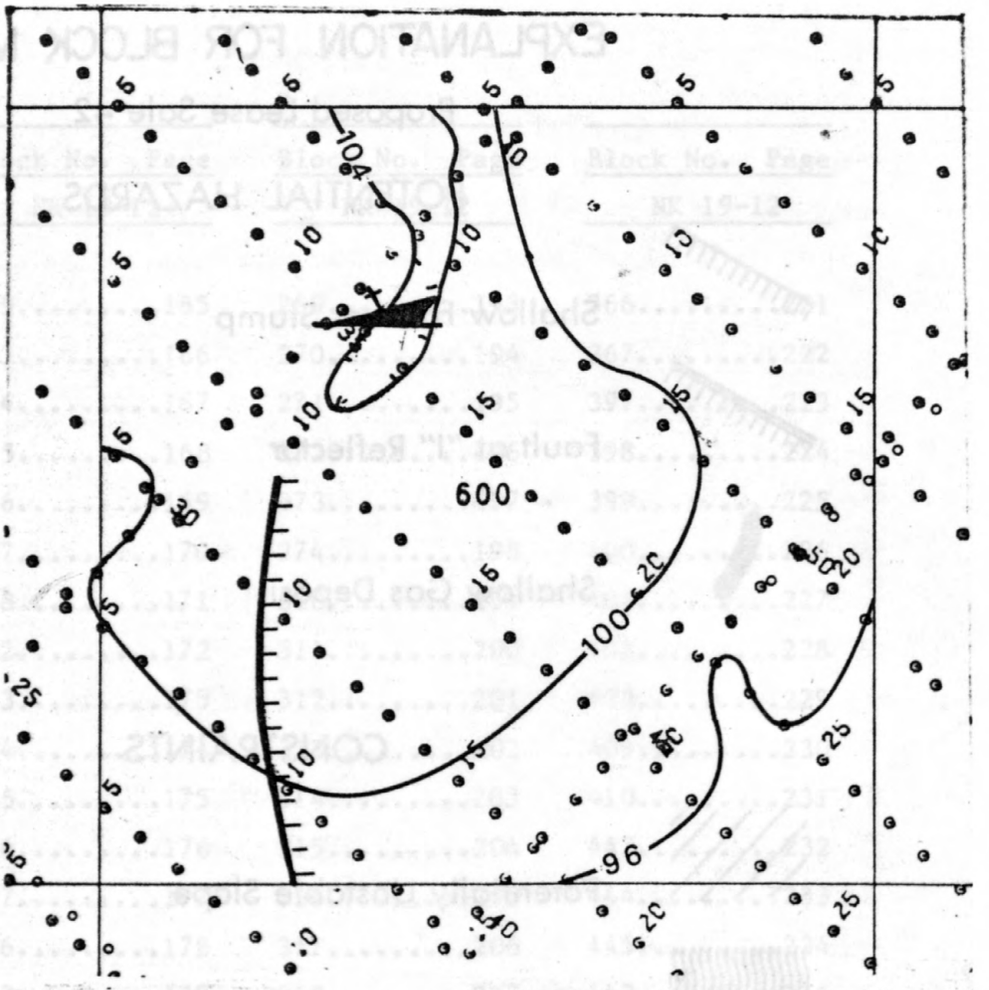
Navigation Shot-Points

Note: Due to highly irregular bottom topography, isobaths have been omitted from some sand wave fields.

Isobath intervals are 4 meters for water depths to 120 meters and 10 meters for all waters depths below 120 meters.

Proposed Lease
Sale 42

Block
NK 19–8–600*



Water Depth: max. 104 m, min. 94 m
Slope Gradient: 1.4 m/km, Direction: NW
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

POTENTIAL HAZARD

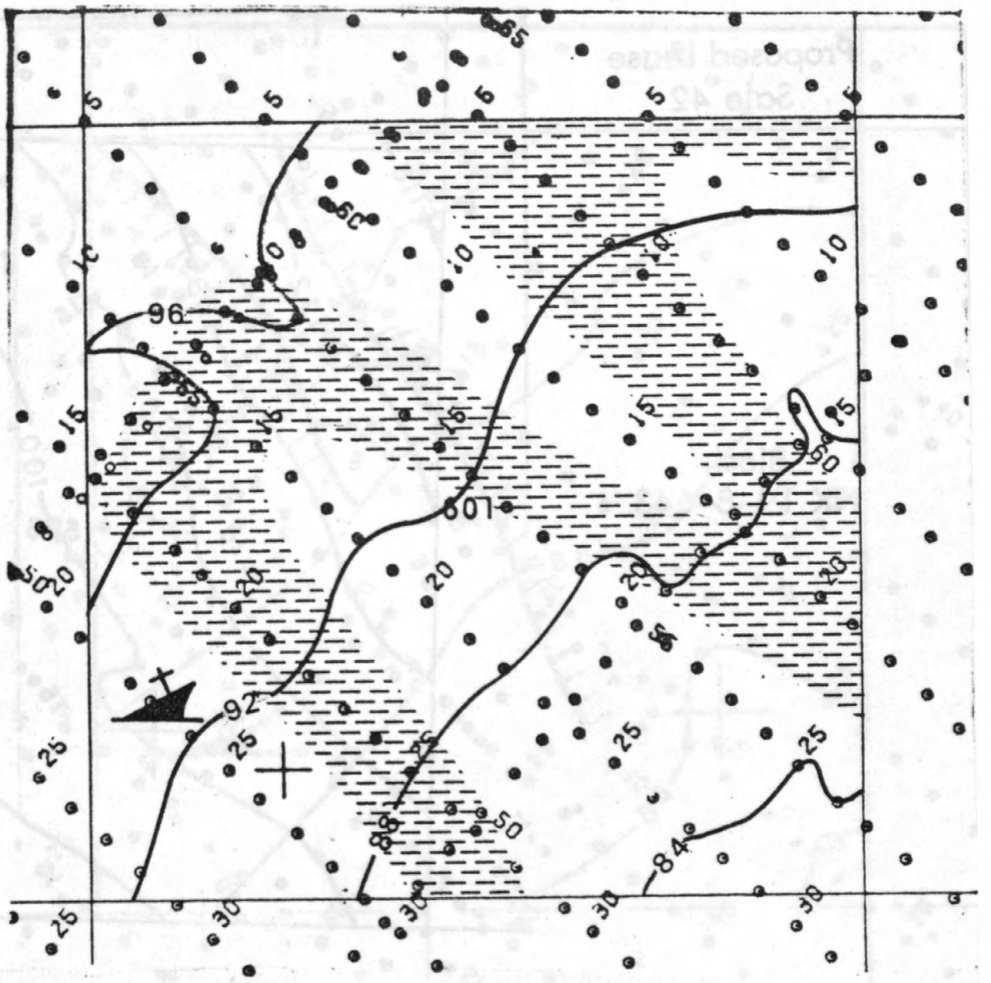
Shallow Fault or Slump

CONSTRAINT

Shipwreck

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Water Depth: max. 99 m, min. 82 m
Slope Gradient: 0.9 m/km, Direction: NW
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINTS

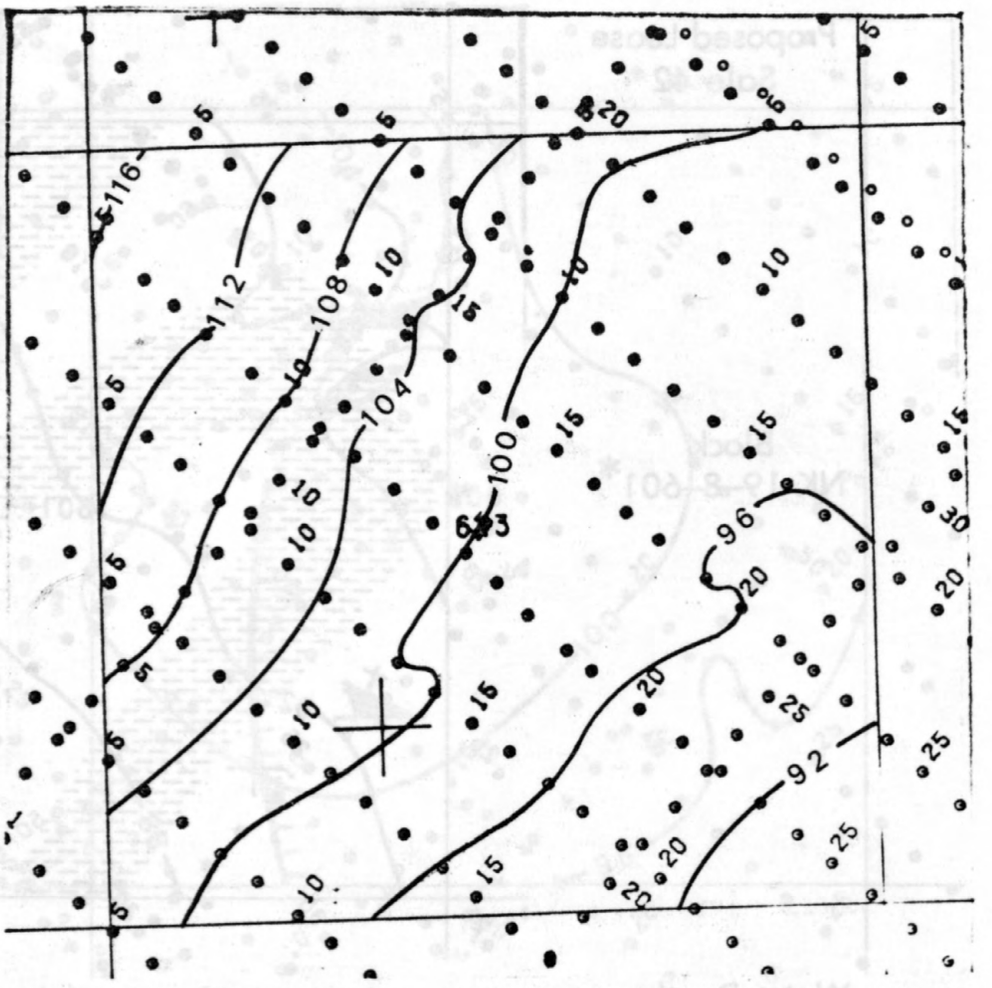
Filled Channel

Shipwreck

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–8–643



Water Depth: max. 116 m , min. 90 m
Slope Gradient: 4.1 m/km, Direction: NW
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

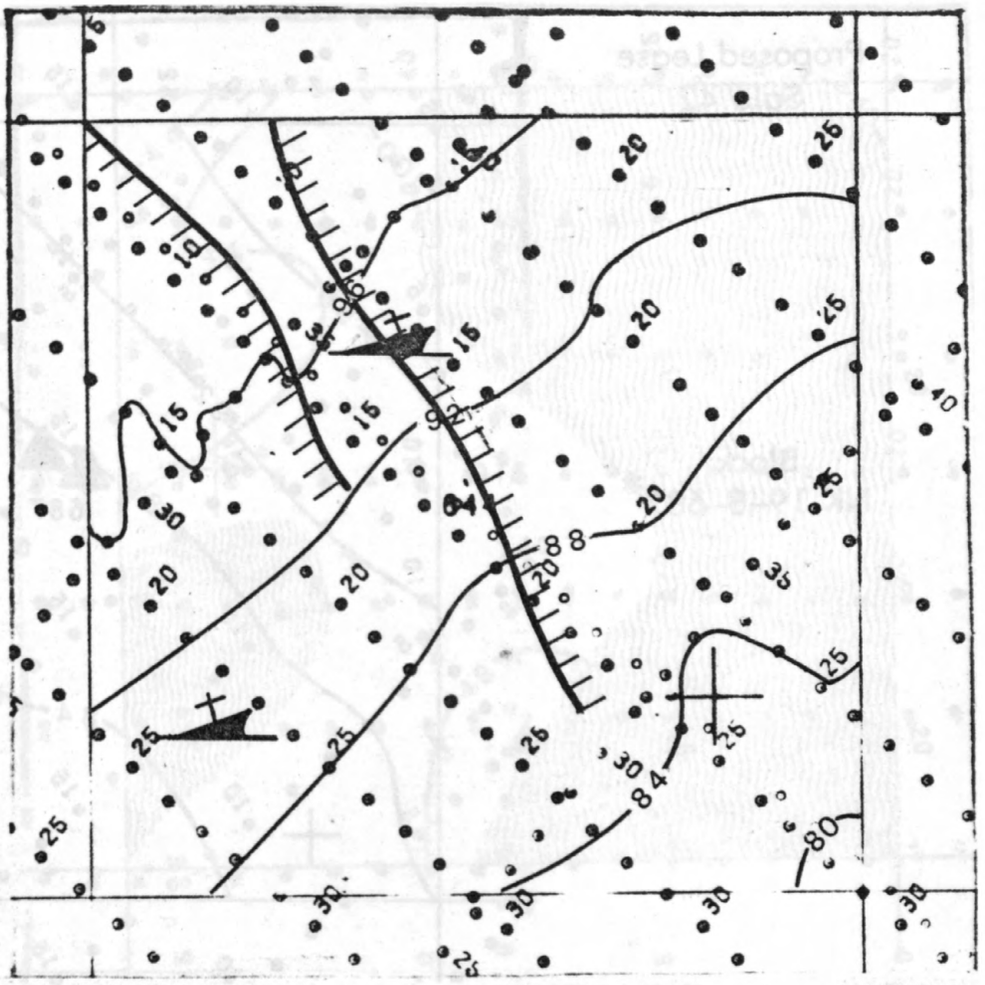
0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Proposed Lease Sale 42

Block NK 19–8–644*



Water Depth: max. 99 m , min. 79 m
Slope Gradient: 3 m/km, Direction: NW
Surface Sediment Type: Sand

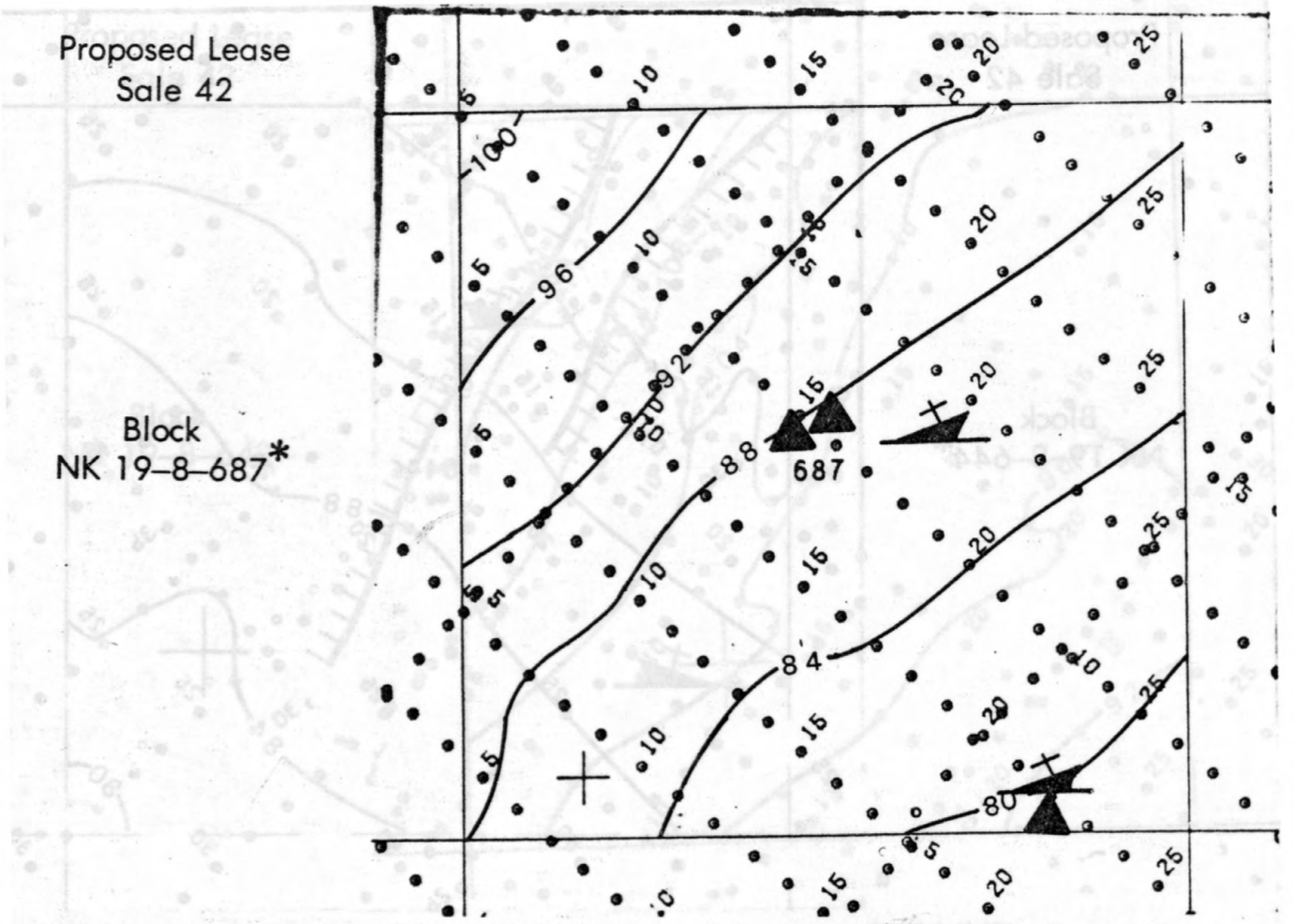
POTENTIAL HAZARD

Shallow Fault or Slump

CONSTRAINT

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 101 m , min. 79 m
Slope Gradient: 3.5 m/km, Direction: NW
Surface Sediment Type: Sand

CONSTRAINTS

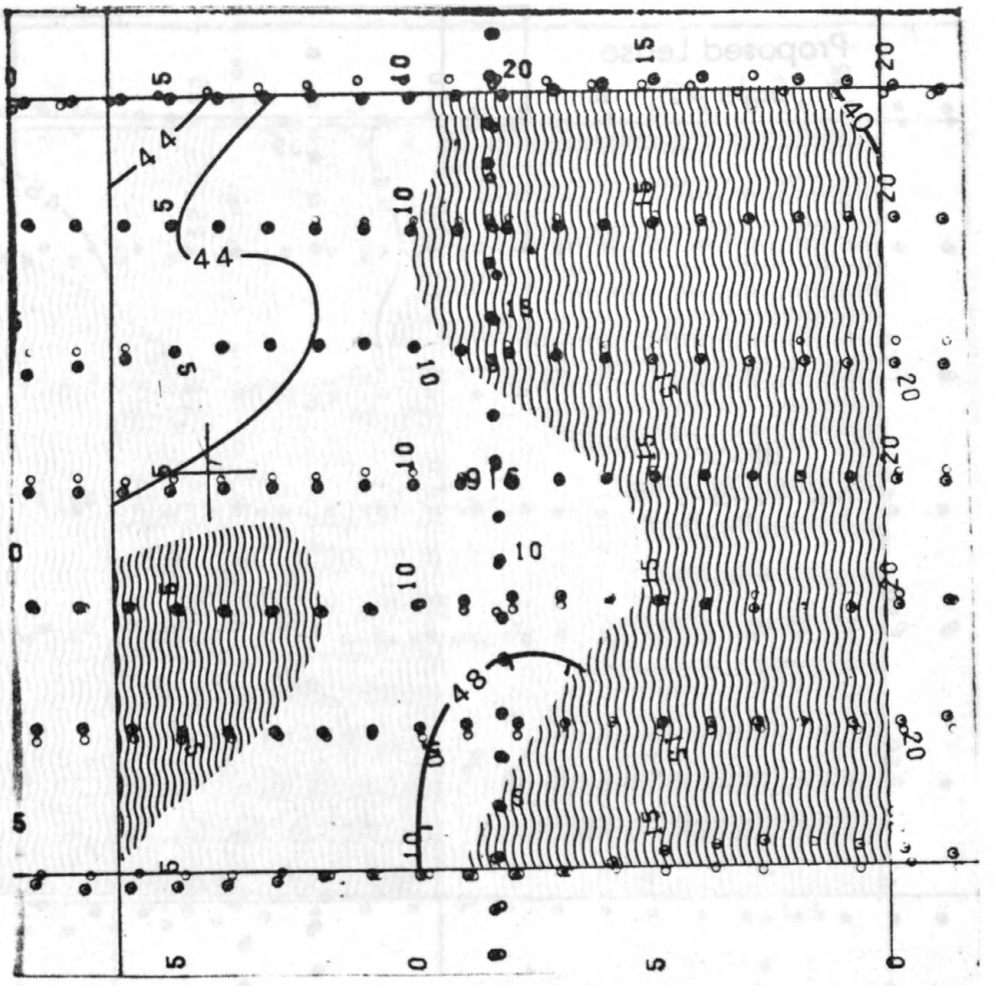
Shipwreck (northern shipwreck from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

Bottom Object

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–8–916

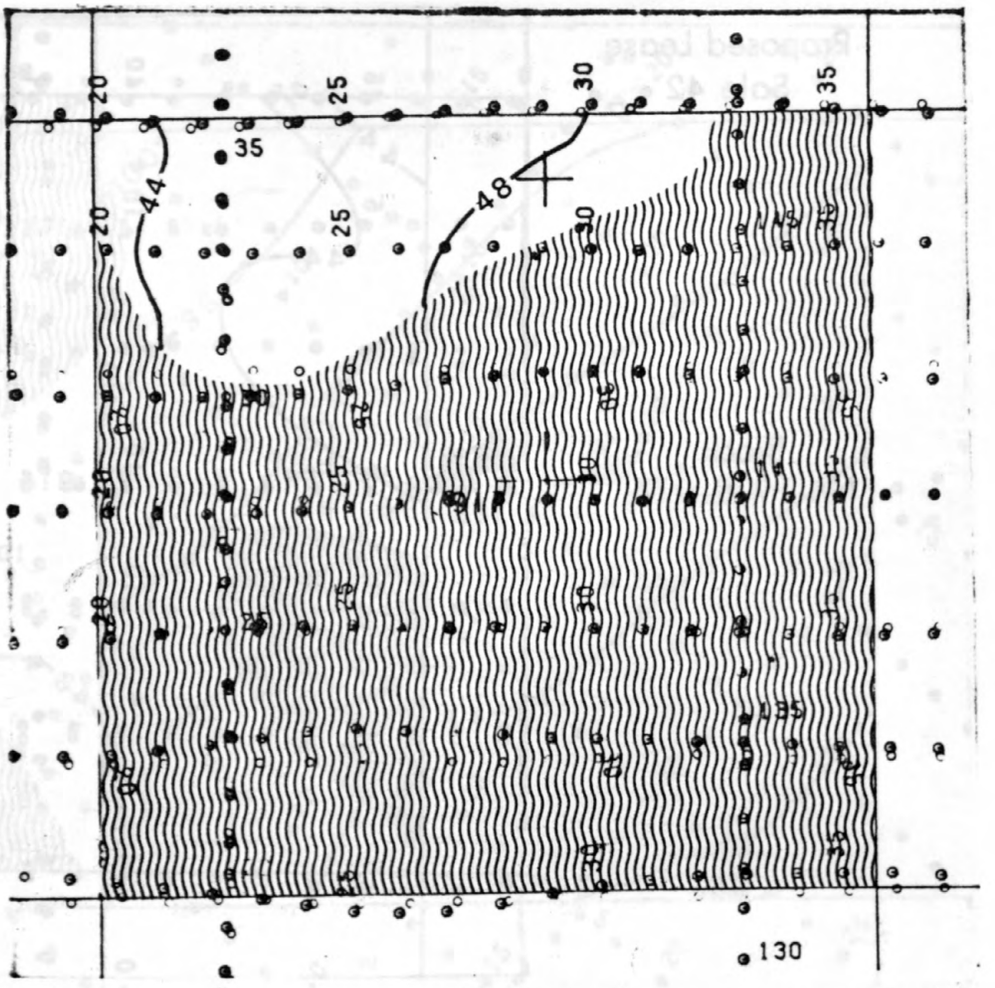


Water Depth: max. 51 m , min. 23 m
Slope Gradient: 2.3 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42



Block
NK 19–8–917

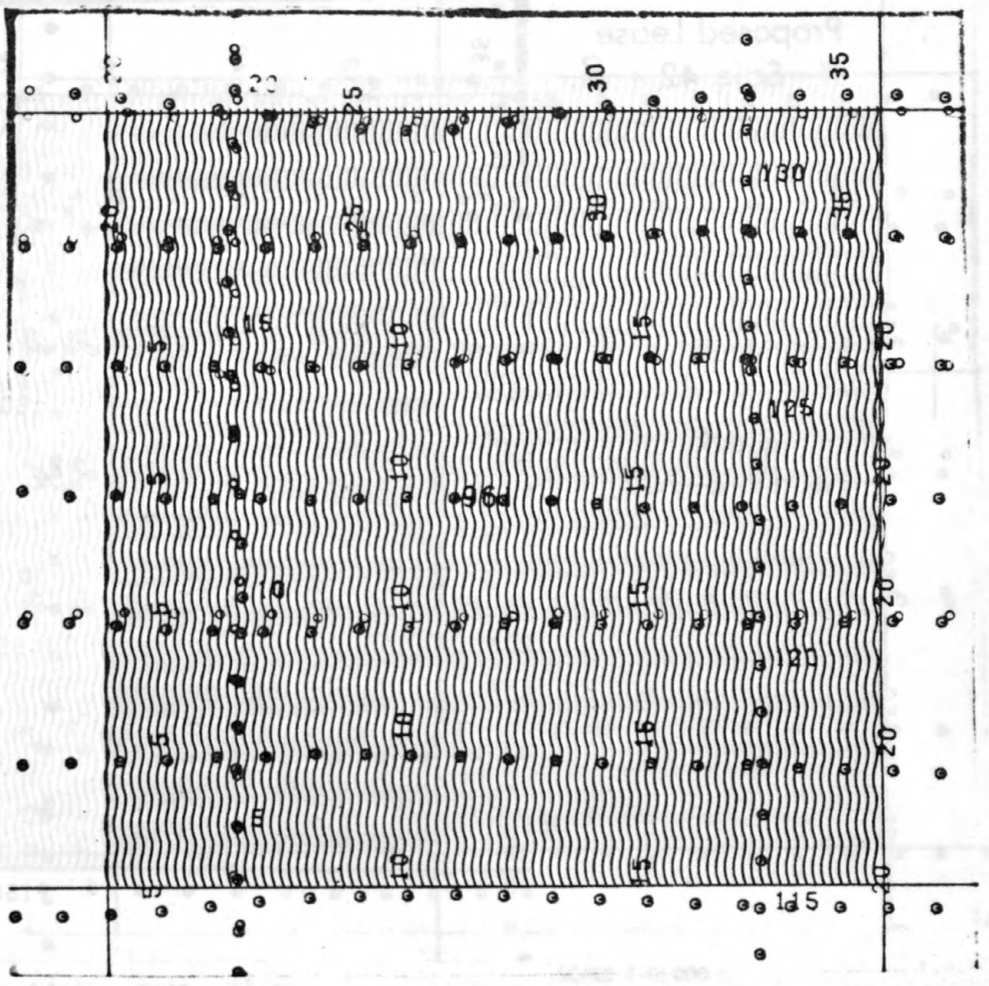
Water Depth: max. 50 m, min. 30 m
Slope Gradient: 2.3 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42



Block
NK 19–8–961

Water Depth: max. 50 m, min. 30 m
Slope Gradient: Variable m/km, Direction: N
Surface Sediment Type: Sand

SCALE 1:48 000

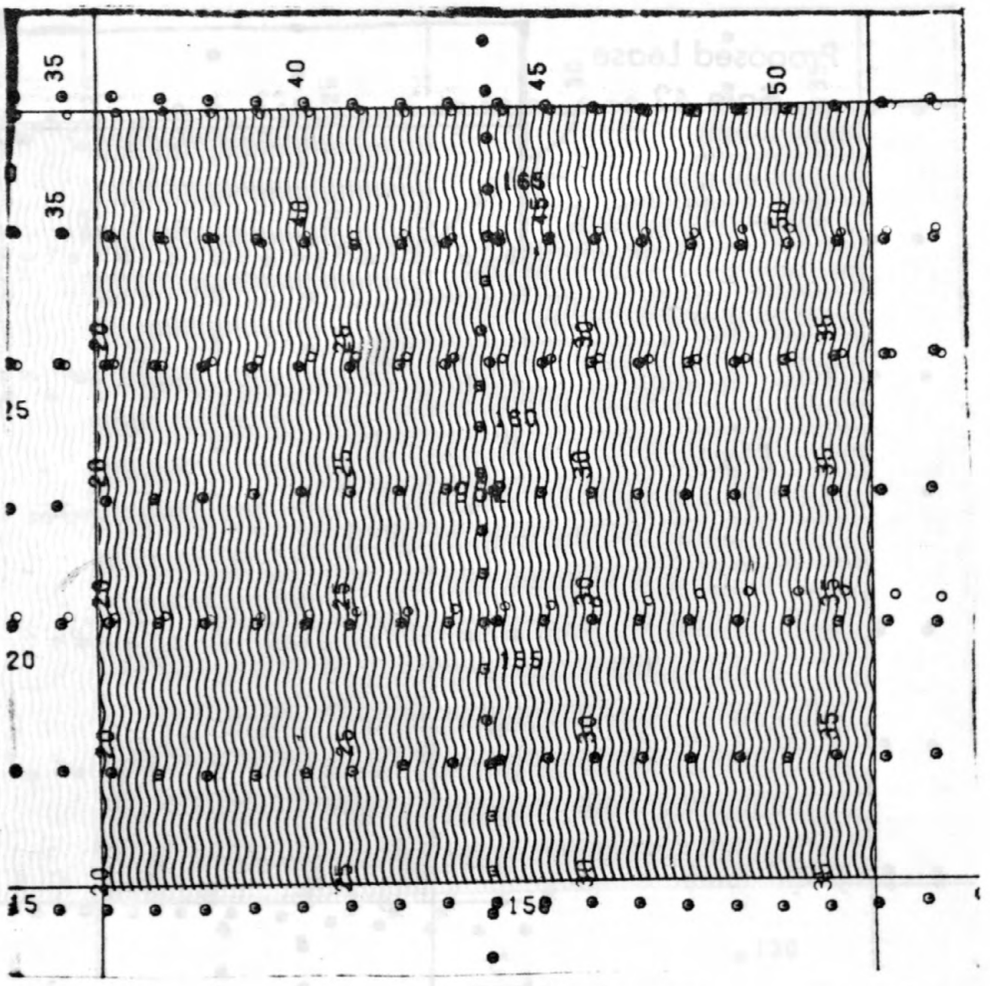
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42



Block
NK 19–8–962

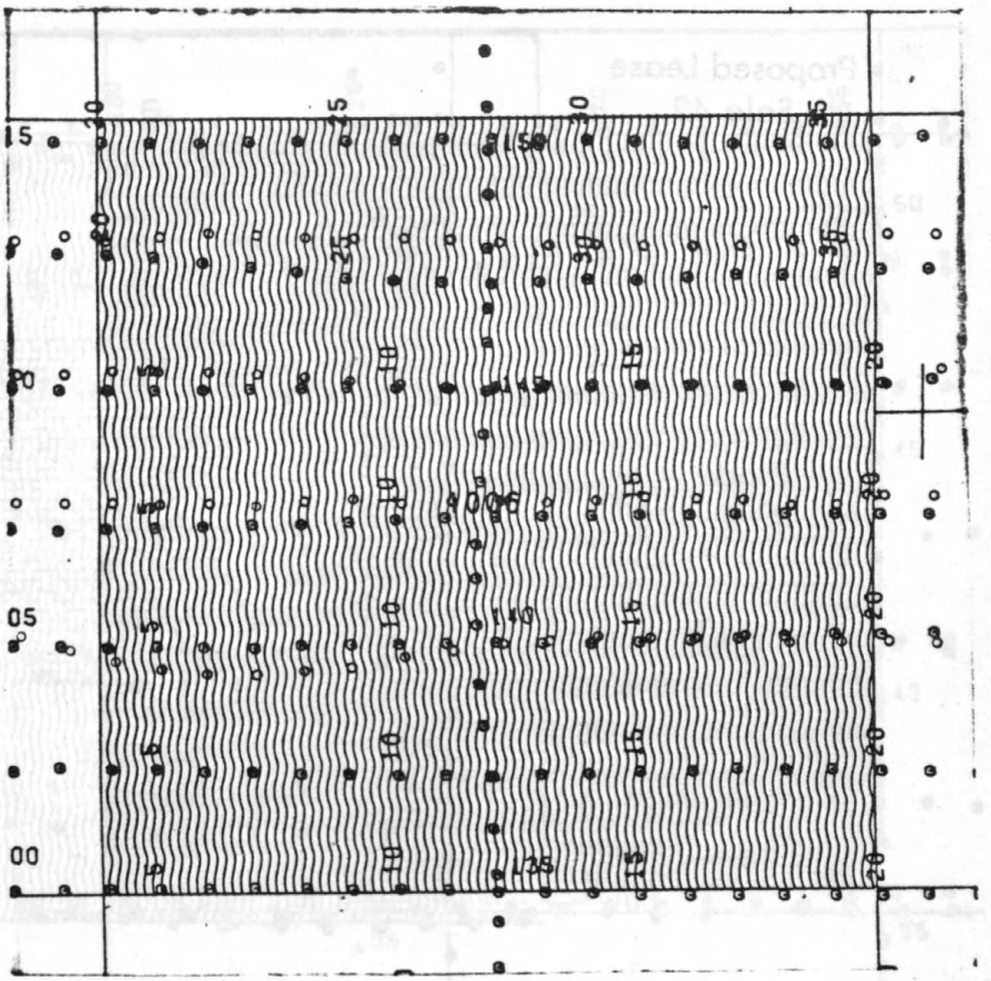
Water Depth: max. 51 m , min. 28 m
Slope Gradient: Variable m/km, Direction: Variable
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42



Block
NK 19–8–1006

Water Depth: max. 51 m , min. 35 m
Slope Gradient: Variable m/km, Direction: Variable
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

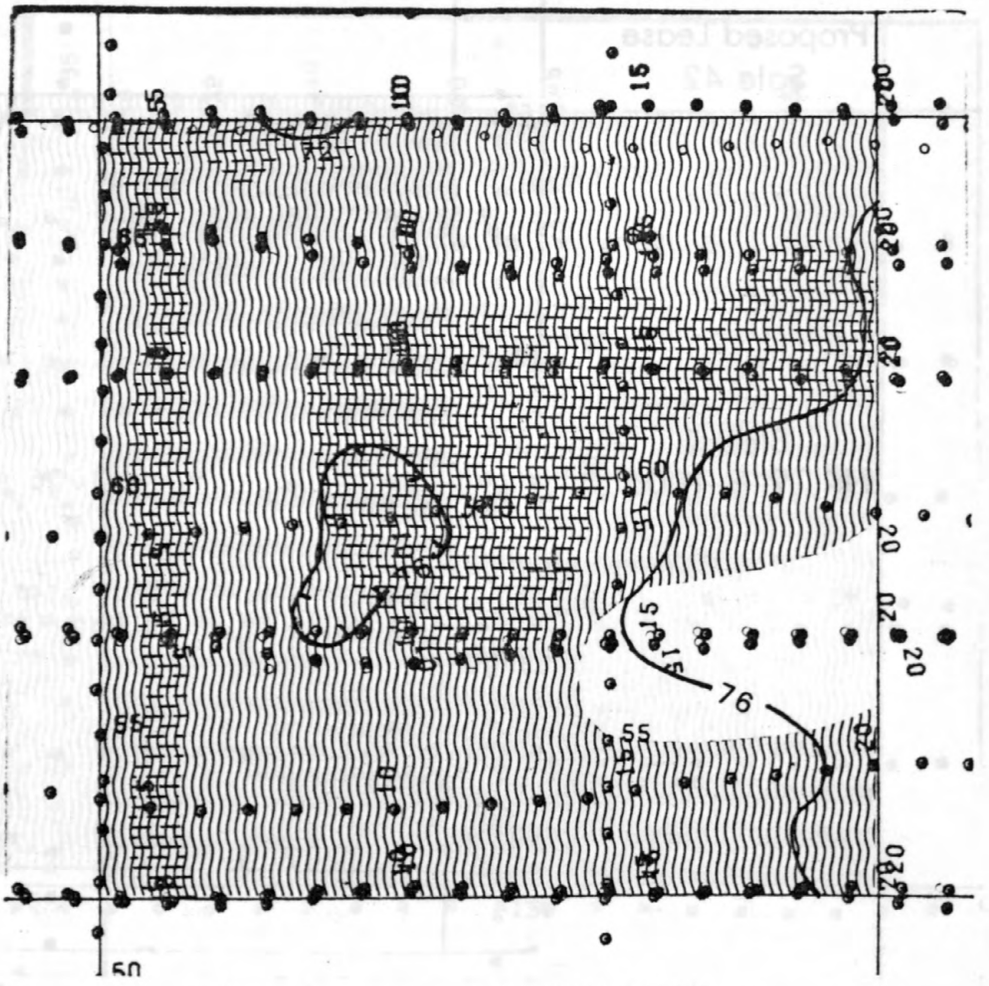
ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–9–330*



Water Depth: max. 77 m , min. 72 m
Slope Gradient: 0–4 m/km, Direction: E
Surface Sediment Type: Sand

CONSTRAINTS

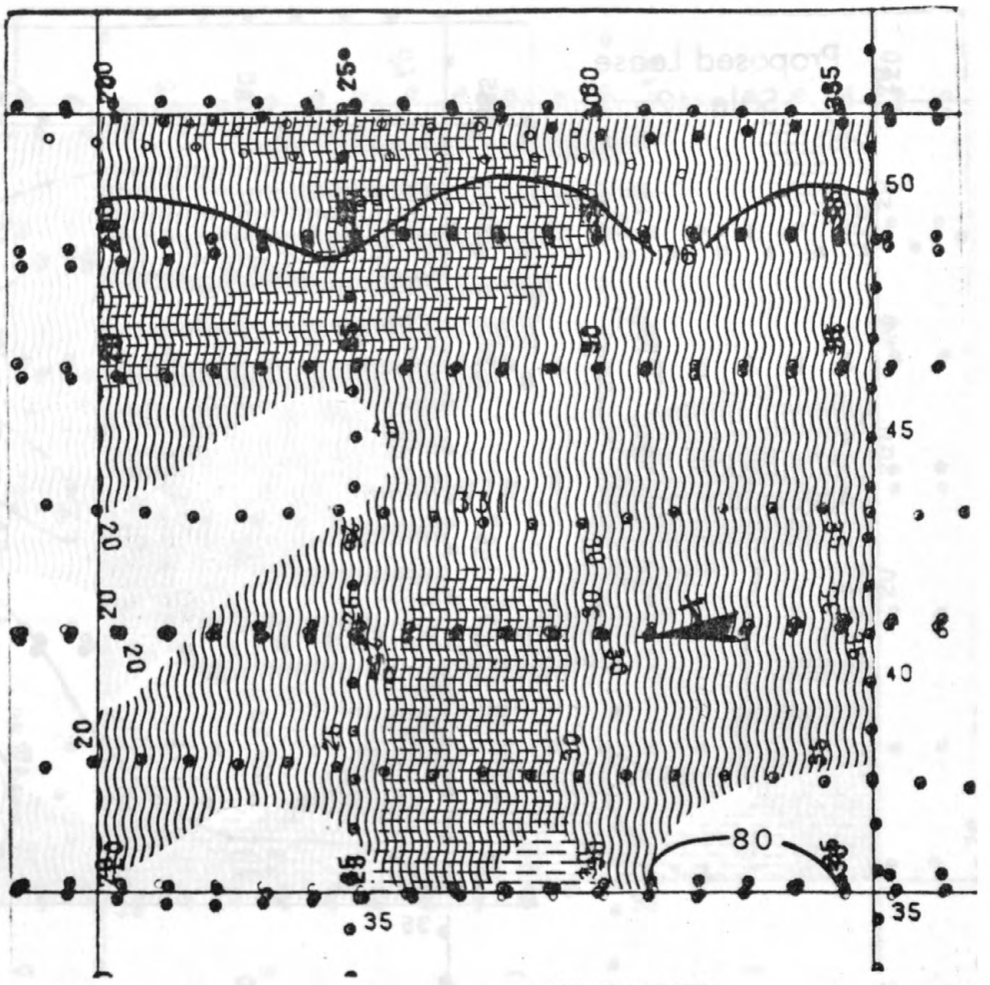
Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–331*



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 80 m , min. 74 m
Slope Gradient: 0–4 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINTS

Sand Wave Field

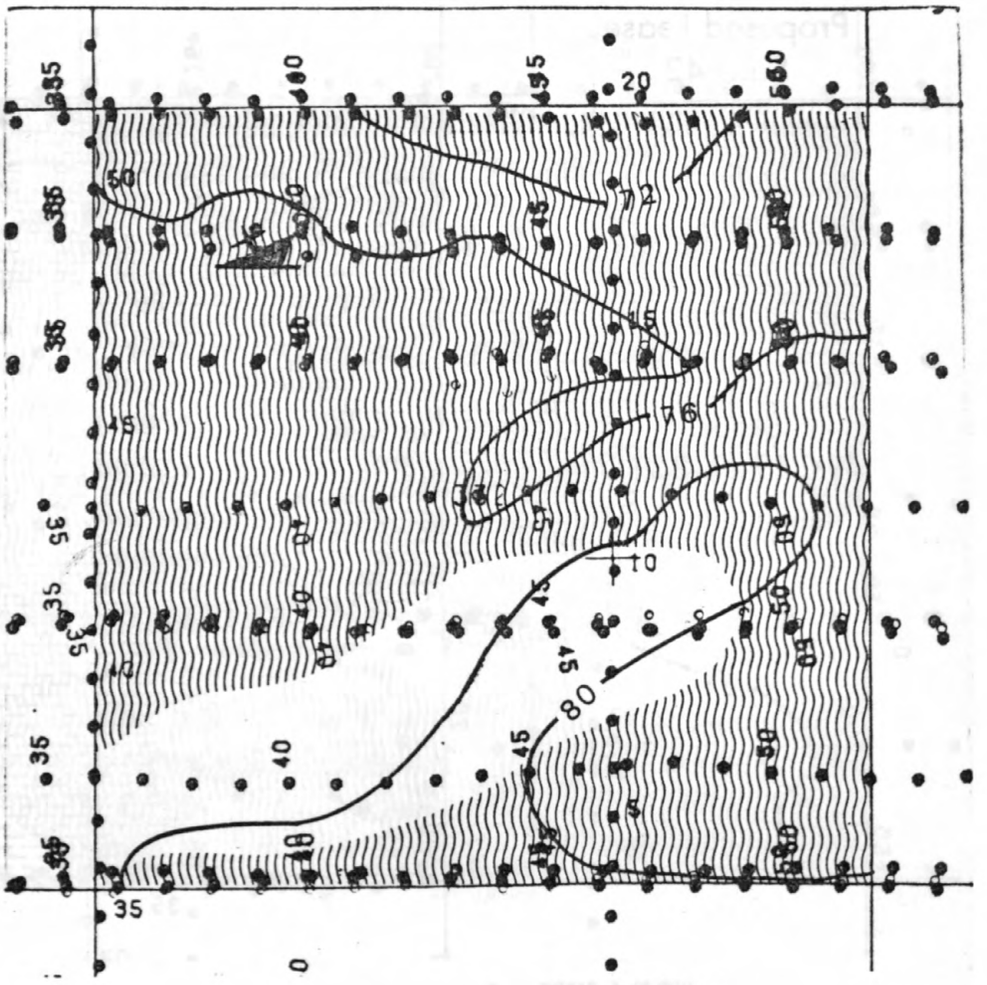
Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease Sale 42

Block NK 19–9–332*



Water Depth: max. 81 m , min. 71 m
Slope Gradient: 0–8 m/km, Direction: S
Surface Sediment Type: Sand

CONSTRAINTS

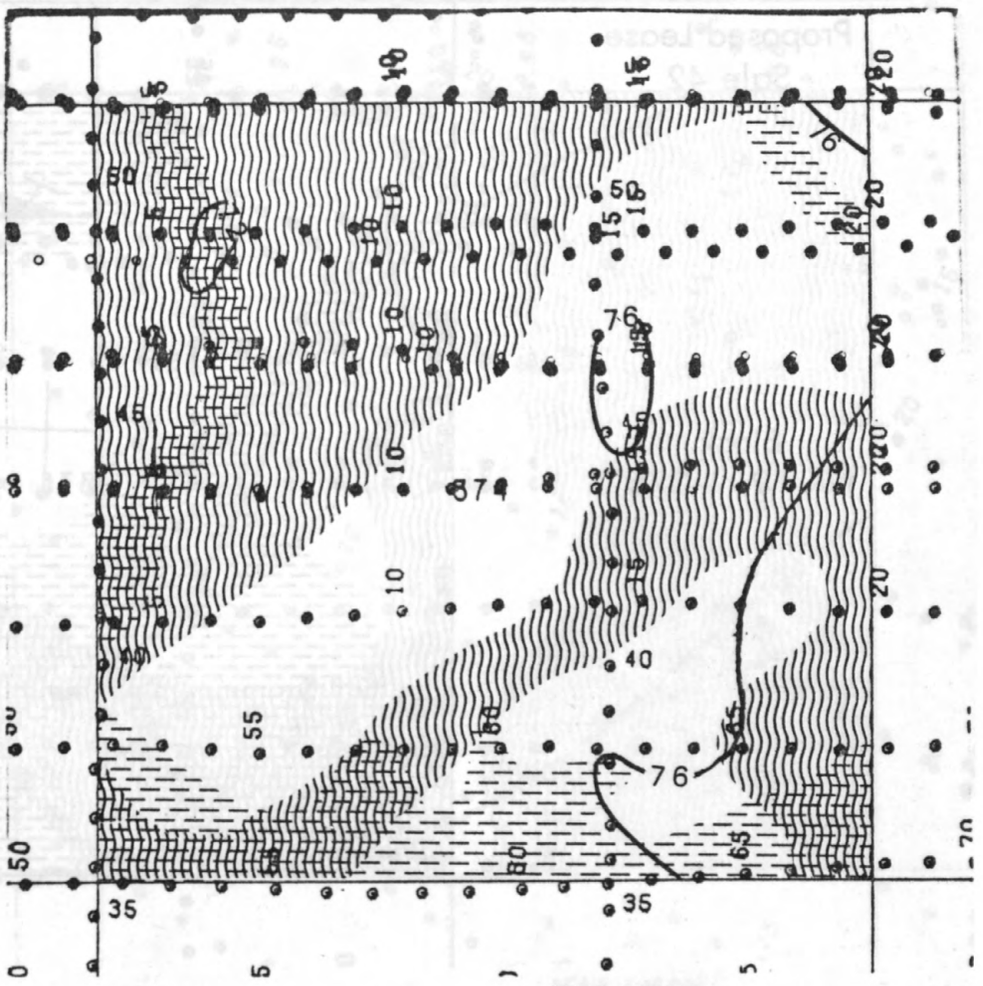
Sand Wave Field

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–374*



Water Depth: max. 76 m , min. 72 m
Slope Gradient: 0–3 m/km, Direction: E
Surface Sediment Type: Sand

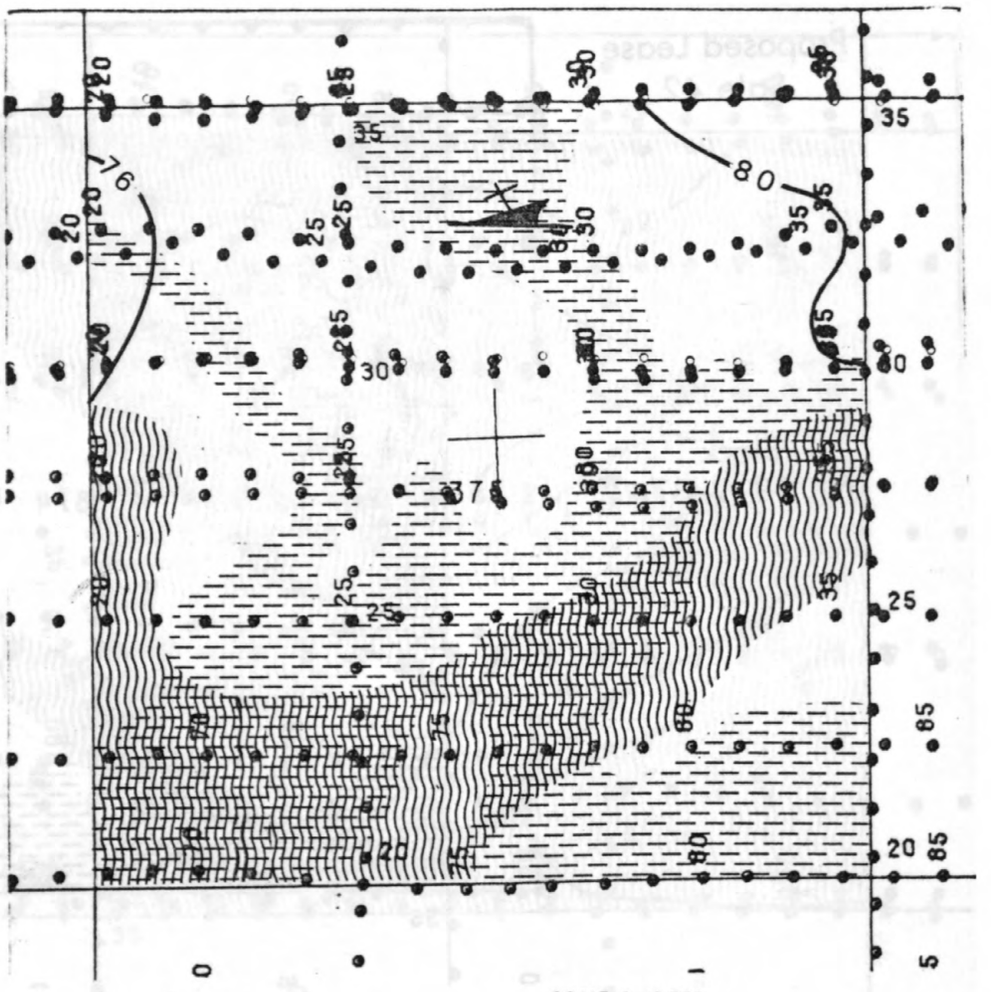
CONSTRAINTS

Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Water Depth: max. 80 m , min. 75 m
Slope Gradient: 0–3 m/km, Direction: E
Surface Sediment Type: Sand

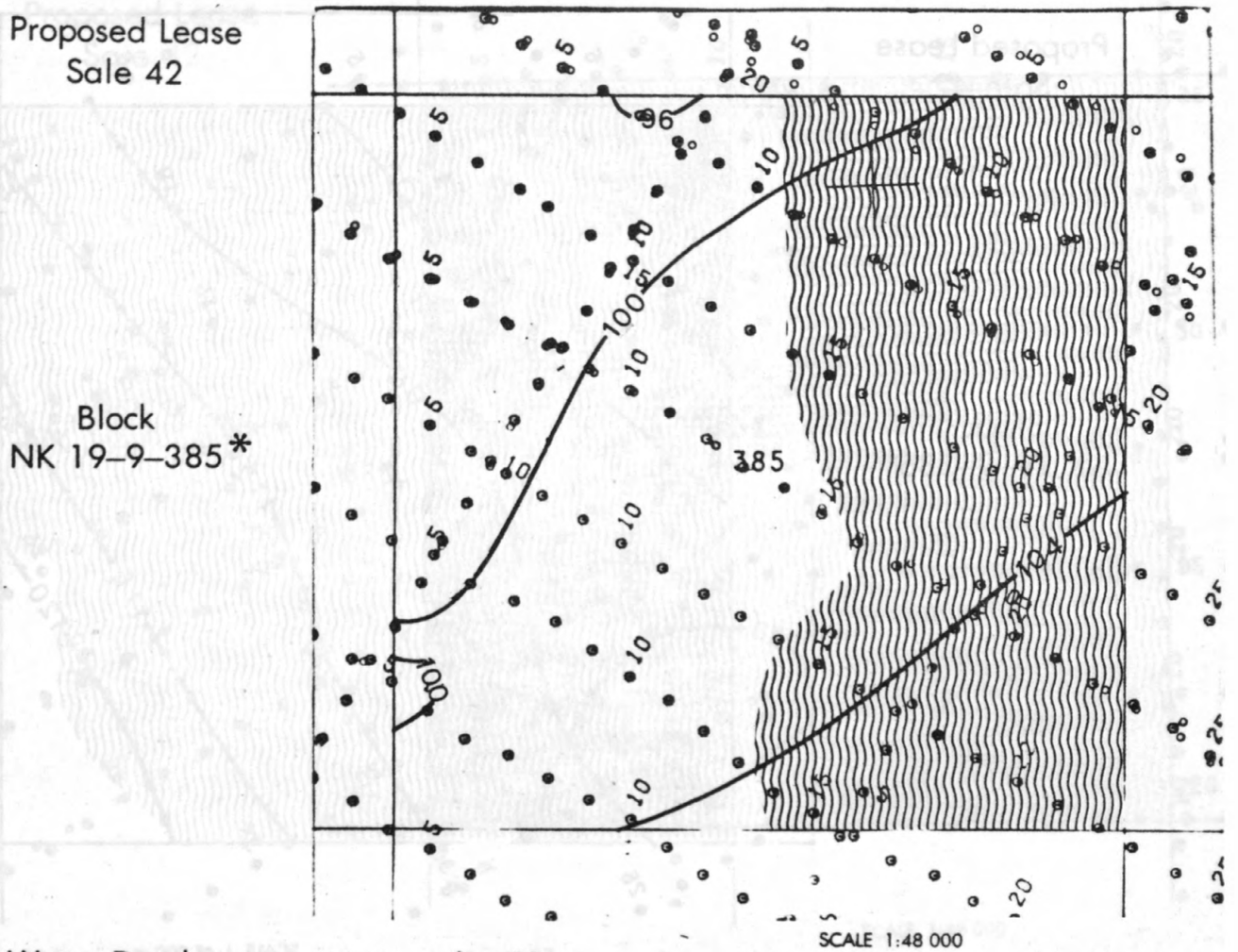
CONSTRAINTS

Sand Wave Field

Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

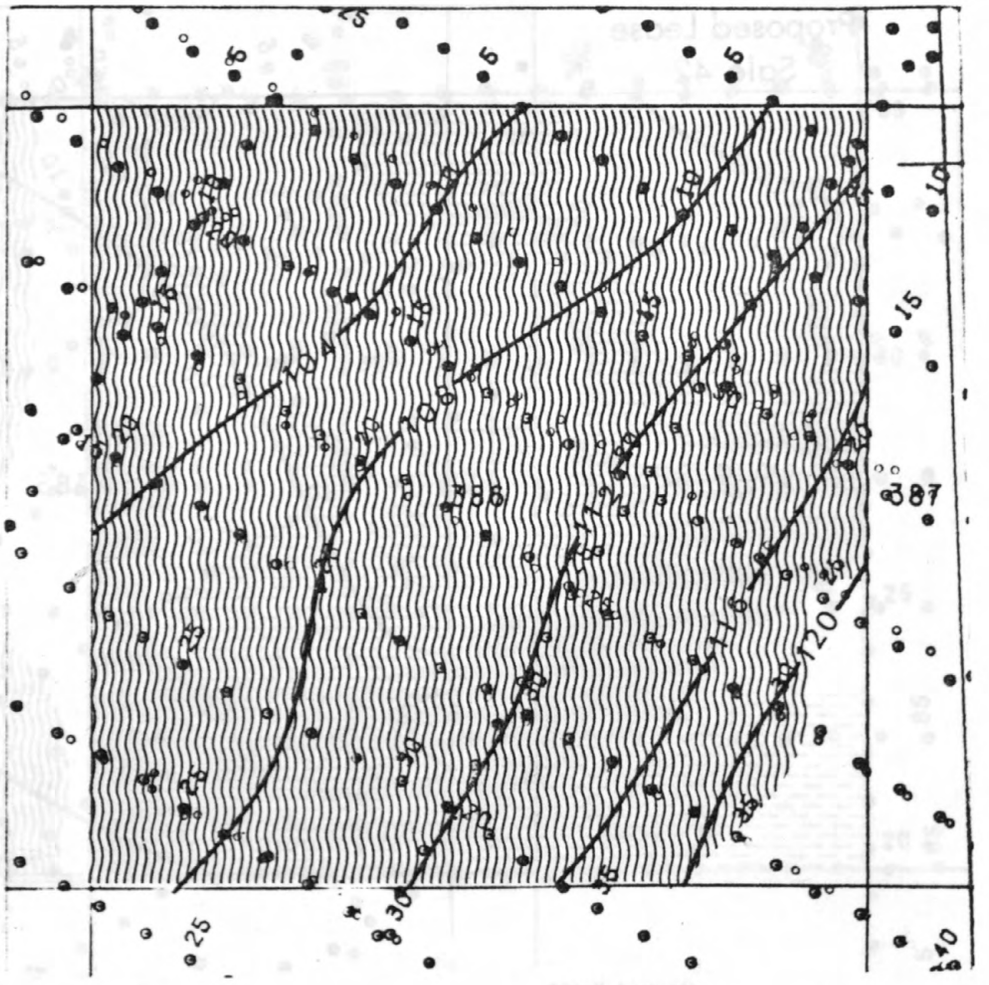


Water Depth: max. 106 m , min. 98 m
Slope Gradient: 1–4 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field (See figure 5)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

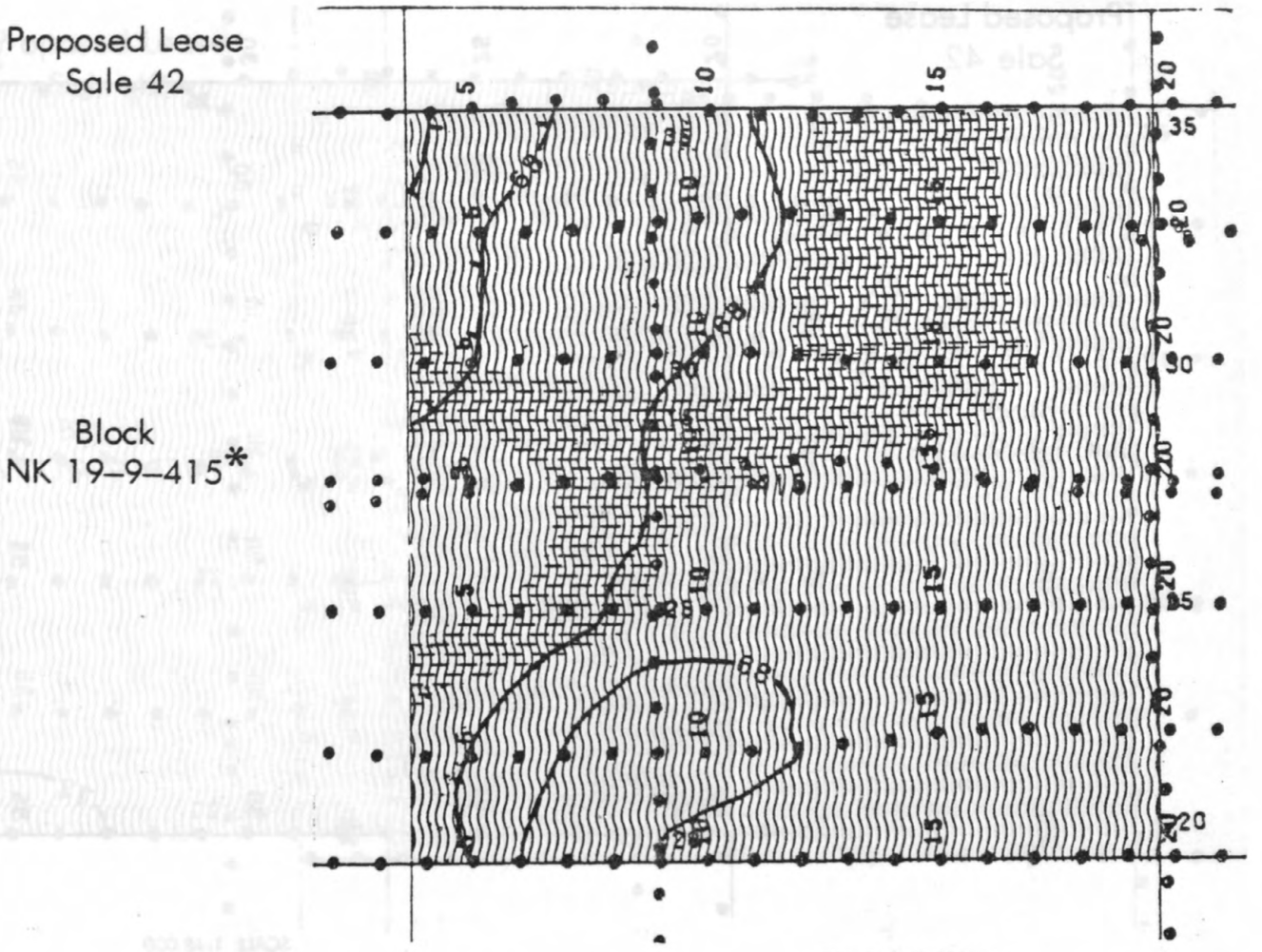


Water Depth: max. 127 m , min. 101 m
Slope Gradient: 1–9 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field (See figure 4)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 66 m , min. 71 m
Slope Gradient: 0–3 m/km, Direction: E
Surface Sediment Type: Sand

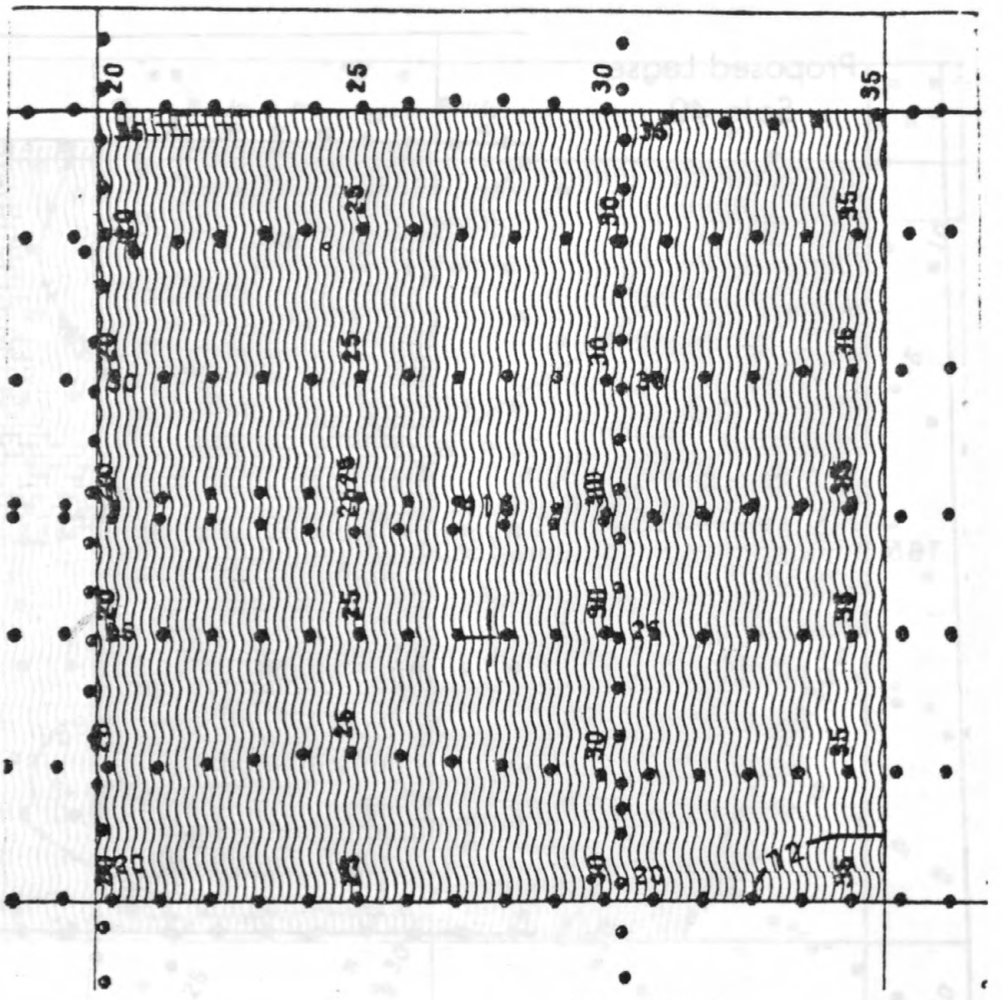
CONSTRAINTS

Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–9–416*

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 72 m , min. 69 m
Slope Gradient: 0–2 m/km, Direction: E
Surface Sediment Type: Sand

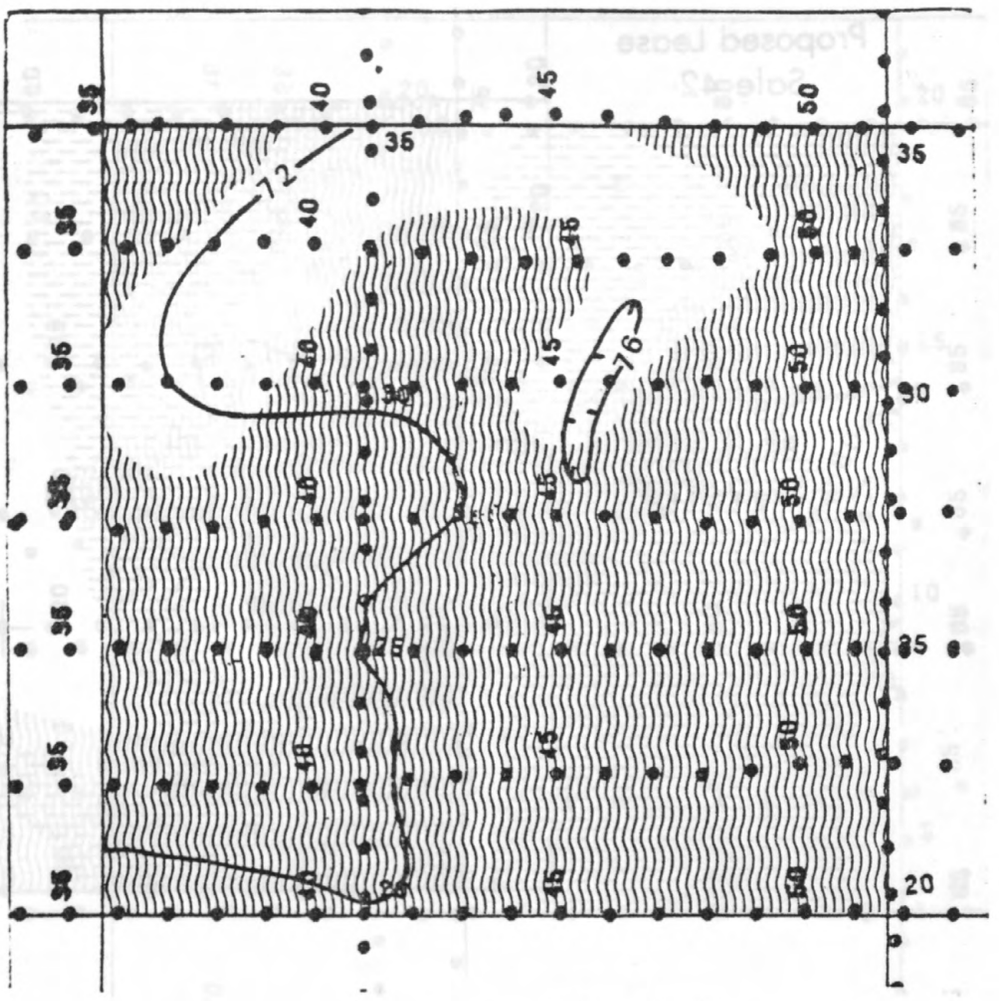
CONSTRAINT

Sand Wave Field

Filled Channel

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–9–417*

Water Depth: max. 76 m , min. 70 m
Slope Gradient: 0–6 m/km, Direction: E
Surface Sediment Type: Sand

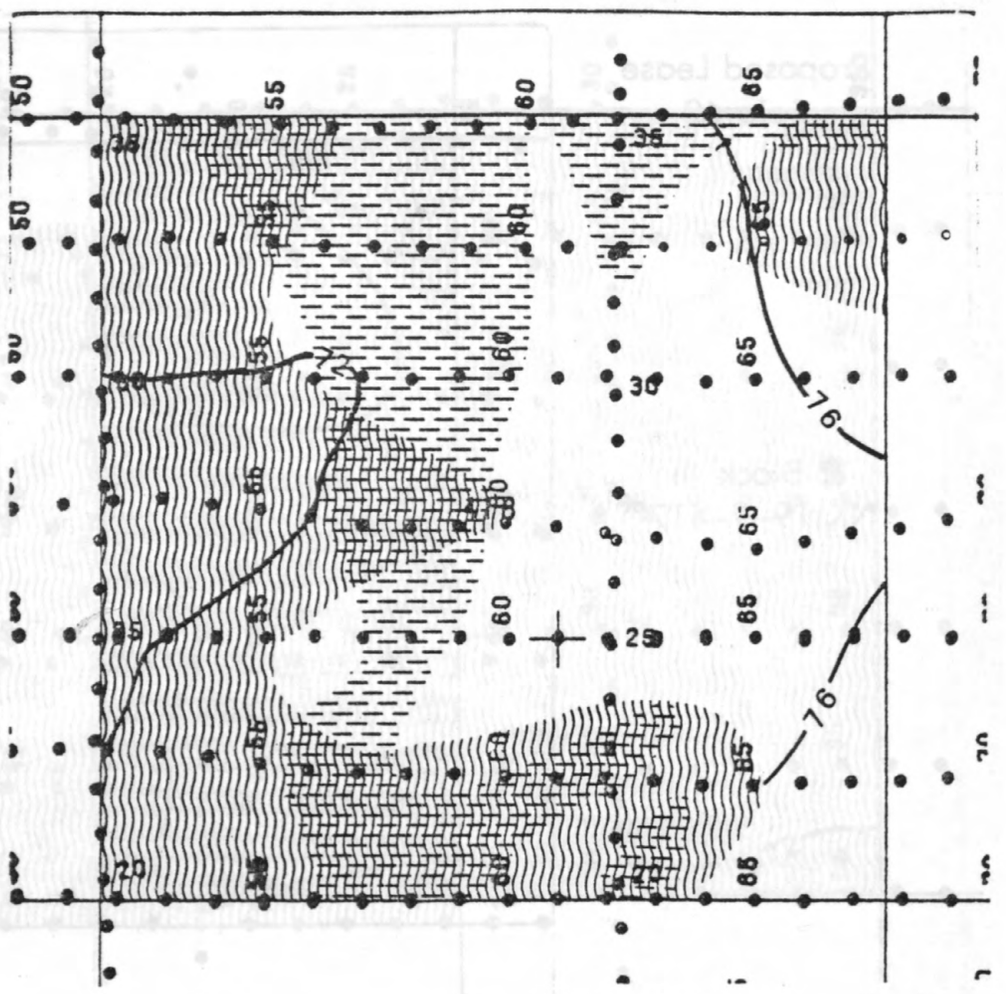
SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Water Depth: max. 77 m , min. 71 m
Slope Gradient: 0–3 m/km, Direction: E
Surface Sediment Type: Sand

CONSTRAINTS

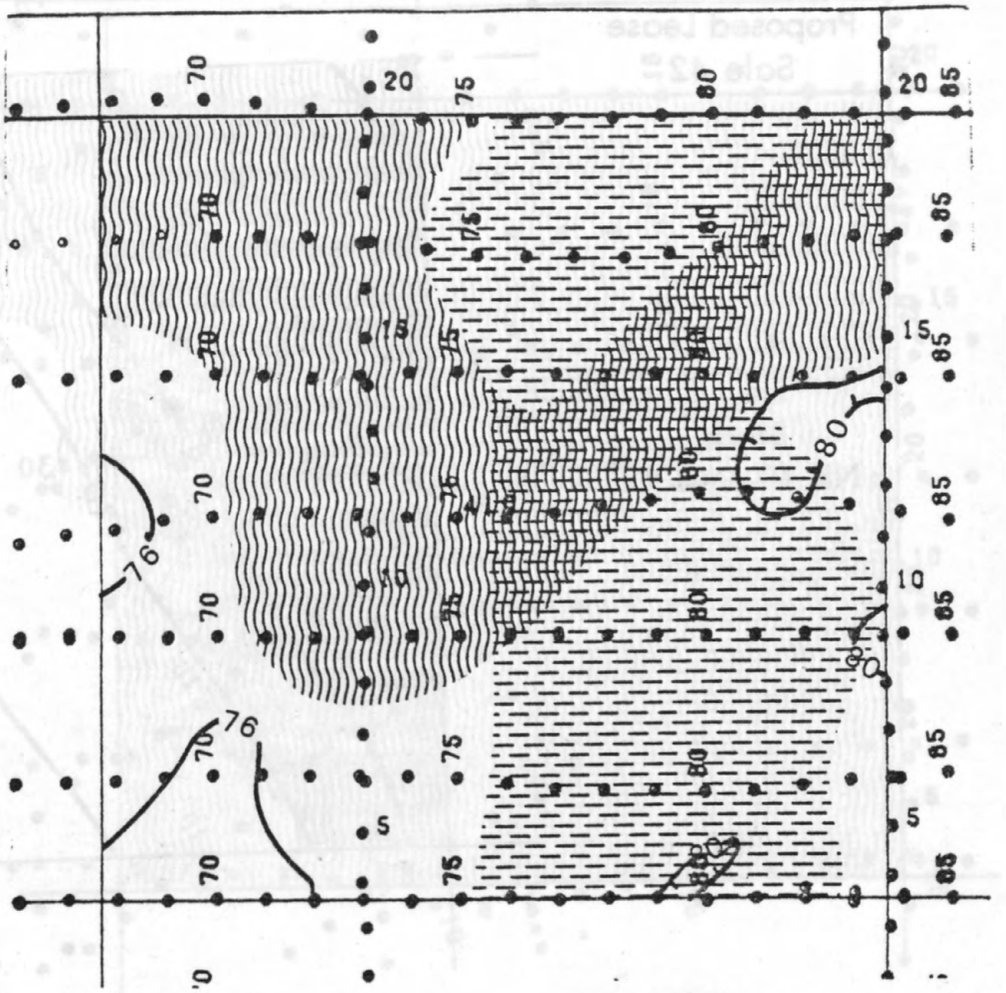
Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–419*



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 80 m , min. 75 m
Slope Gradient: 0–4 m/km, Direction: E
Surface Sediment Type: Sand

CONSTRAINTS

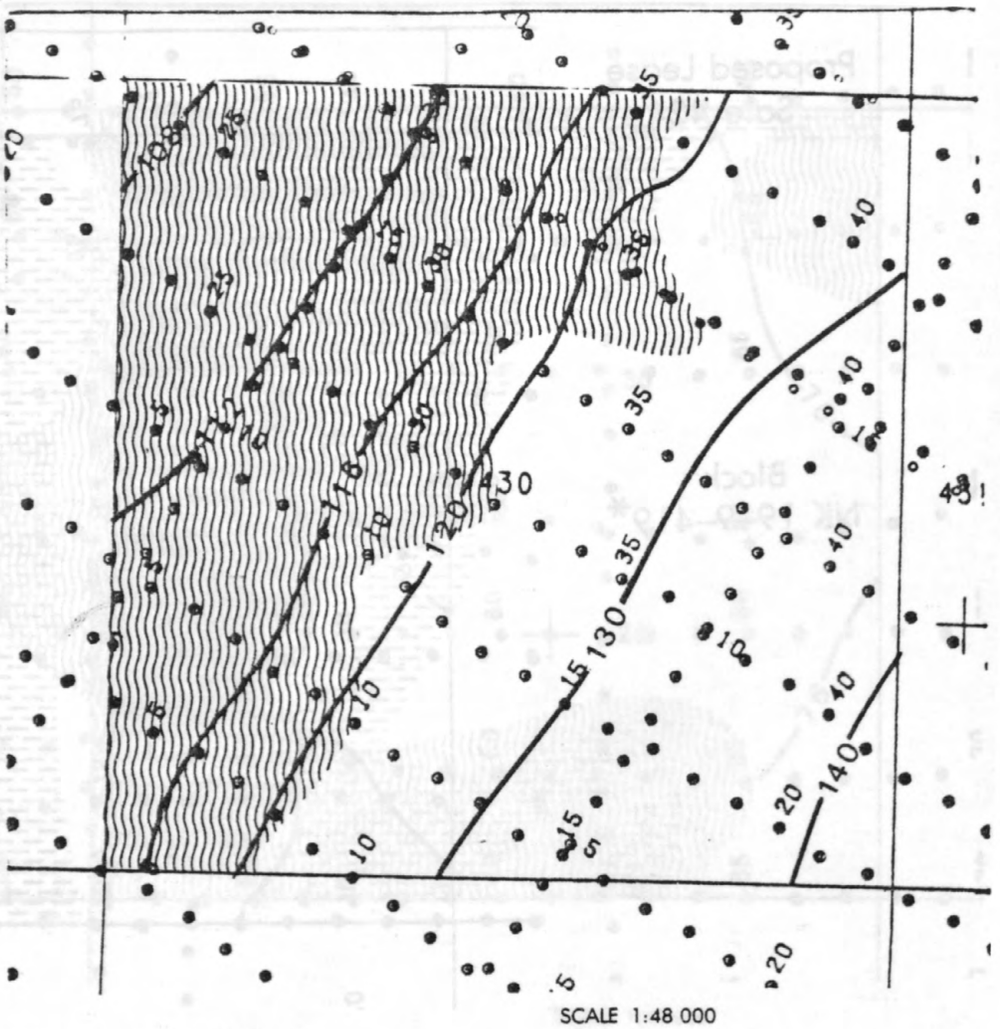
Sand Wave Field

Filled Channel

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–430*

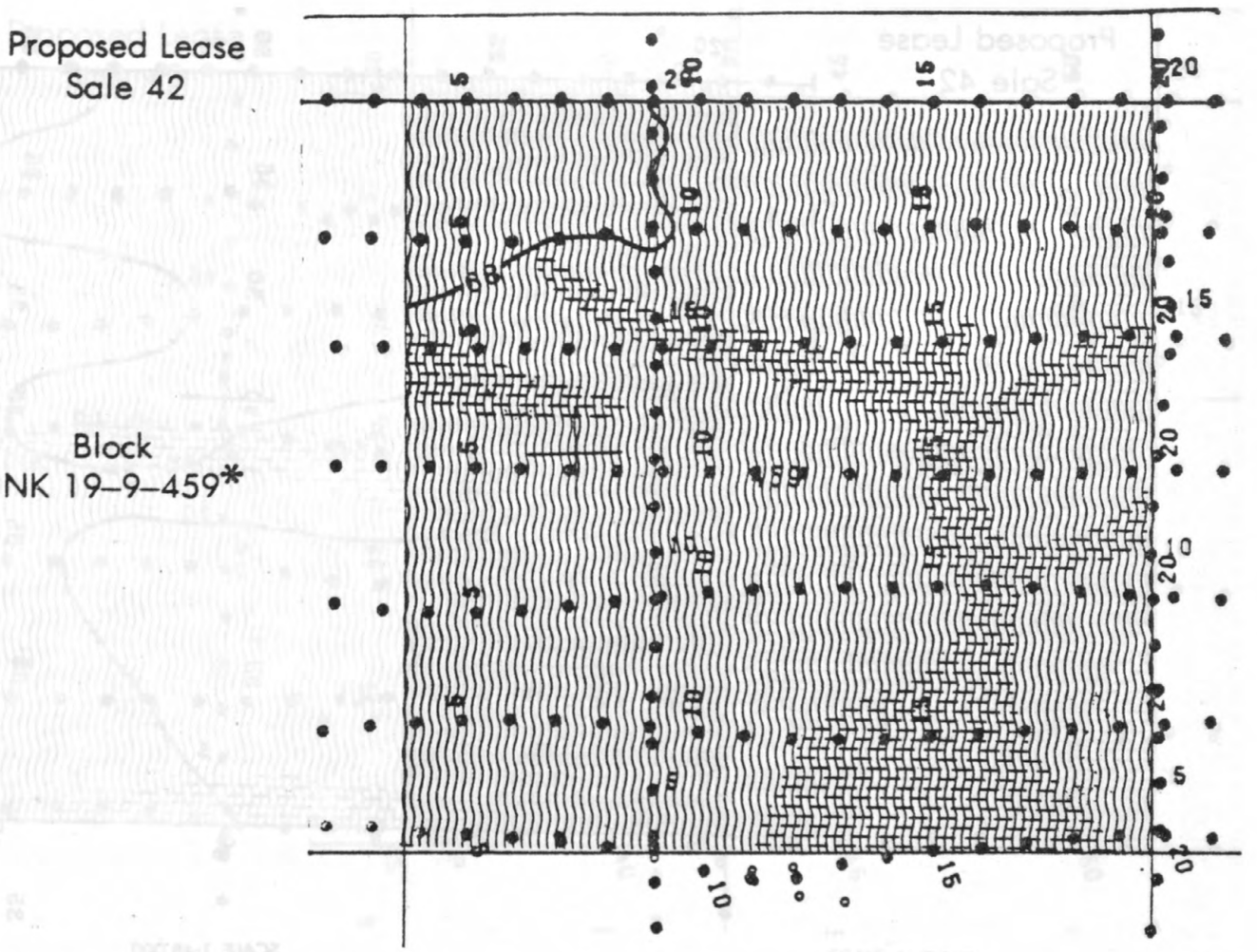


Water Depth: max. 142 m , min. 107 m
Slope Gradient: 1–10 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



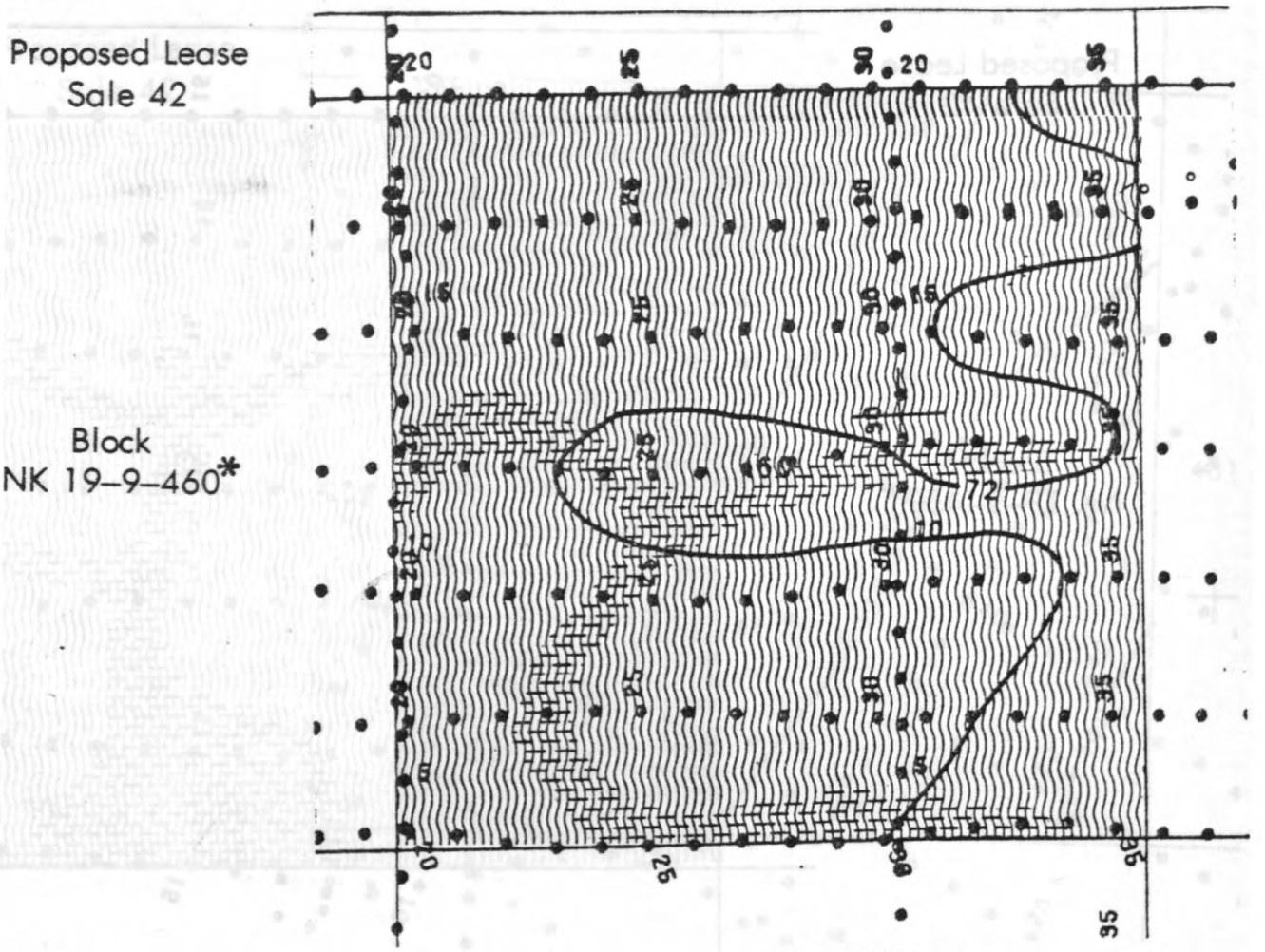
Water Depth: max. 70 m , min. 67 m
Slope Gradient: 0–2 m/km, Direction: E
Surface Sediment Type: Sand

CONSTRAINTS

Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 73 m , min. 69 m
Slope Gradient: 0–2 m/km, Direction: E
Surface Sediment Type: Sand

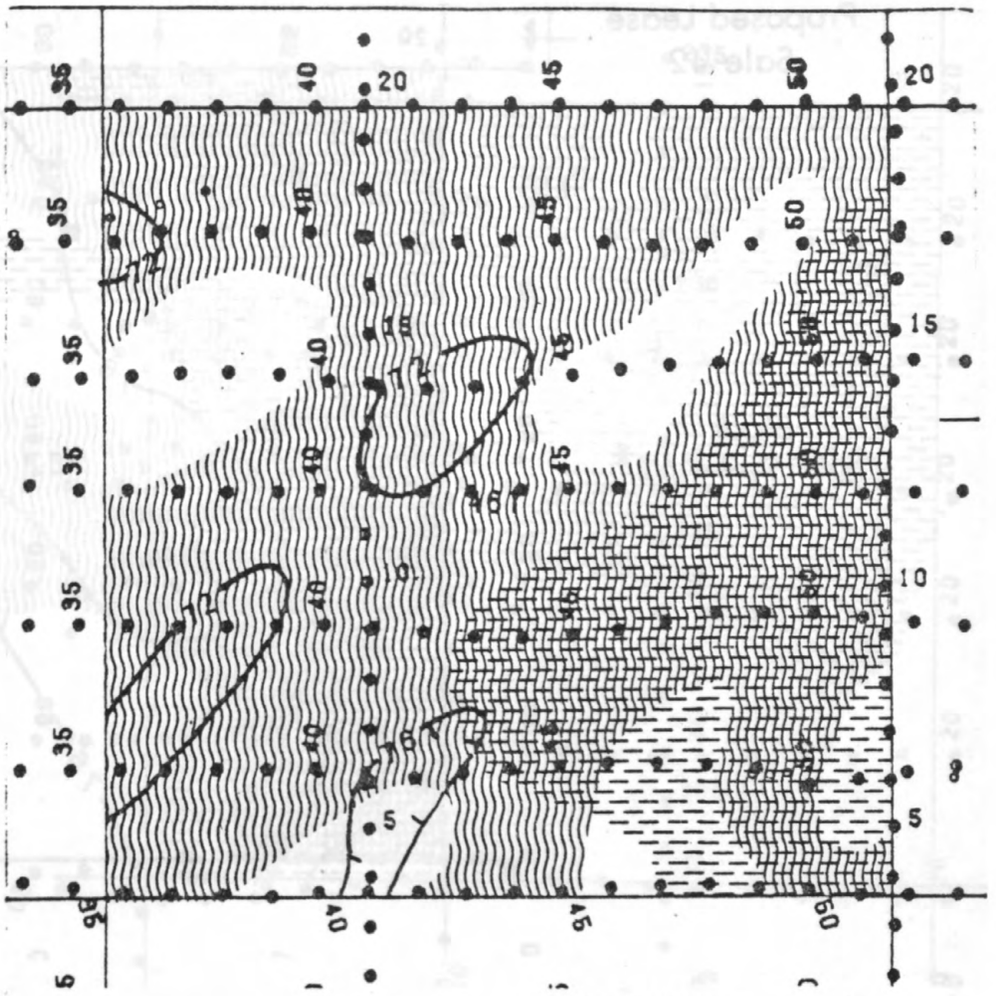
CONSTRAINTS

Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Water Depth: max. 76 m , min. 71 m
Slope Gradient: 0–5 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINTS

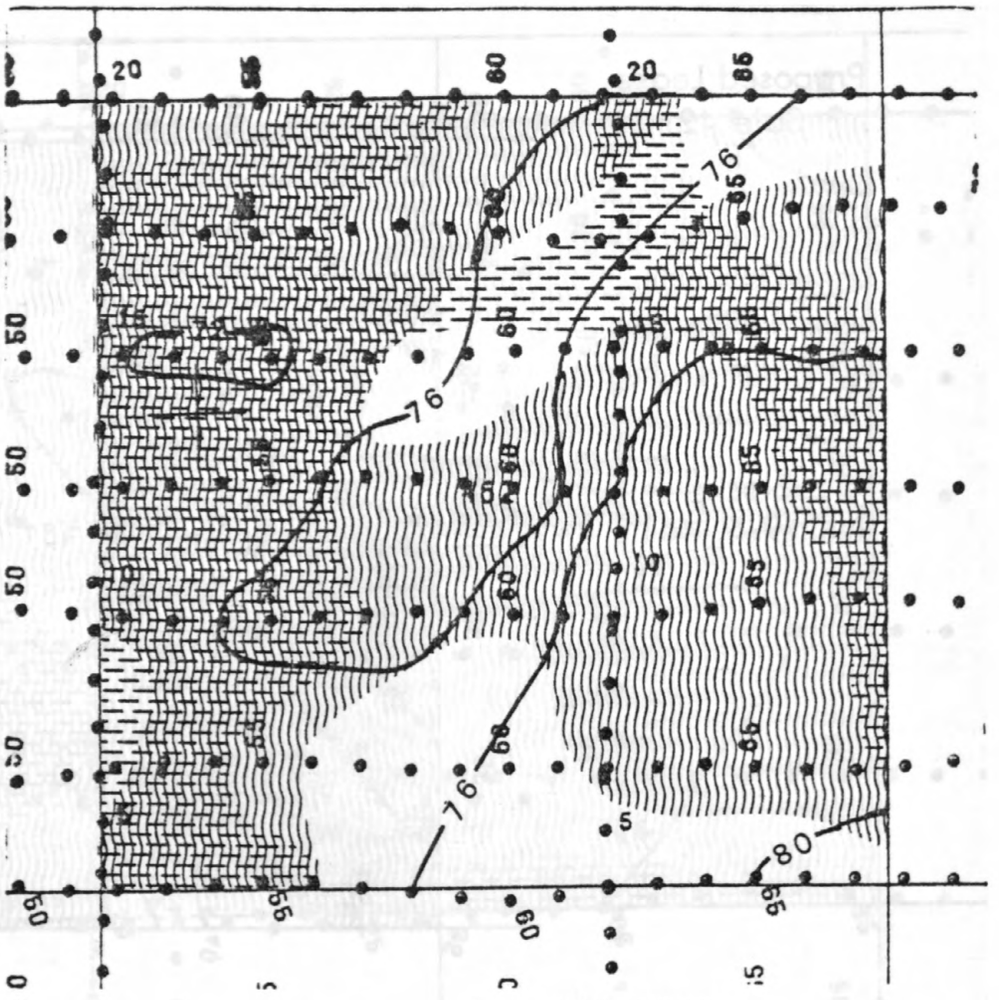
Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–462*



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 81 m , min. 72 m
Slope Gradient: 0–5 m/km, Direction: SE
Surface Sediment Type: Sand.

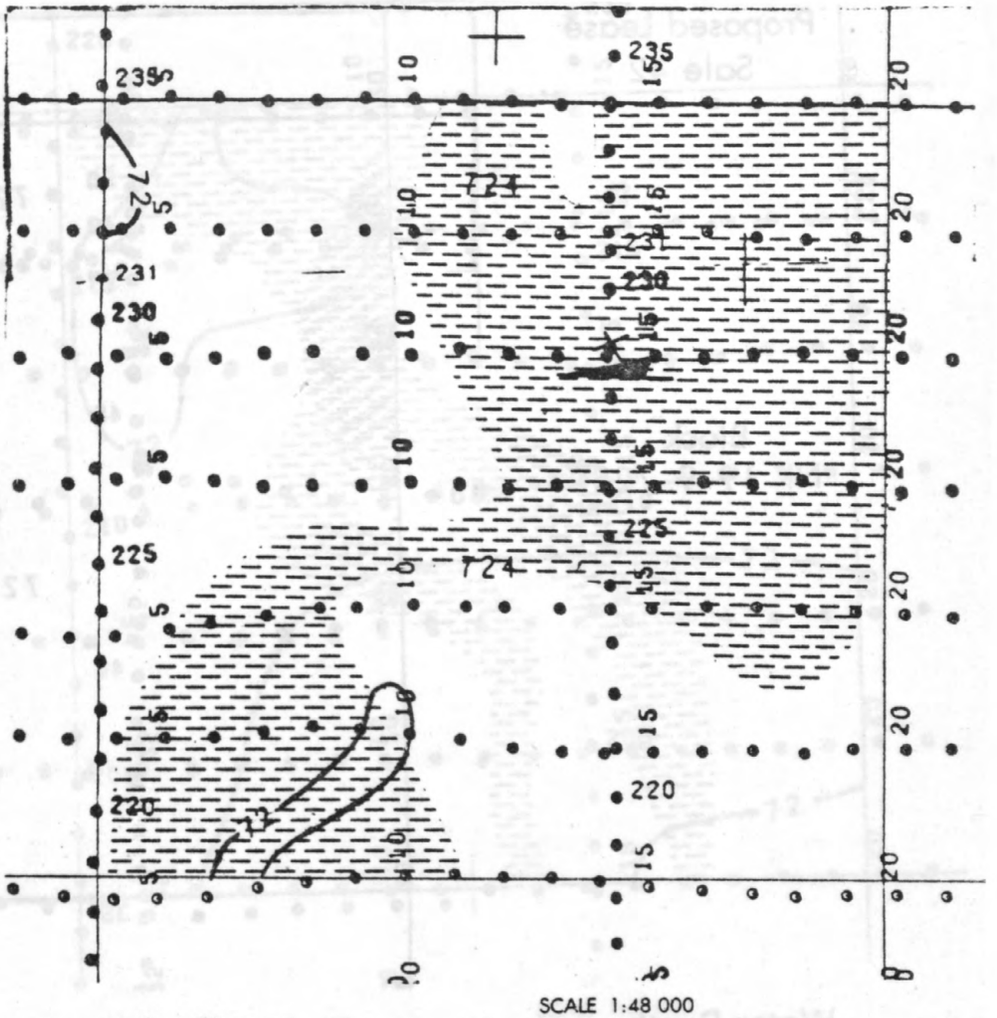
CONSTRAINTS

Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease Sale 42



Block NK 19–9–724*

Water Depth: max. 74 m , min. 72 m
Slope Gradient: 0–1 m/km, Direction: SE
Surface Sediment Type: Sand

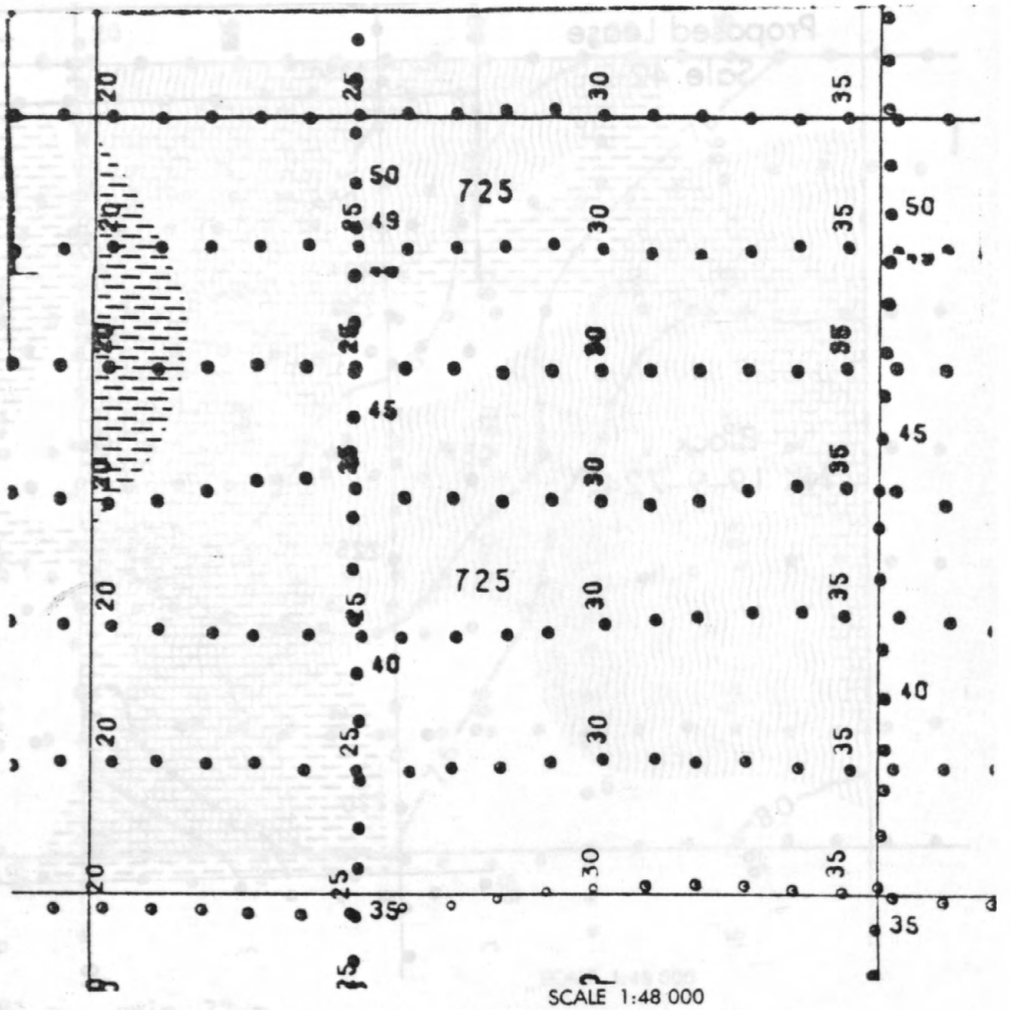
CONSTRAINTS

Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–9–725*

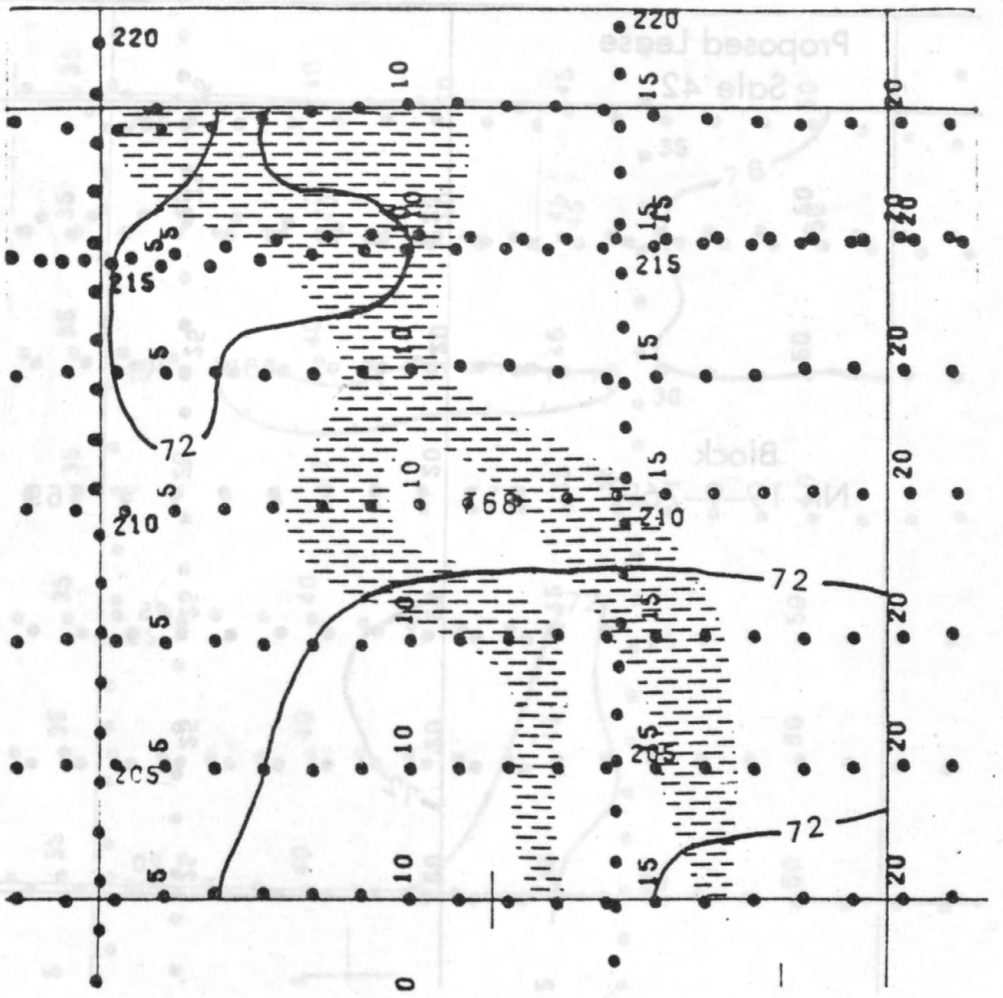
Water Depth: max. 75 m , min. 73 m
Slope Gradient: 0–3 m/km, Direction: NE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

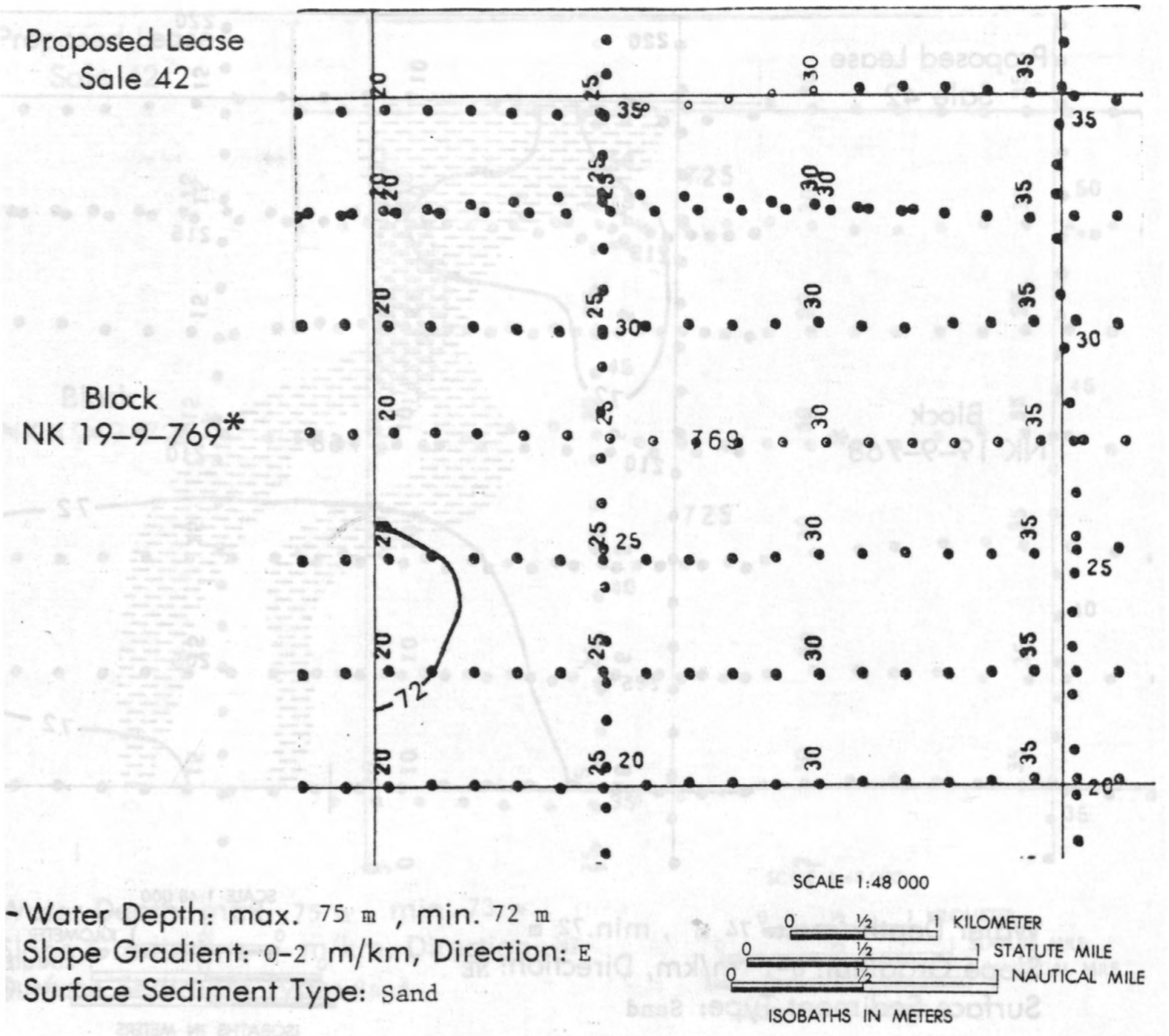
ISOBATHS IN METERS

Water Depth: max. 74 m , min. 72 m
Slope Gradient: 0-1 m/km, Direction: NE
Surface Sediment Type: Sand

CONSTRAINT

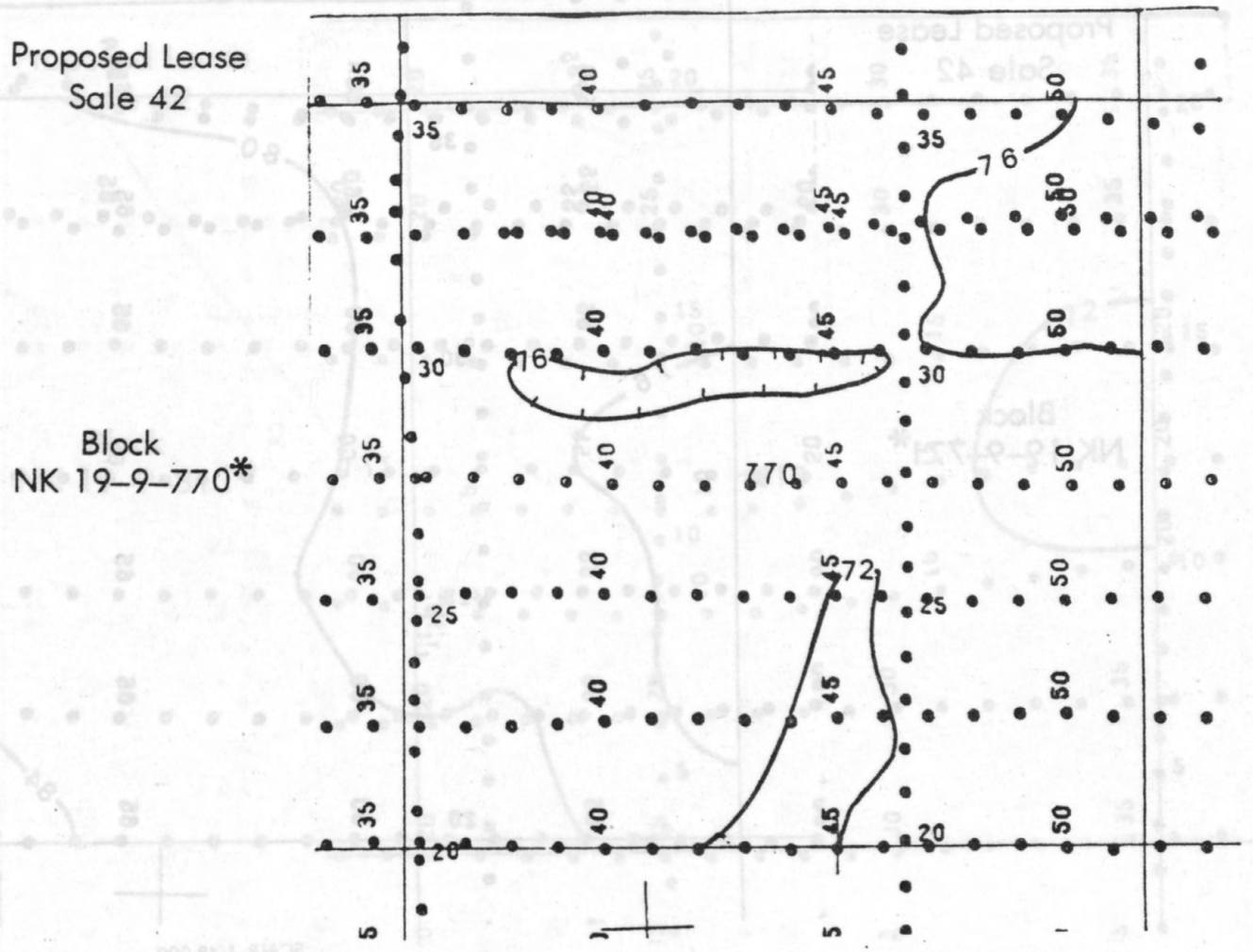
Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



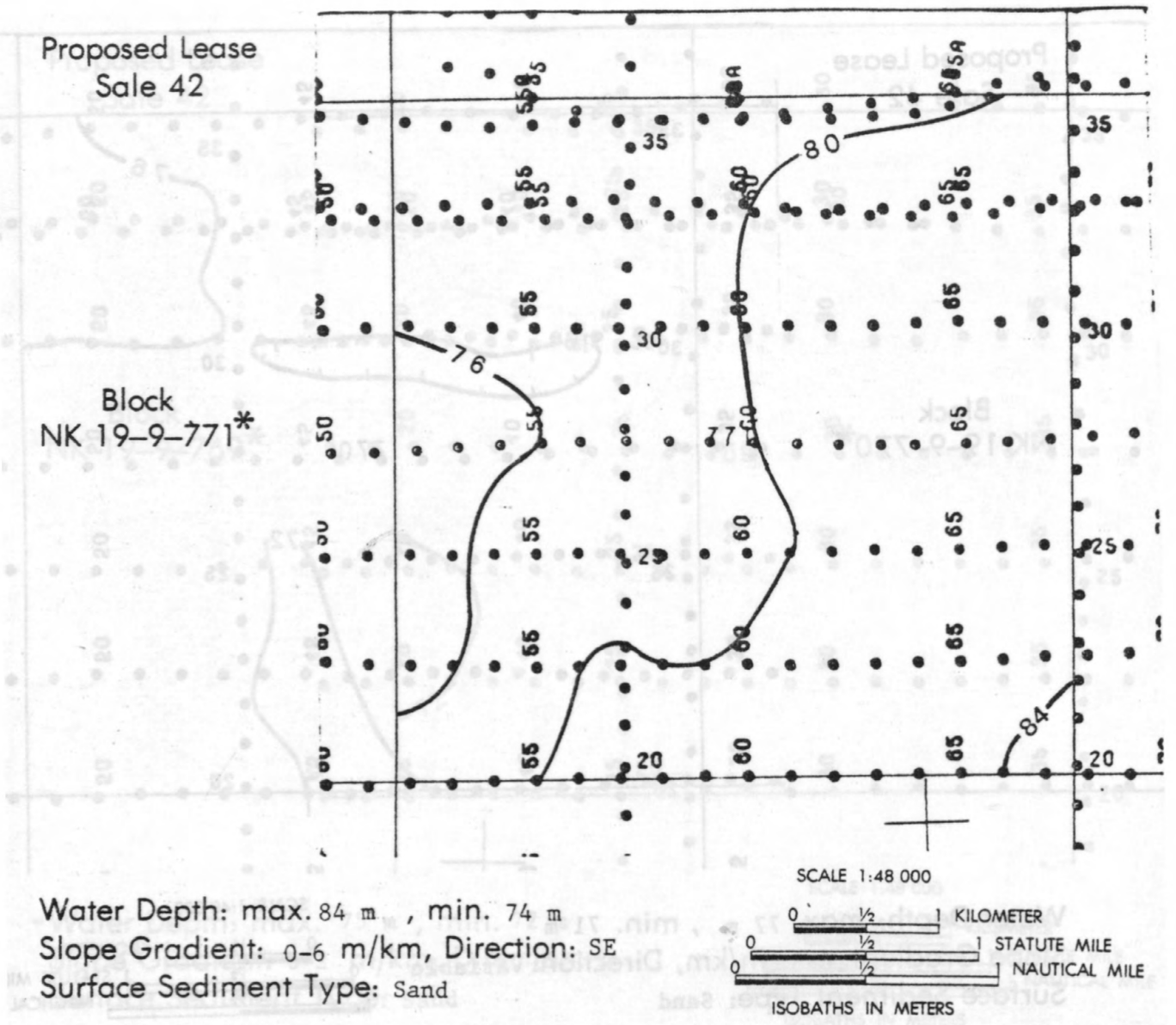
- Water Depth: max. 75 m , min. 72 m
Slope Gradient: 0–2 m/km, Direction: E
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



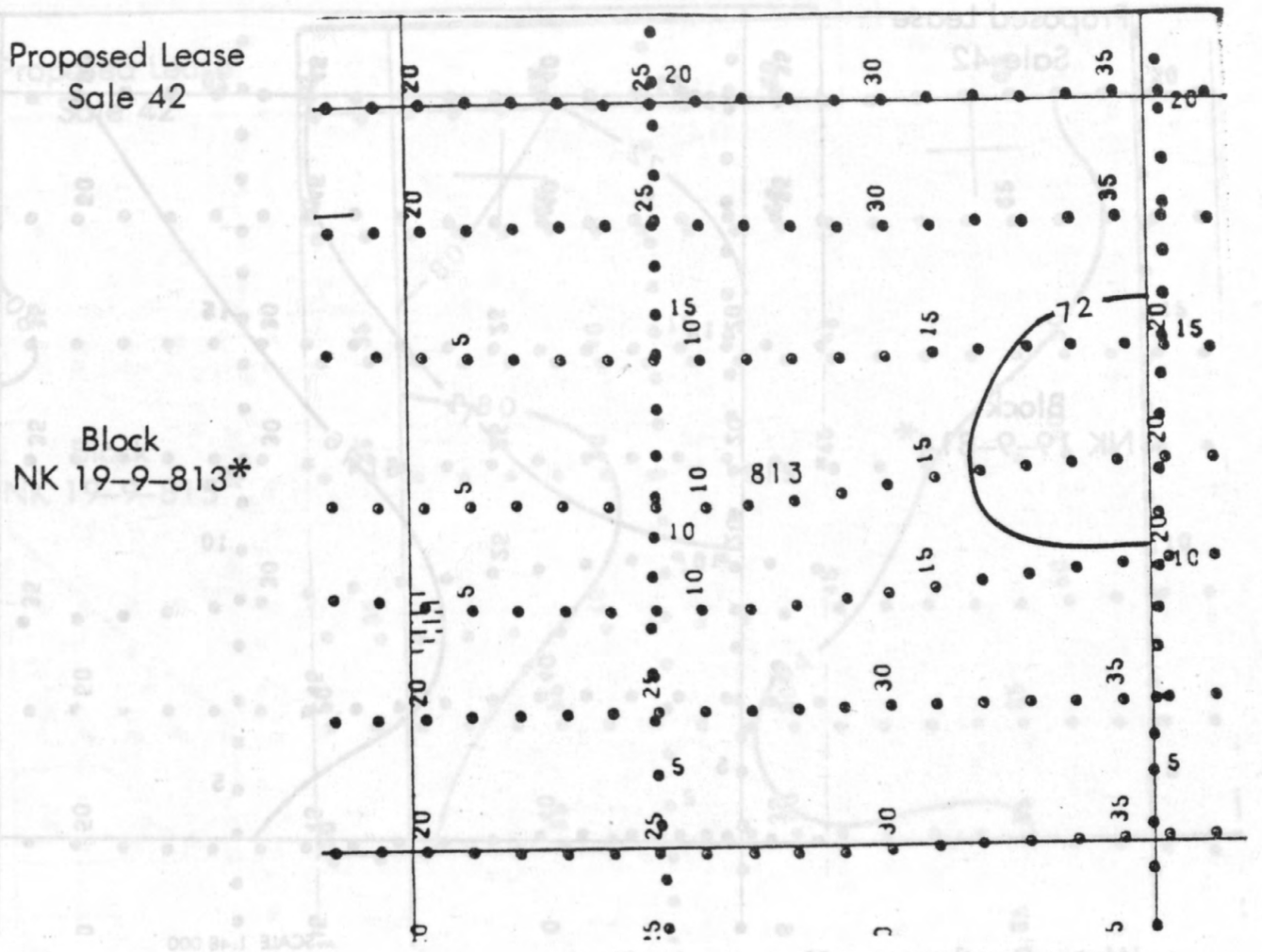
Water Depth: max. 77 m , min. 71 m
Slope Gradient: 0-5 m/km, Direction: Variable
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 84 m , min. 74 m
Slope Gradient: 0–6 m/km, Direction: SE
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 75 m , min. 71 m
Slope Gradient: 0–4 m/km, Direction: SW
Surface Sediment Type: Sand

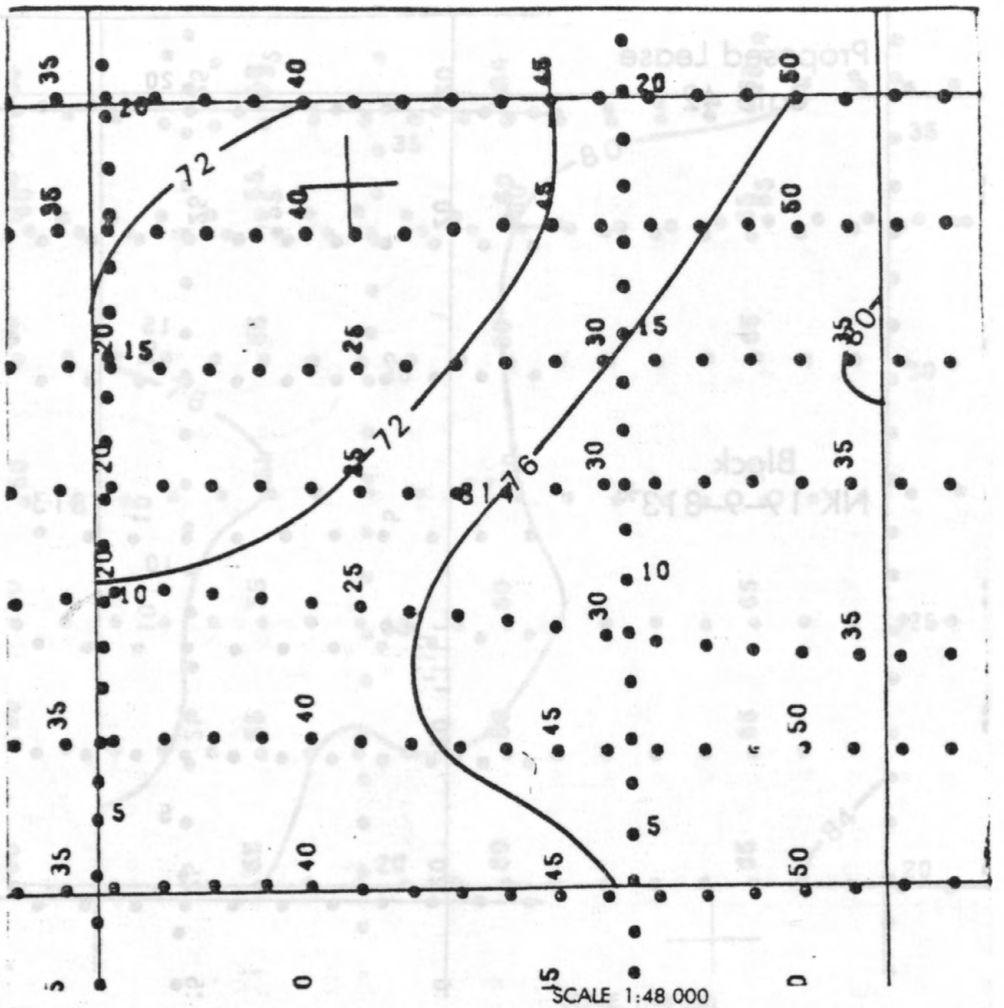
CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–814*

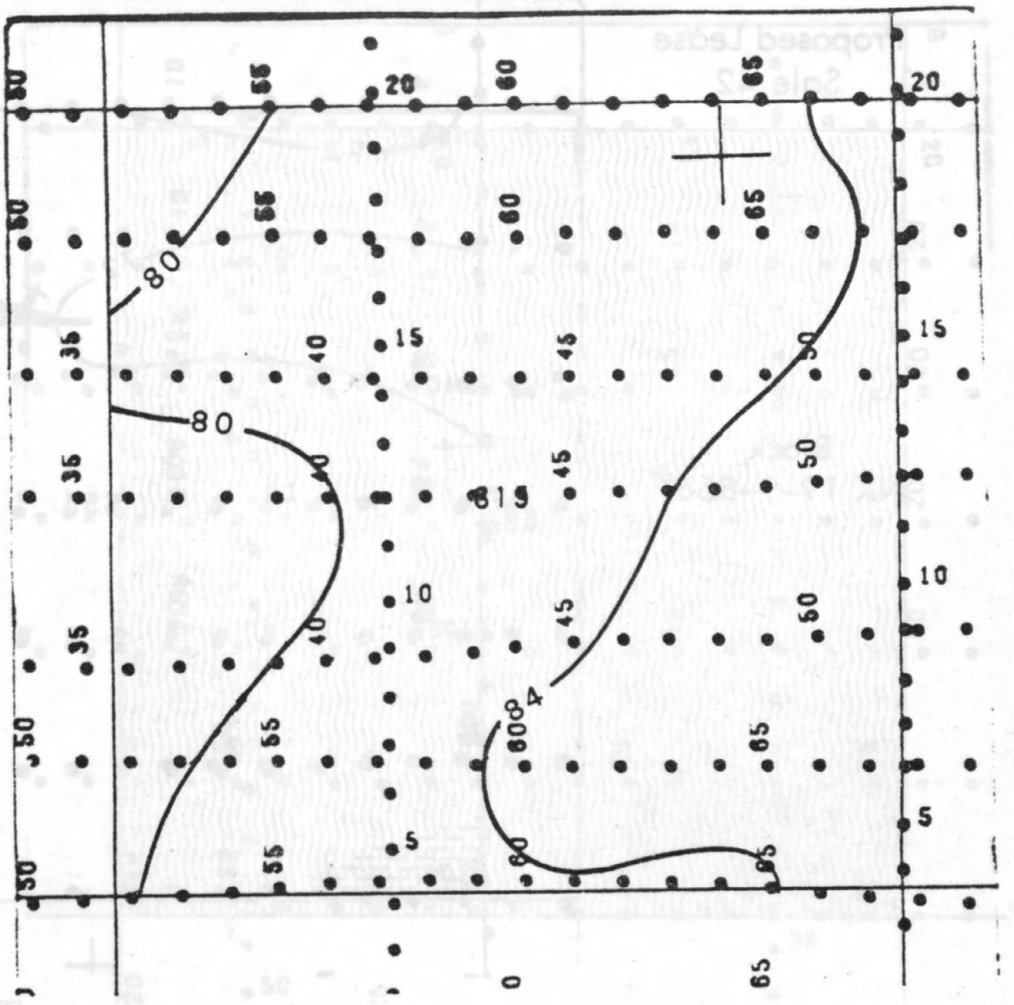


Water Depth: max. 80 m , min. 69 m
Slope Gradient: 1-8 m/km, Direction: SE
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

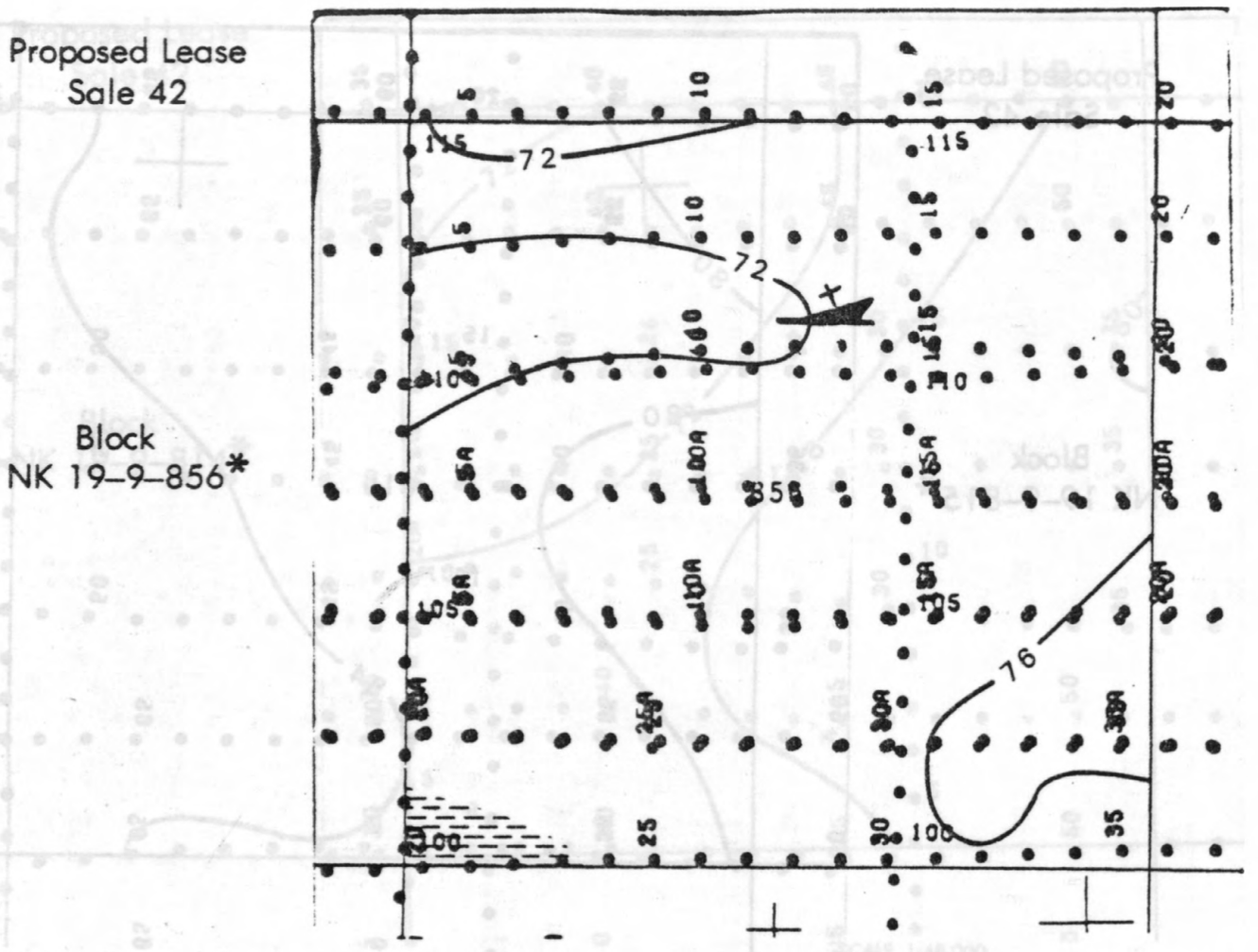
Proposed Lease
Sale 42

Block
NK 19–9–815*



Water Depth: max. 86 m , min. 78 m
Slope Gradient: 1–5 m/km, Direction: SE
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 77 m , min. 71 m
Slope Gradient: 0-4 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINTS

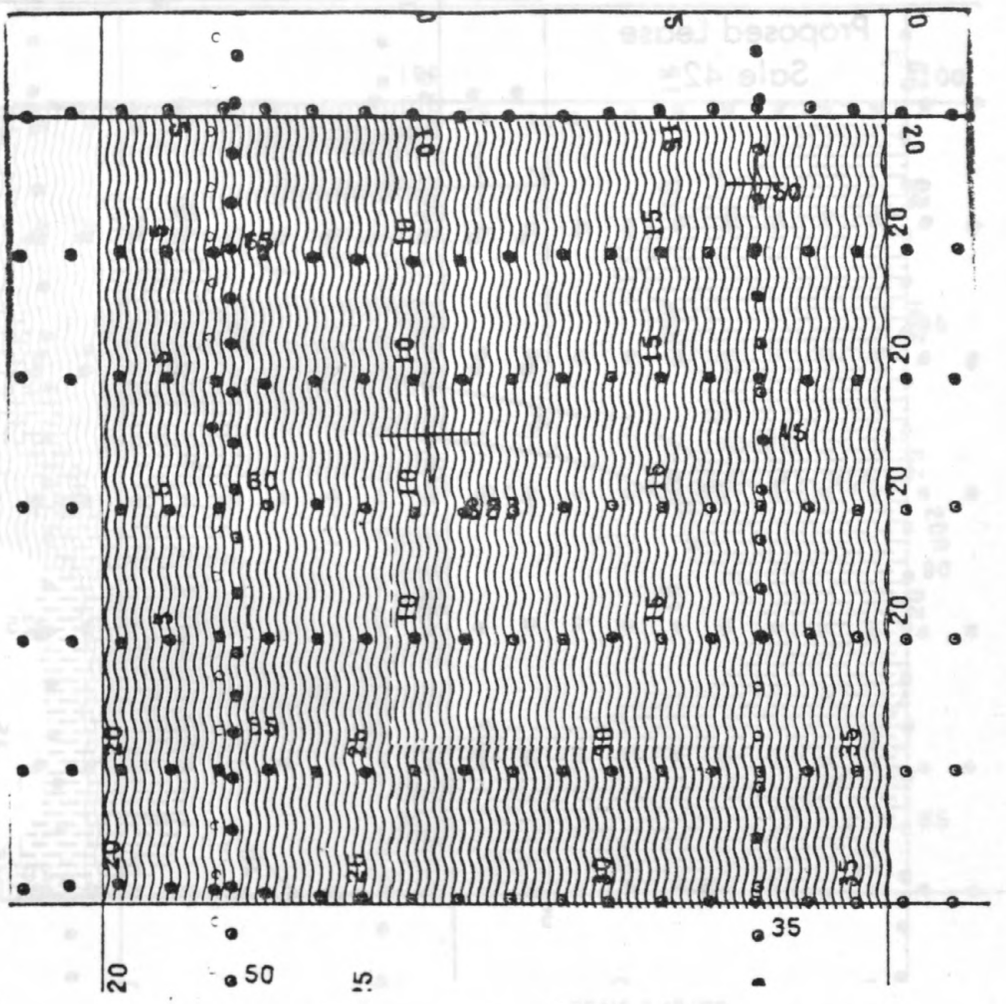
Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–883



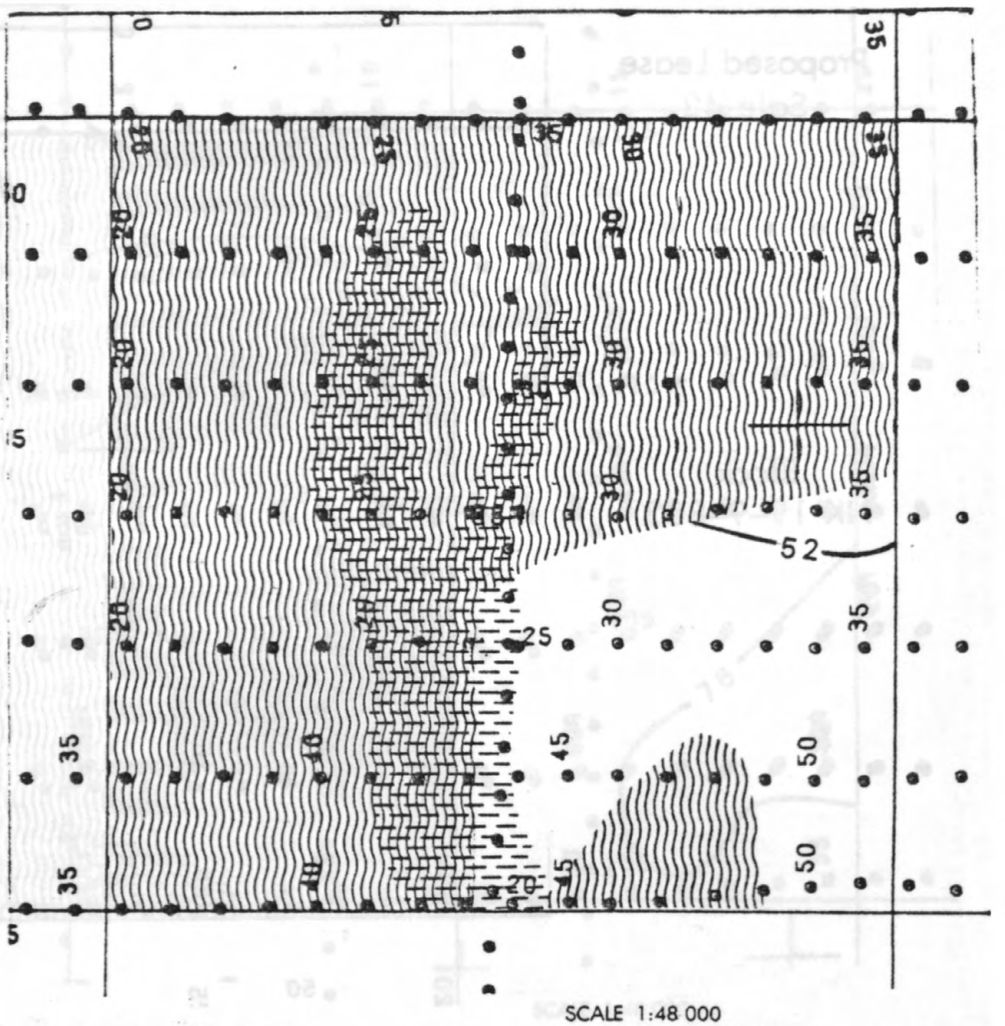
Water Depth: max. 54 m , min. 40 m
Slope Gradient: 1.0 m/km, Direction: NE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–9–884



Water Depth: max. 55 m , min. 38 m
Slope Gradient: 2.0 m/km, Direction: Variable
Surface Sediment Type: Sand

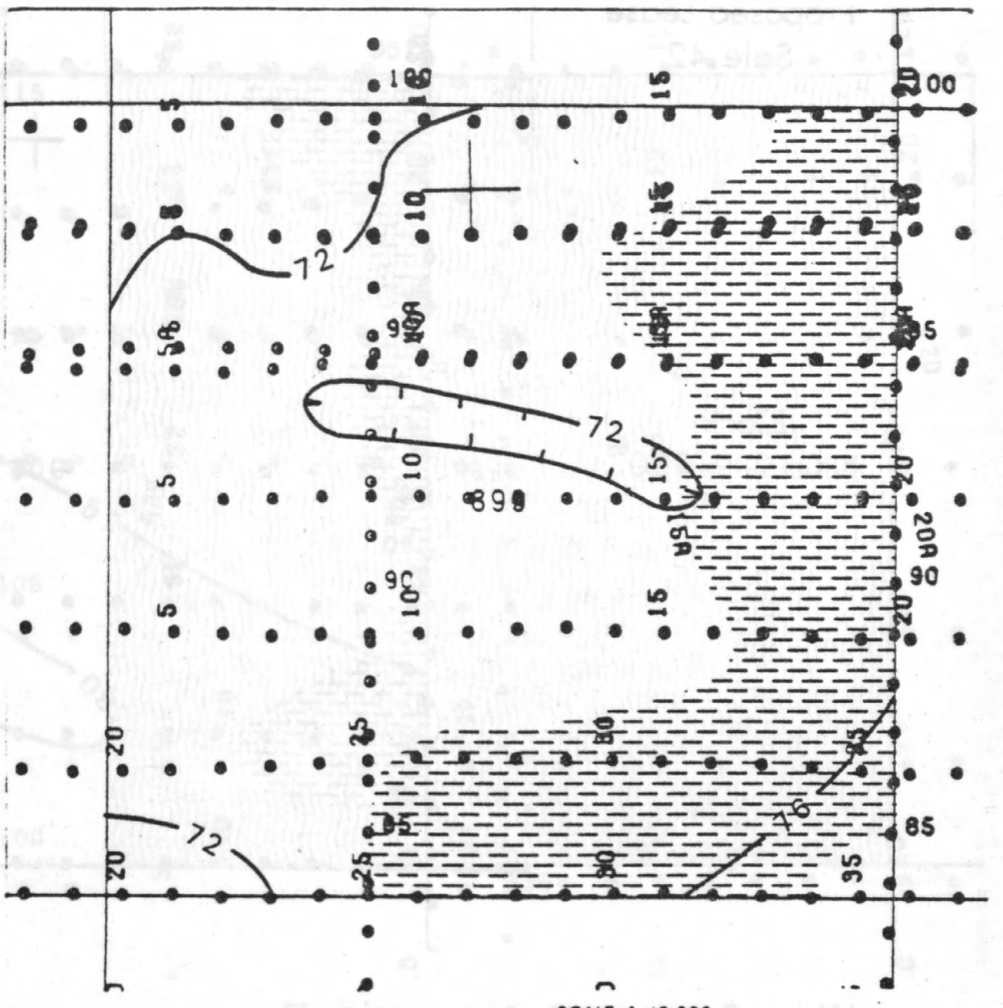
CONSTRAINTS

Sand Wave Field

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–9–899*



Water Depth: max. 79 m , min. 71 m
Slope Gradient: 0–7 m/km, Direction: SE
Surface Sediment Type: Sand

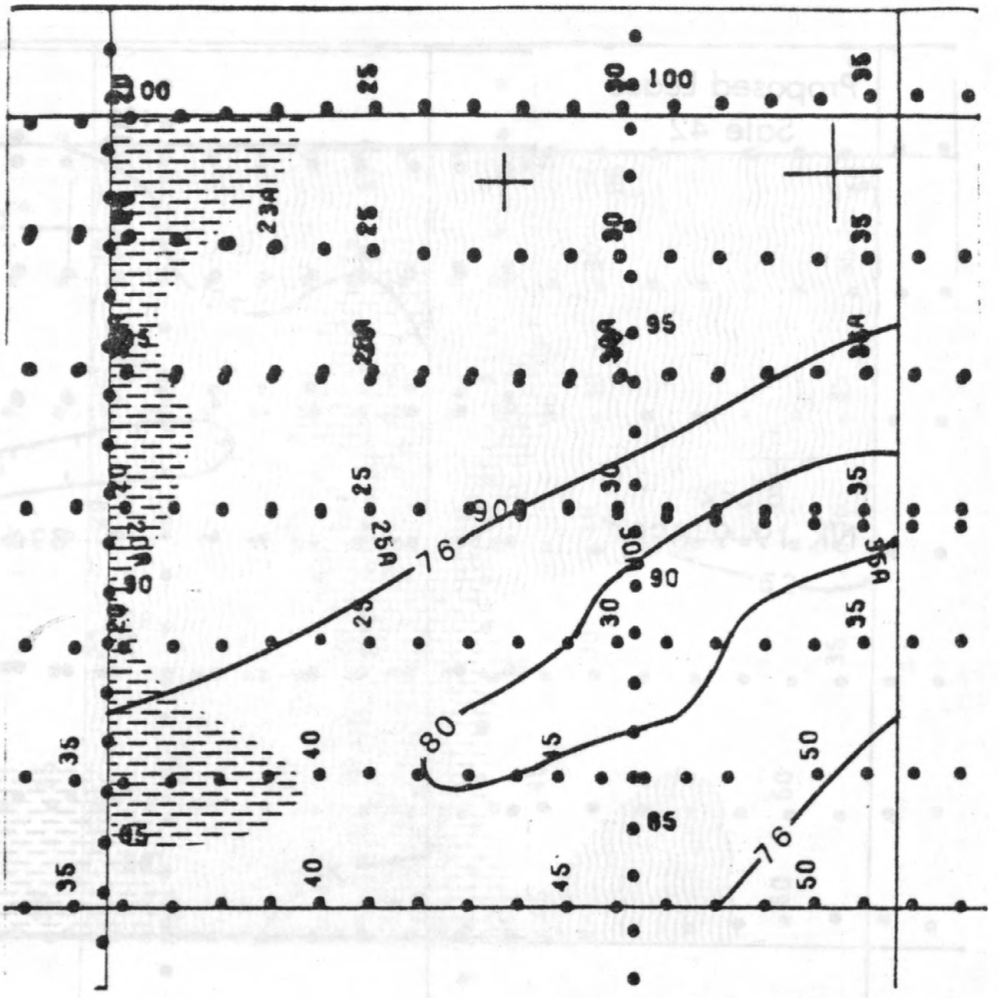
CONSTRAINT

Filled Channel

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–900*



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

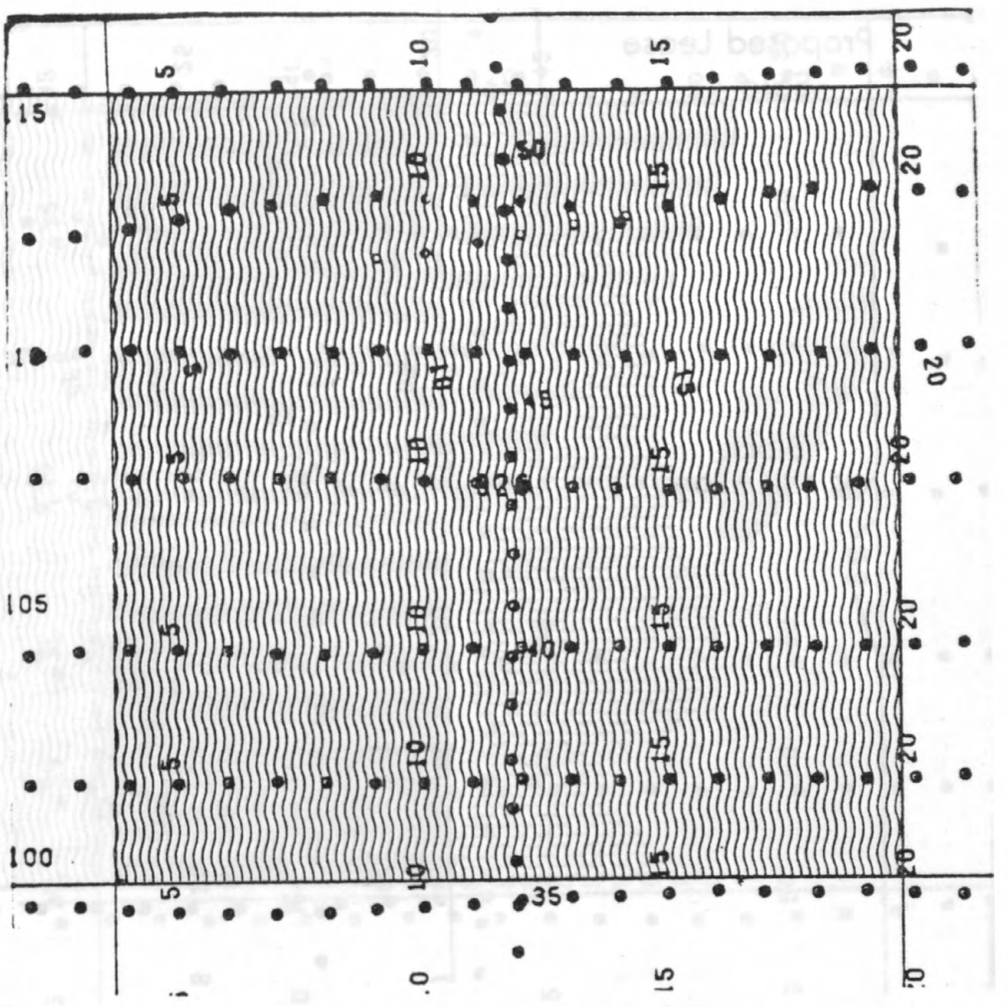
Water Depth: max. 81 m , min. 73 m
Slope Gradient: 1–7 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

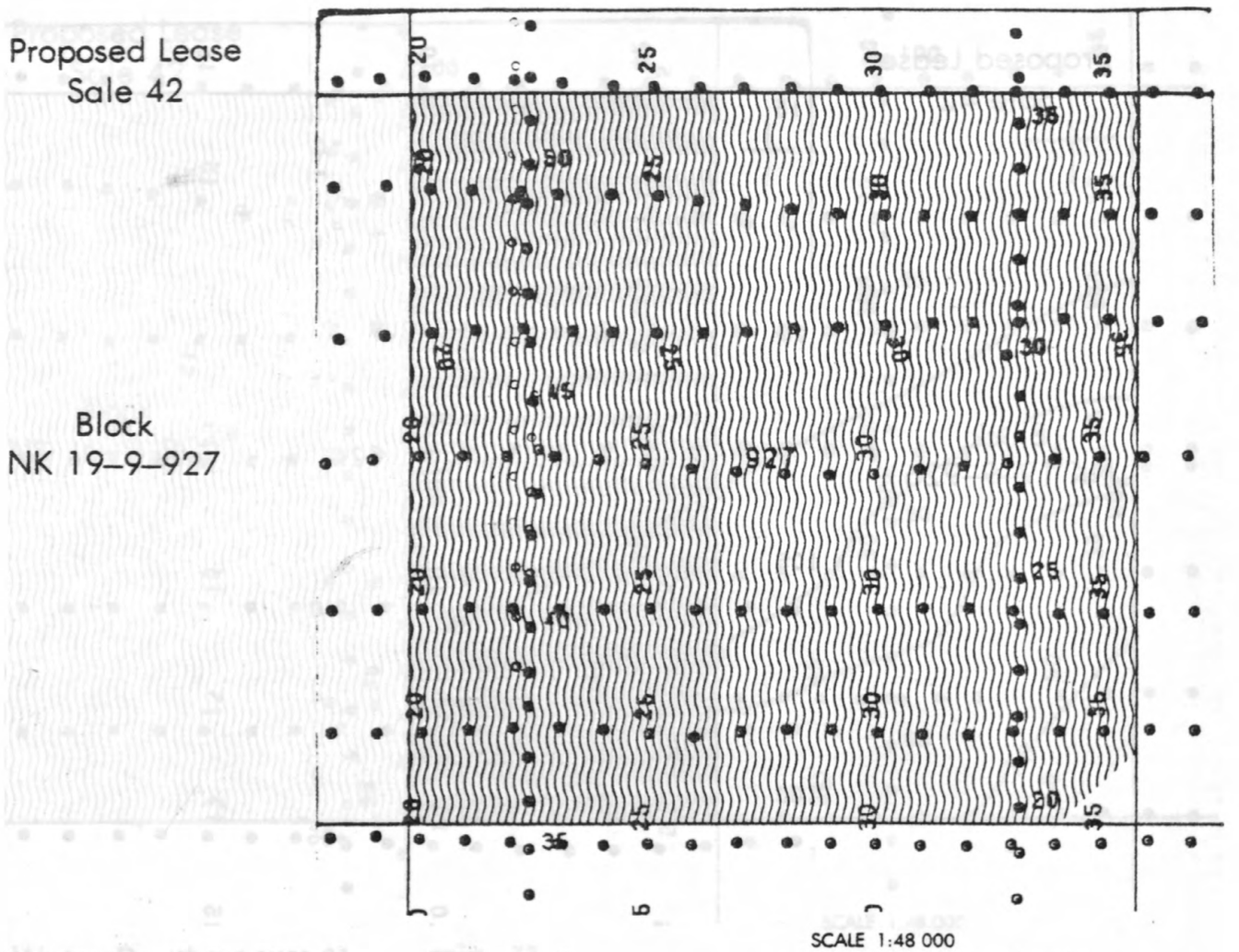
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 52 m , min. 43 m
Slope Gradient: 1.1 m/km, Direction: NNE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field



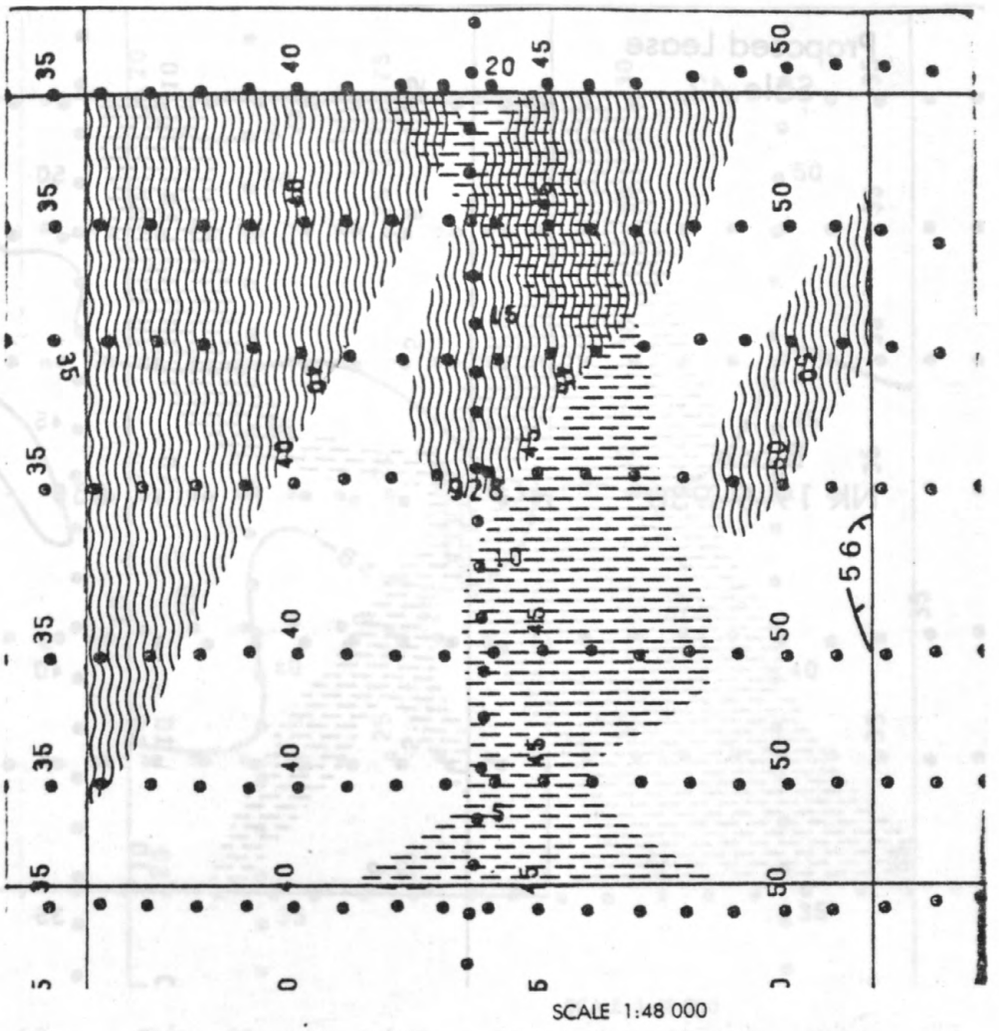
Water Depth: max. 54 m , min. 44 m
Slope Gradient: 1.3 m/km, Direction: NE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–9–928



Water Depth: max. 57 m , min. 50 m
Slope Gradient: 0.5 m/km, Direction: SE
Surface Sediment Type: Sand

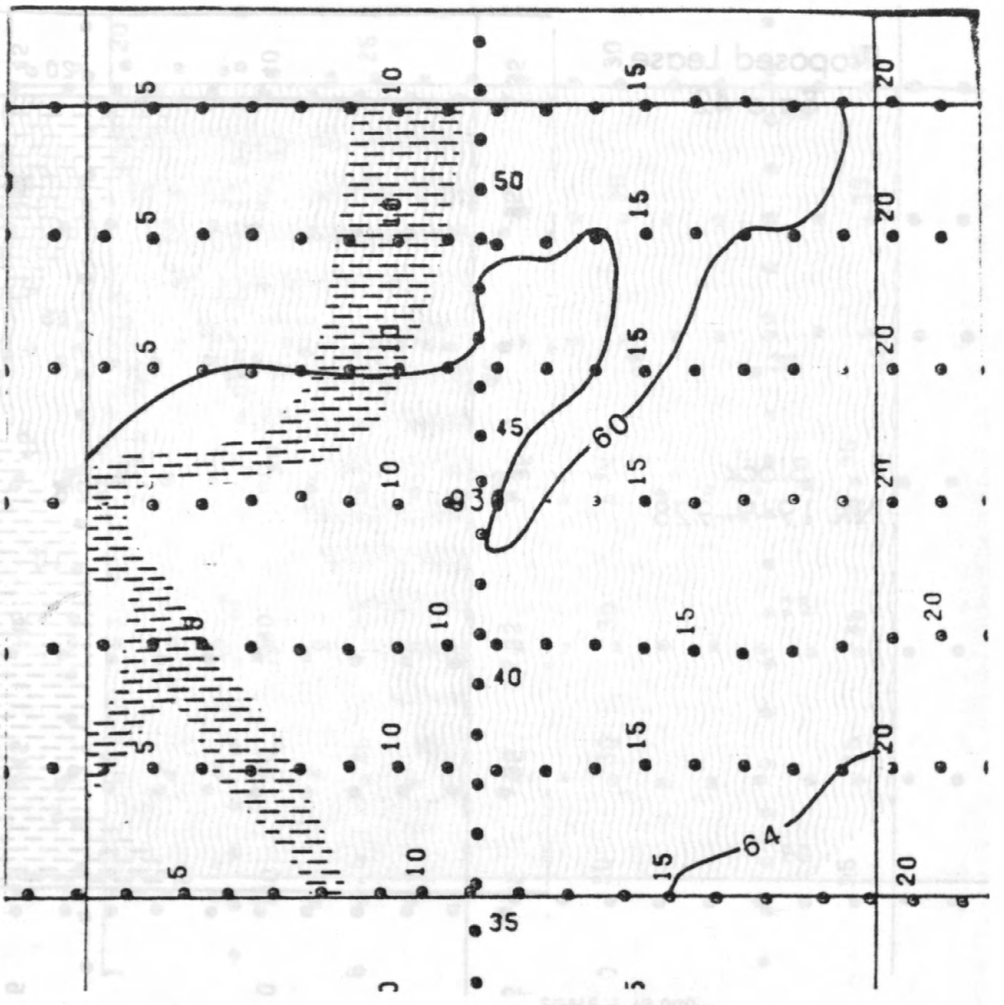
CONSTRAINTS

Sand Wave Field

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–9–930



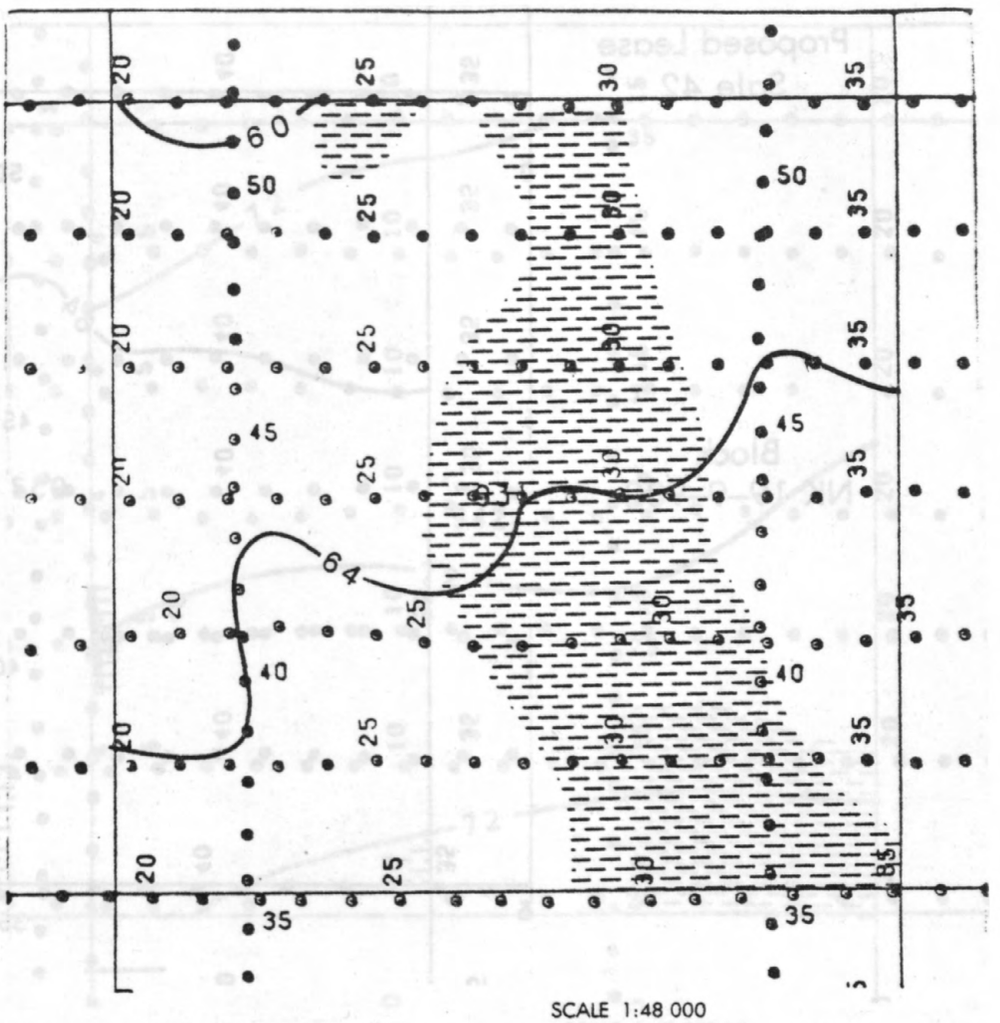
Water Depth: max. 65 m , min. 57 m
Slope Gradient: 1.2 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–9–931



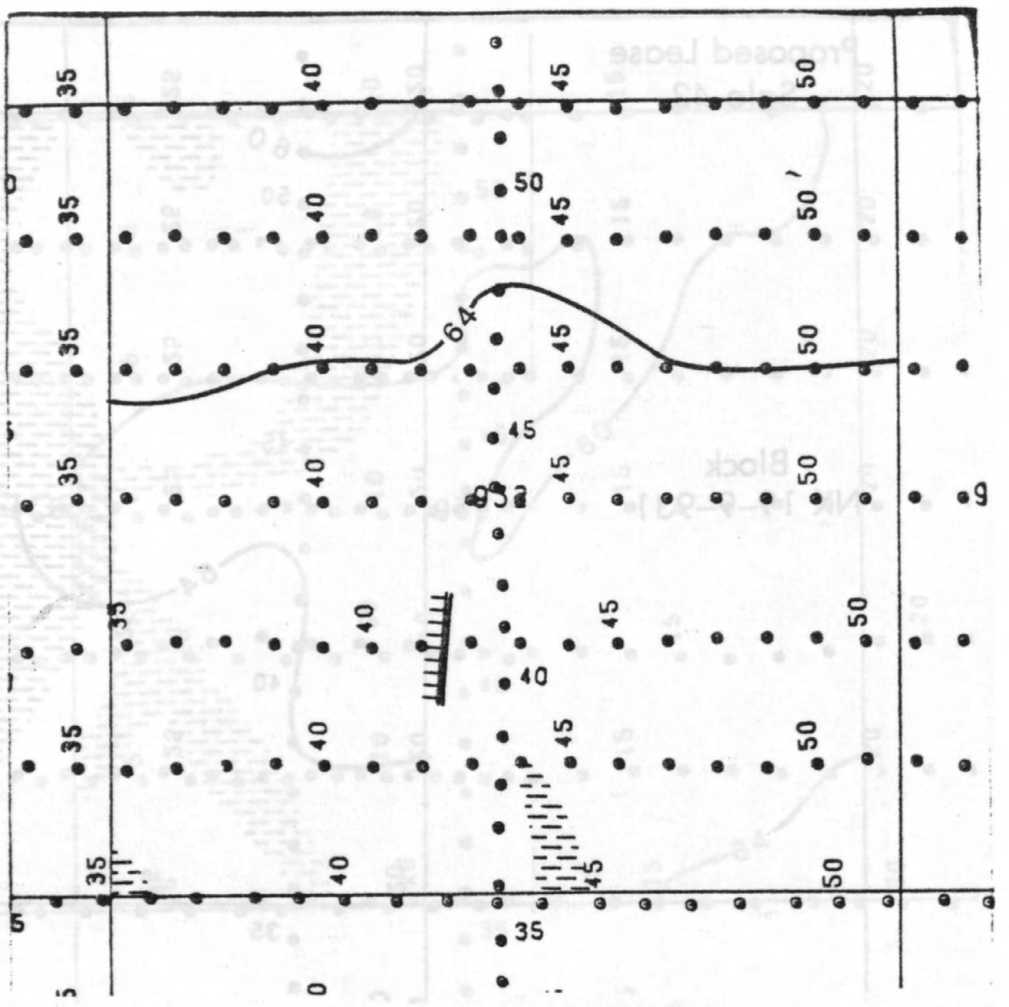
Water Depth: max. 66 m , min. 59 m
Slope Gradient: 1.4 m/km, Direction: SSE .
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–9–932



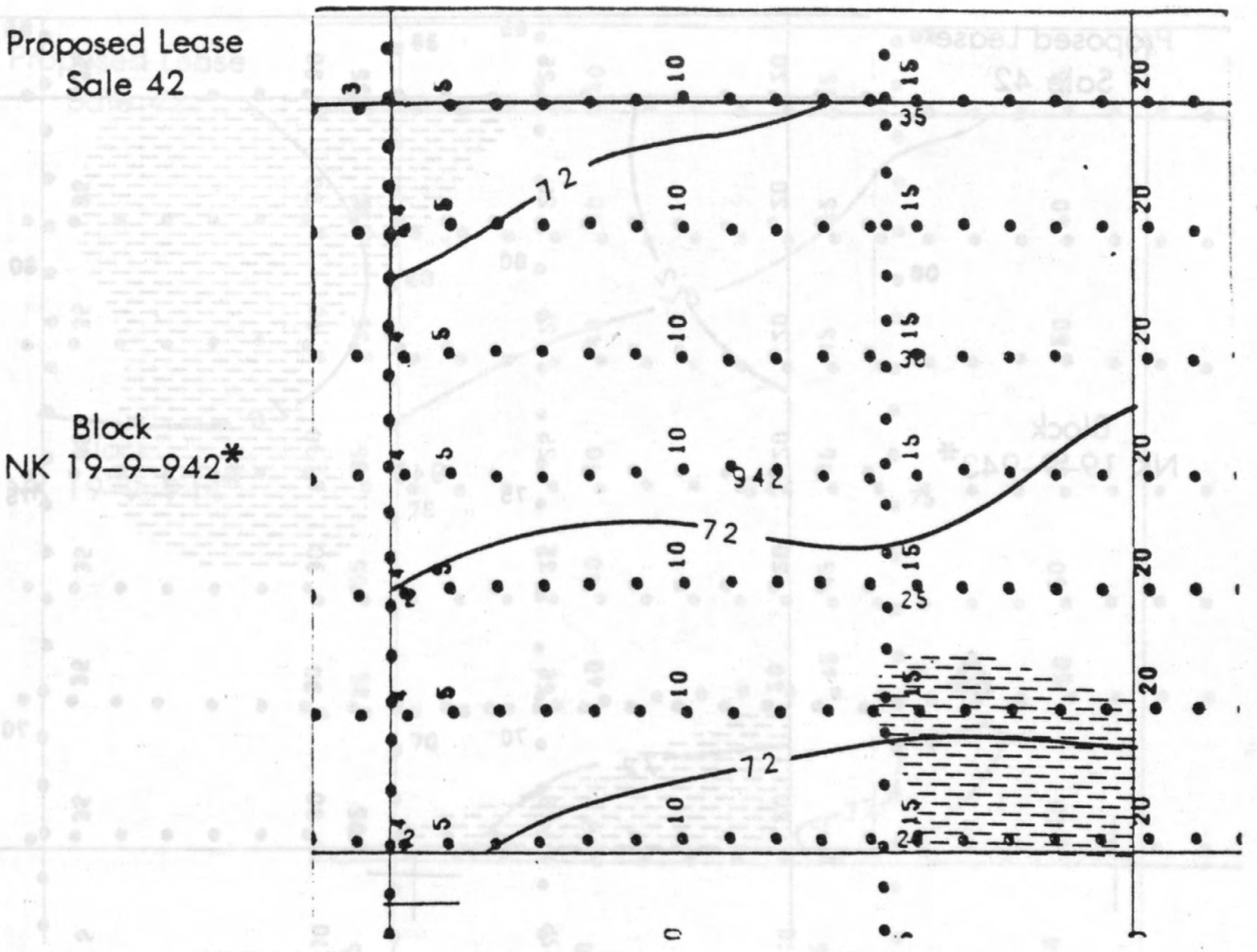
Water Depth: max. 67 m , min. 62 m
Slope Gradient: 1.0 m/km, Direction: S
Surface Sediment Type: Sand

POTENTIAL HAZARD

Fault at "I" Reflector

CONSTRAINT

Filled Channel



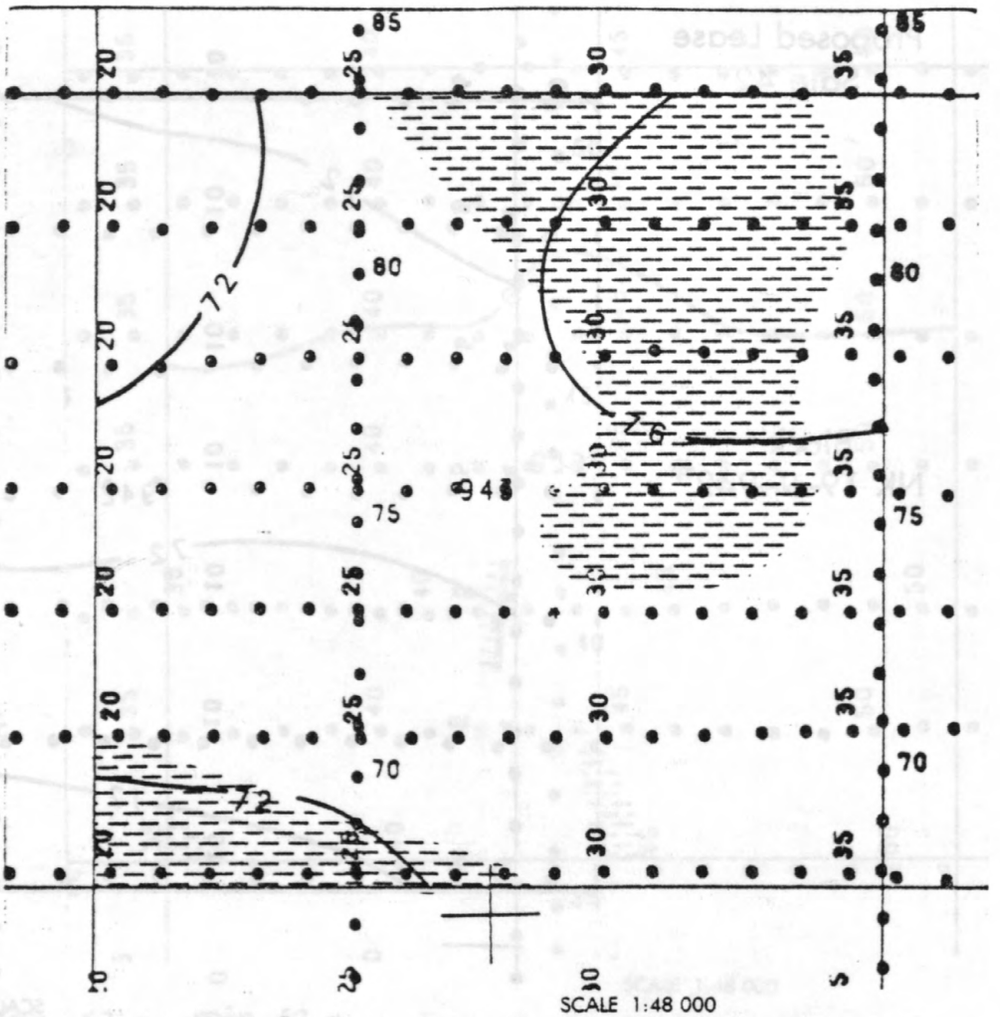
Water Depth: max. 73 m , min. 70 m
Slope Gradient: 1-3 m/km, Direction: Variable
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–9–943*

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

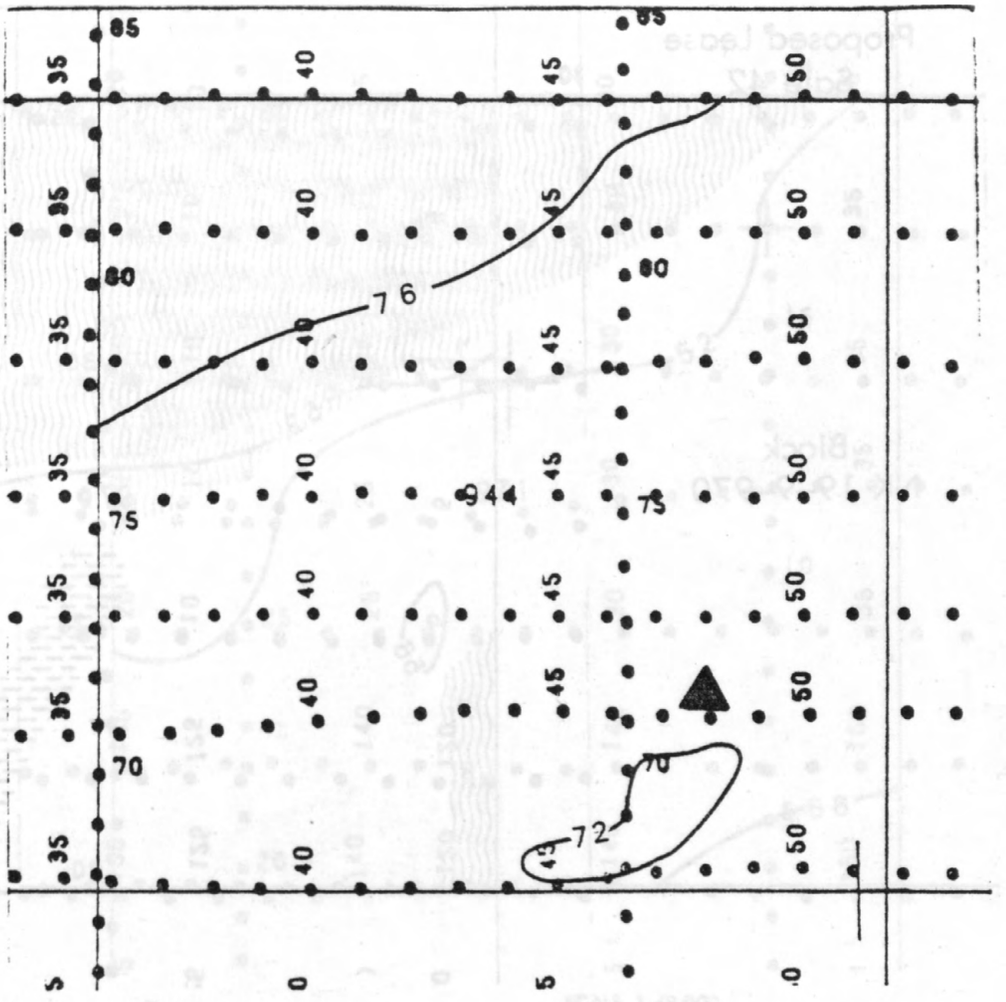
Water Depth: max. 78 m , min. 70 m
Slope Gradient: 0–4 m/km, Direction: NE
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease Sale 42



Block NK 19–9–944*

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 78 m , min. 72 m

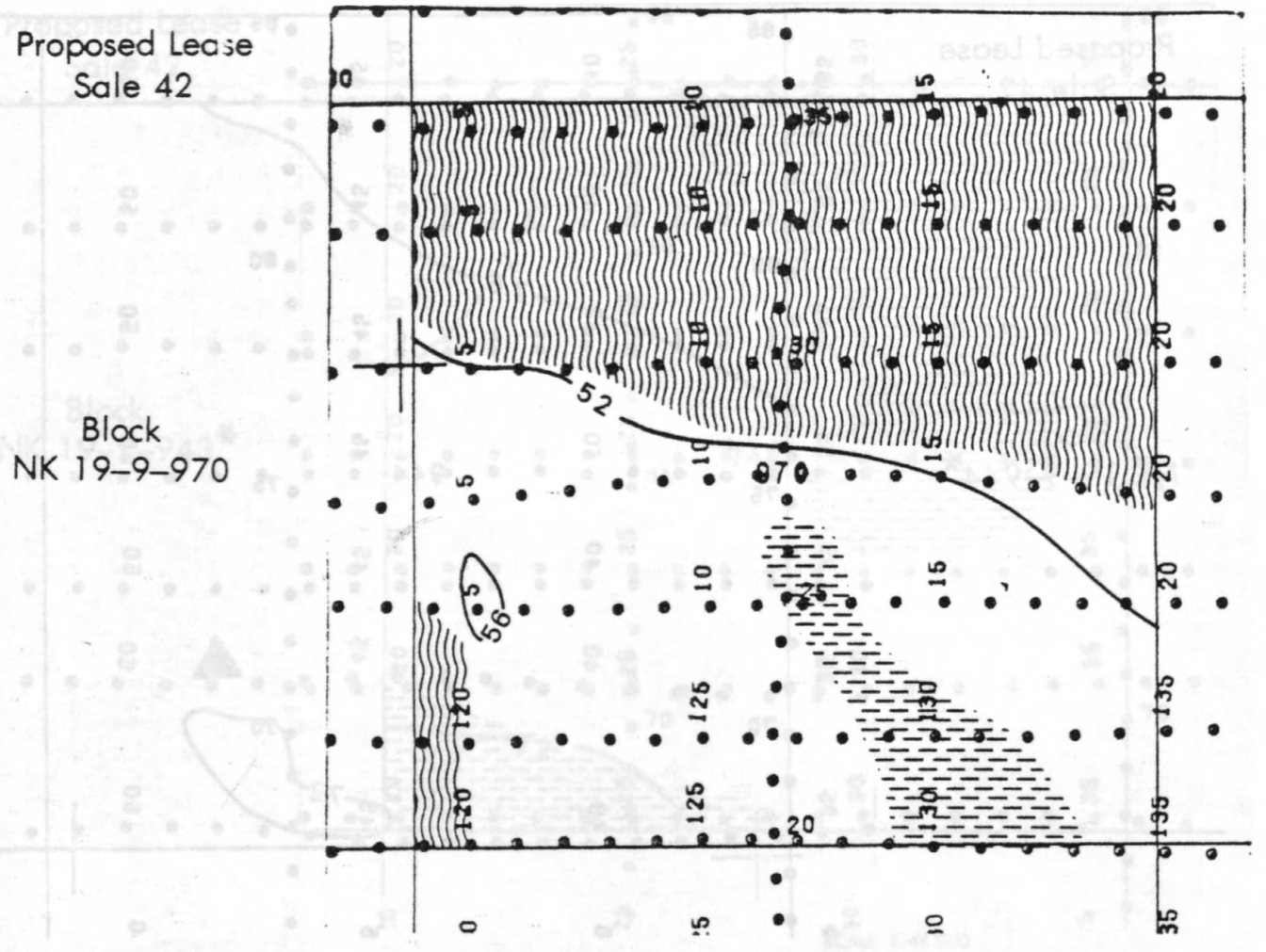
Slope Gradient: 0–4 m/km, Direction: NW

Surface Sediment Type: Gravelly Sand

CONSTRAINT

▲ Bottom Object

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 56 m , min. 45 m
Slope Gradient: 1.6 m/km, Direction: S
Surface Sediment Type: Sand

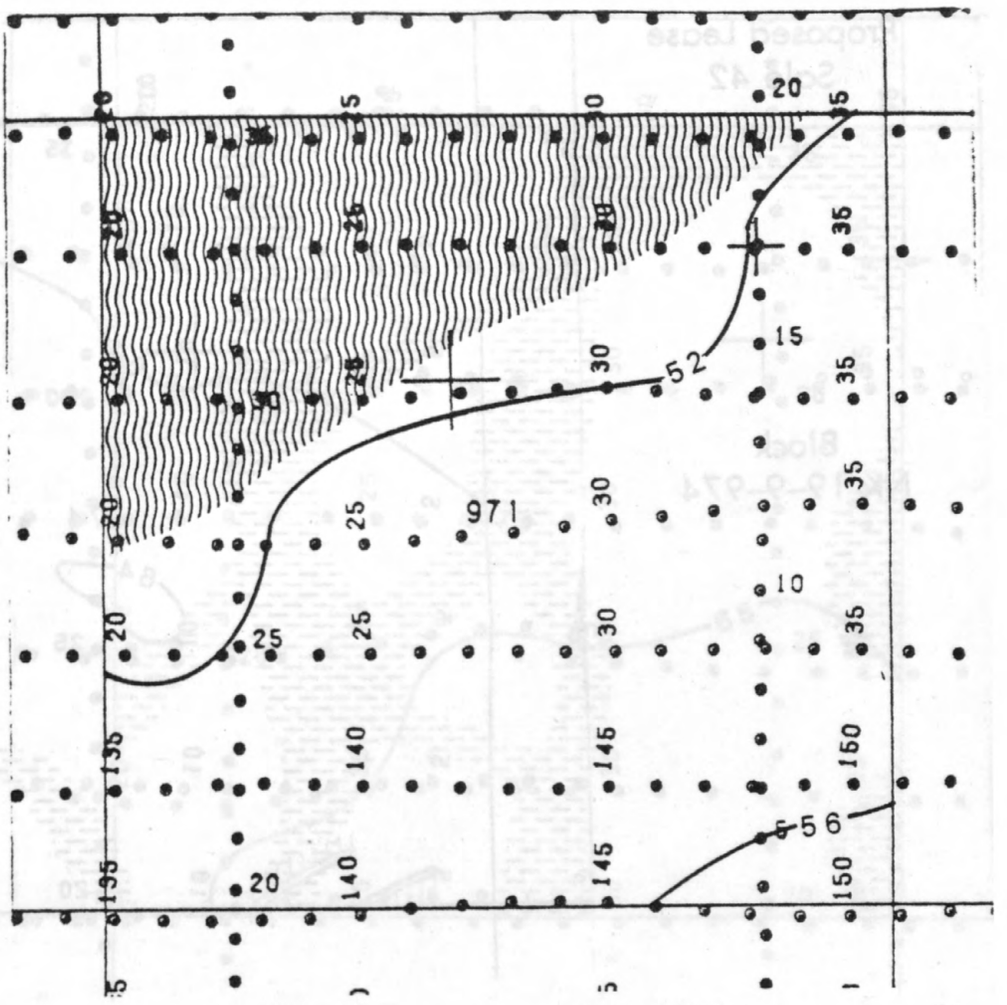
CONSTRAINTS

Sand Wave Field

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–9–971



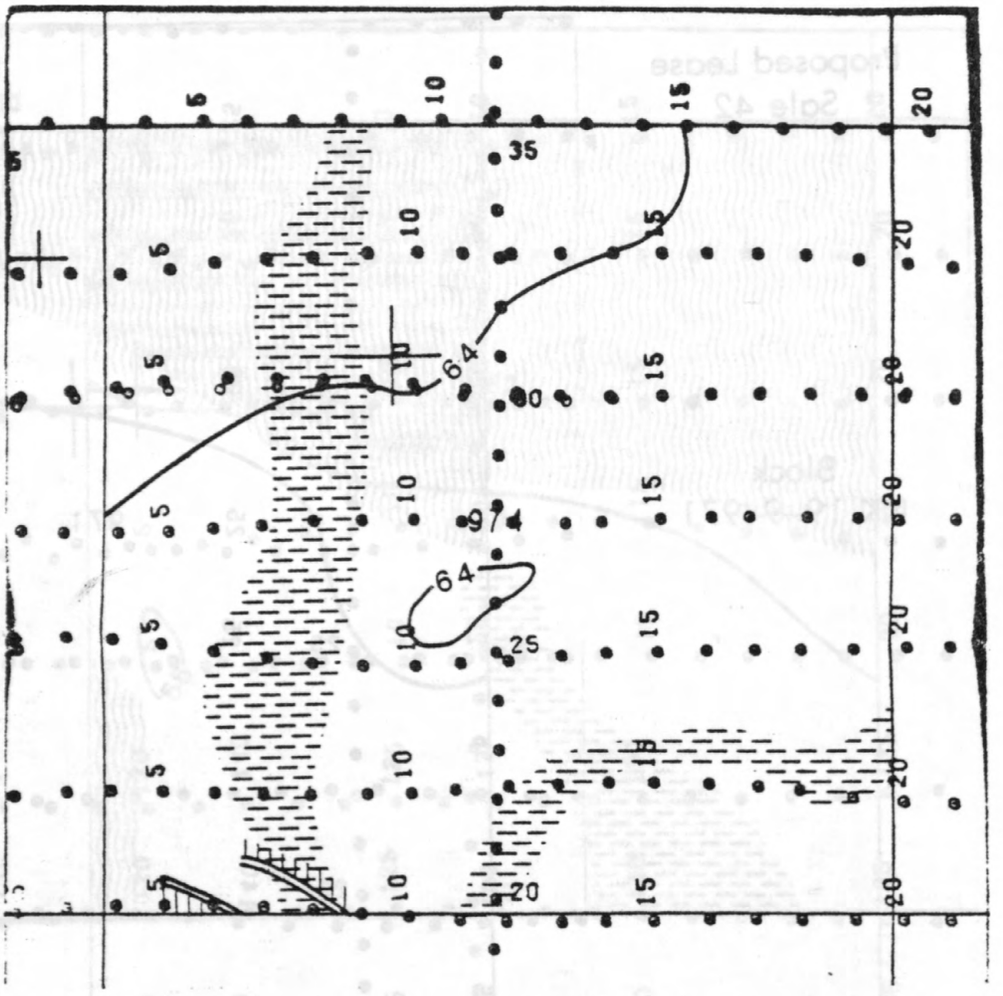
Water Depth: max. 56 m , min. 46 m
Slope Gradient: 1.4 m/km, Direction: SSE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–9–974



Water Depth: max. 67 m , min. 62 m
Slope Gradient: 0.8 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

POTENTIAL HAZARD

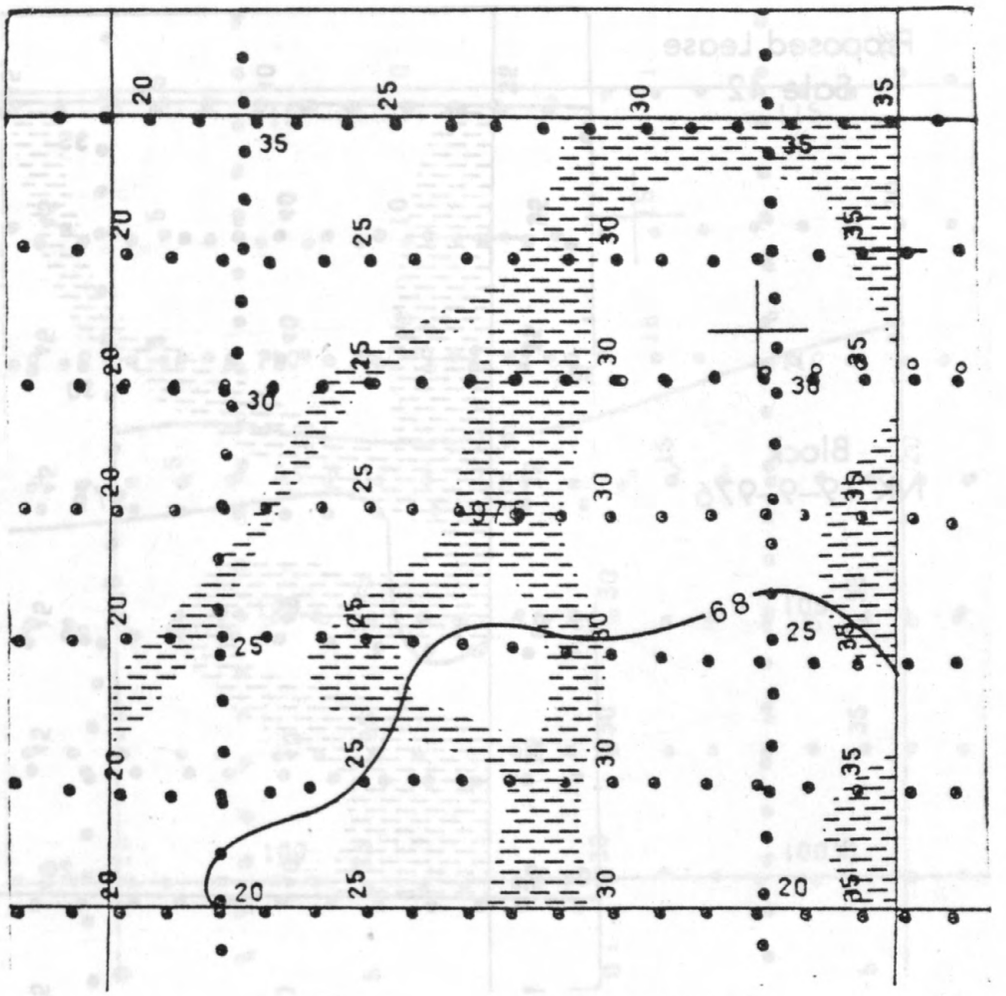
Fault at "I" Reflector

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–9–975



Water Depth: max. 69 m , min. 65 m
Slope Gradient: 0.8 m/km, Direction: SSE
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

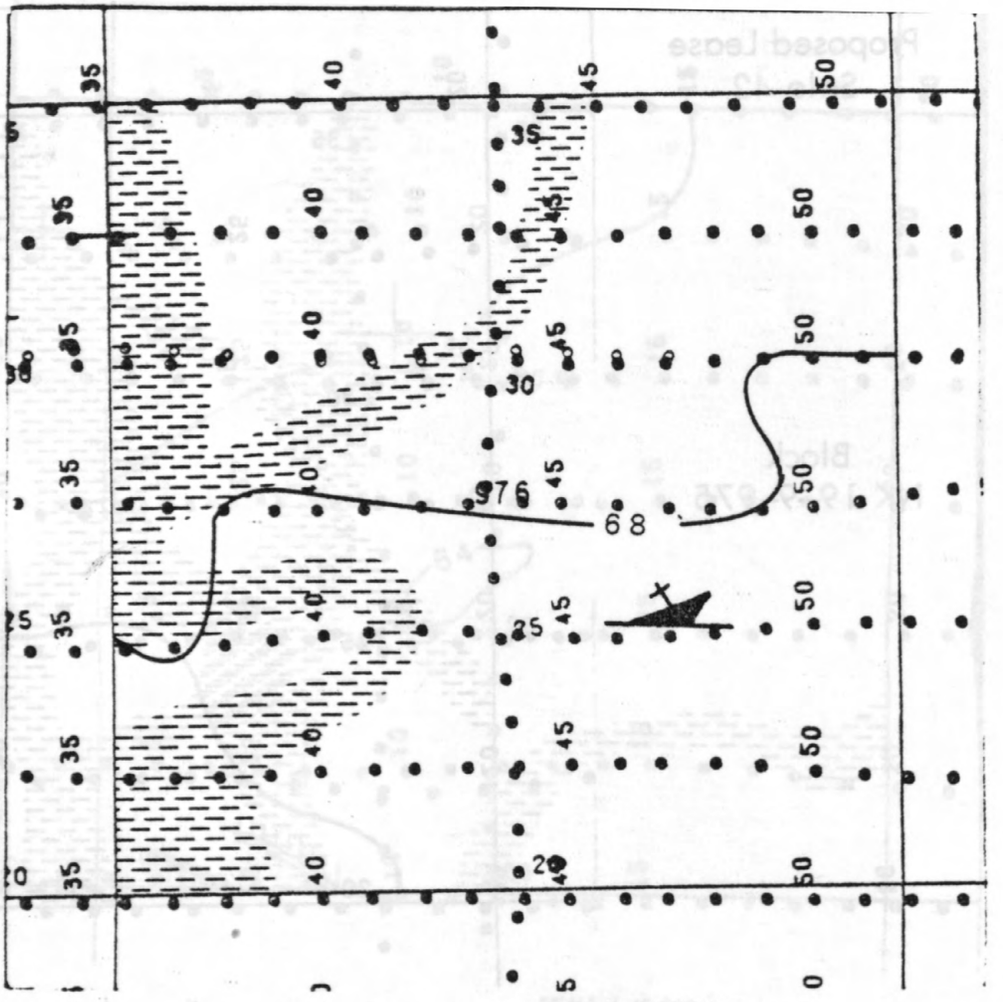
ISOBATHS IN METERS

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19-9-976



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 69 m , min. 65 m
Slope Gradient: 0.9 m/km, Direction: S
Surface Sediment Type: Sand

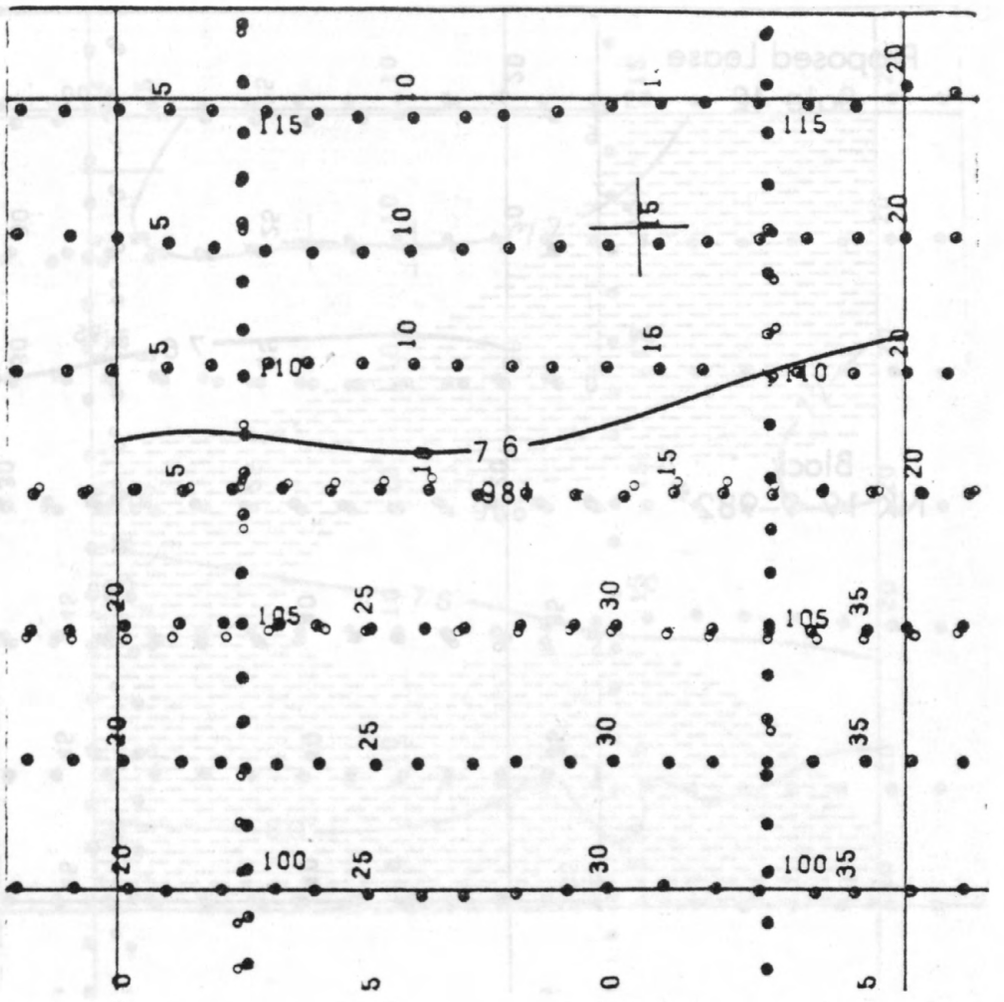
CONSTRAINTS

Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

Proposed Lease
Sale 42

Block
NK 19-9-981*

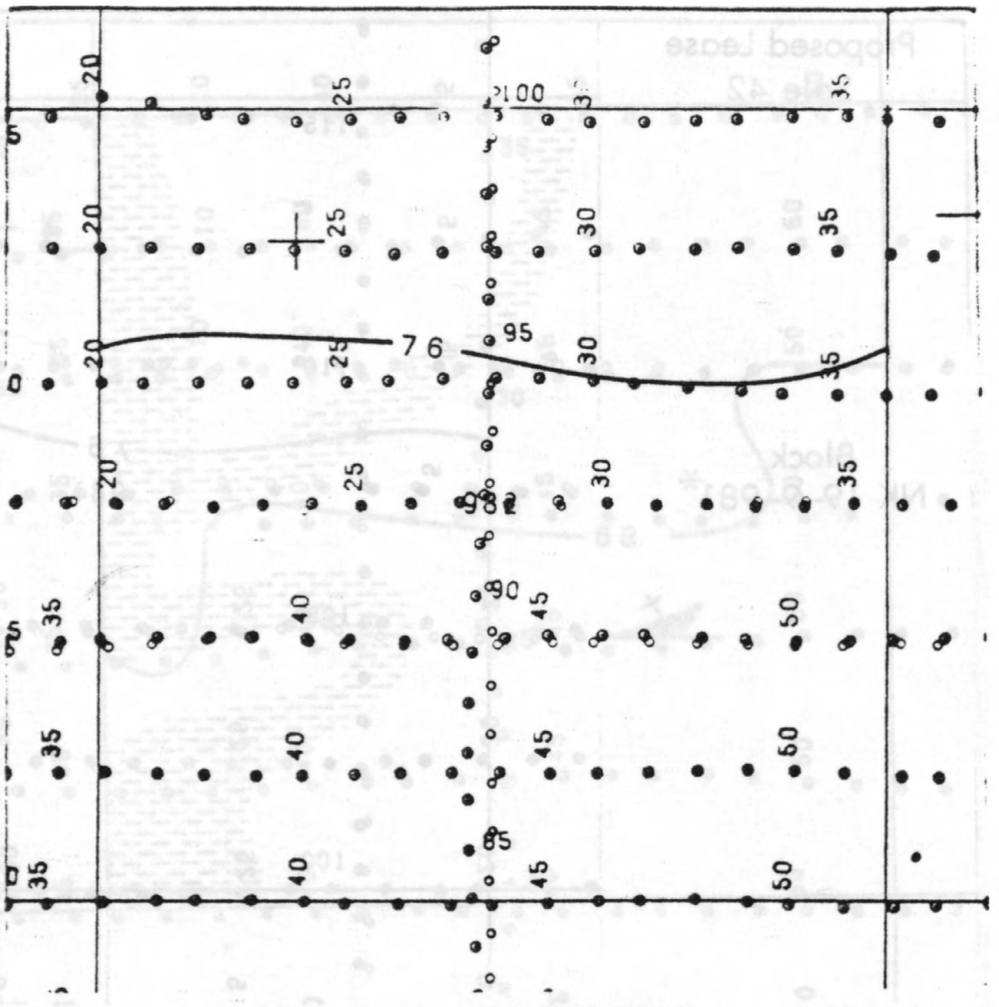


Water Depth: max. 79 m , min. 73 m
Slope Gradient: 1-2 m/km, Direction: S
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–9–982*

SCALE 1:48 000

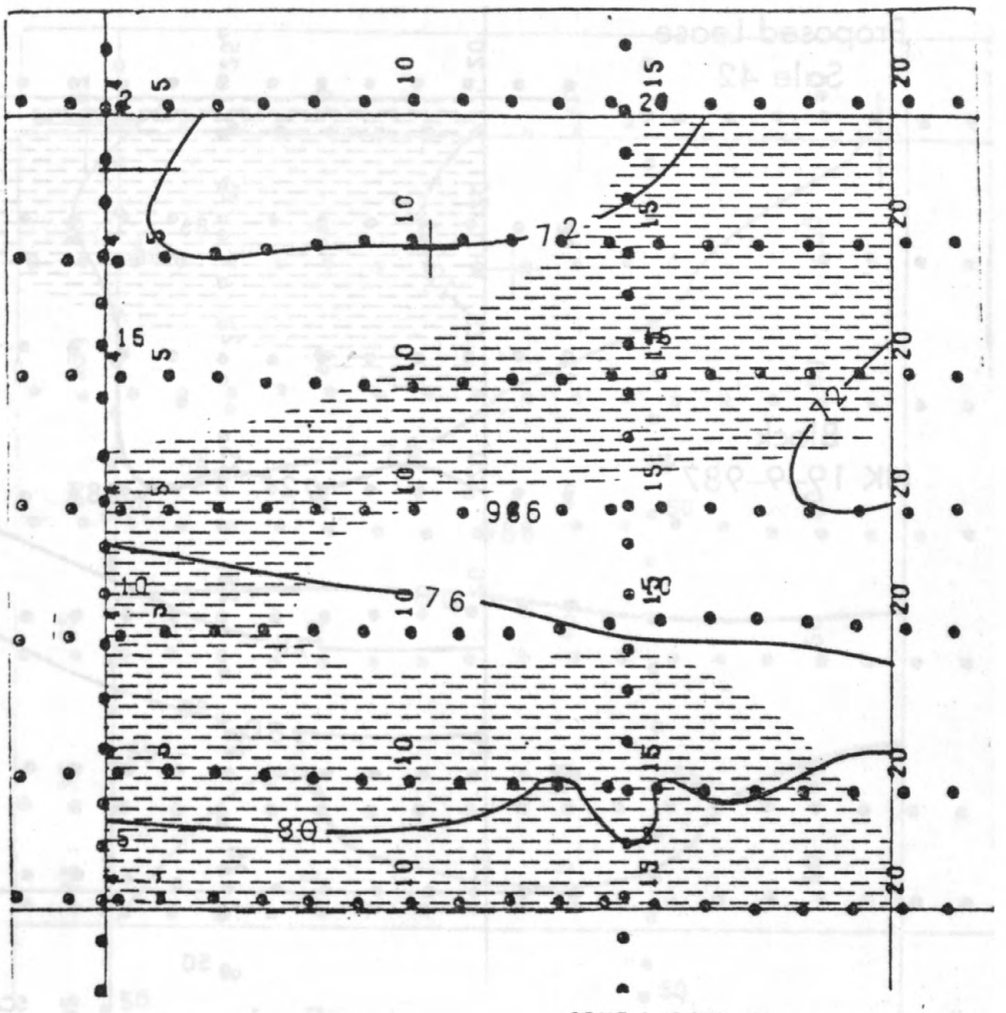
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 79 m , min. 74 m
Slope Gradient: 1-3 m/km, Direction: S
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Water Depth: max. 83 m , min. 71 m
Slope Gradient: 0–10 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

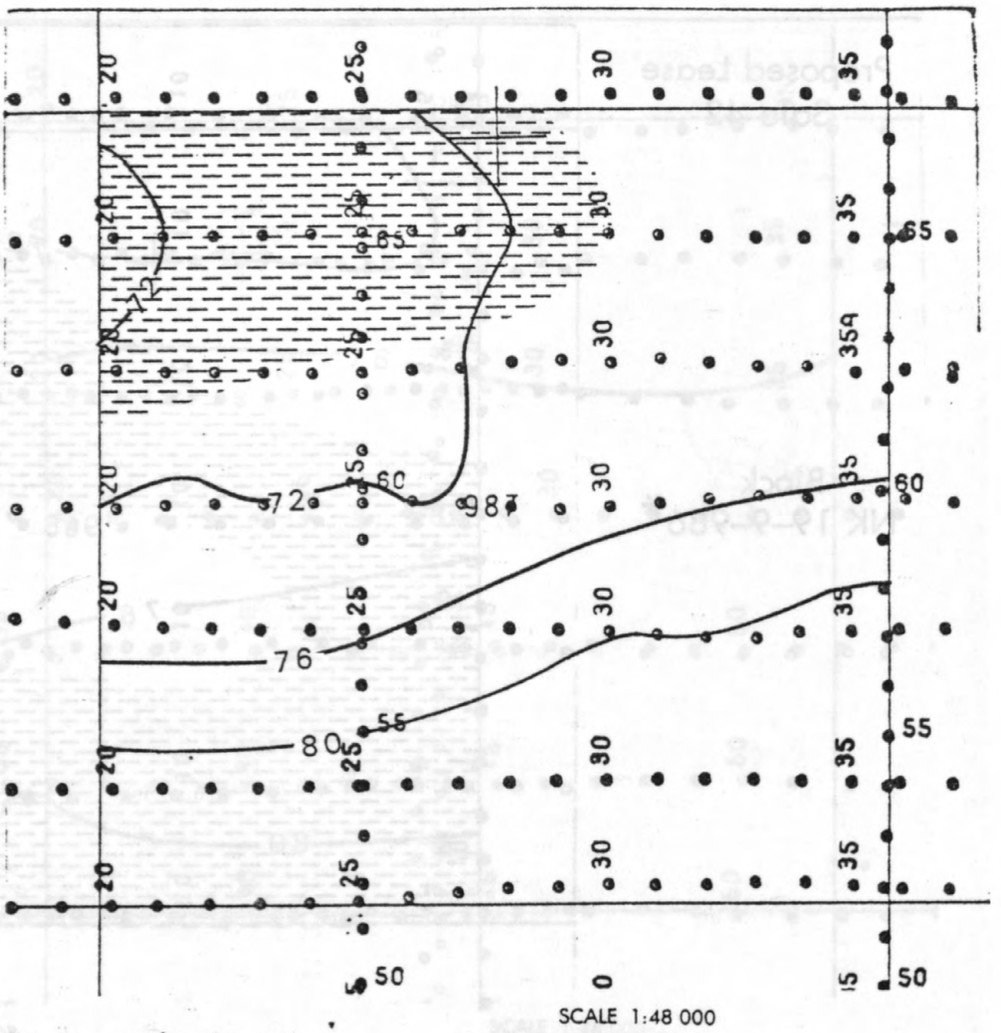
CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–987*



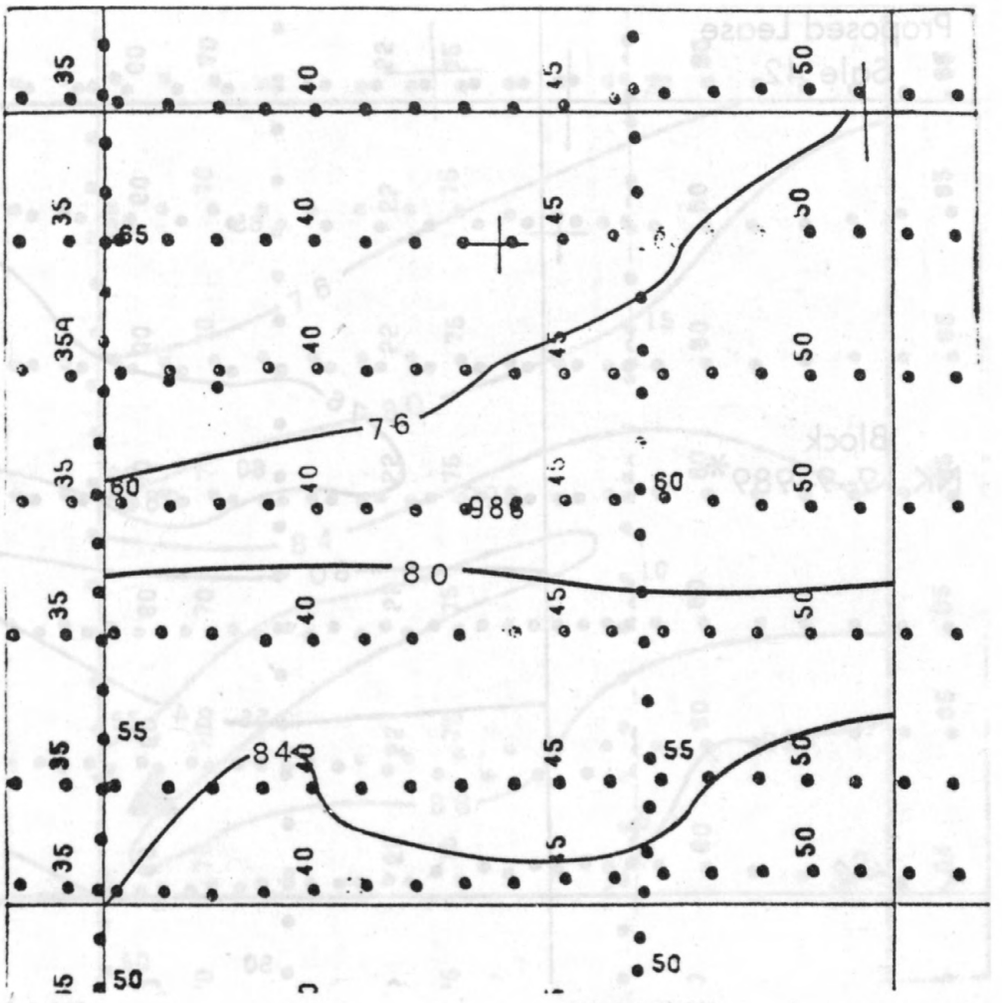
Water Depth: max. 83 m , min. 71 m
Slope Gradient: 0–11 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–9–988*

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

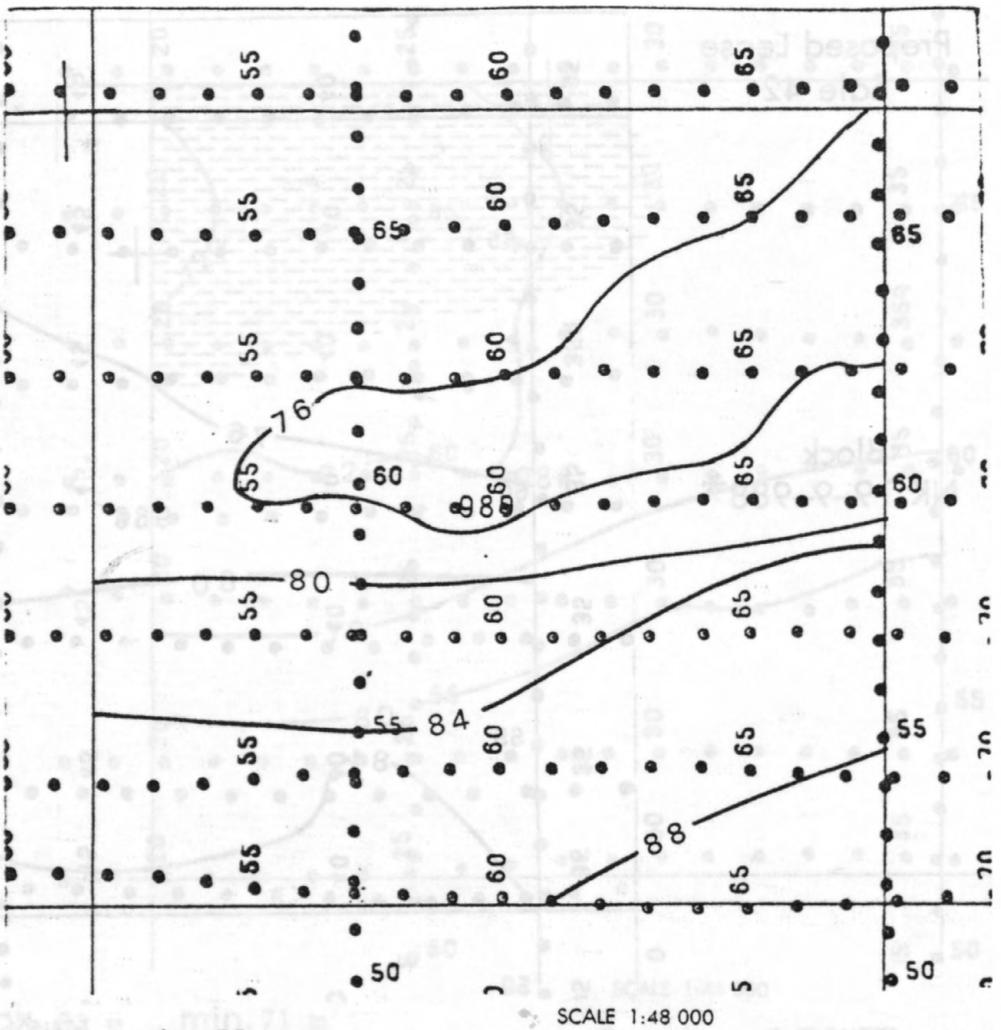
ISOBATHS IN METERS

Water Depth: max. 84 m , min. 73 m
Slope Gradient: 3–8 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–989*

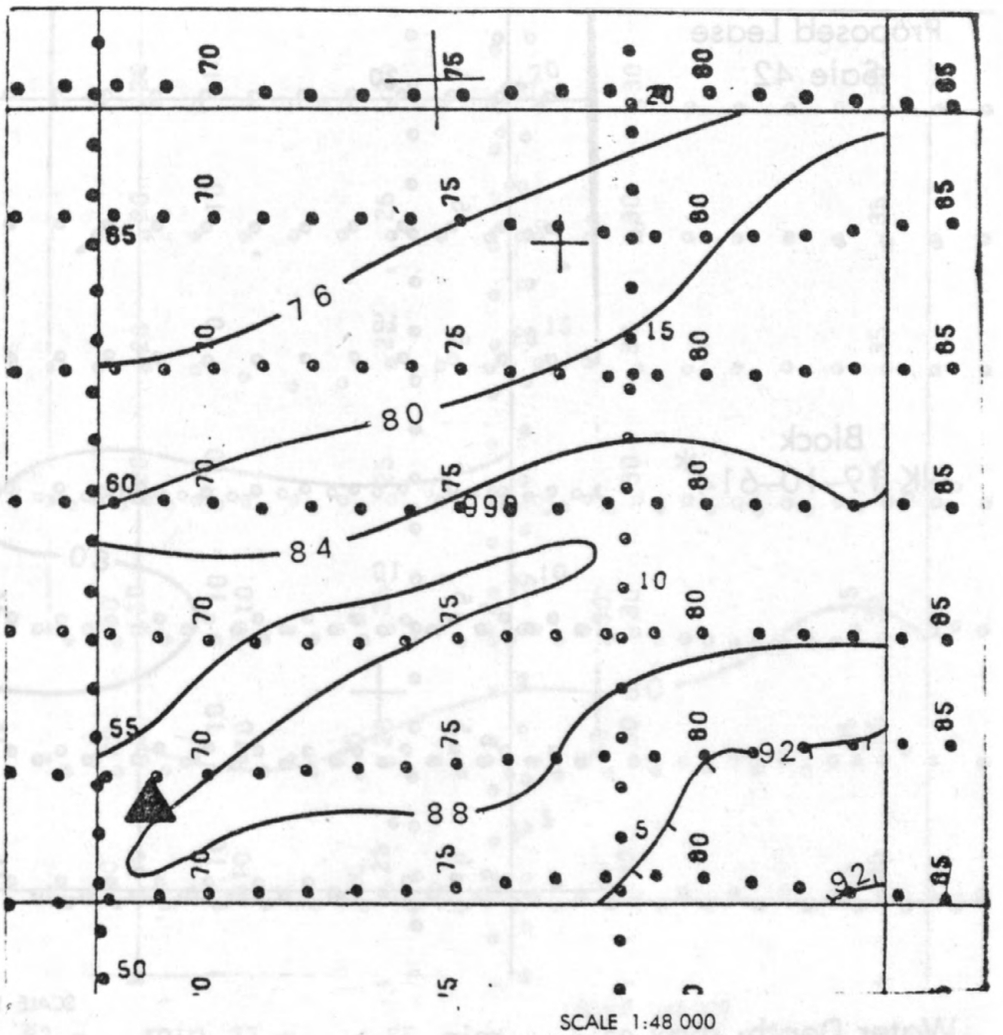


Water Depth: max. 90 m , min. 75 m
Slope Gradient: 2-11 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–9–990*



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 95 m , min. 75 m
Slope Gradient: 3–12 m/km, Direction: SE
Surface Sediment Type: Gravelly Sand

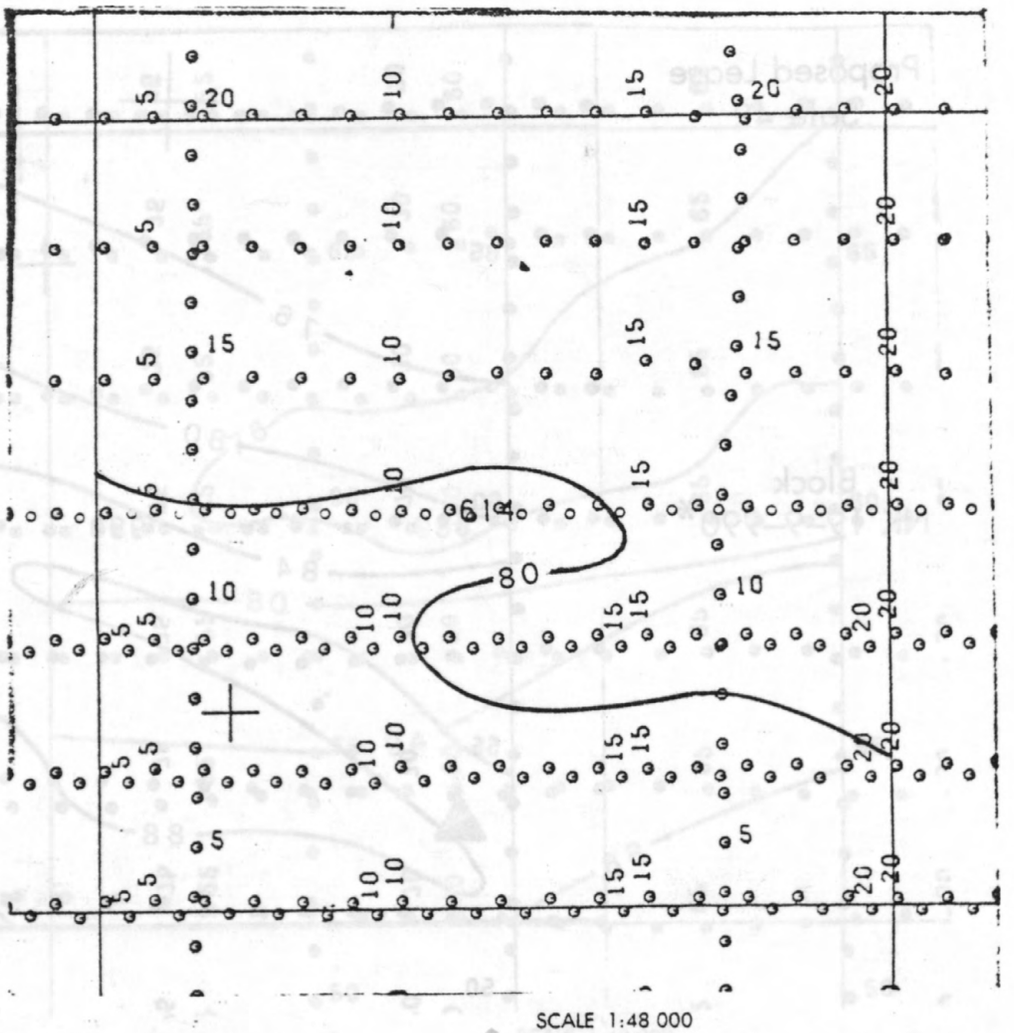
CONSTRAINT

▲ Bottom Object

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–10–614*

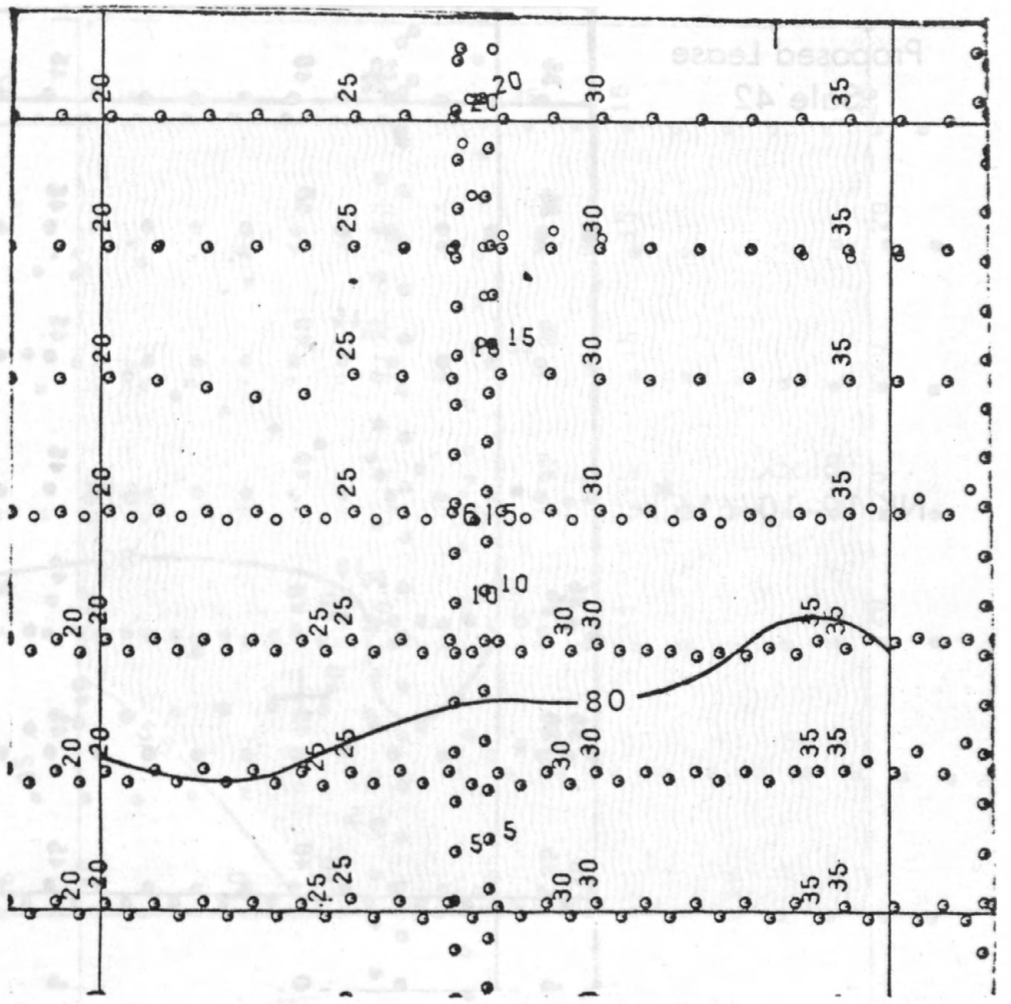


Water Depth: max. 83 m , min. 77 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Silty Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–10–615*



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

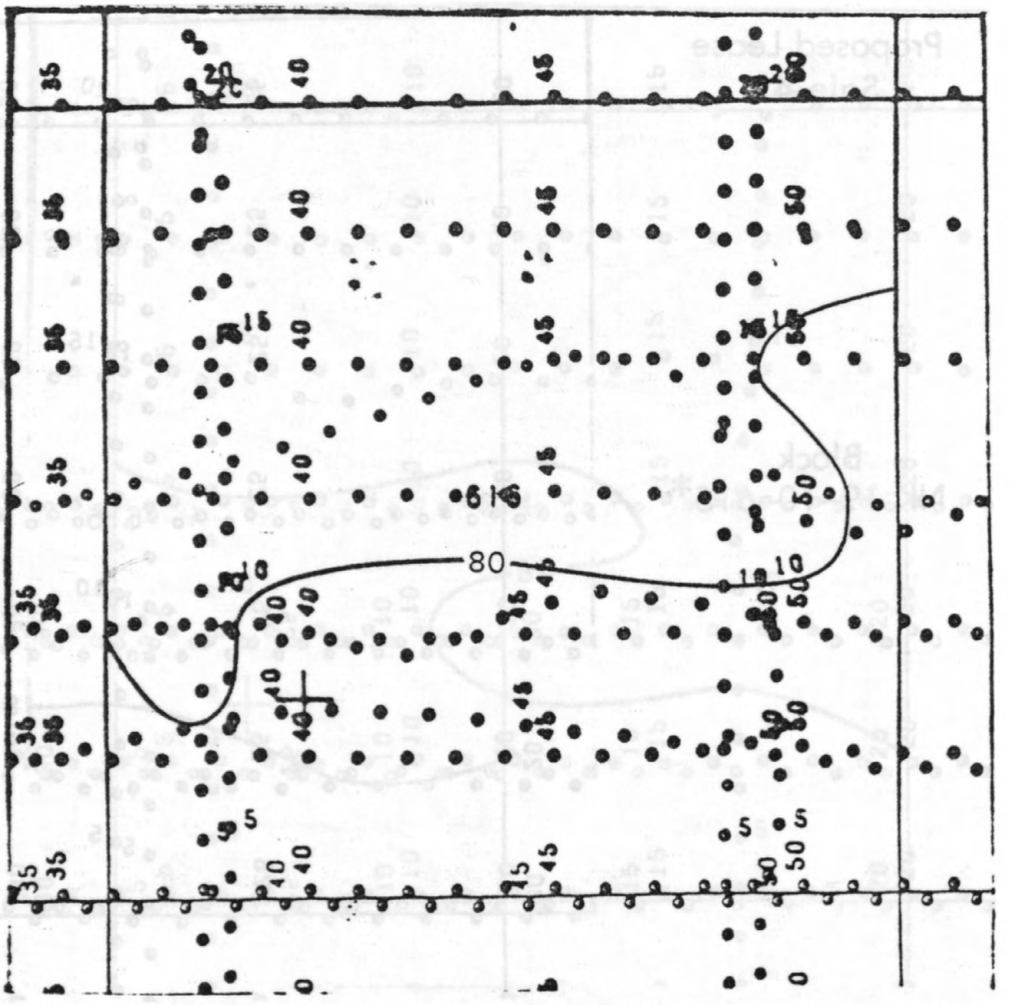
ISOBATHS IN METERS

Water Depth: max. 82 m , min. 77 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Silty Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

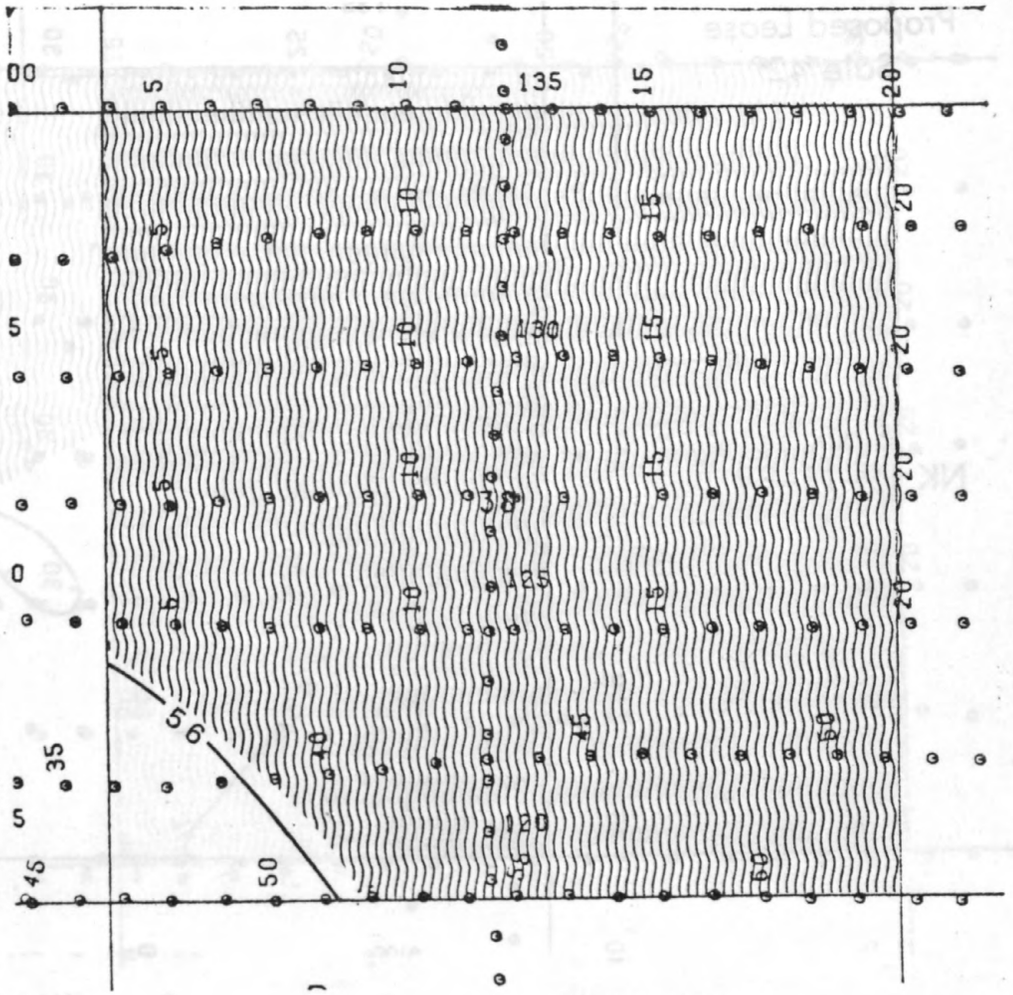
Block
NK 19–10–616*



Water Depth: max. 83 m , min. 77 m
Slope Gradient: 1 m/km, Direction: S
Surface Sediment Type: Silty Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



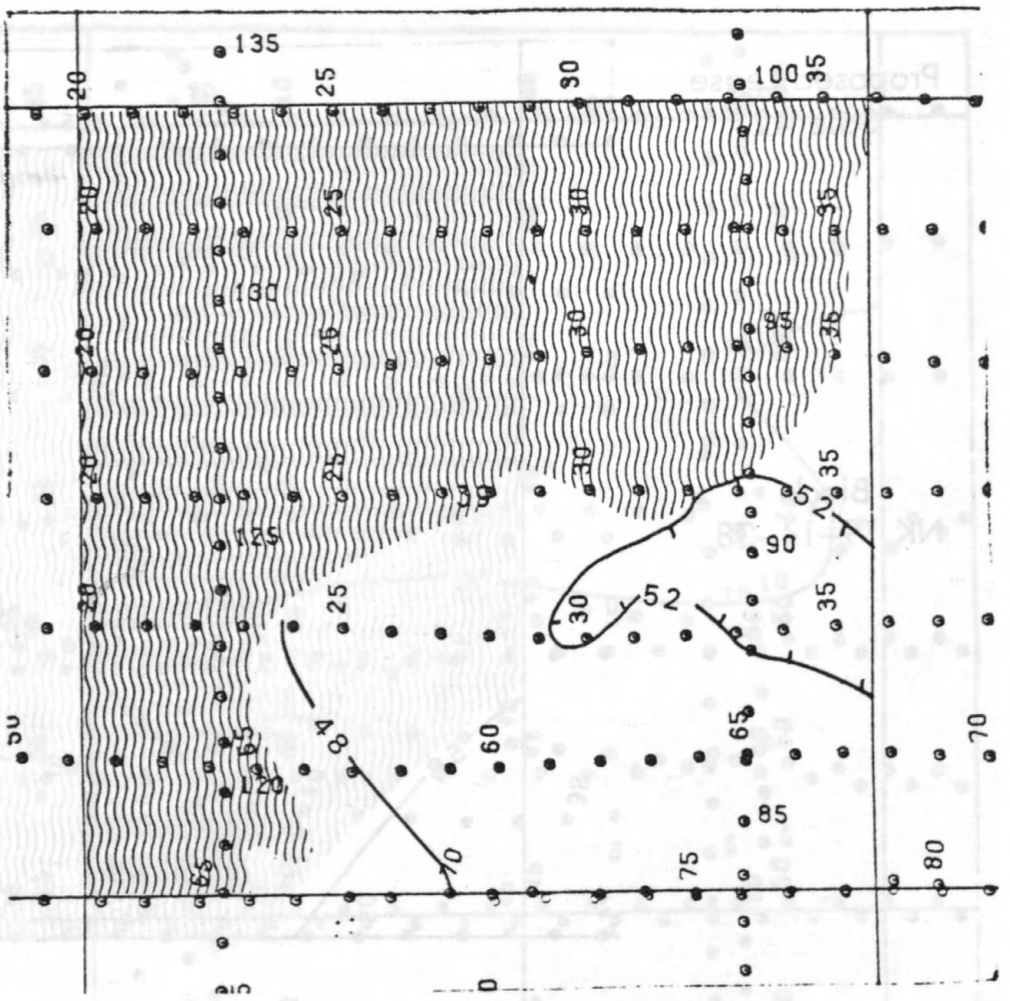
Water Depth: max. 56 m , min. 39 m
Slope Gradient: Variable m/km, Direction: Variable
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–39



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

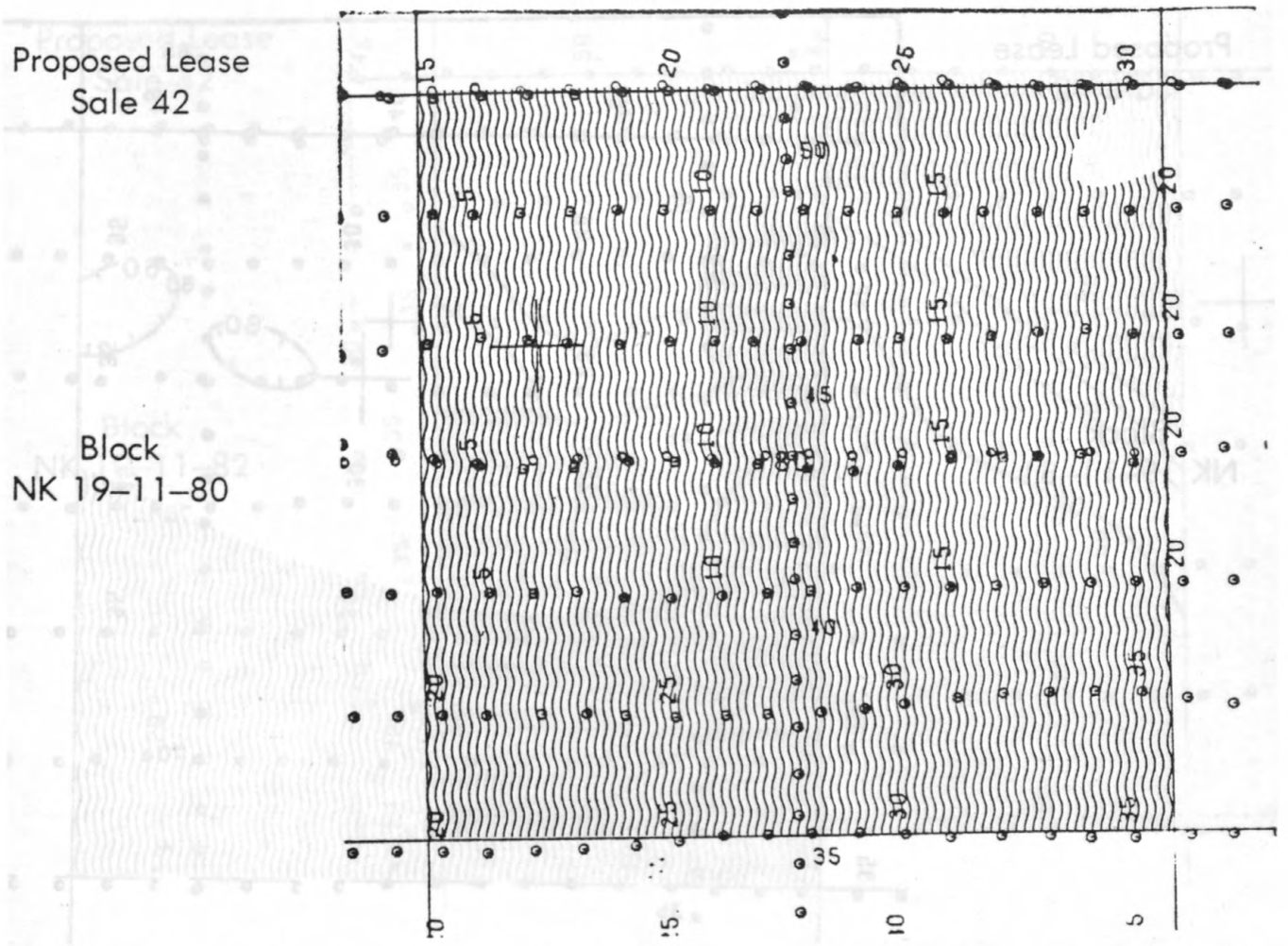
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 55 m , min. 37 m
Slope Gradient: 4.2 m/km, Direction: NE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field



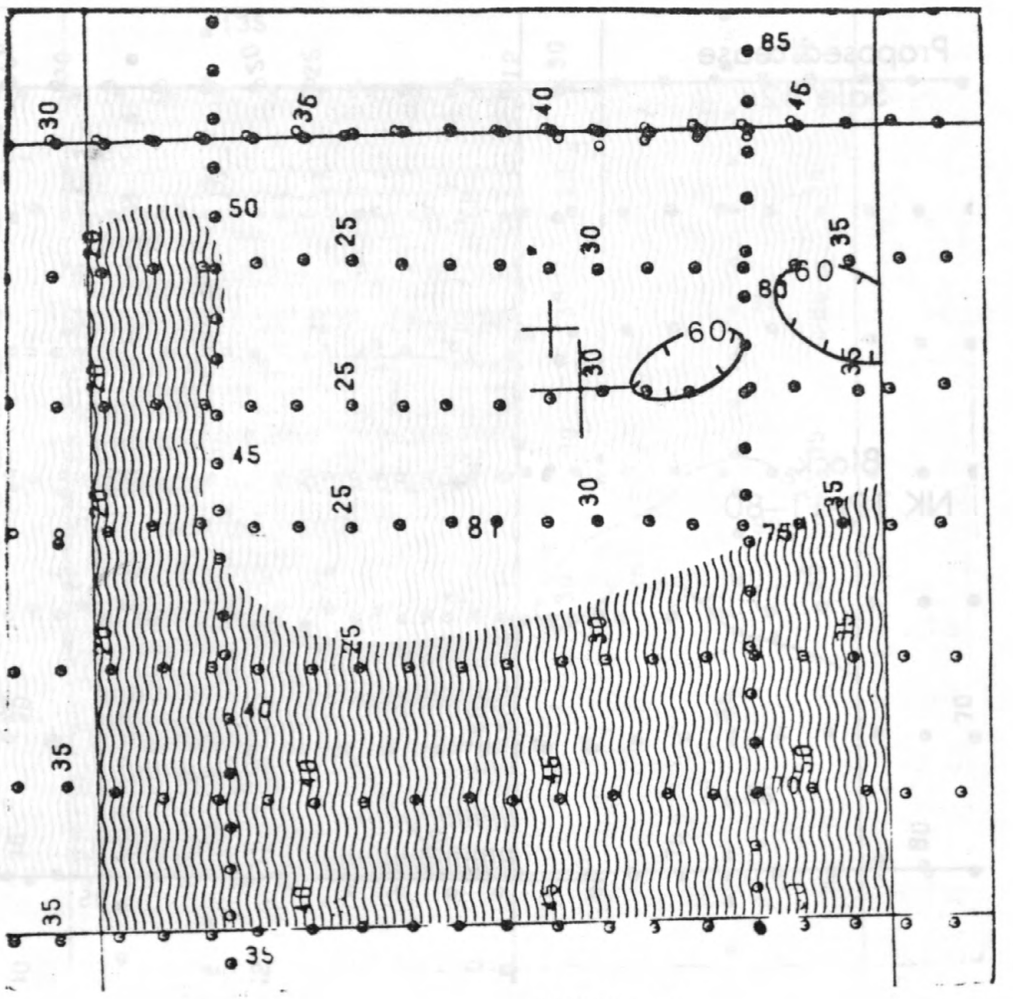
Water Depth: max. 59 m , min. 41 m
Slope Gradient: 3.8 m/km, Direction: Variable
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–81



Water Depth: max. 60 m , min. 55 m
Slope Gradient: 1.3 m/km, Direction: Variable
Surface Sediment Type: Sand

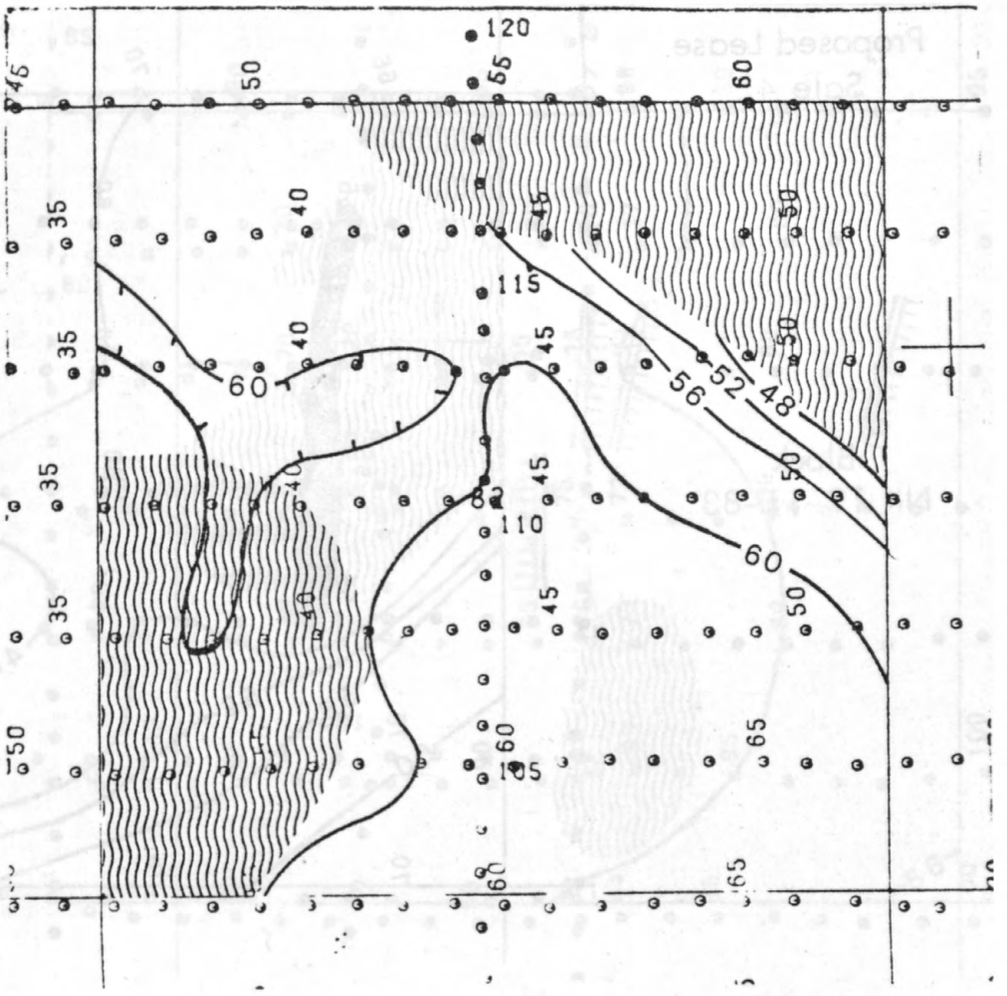
SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–82



Water Depth: max. 62 m , min. 41 m
Slope Gradient: 15.6 m/km, Direction: SW
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

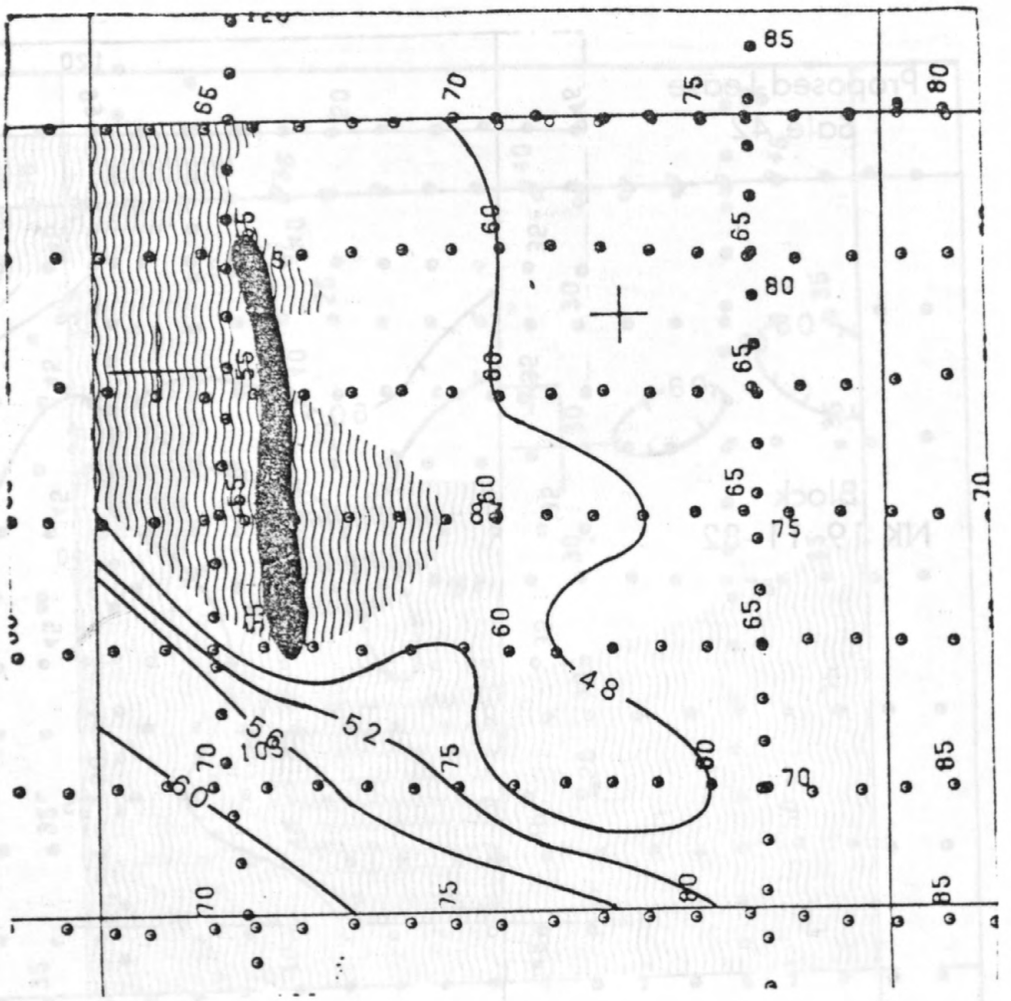
ISOBATHS IN METERS

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–83



Water Depth: max. 61 m , min. 44 m
Slope Gradient: 17 m/km, Direction: SW
Surface Sediment Type: Sand

POTENTIAL HAZARD

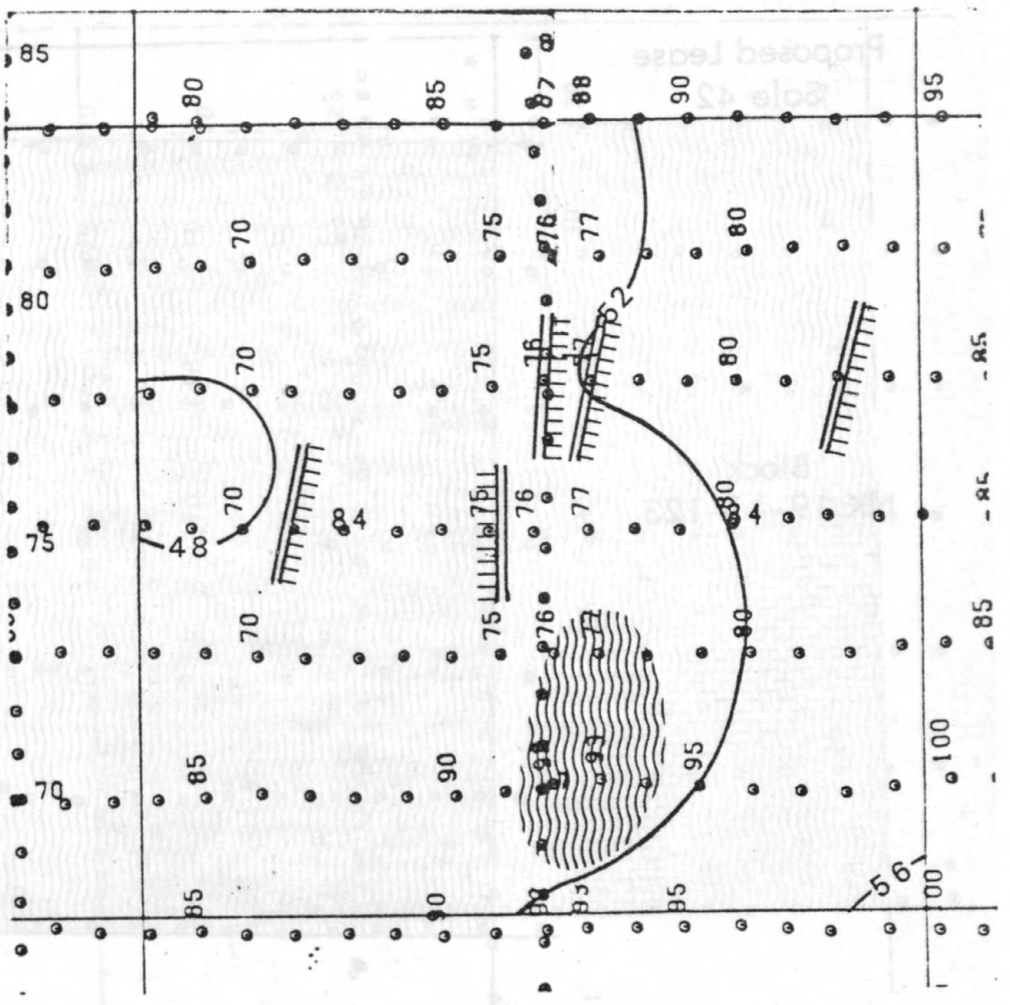
Shallow Gas Deposit (See figure 3)

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–84



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 57 m , min. 48 m
Slope Gradient: 1,8 m/km, Direction: ESE
Surface Sediment Type: Sand

POTENTIAL HAZARD

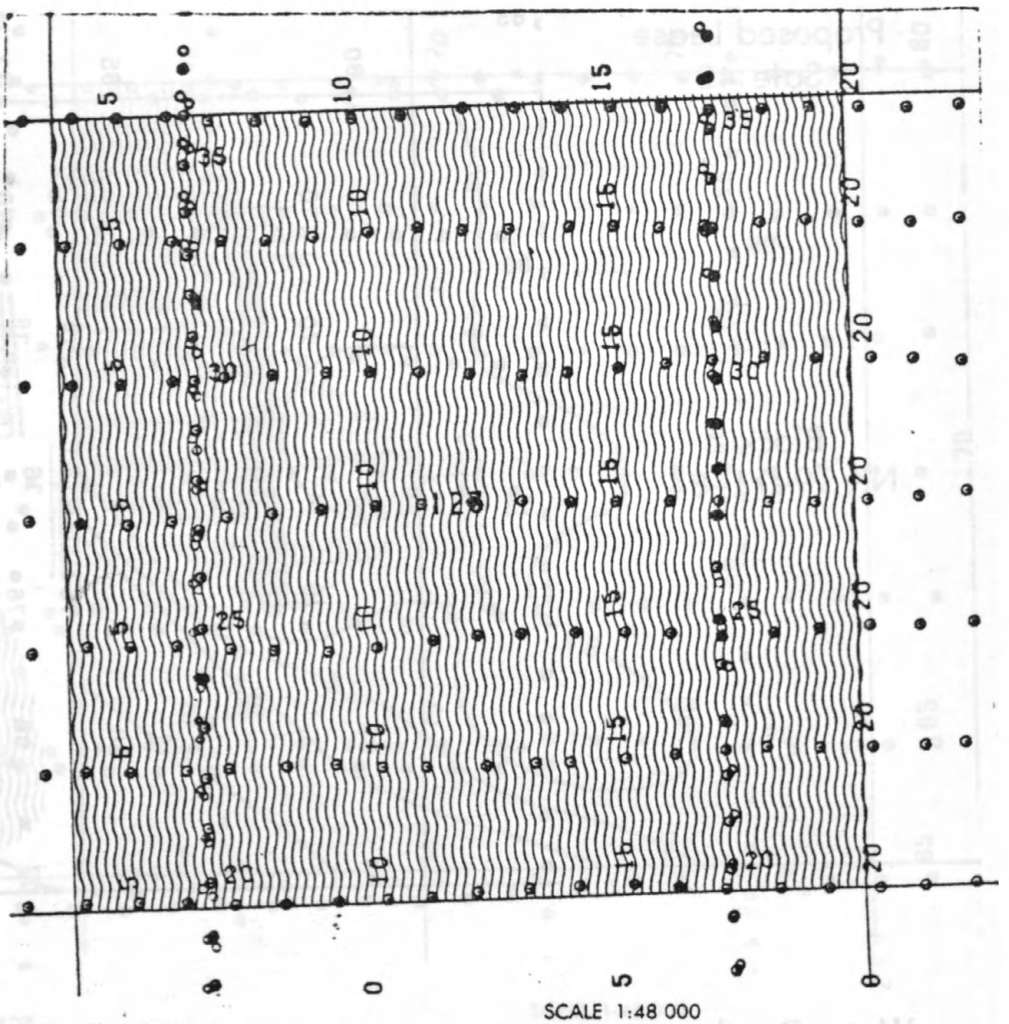
Fault at "I" Reflector

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–123



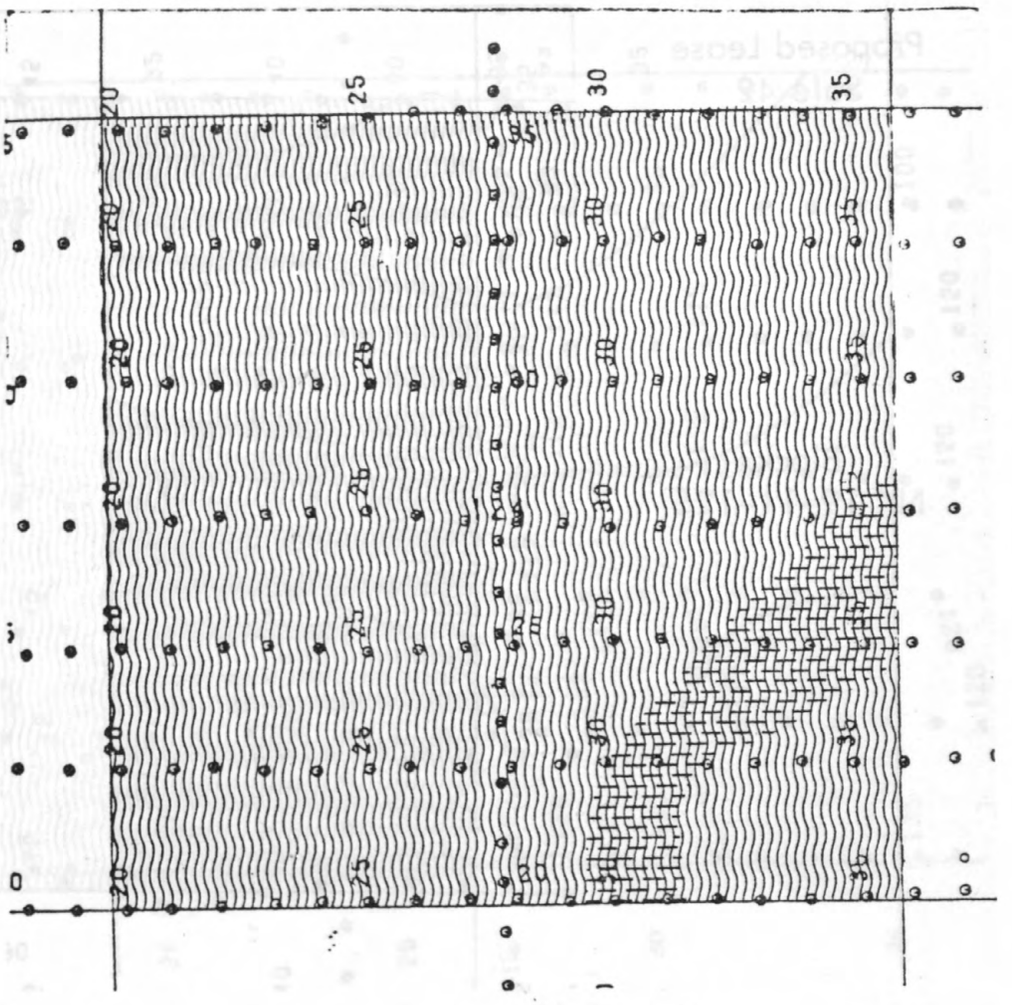
Water Depth: max. 53 m , min. 38 m
Slope Gradient: 4.5 m/km, Direction: NE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–124



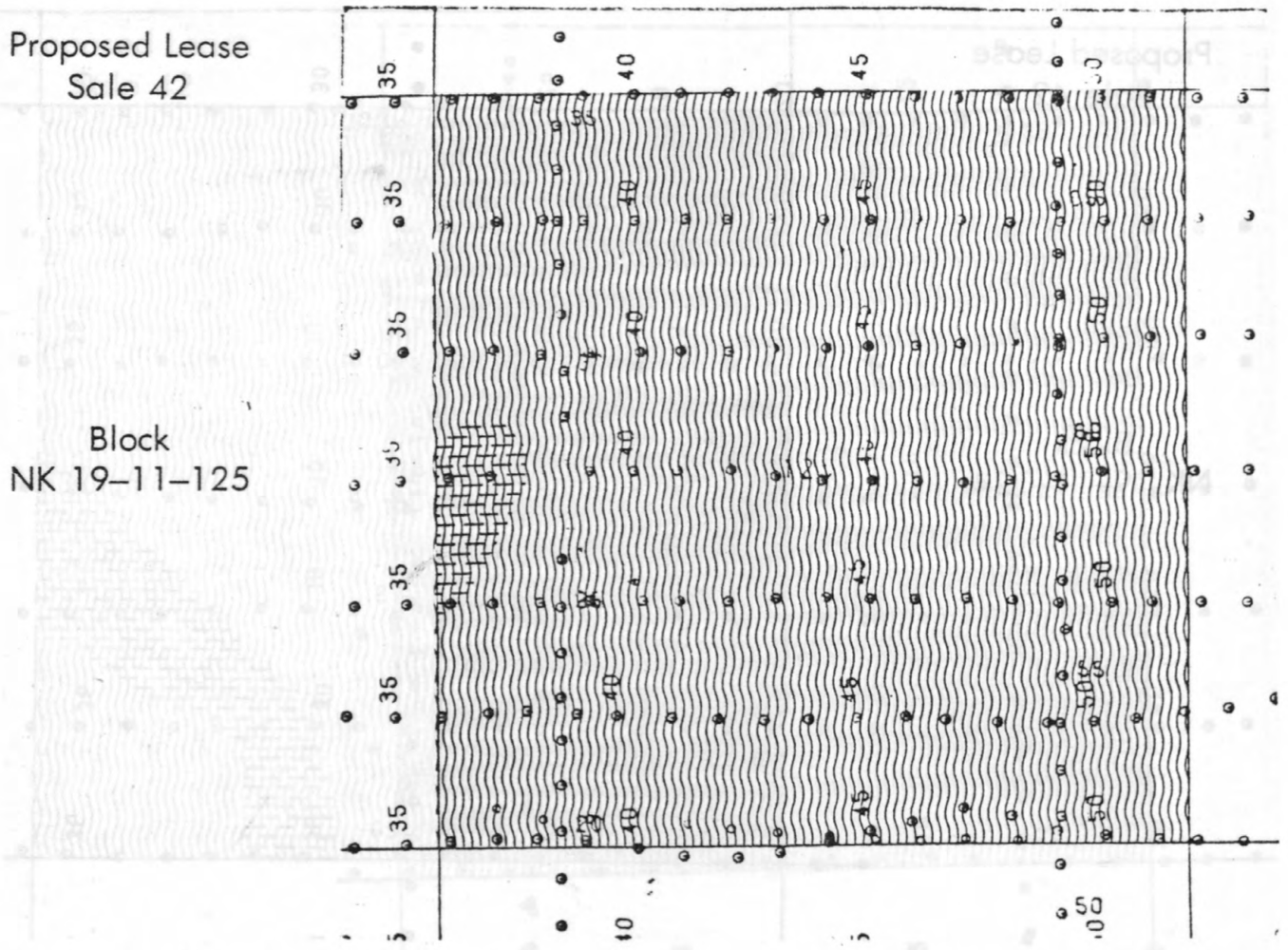
Water Depth: max. 60 m , min. 41 m
Slope Gradient: 4.6 m/km, Direction: NE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINTS

Sand Wave Field

Filled Channel



Water Depth: max. 61 m , min. 50 m
Slope Gradient: 4.6 m/km, Direction: NE
Surface Sediment Type: Sand

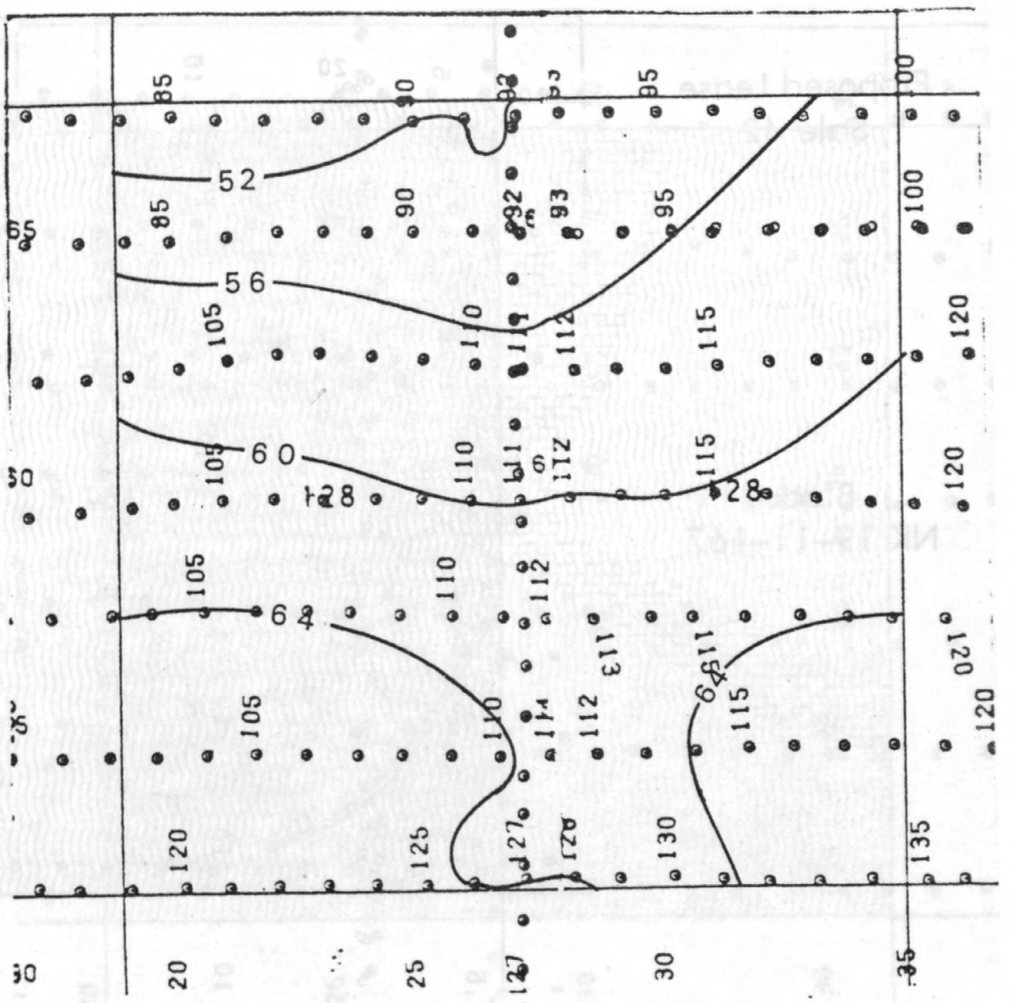
CONSTRAINTS

Sand Wave Field

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–11–128



SCALE 1:48 000

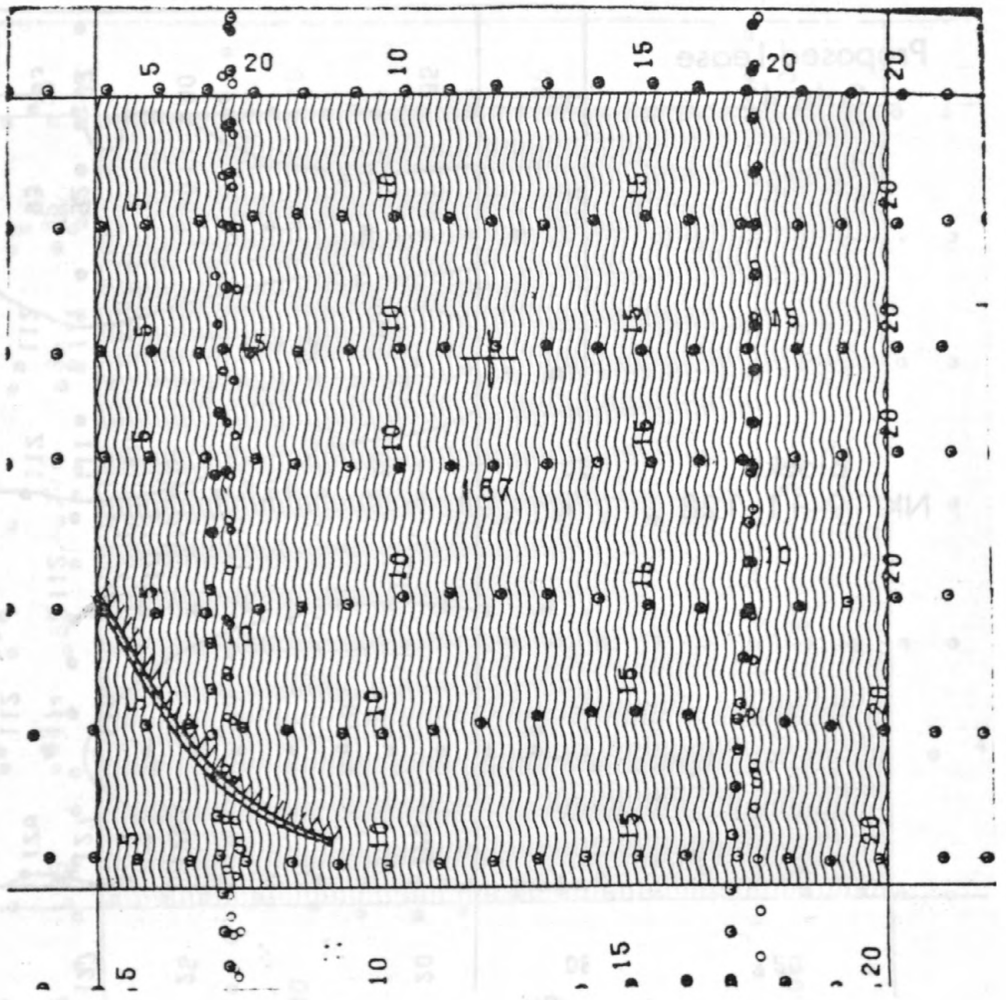
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 66 m , min. 49 m
Slope Gradient: 3.5 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–11–167



Water Depth: max. 58 m , min. 42 m
Slope Gradient: 2.5 m/km, Direction: NE
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

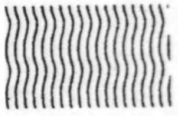
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

POTENTIAL HAZARD

Fault at "I" Reflector

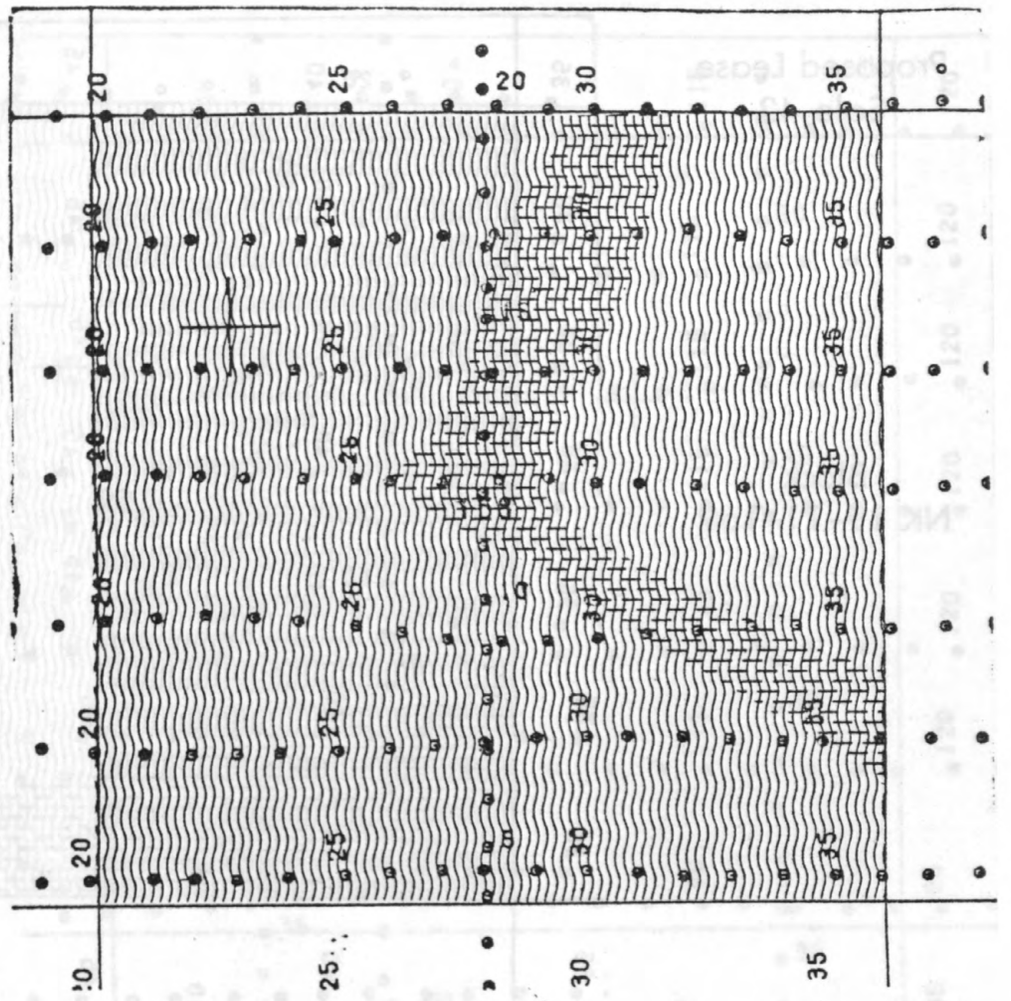
CONSTRAINT



Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–11–168



Water Depth: max. 57 m , min. 47 m.
Slope Gradient: 2 m/km, Direction: NE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

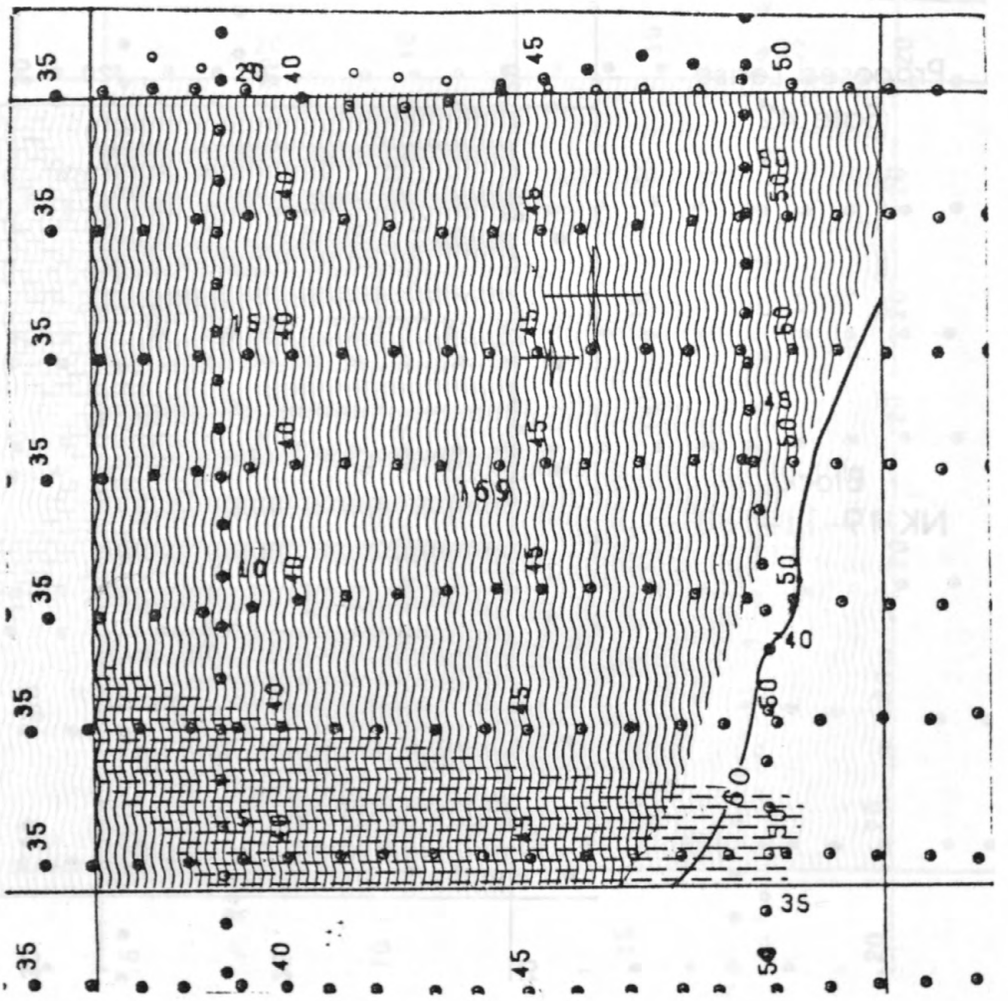
CONSTRAINTS

Sand Wave Field

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–11–169

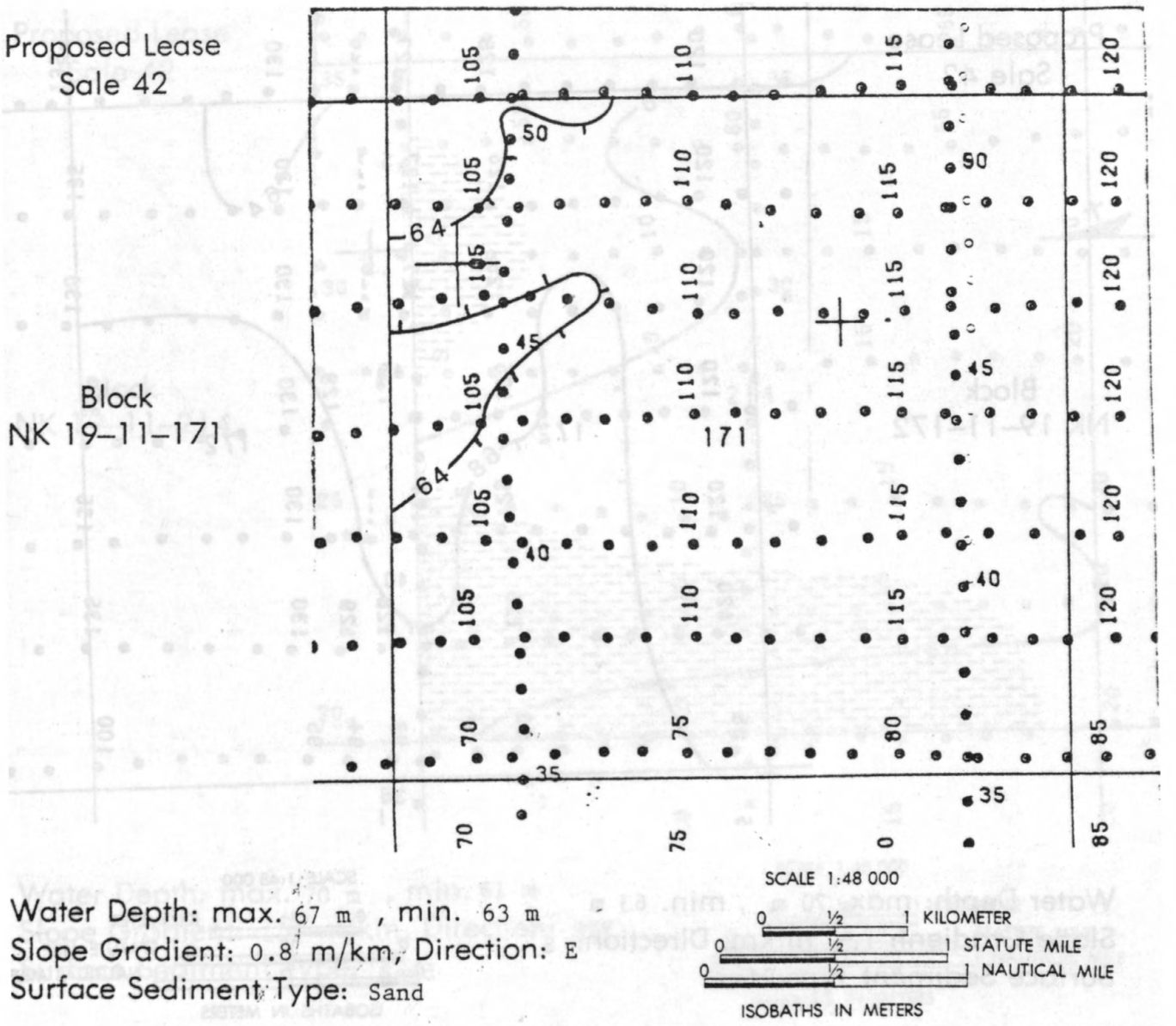


Water Depth: max. 62 m , min. 49 m
Slope Gradient: 3.8 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINTS

Sand Wave Field

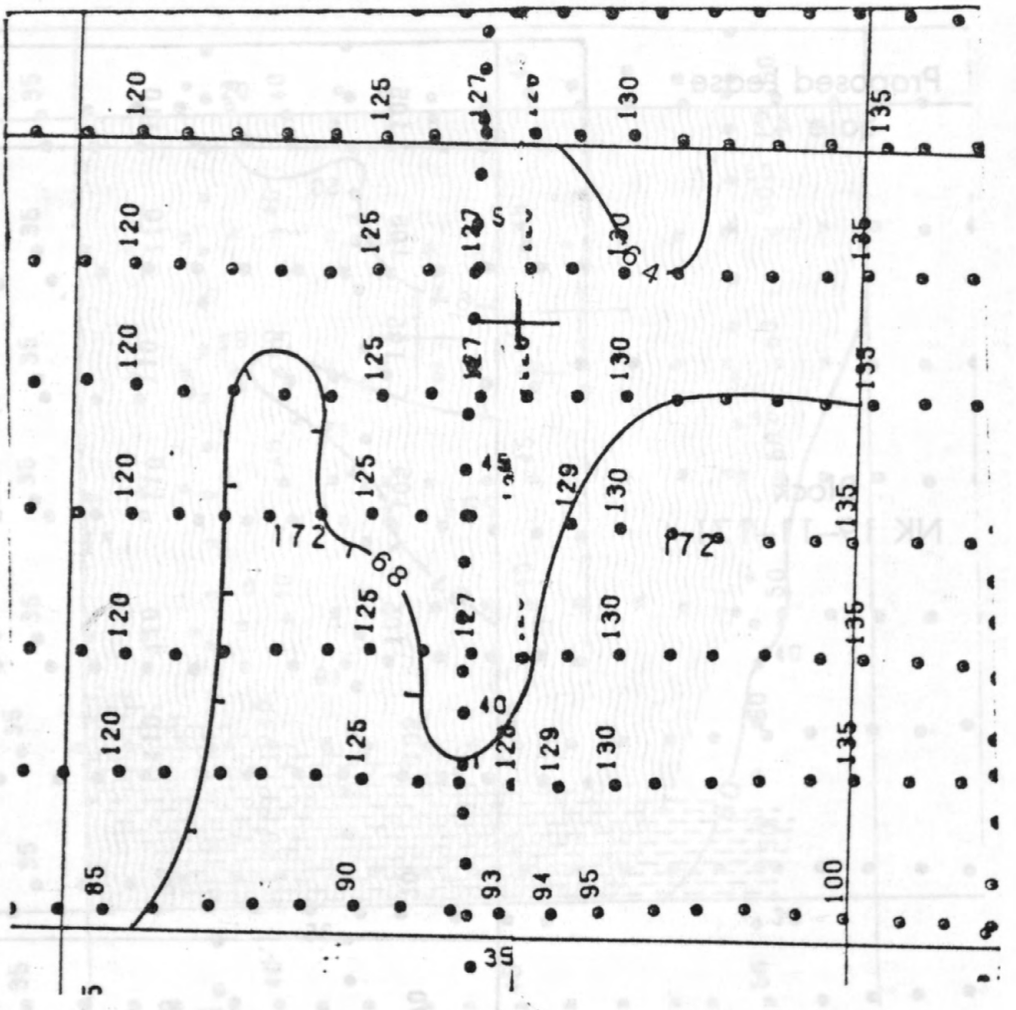
Filled Channel



Water Depth: max. 67 m , min. 63 m
Slope Gradient: 0.8 m/km, Direction: E
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–11–172



SCALE 1:48 000

0 ½ 1 KILOMETER

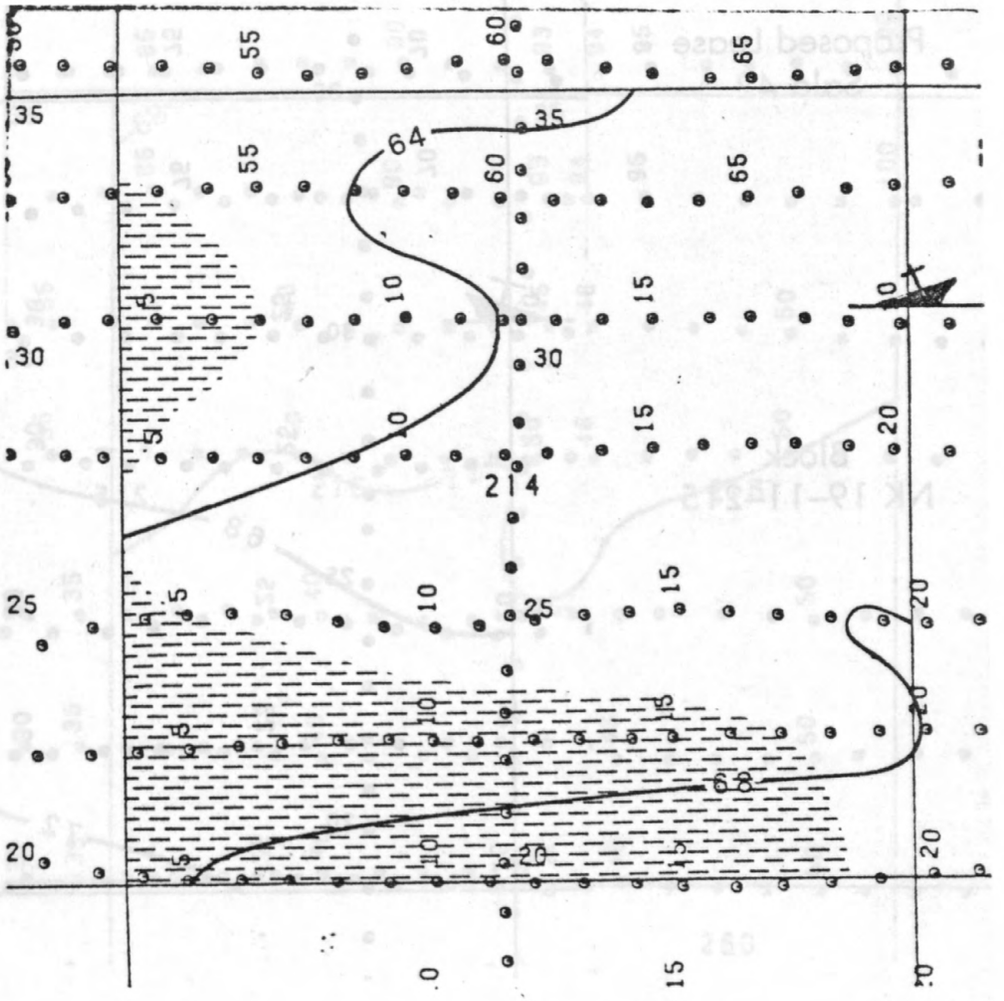
0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 70 m , min. 63 m
Slope Gradient: 1.5 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42



Block
NK 19–11–214

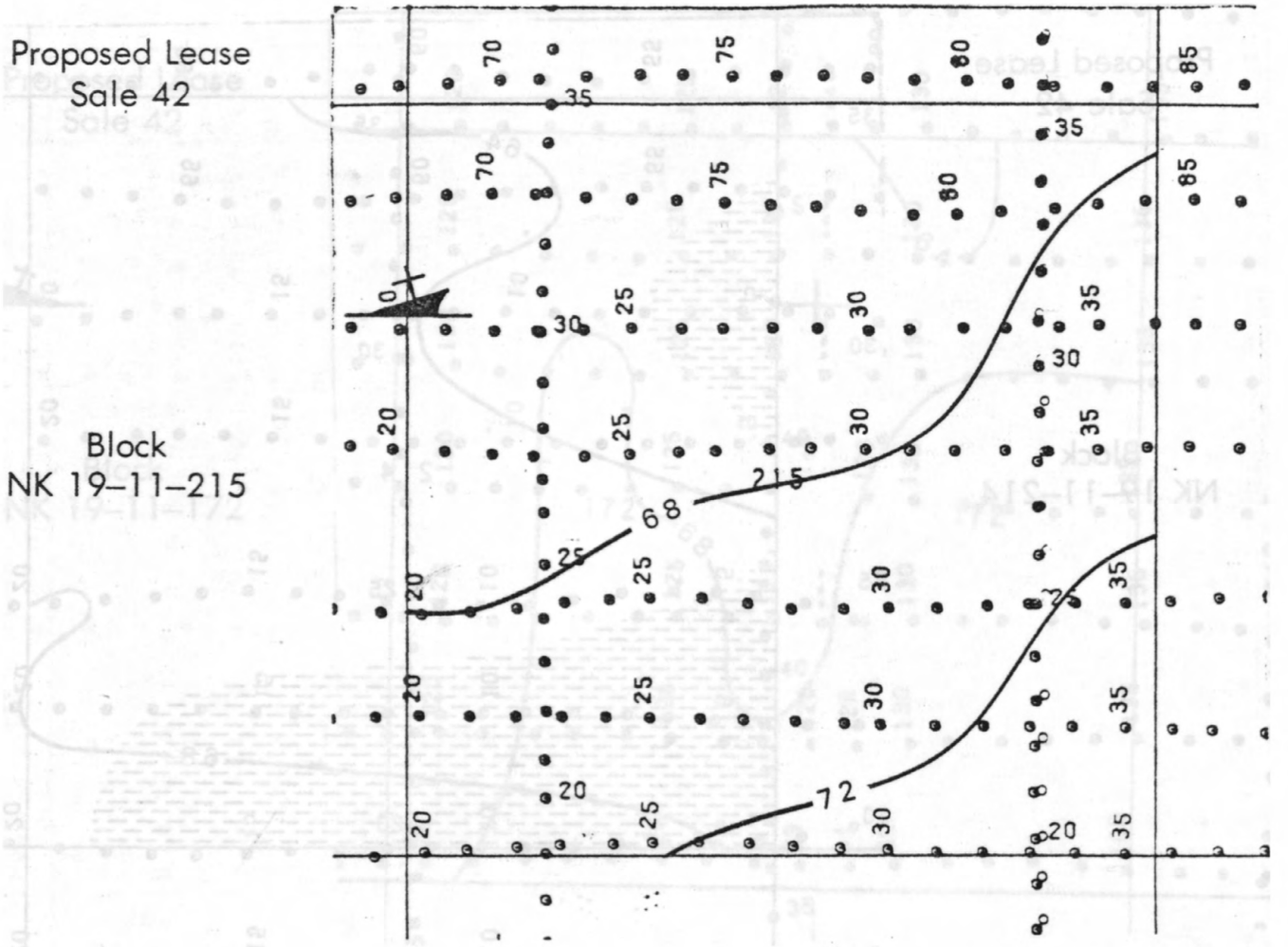
Water Depth: max. 70 m , min. 61 m
Slope Gradient: 1.5 m/km, Direction: SSE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINTS

Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

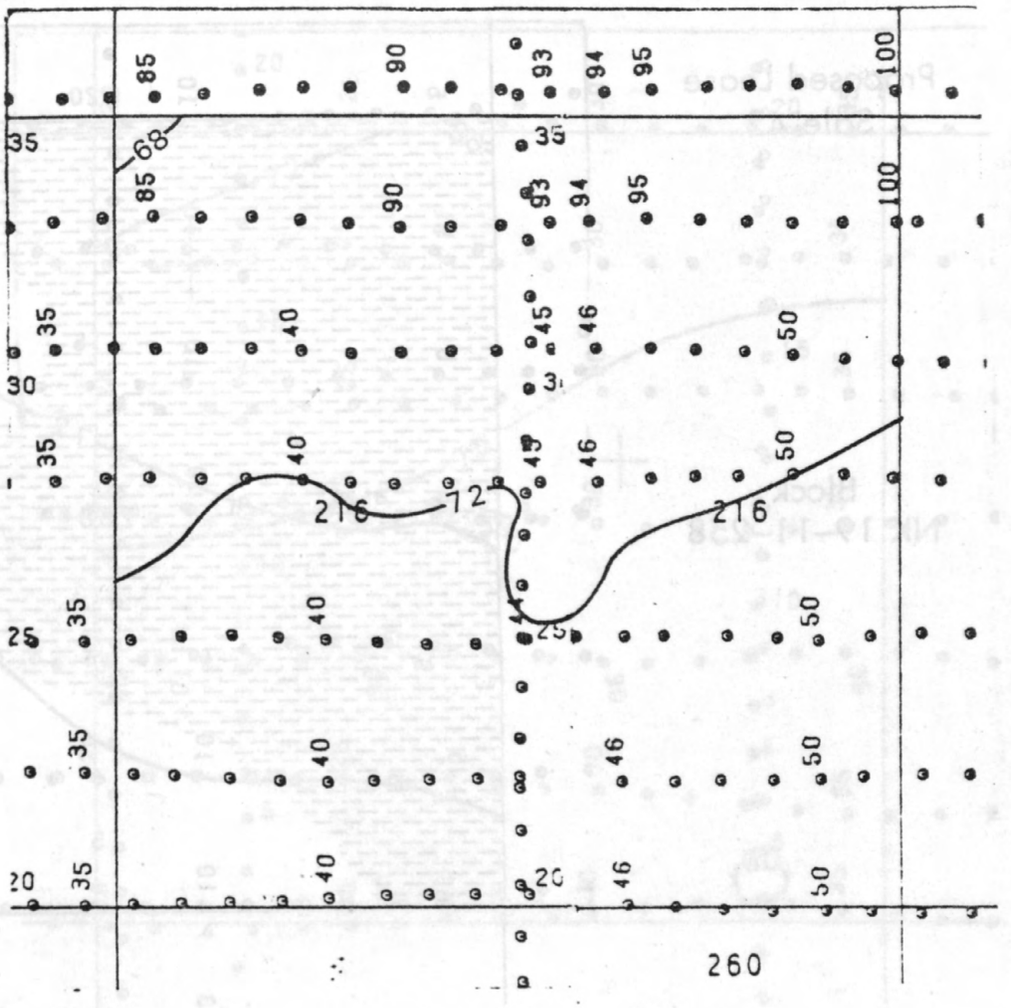


Water Depth: max. 74 m , min. 65 m
Slope Gradient: 1.5 m/km, Direction: SSE
Surface Sediment Type: Sand

CONSTRAINT

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

Proposed Lease
Sale 42

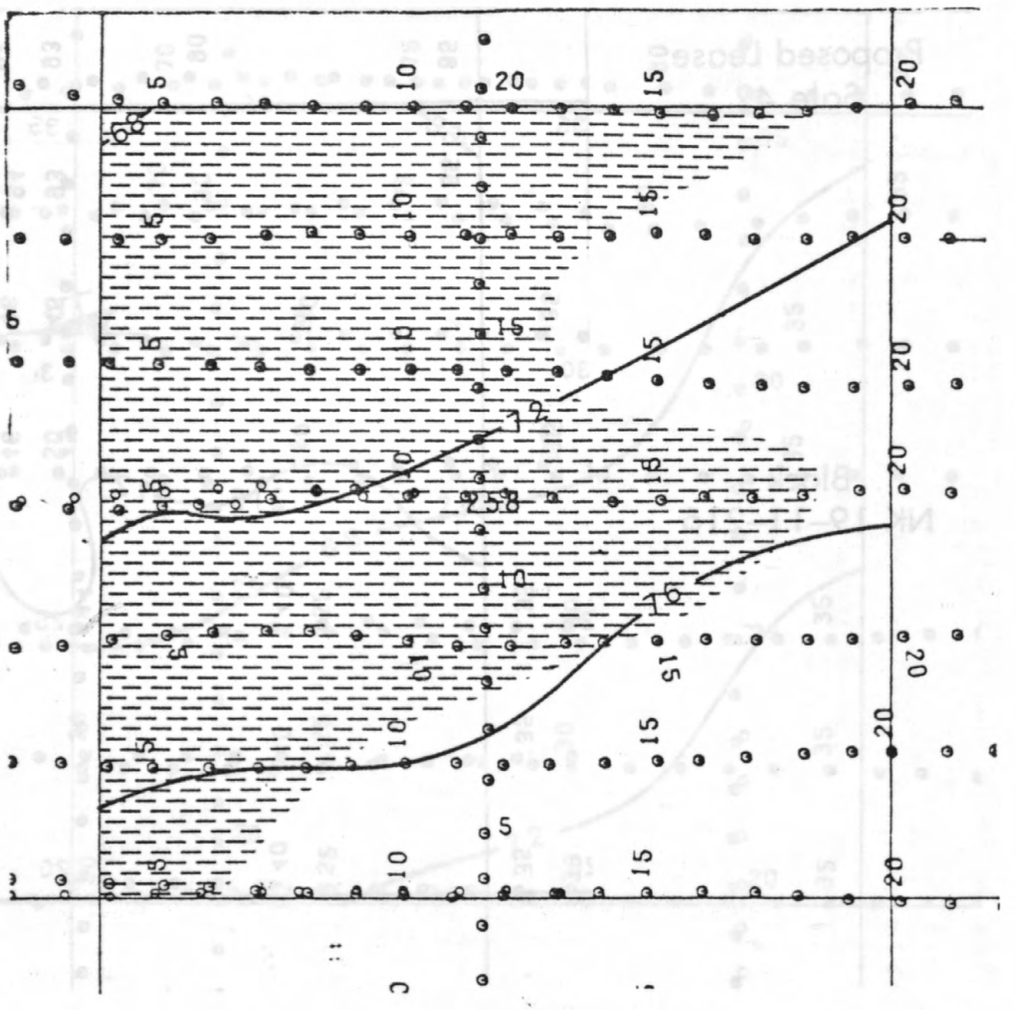


Water Depth: max. 75 m , min. 65 m
Slope Gradient: 2 m/km, Direction: SSE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–11–258



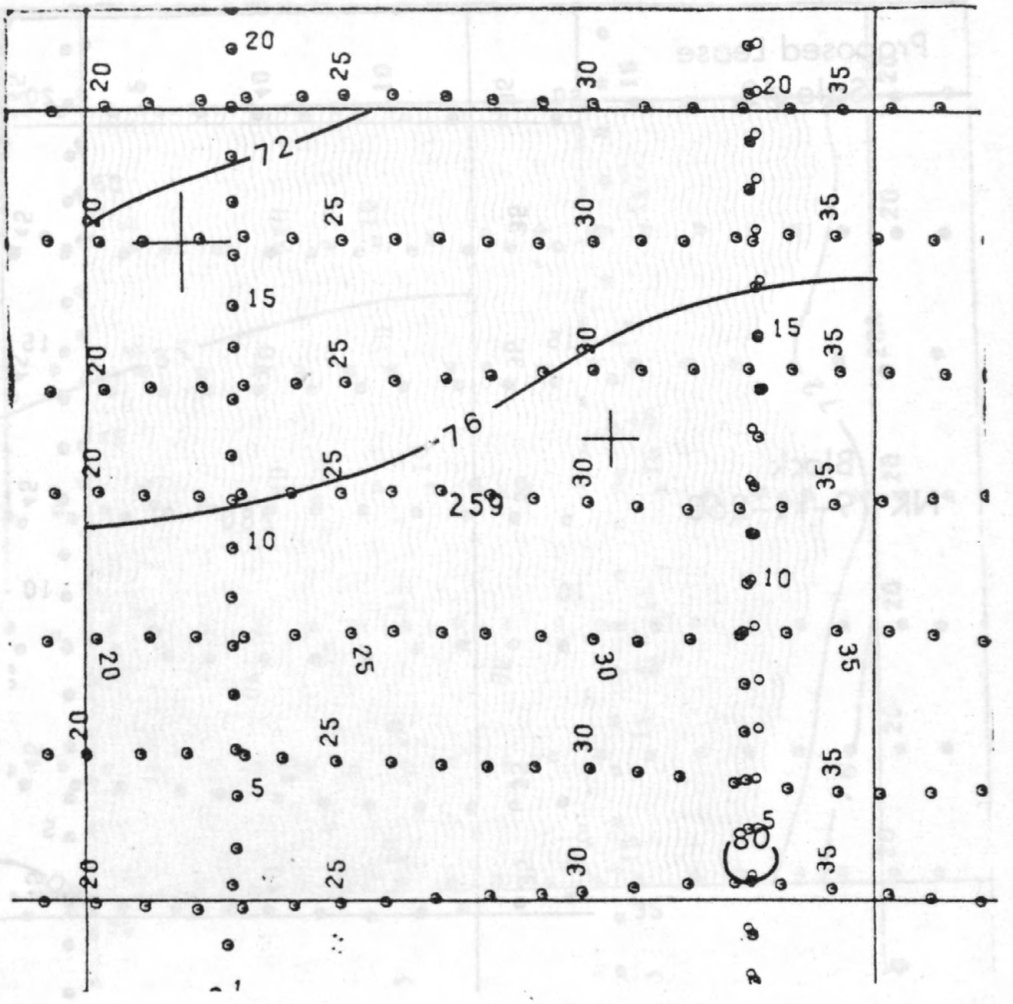
Water Depth: max. 78 m , min. 67 m
Slope Gradient: 2.3 m/km, Direction: S
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Filled Channel

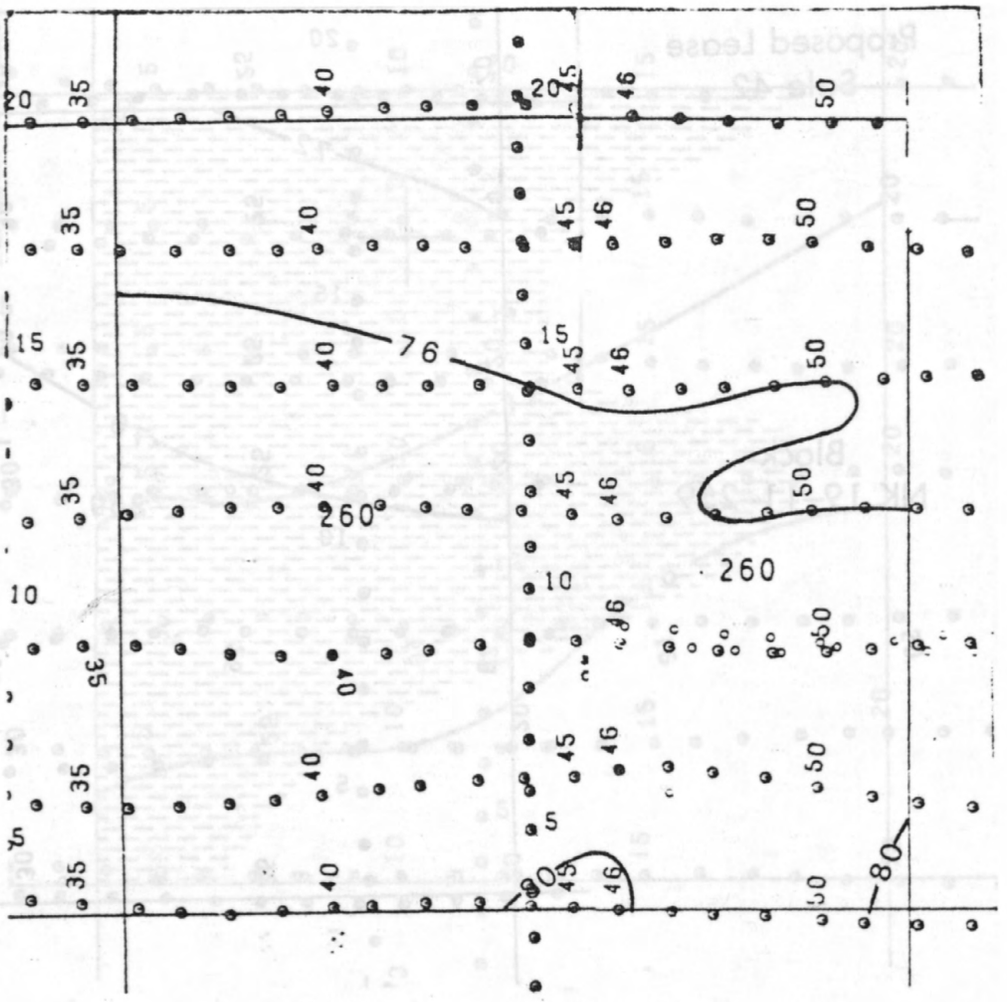
Proposed Lease
Sale 42



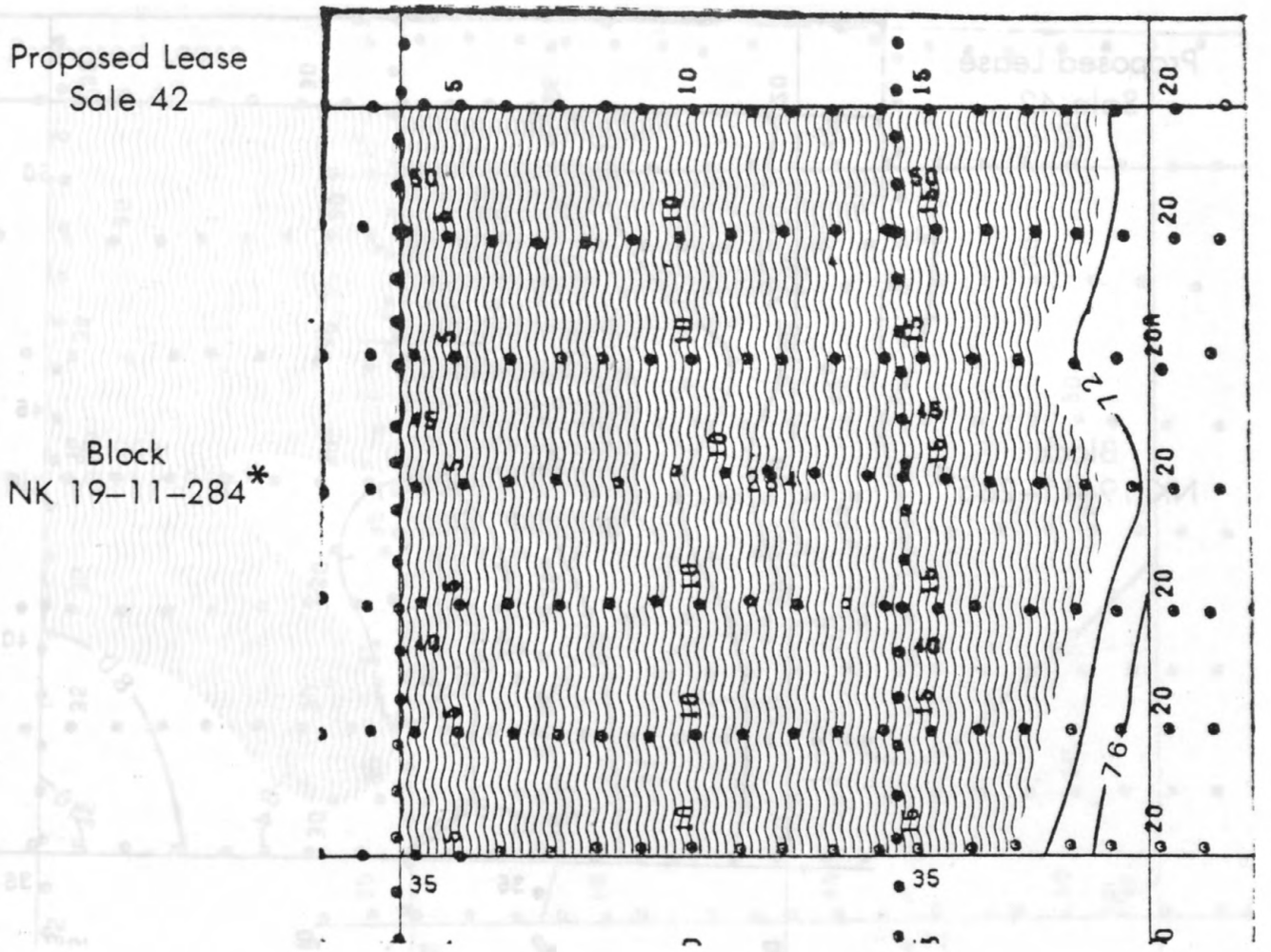
Water Depth: max. 80 m , min. 70 m
Slope Gradient: 2.1 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–11–260



Water Depth: max. 80 m , min. 73 m
Slope Gradient: 1.5 m/km, Direction: S
Surface Sediment Type: Sand



Water Depth: max. 77 m , min. 55 m
Slope Gradient: 4.0 m/km, Direction: E
Surface Sediment Type: Gravelly Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

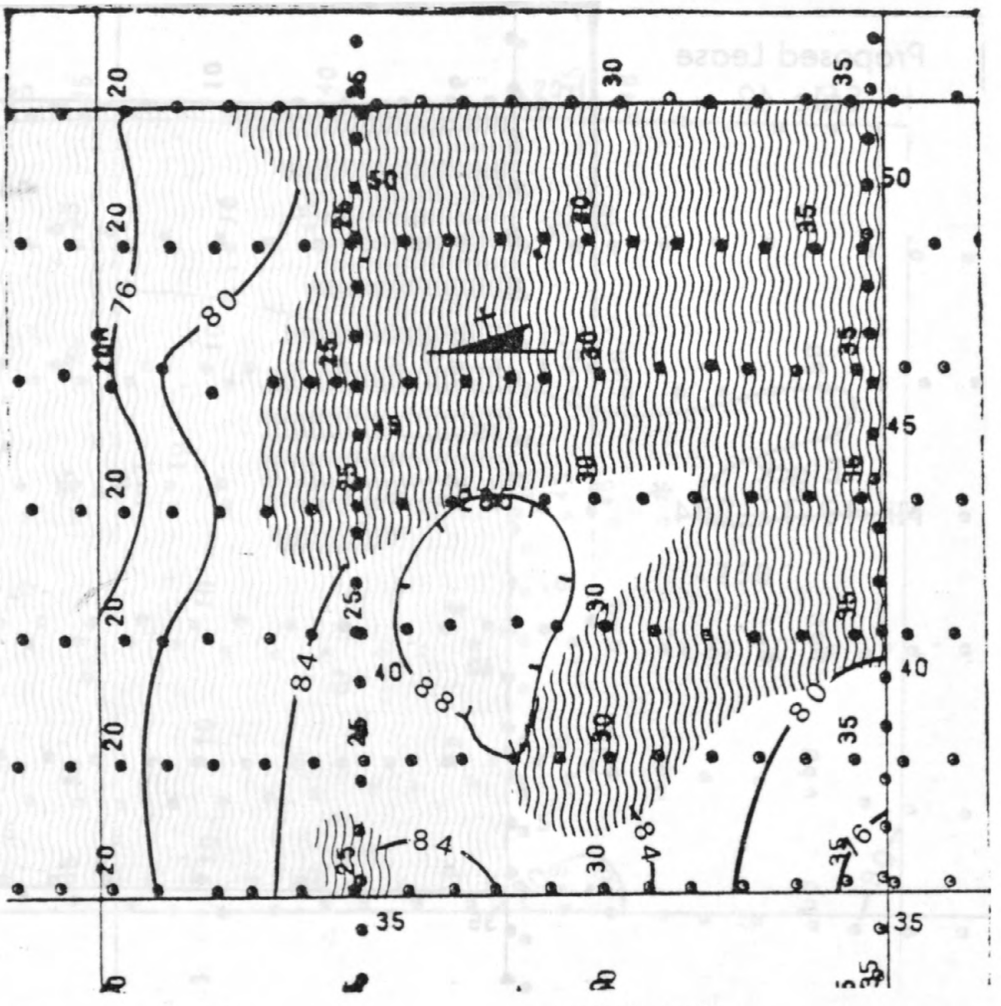
CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–11–285*



Water Depth: max. 90 m , min. 74 m
Slope Gradient: 4.0 m/km, Direction: E
Surface Sediment Type: Gravelly Sand

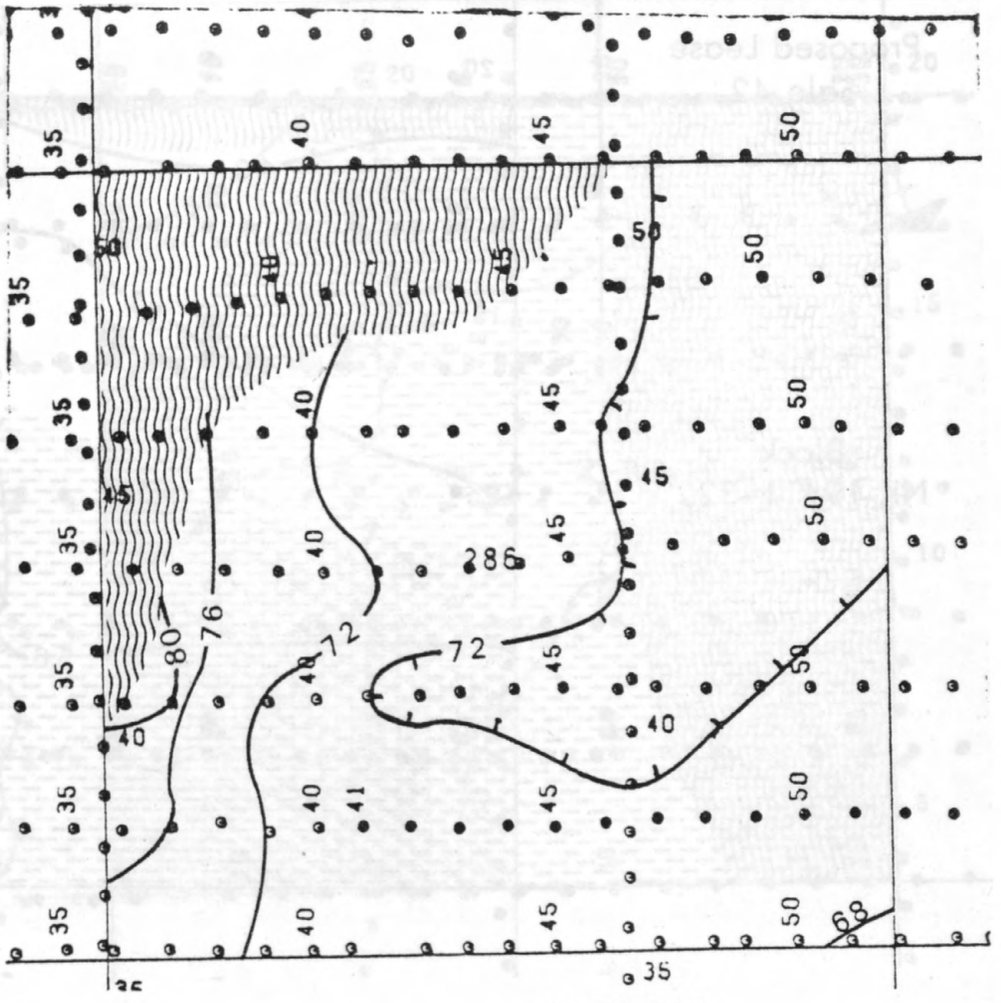
CONSTRAINTS

Sand Wave Field

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

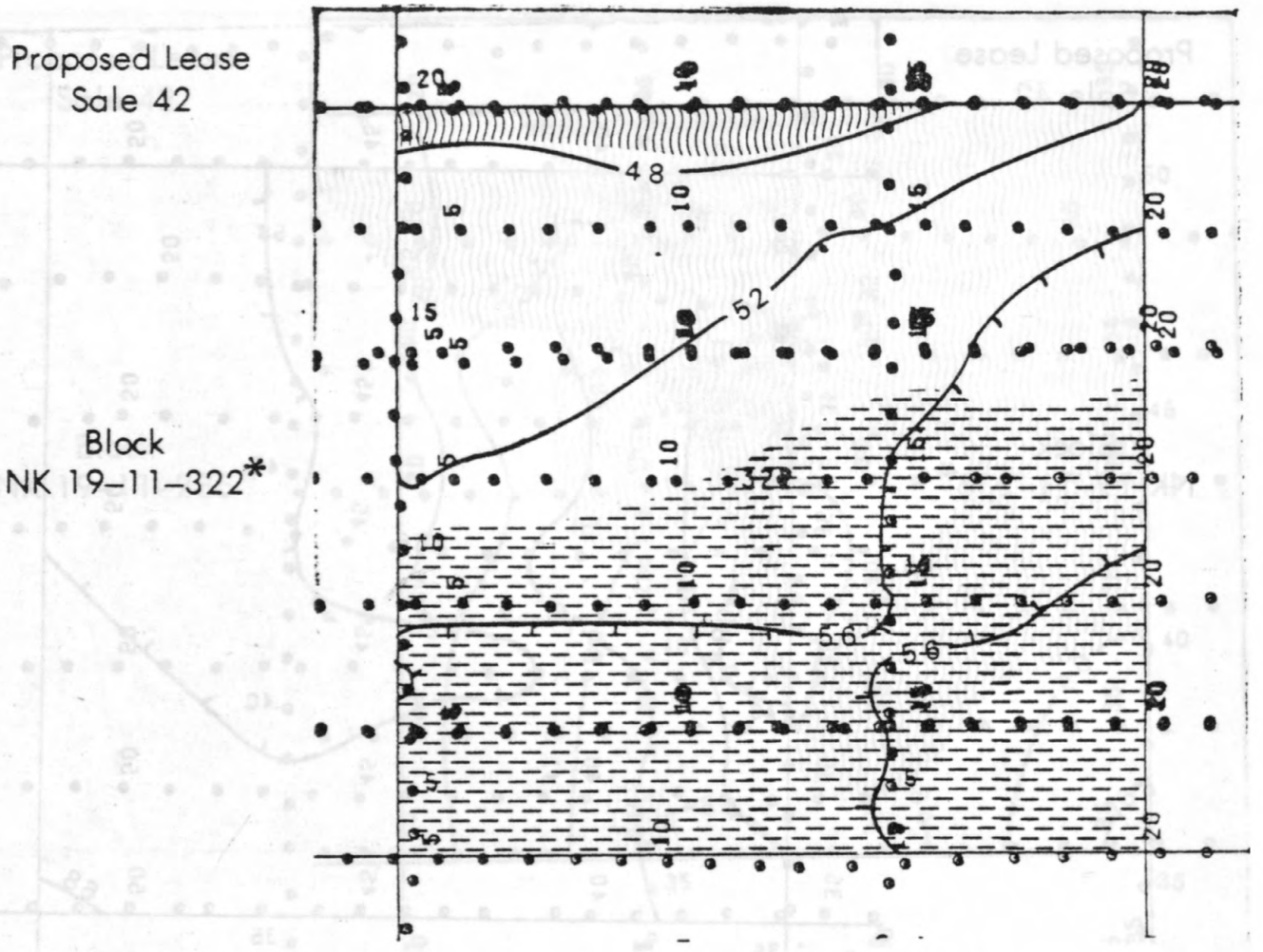


Water Depth: max. 83 m , min. 67 m
Slope Gradient: 4.0 m/km, Direction: SE
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



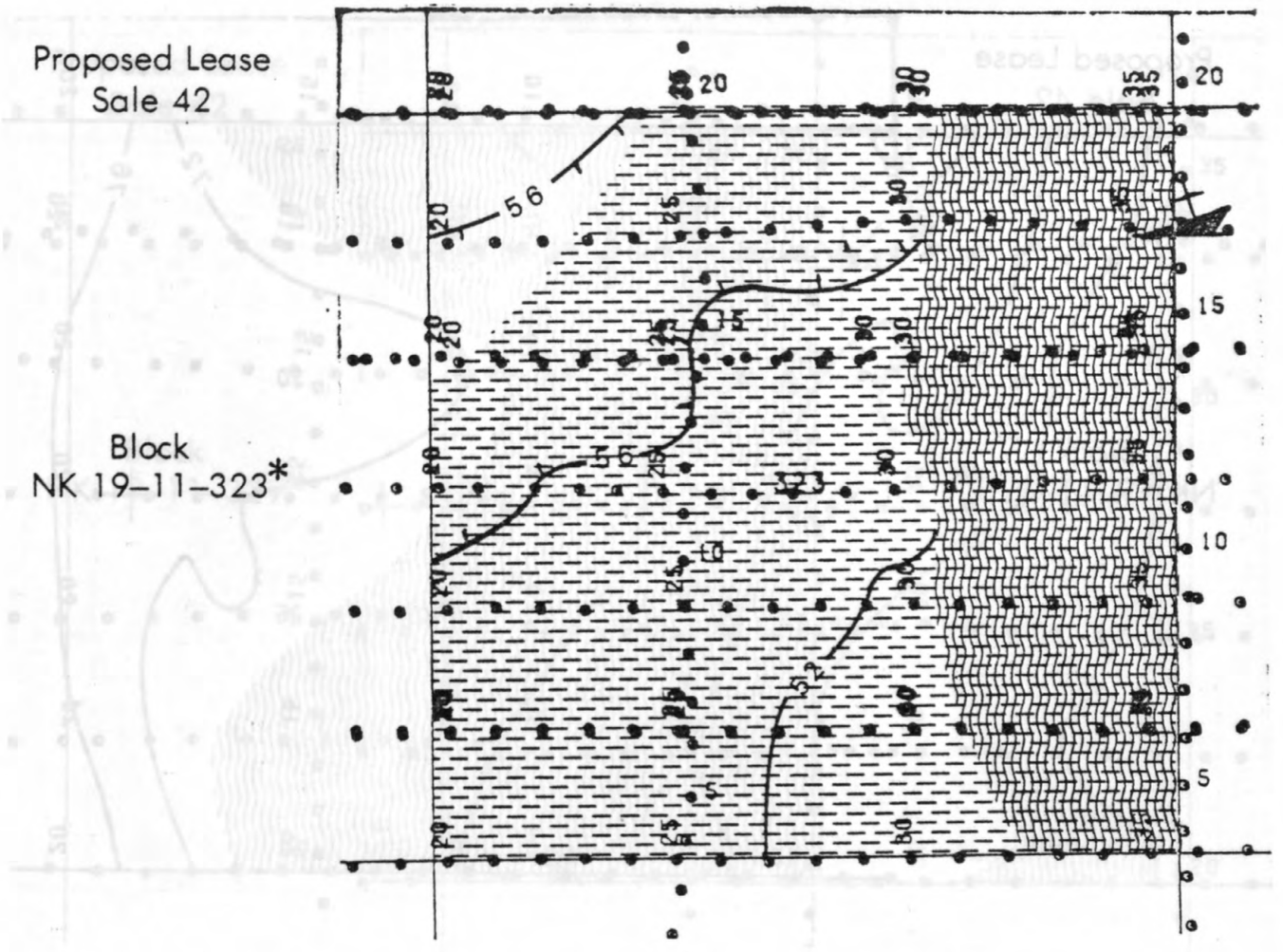
Water Depth: max. 57 m , min. 47 m
Slope Gradient: 2.5 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

CONSTRAINTS

Sand Wave Field

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 58 m, min. 40 m
Slope Gradient: 1.5 m/km, Direction: NW
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

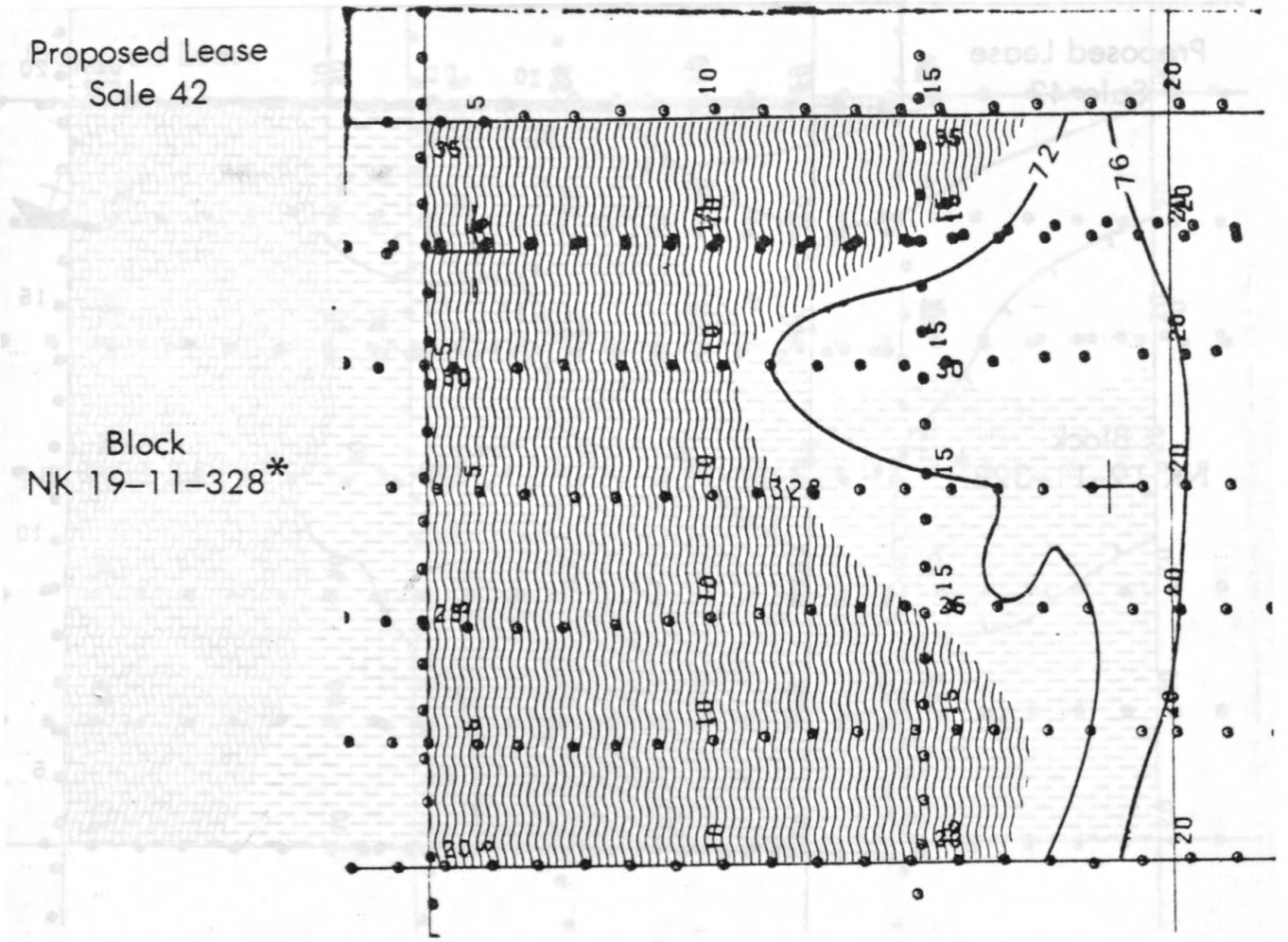
CONSTRAINTS

Sand Wave Field

Filled Channel

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

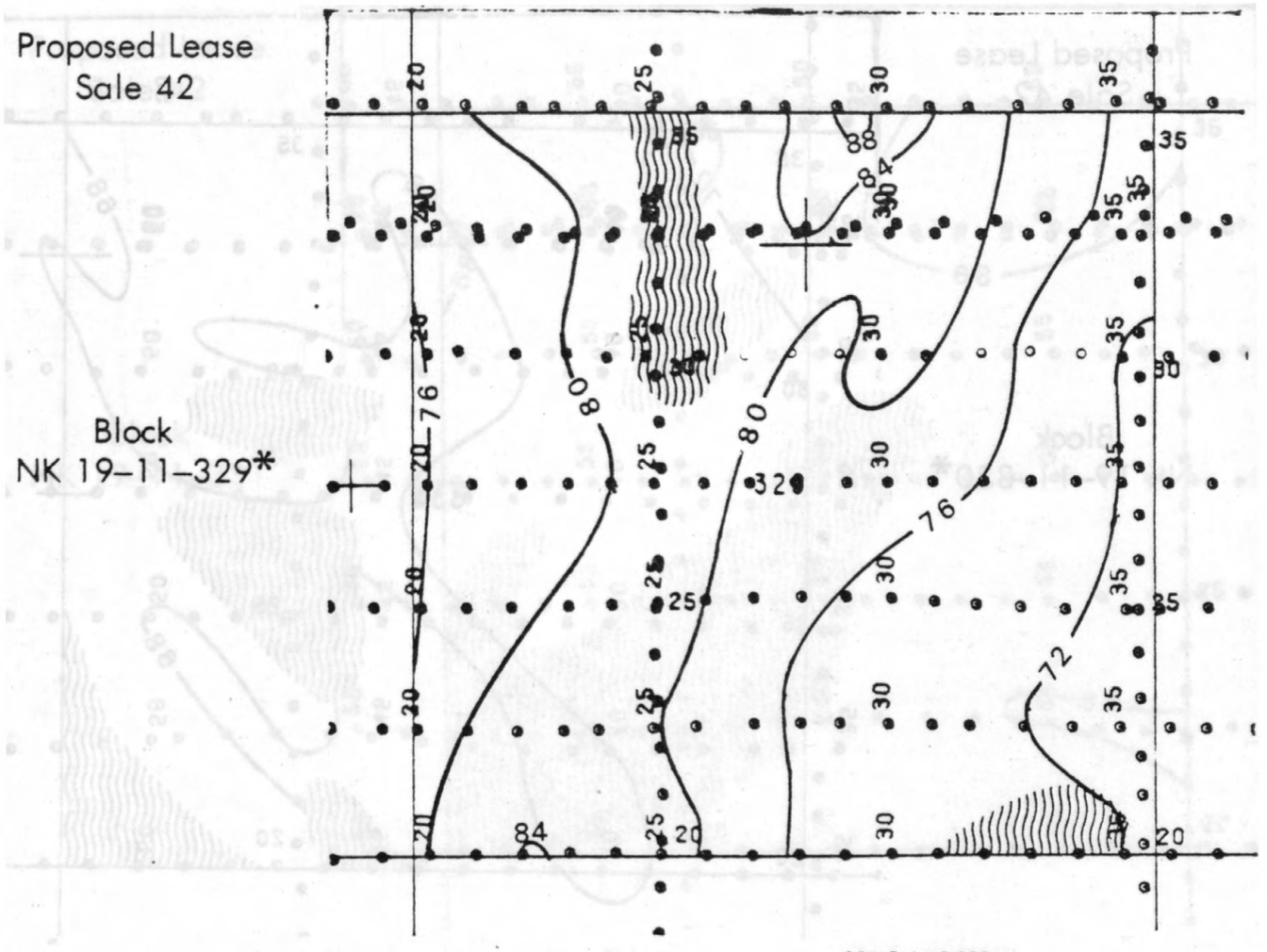


Water Depth: max. 77 m , min. 65 m
Slope Gradient: 7.0 m/km, Direction: E
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 88 m , min. 69 m
Slope Gradient: 3.5 m/km, Direction: E and W
Surface Sediment Type: Gravelly Sand

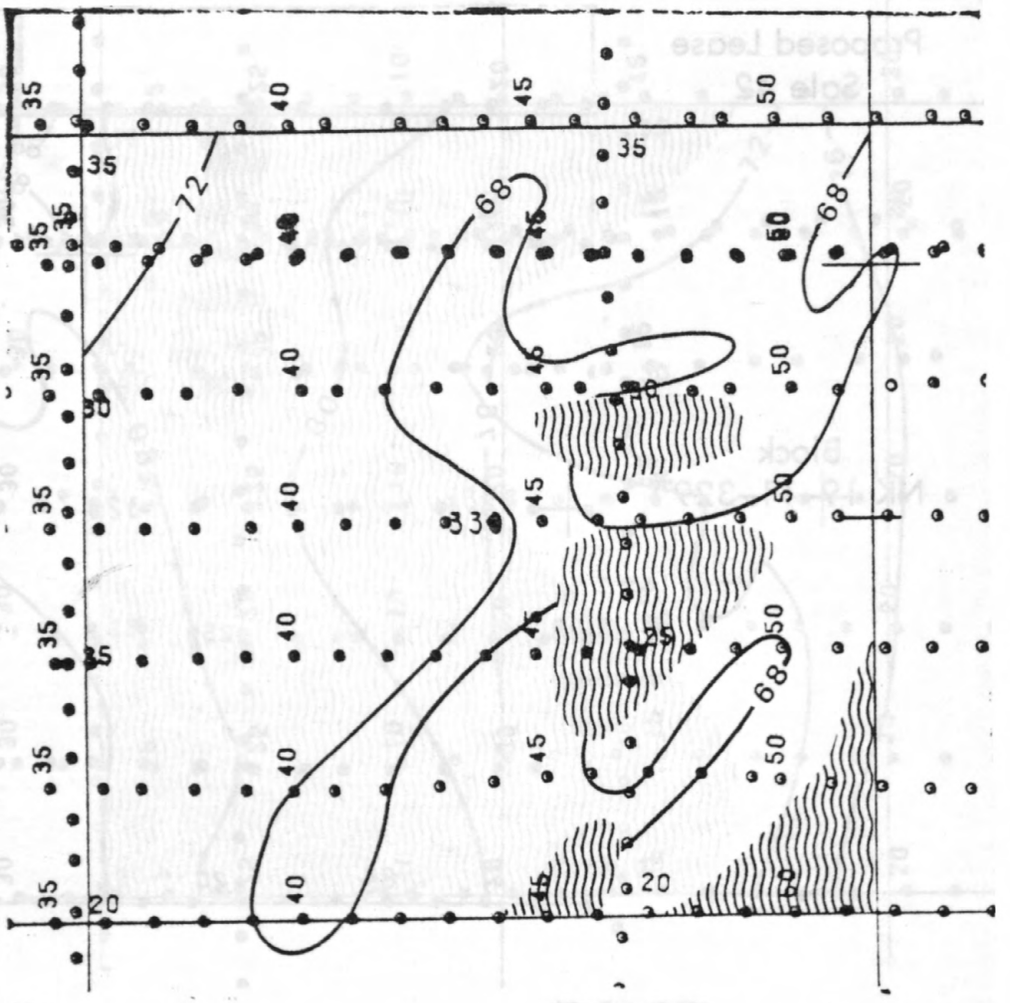
CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–11–330*

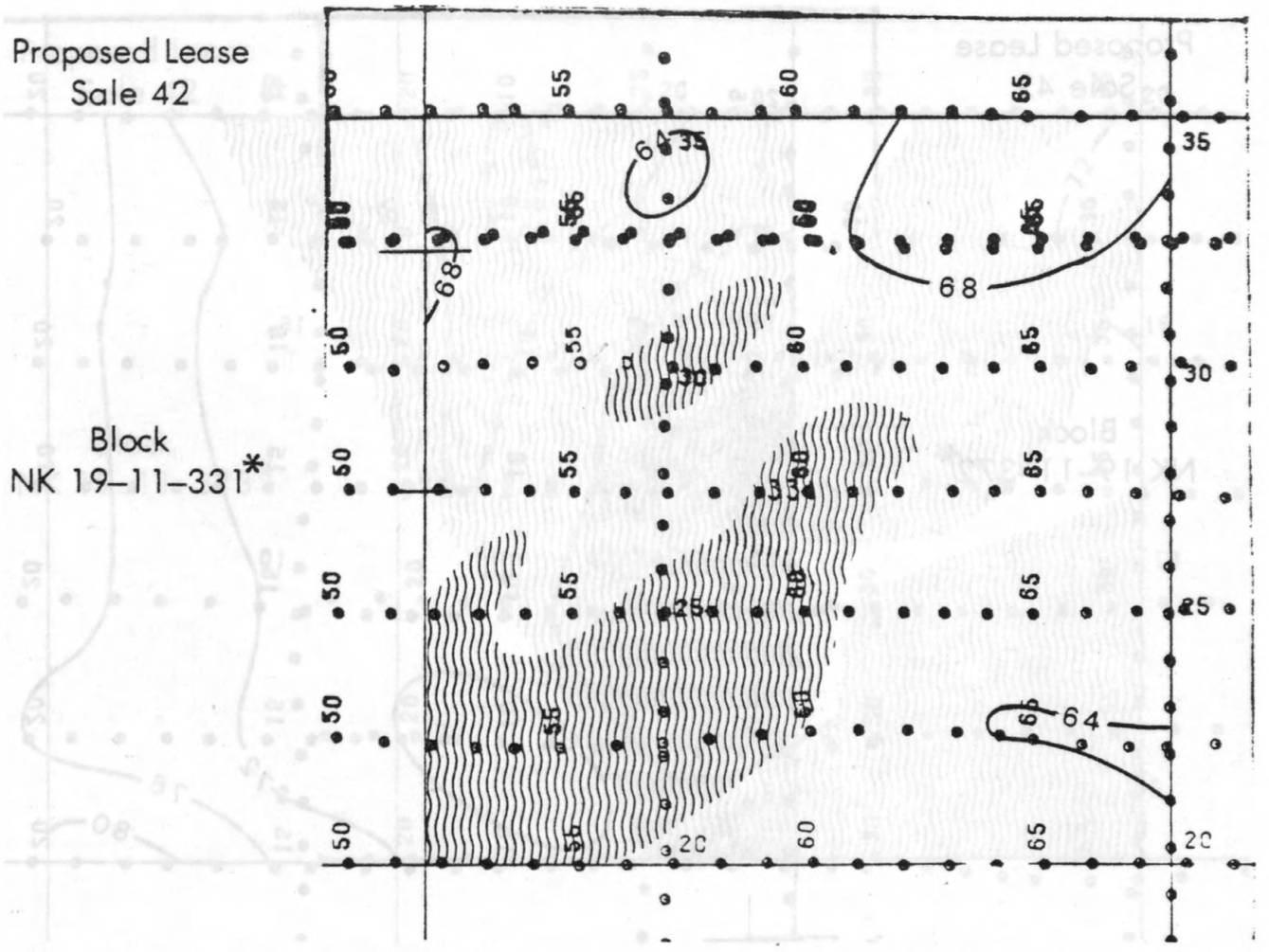


Water Depth: max. 74 m , min. 64 m
Slope Gradient: 2.0 m/km, Direction: NW
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 71 m , min. 63 m
Slope Gradient: 3.8 m/km, Direction: SW
Surface Sediment Type: Gravelly Sand

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

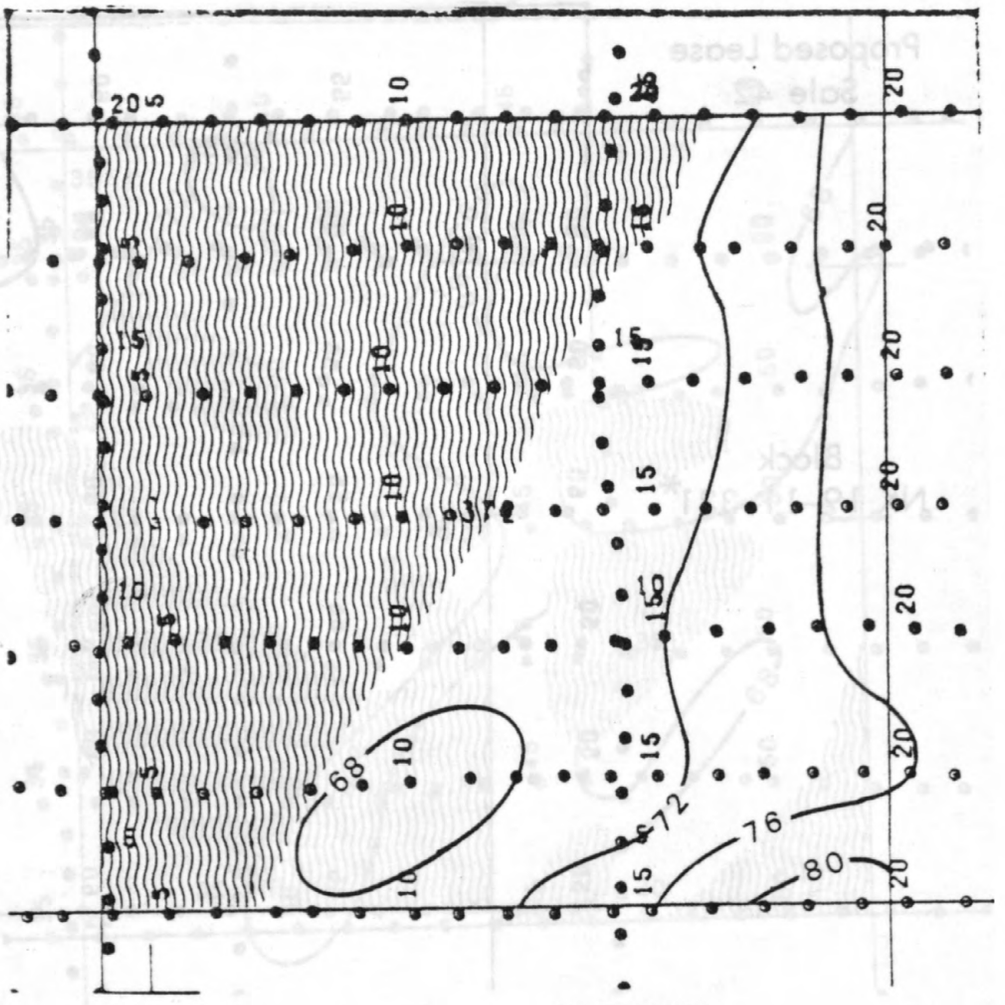
CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–11–372*



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

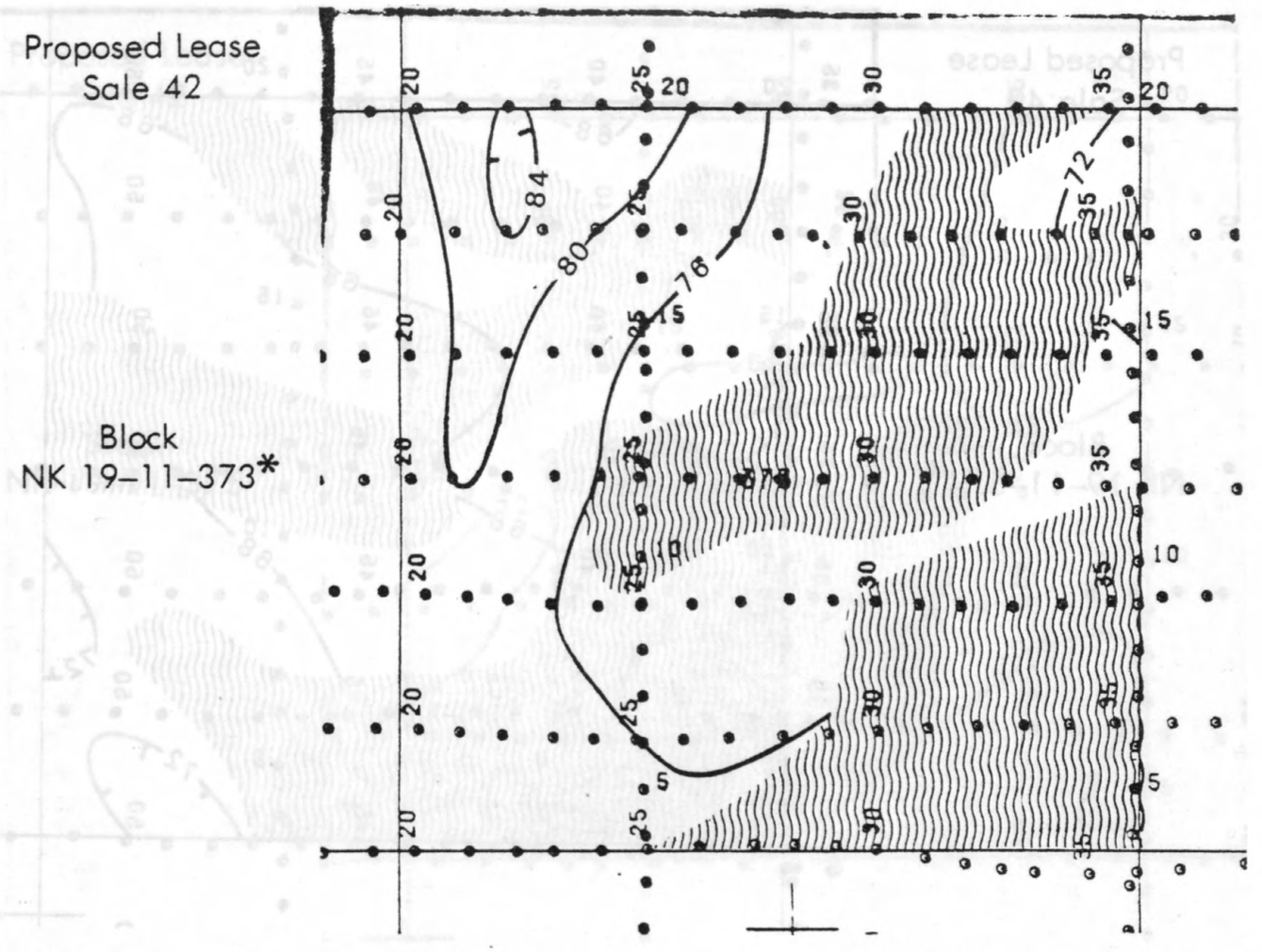
ISOBATHS IN METERS

Water Depth: max. 81 m , min. 67 m
Slope Gradient: 16.0 m/km, Direction: SE
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

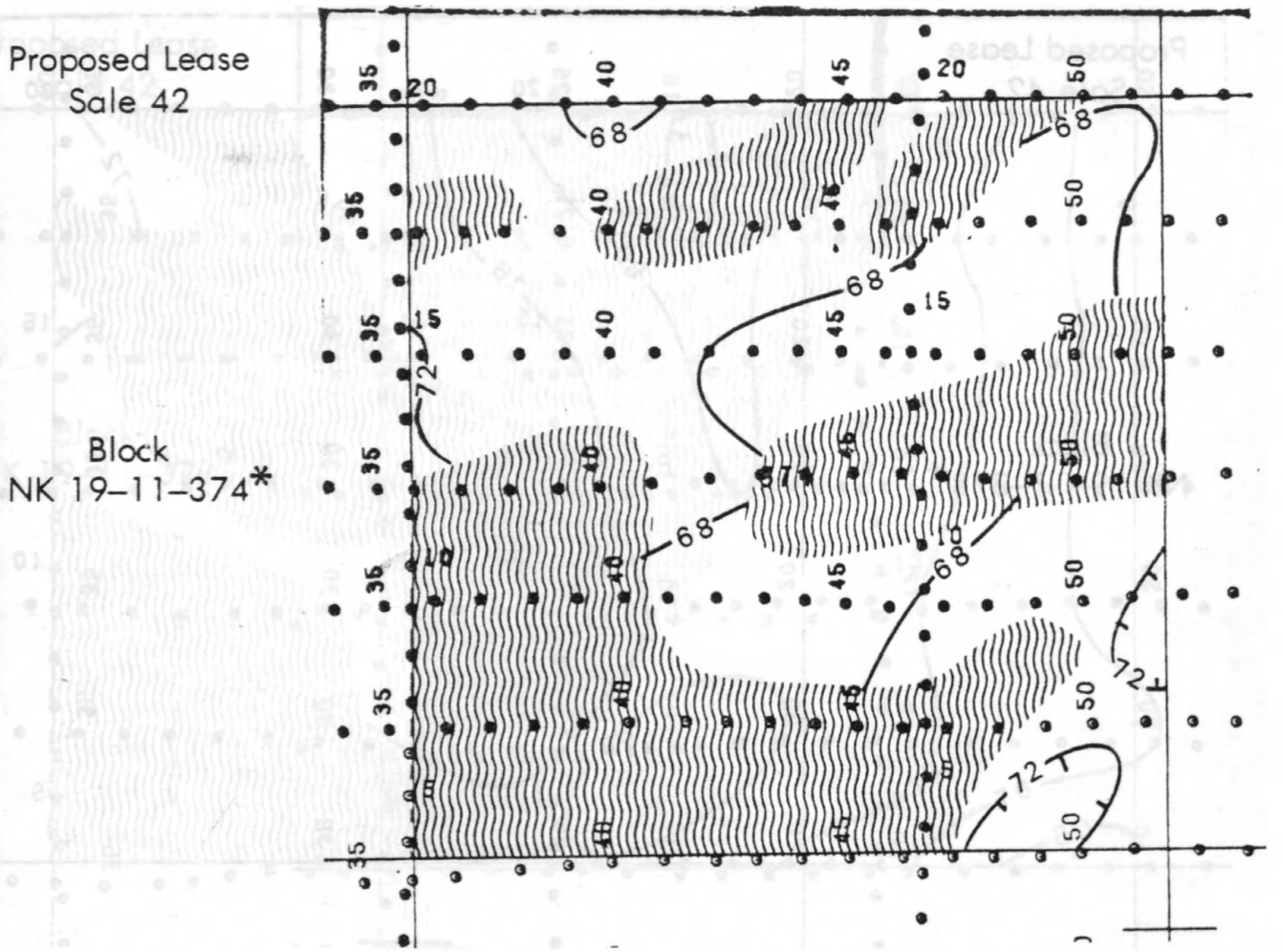


Water Depth: max. 84 m , min. 69 m
Slope Gradient: 2.0 m/km, Direction: NW
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 74 m , min. 64 m
Slope Gradient: 3.3 m/km, Direction: SE
Surface Sediment Type: Gravelly Sand

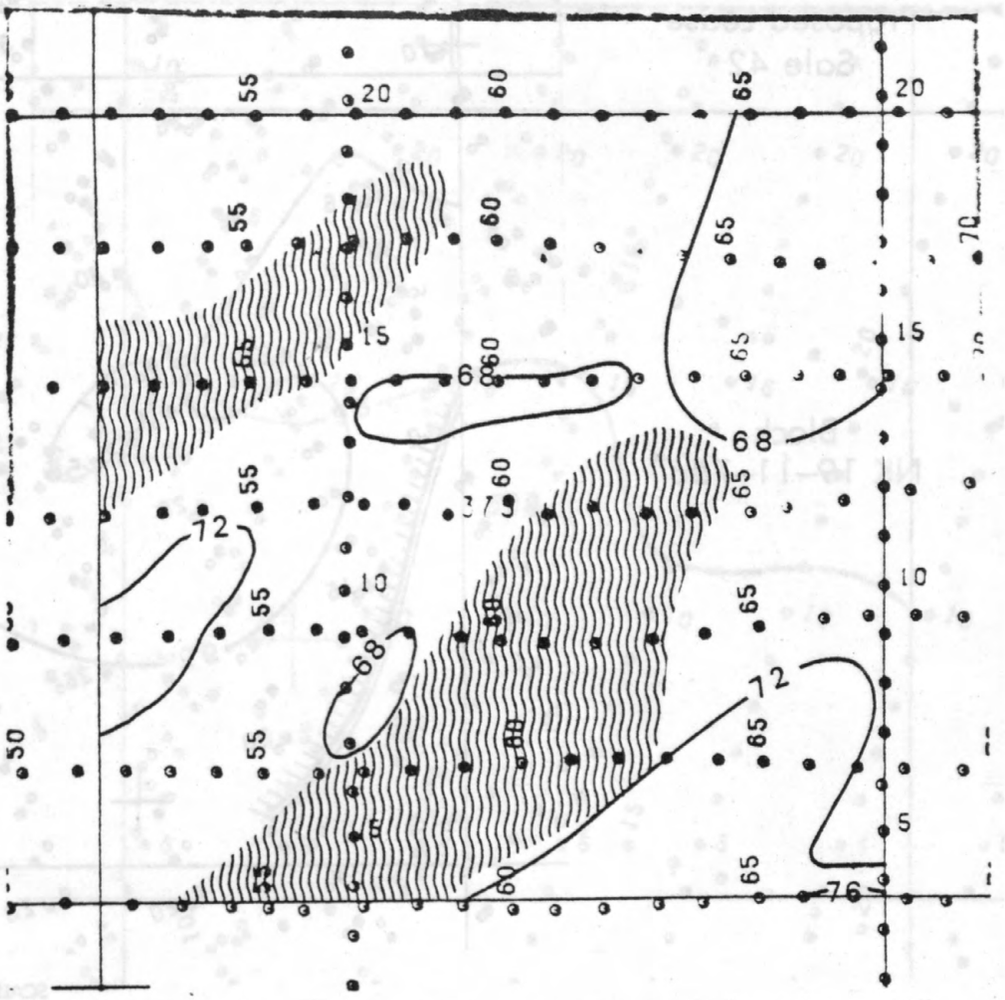
CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–11–375*



Water Depth: max. 76 m , min. 65 m
Slope Gradient: 1.0 m/km, Direction: SE
Surface Sediment Type: Gravelly Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

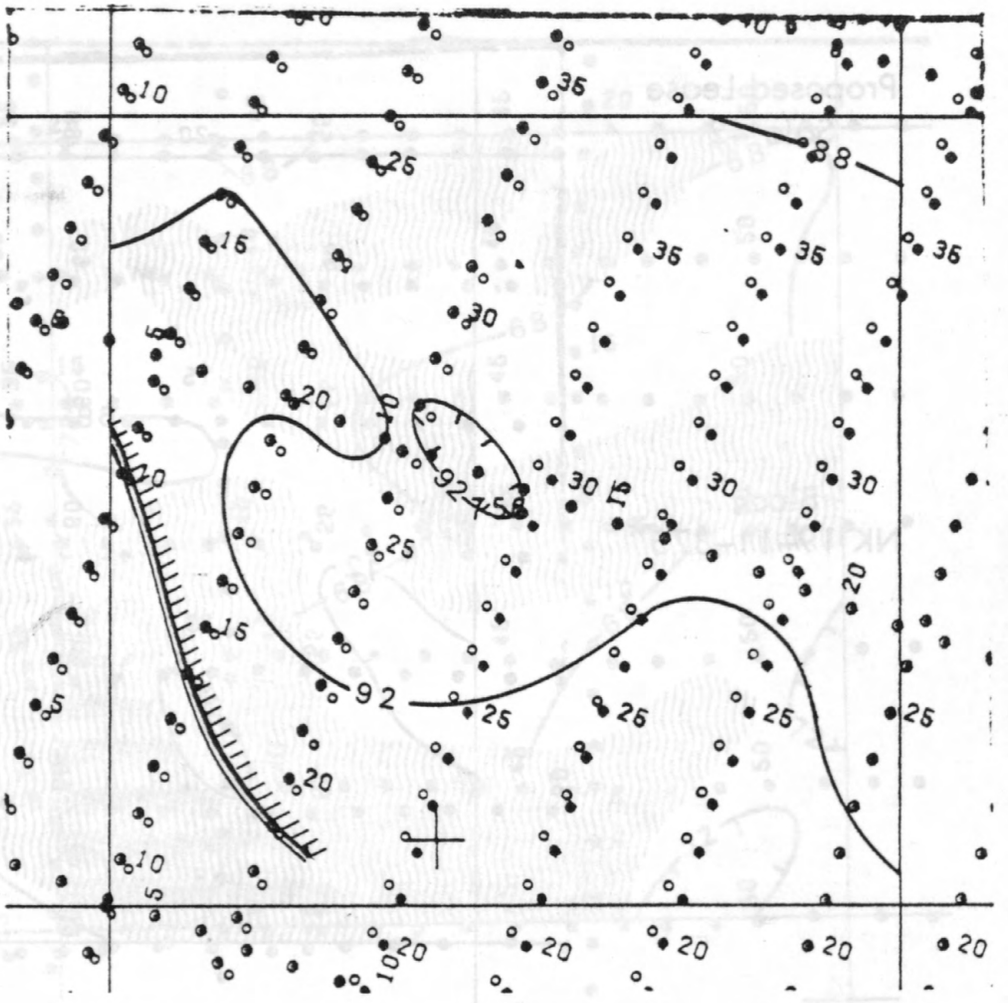
CONSTRAINT

Sand Wave Field

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–11–756*



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 94 m , min. 88 m
Slope Gradient: 0.8 m/km, Direction: SW
Surface Sediment Type: Silty Sand

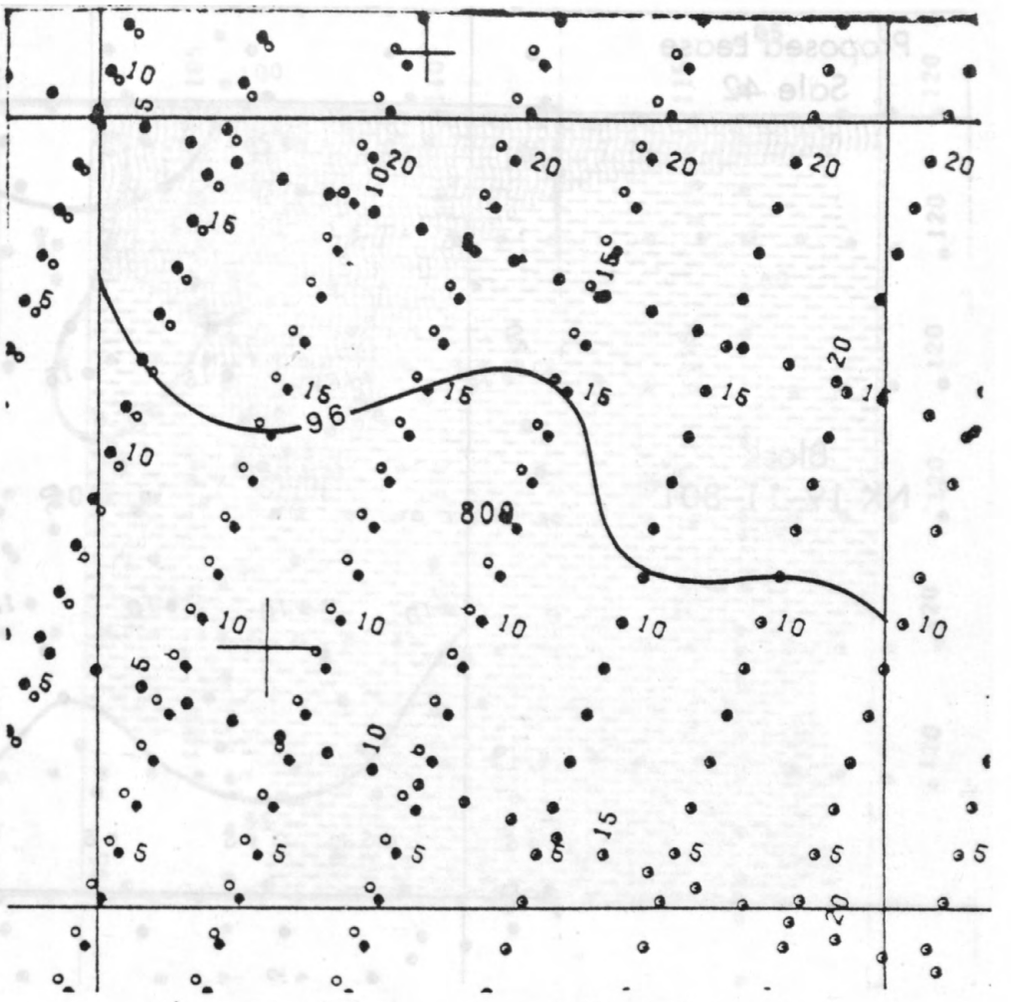
POTENTIAL HAZARD

Fault at "I" Reflector

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–11–800*



Water Depth: max. 99 m, min. 93 m
Slope Gradient: 1.0 m/km, Direction: SW
Surface Sediment Type: Silty Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

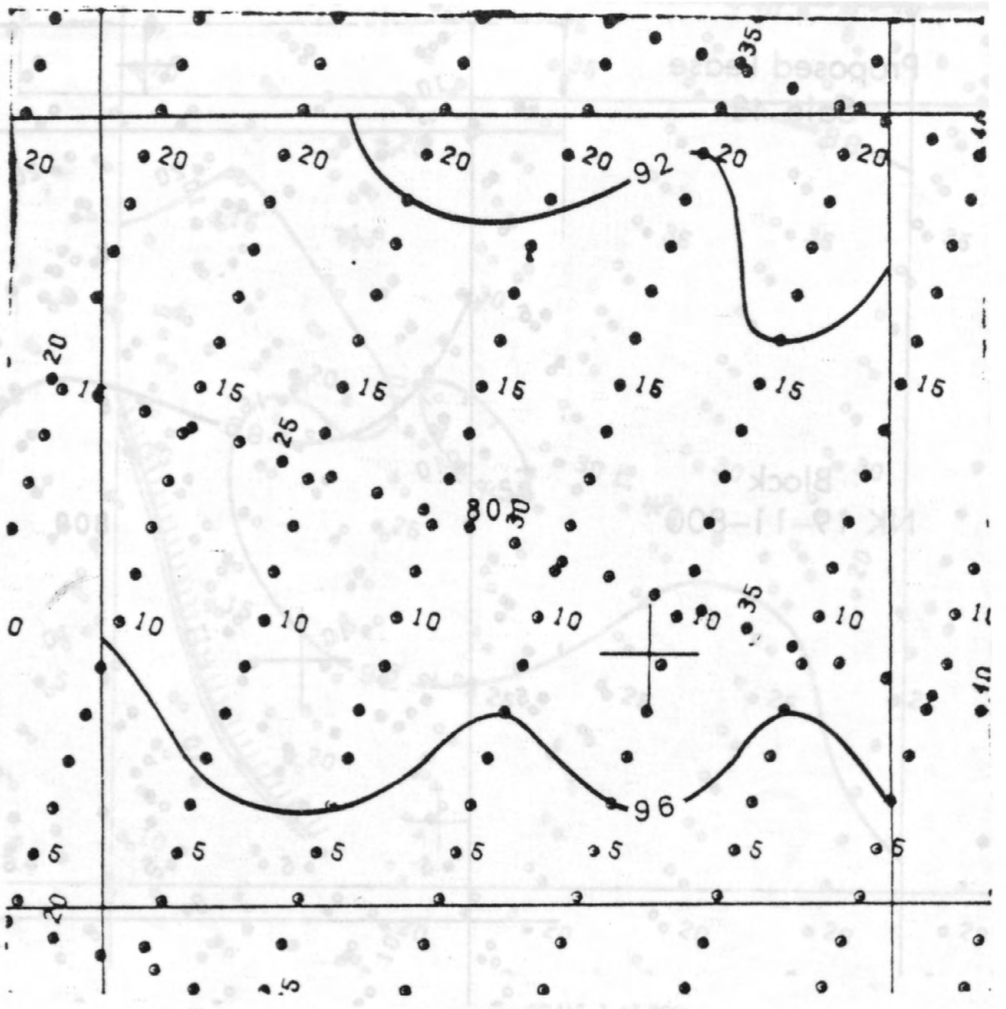
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

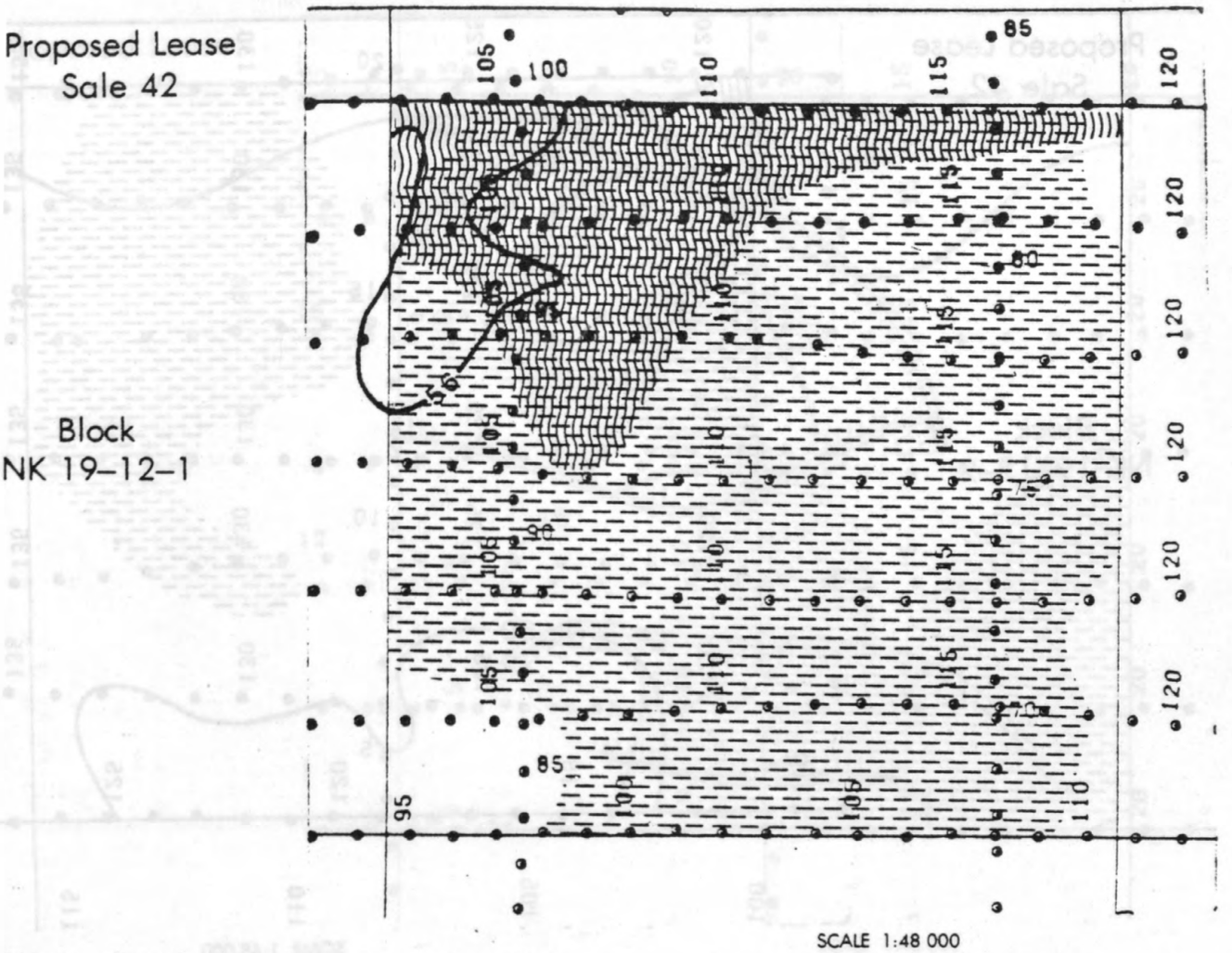
Proposed Lease
Sale 42

Block
NK 19–11–801*



Water Depth: max. 98 m, min. 90 m
Slope Gradient: 1.4 m/km, Direction: SW
Surface Sediment Type: Silty Sand

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

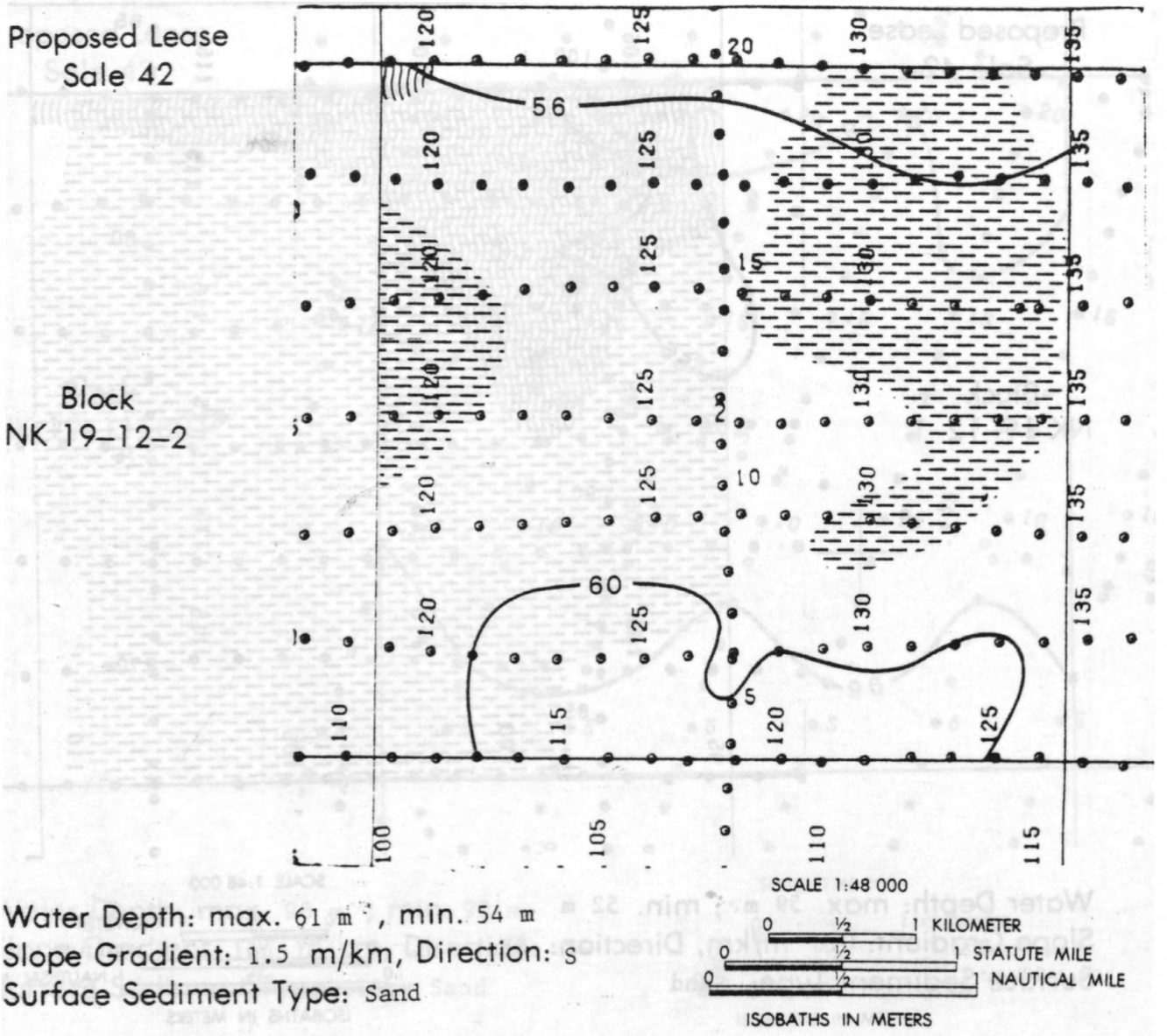


Water Depth: max. 59 m, min. 52 m
Slope Gradient: 0.6 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINTS

Sand Wave Field

Filled Channel



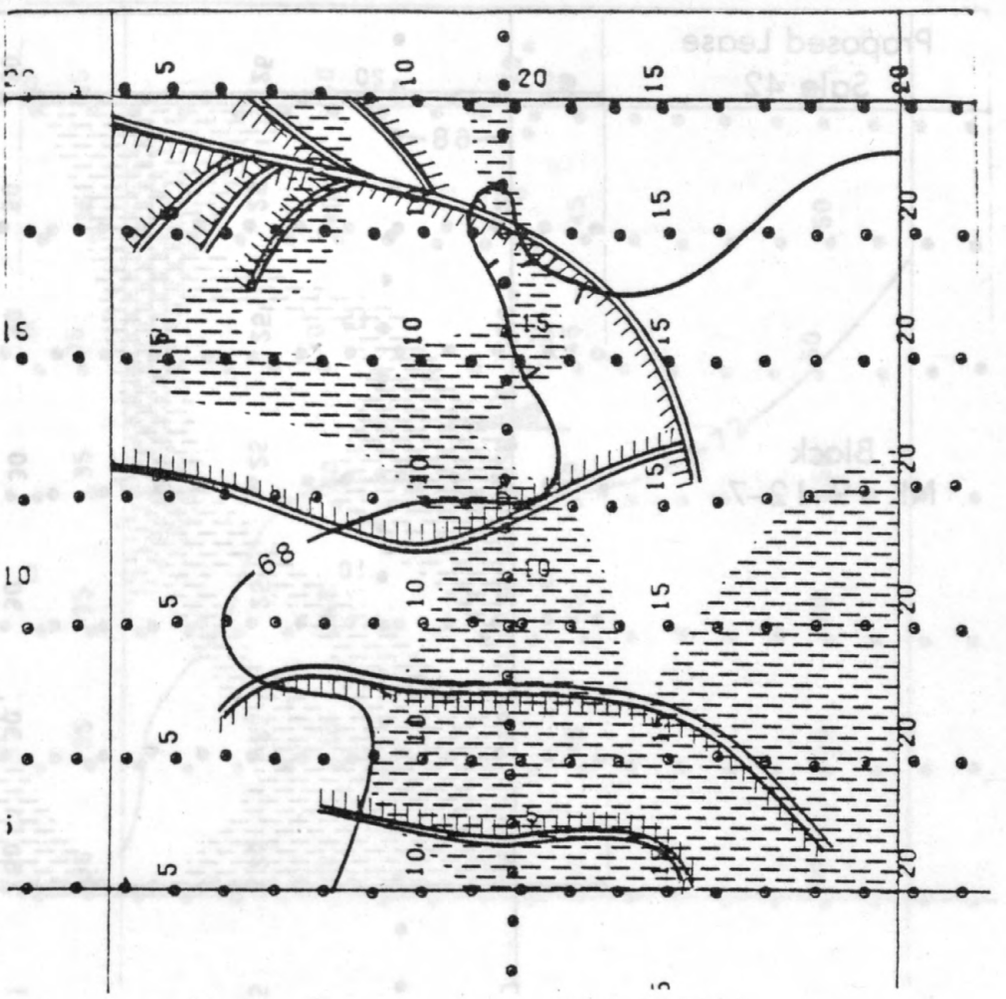
Water Depth: max. 61 m, min. 54 m
Slope Gradient: 1.5 m/km, Direction: S
Surface Sediment Type: Sand

CONSTRAINTS

Sand Wave Field

Filled Channel

Proposed Lease
Sale 42



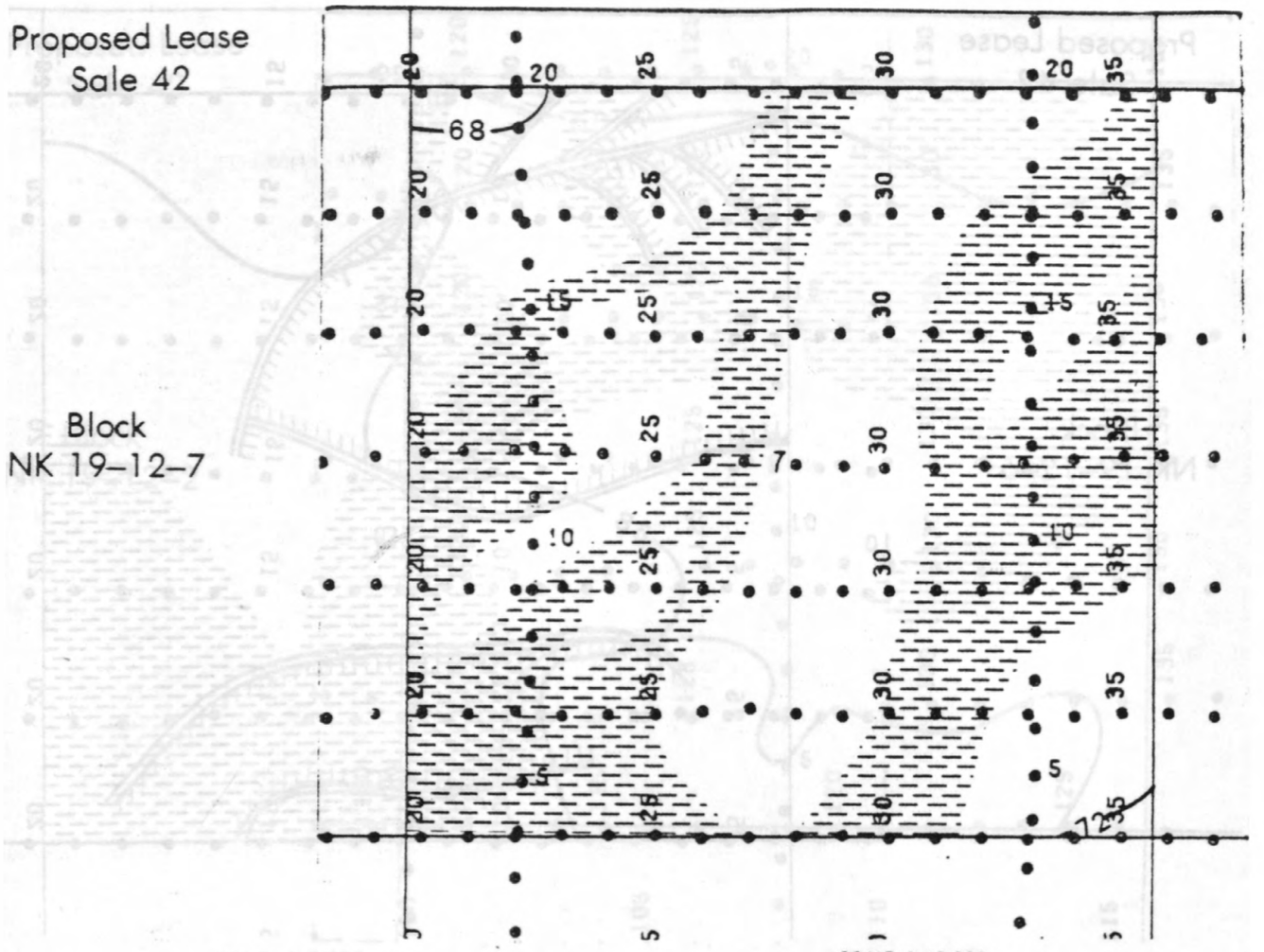
Water Depth: max. 70 m, min. 65 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand

POTENTIAL HAZARDS

Fault at "I" Reflector

CONSTRAINT

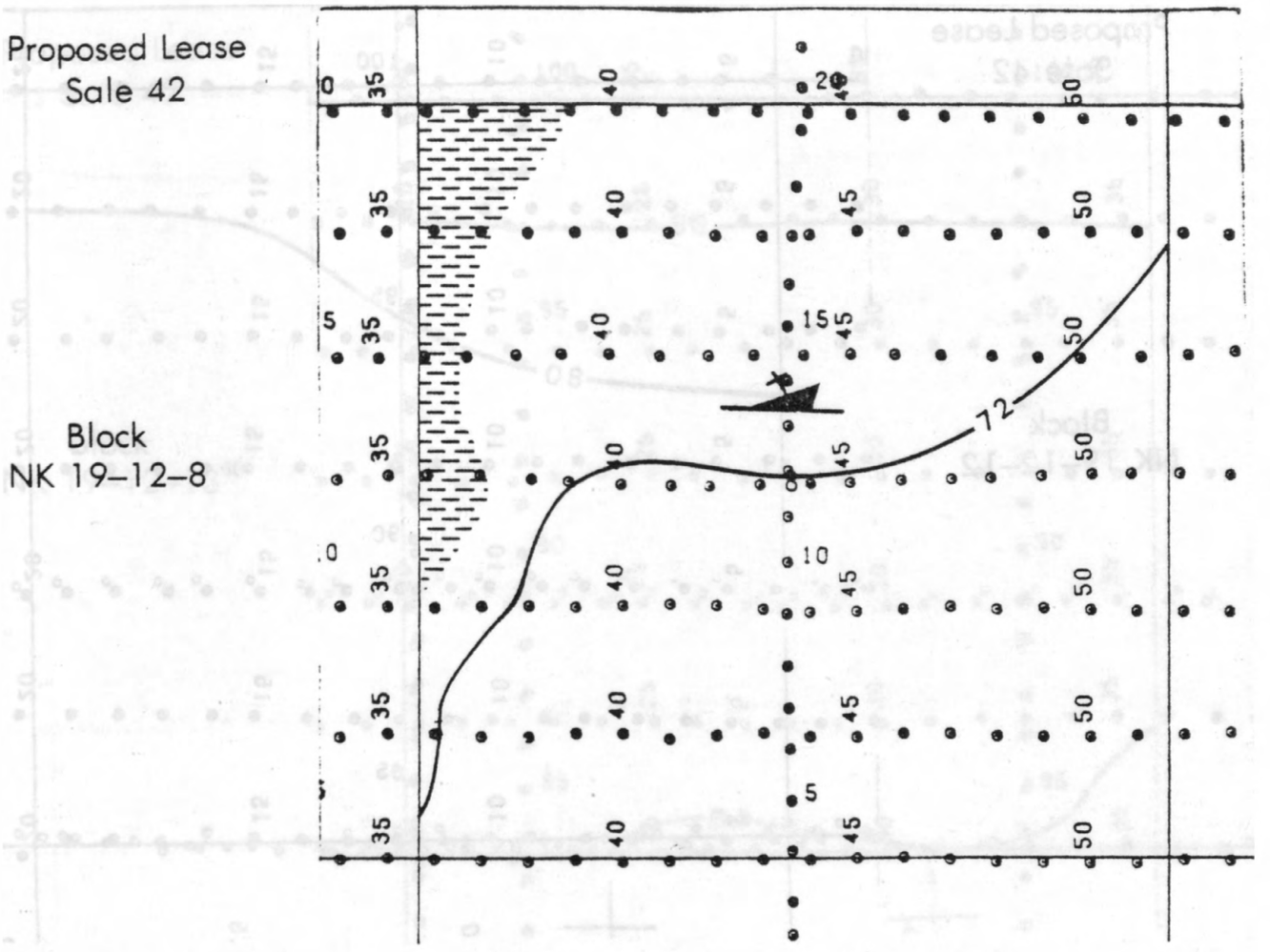
Filled Channel



Water Depth: max. 72 m, min. 67 m
Slope Gradient: 0.8 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel



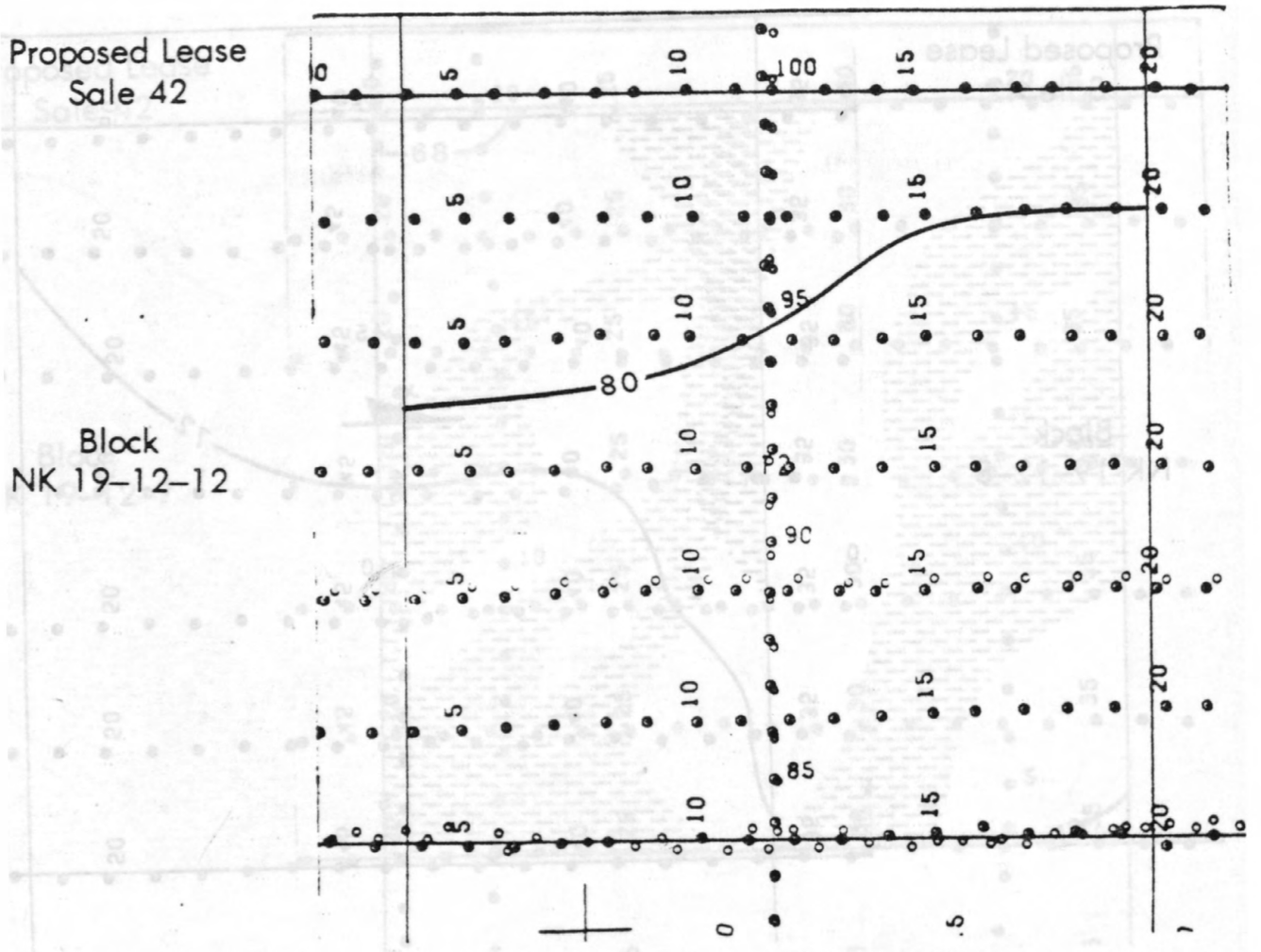
Water Depth: max. 74 m, min. 69 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINTS

Filled Channel

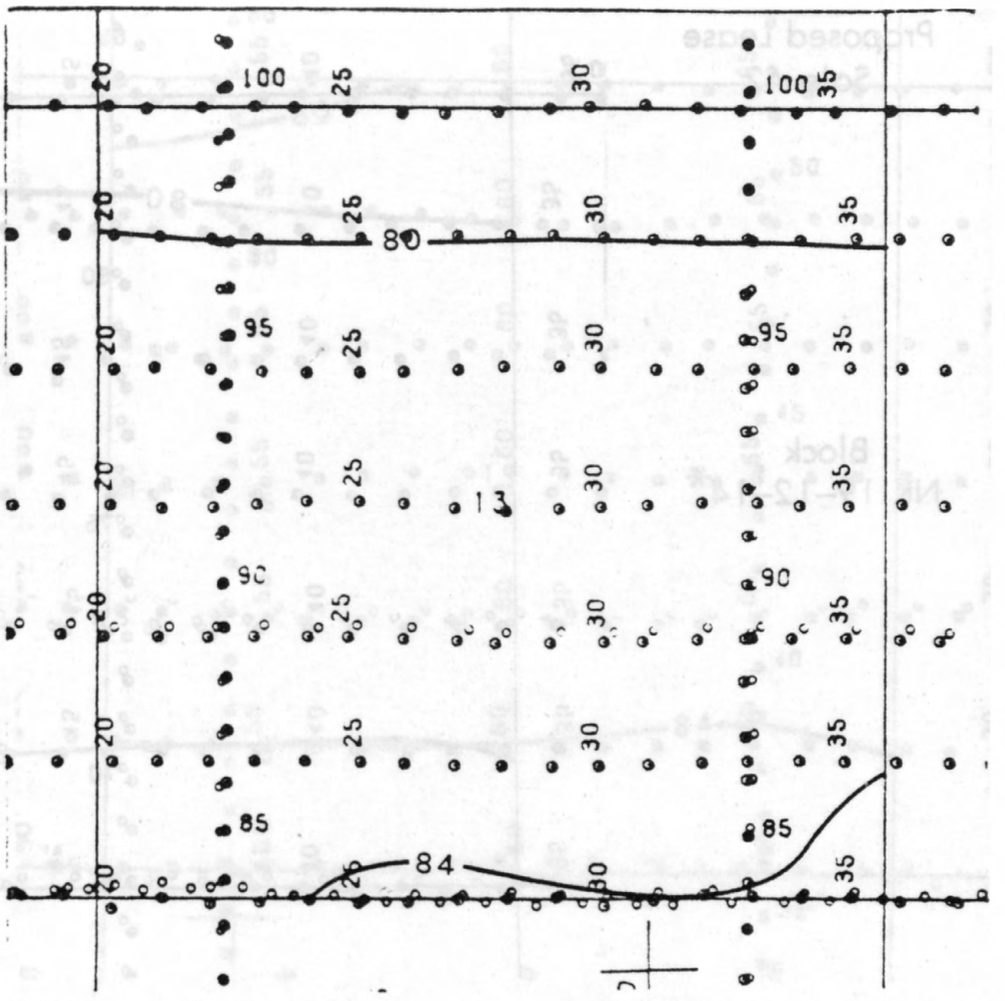
Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)



Water Depth: max. 83 m, min. 77 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–13*



SCALE 1:48 000

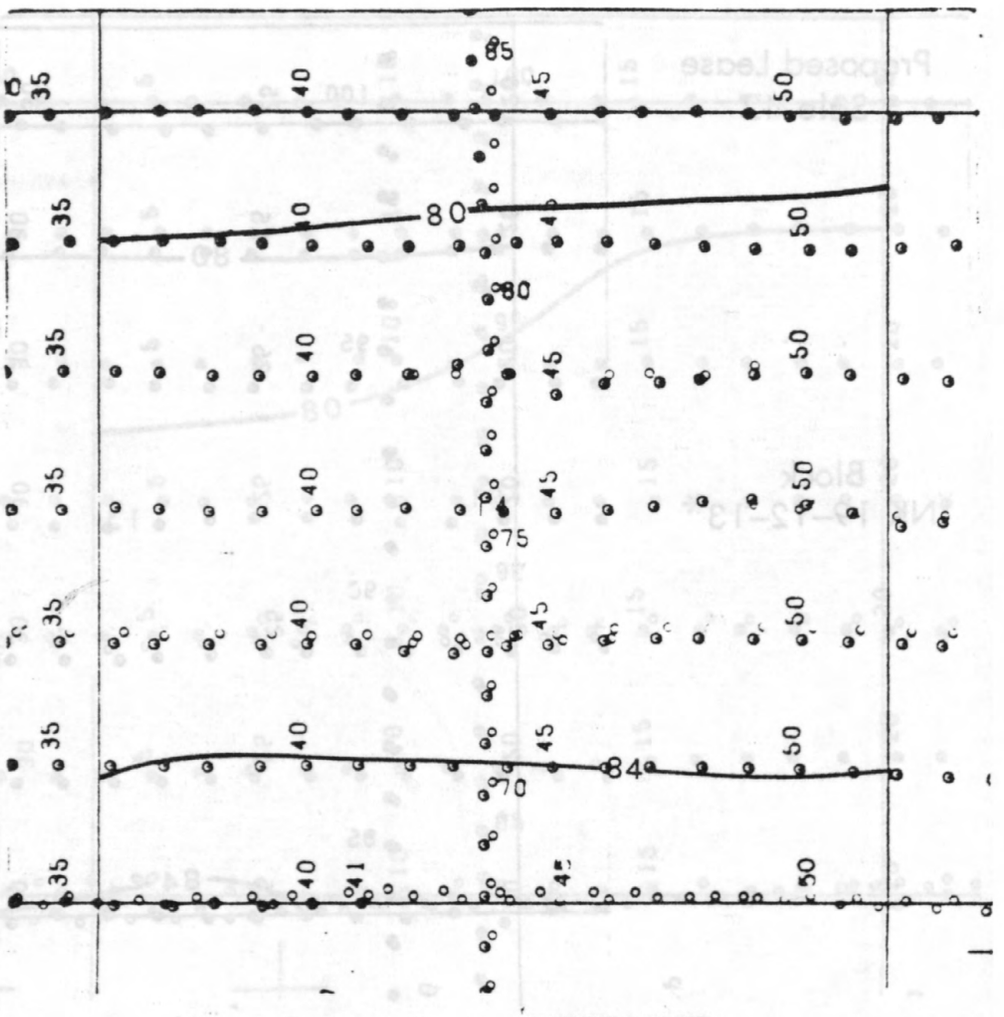
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 84 m, min. 78 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–12–14*

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

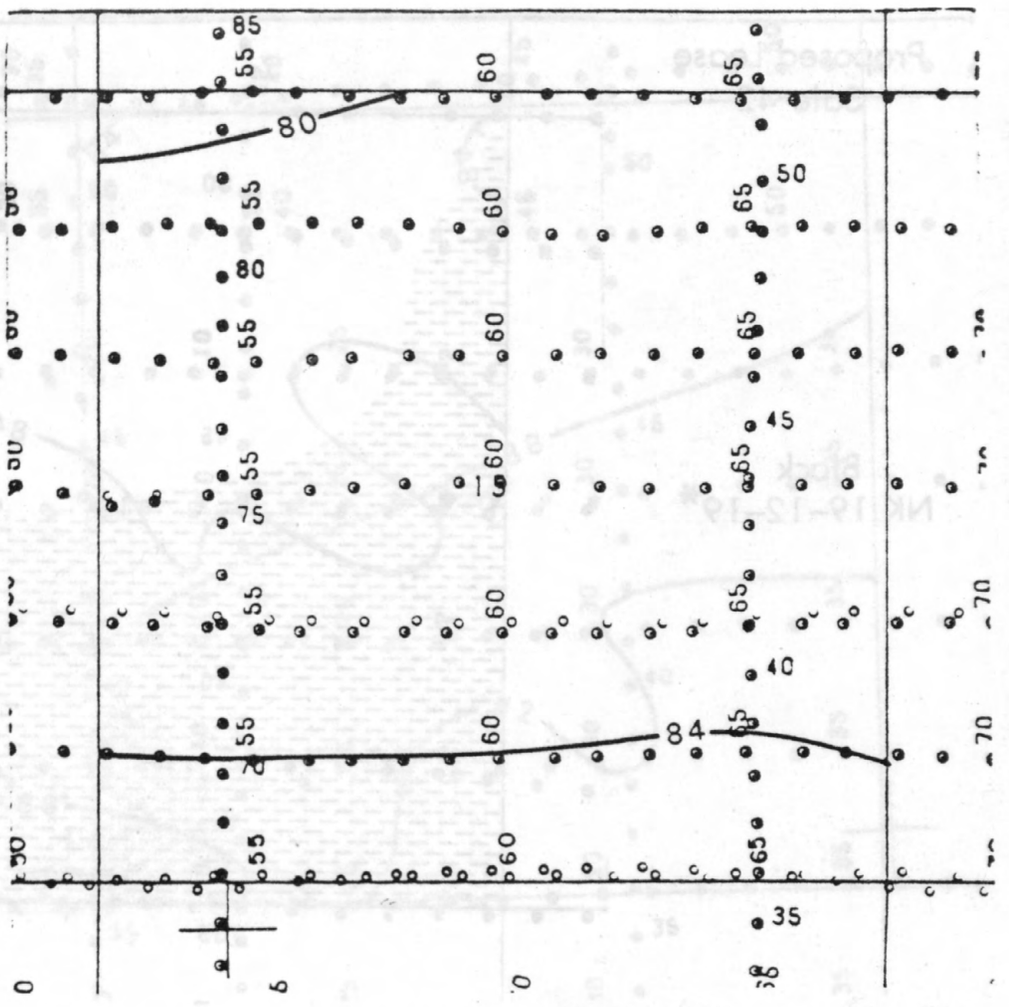
ISOBATHS IN METERS

Water Depth: max. 85 m, min. 79 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–12–15*



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

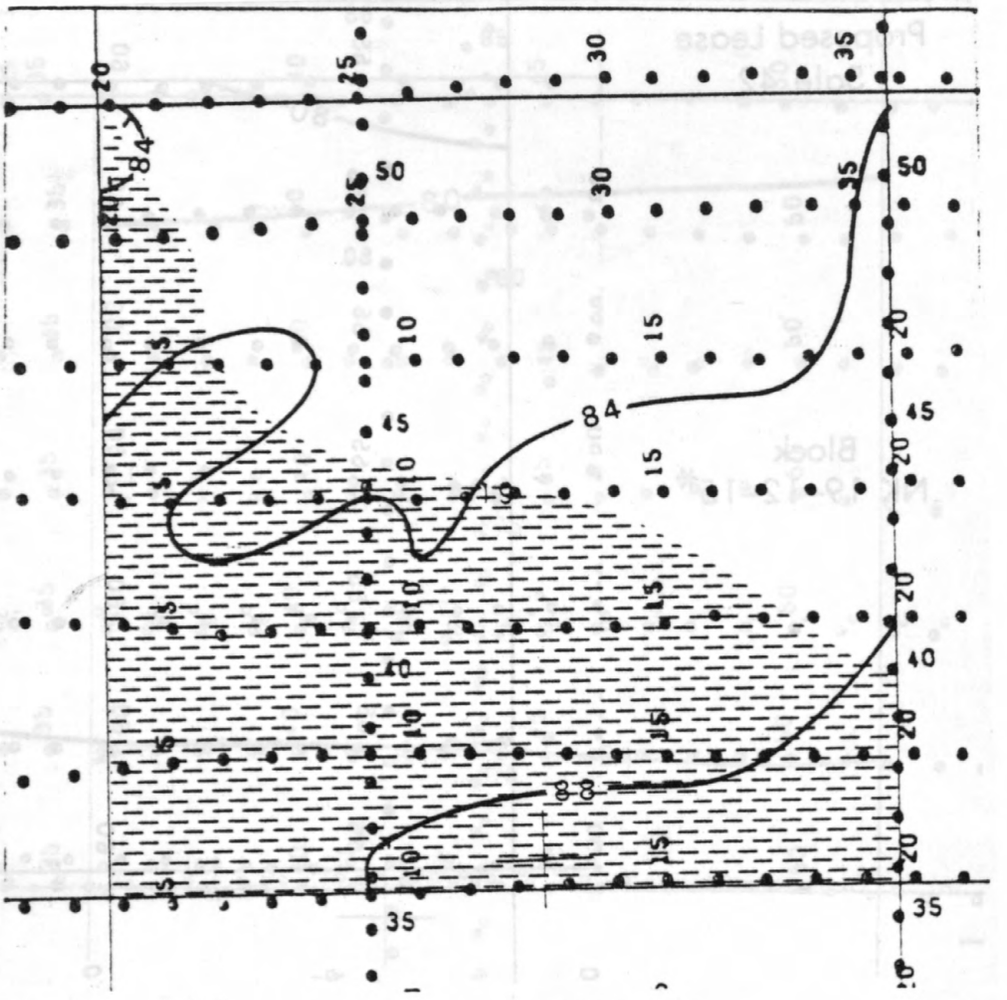
ISOBATHS IN METERS

Water Depth: max. 85 m, min. 79 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–12–19*



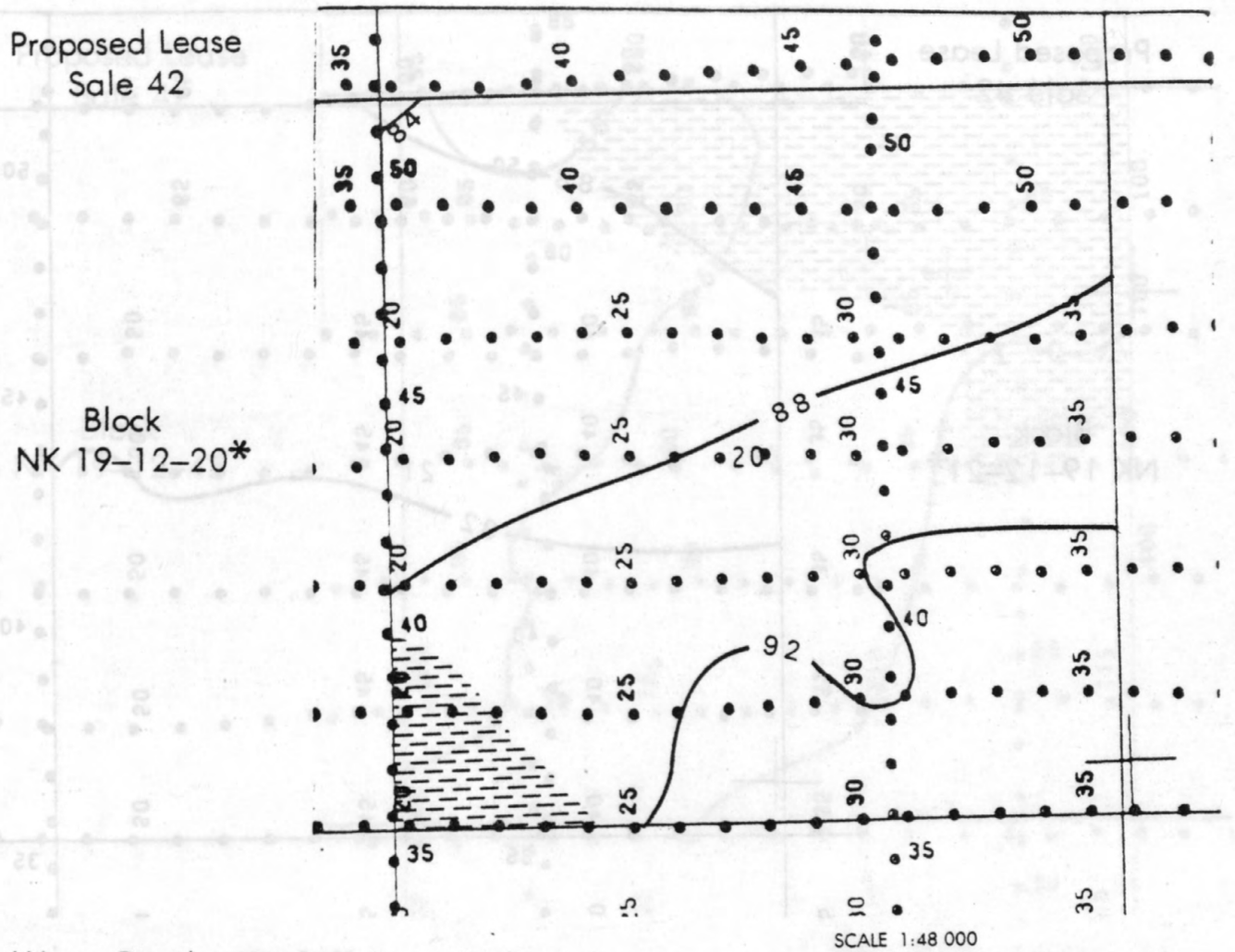
Water Depth: max. 91 m, min. 82 m
Slope Gradient: 1.9 m/km, Direction: SSE
Surface Sediment Type: Gravelly Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

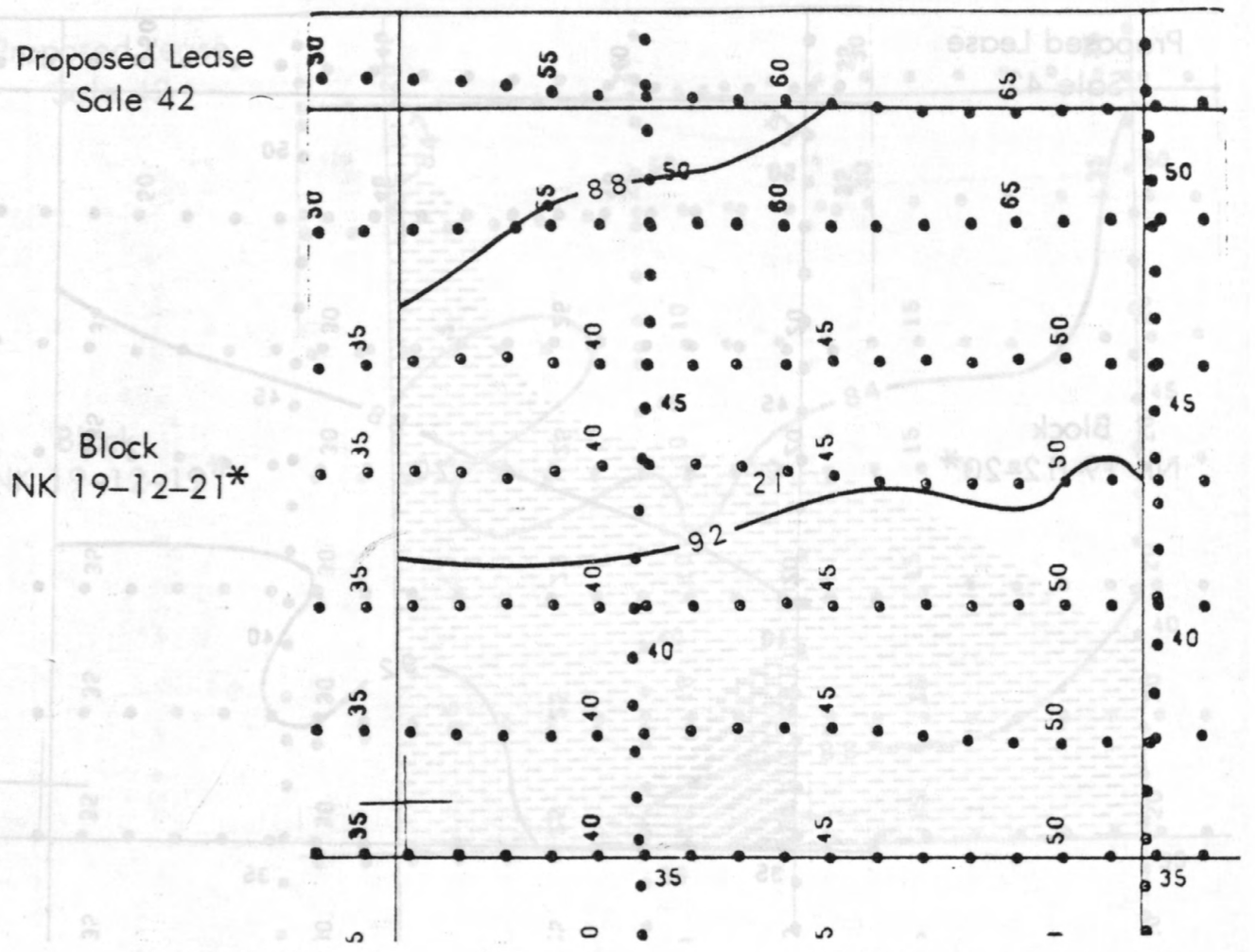


Water Depth: max. 92 m, min. 84 m
Slope Gradient: 1.7 m/km, Direction: SSE
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

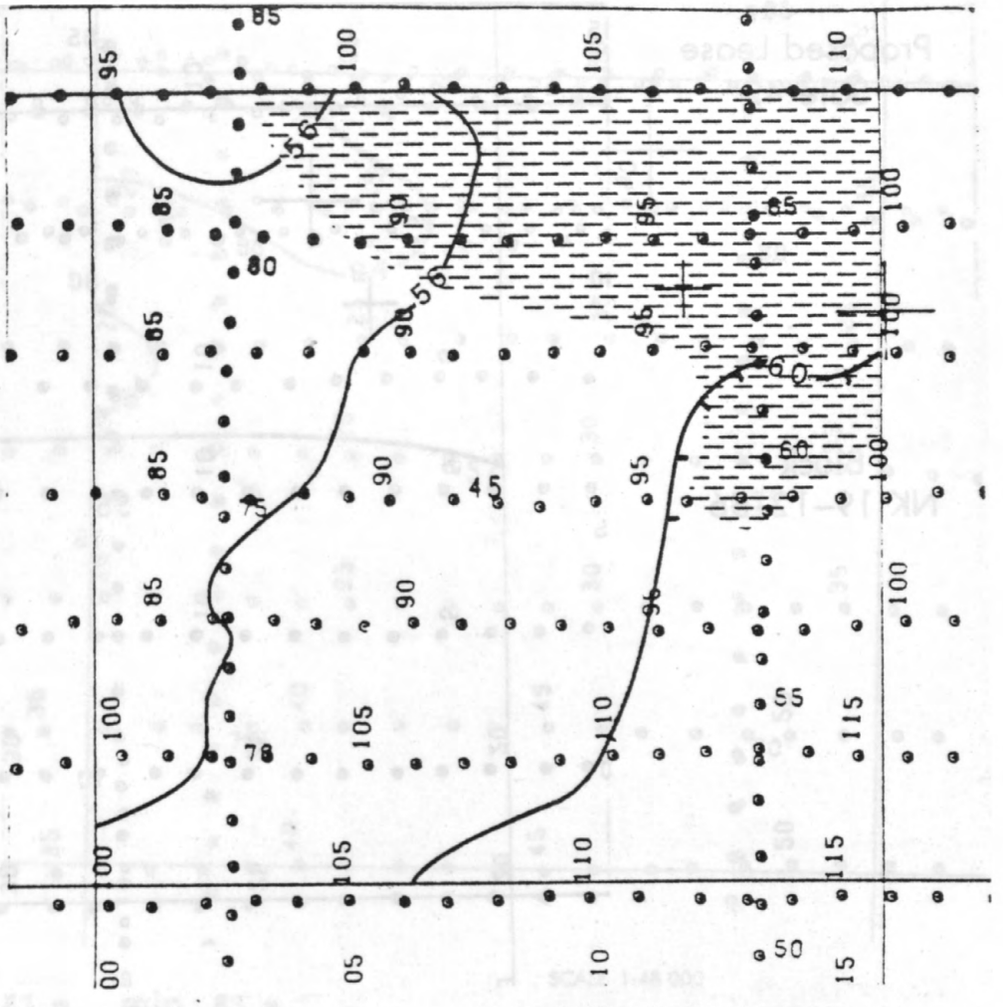


Water Depth: max. 94 m , min. 86 m
Slope Gradient: 2.1 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–12–45



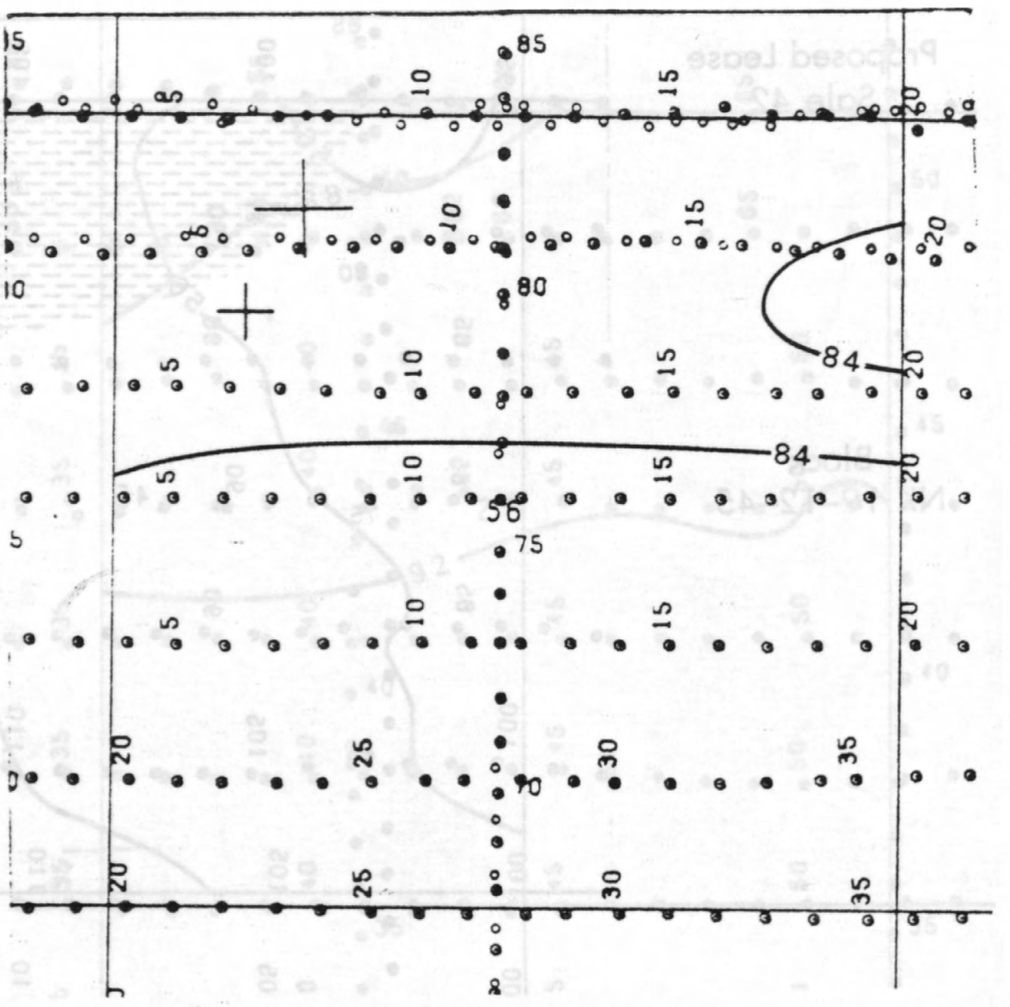
Water Depth: max. 63 m, min. 53 m
Slope Gradient: 1.6 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–12–56

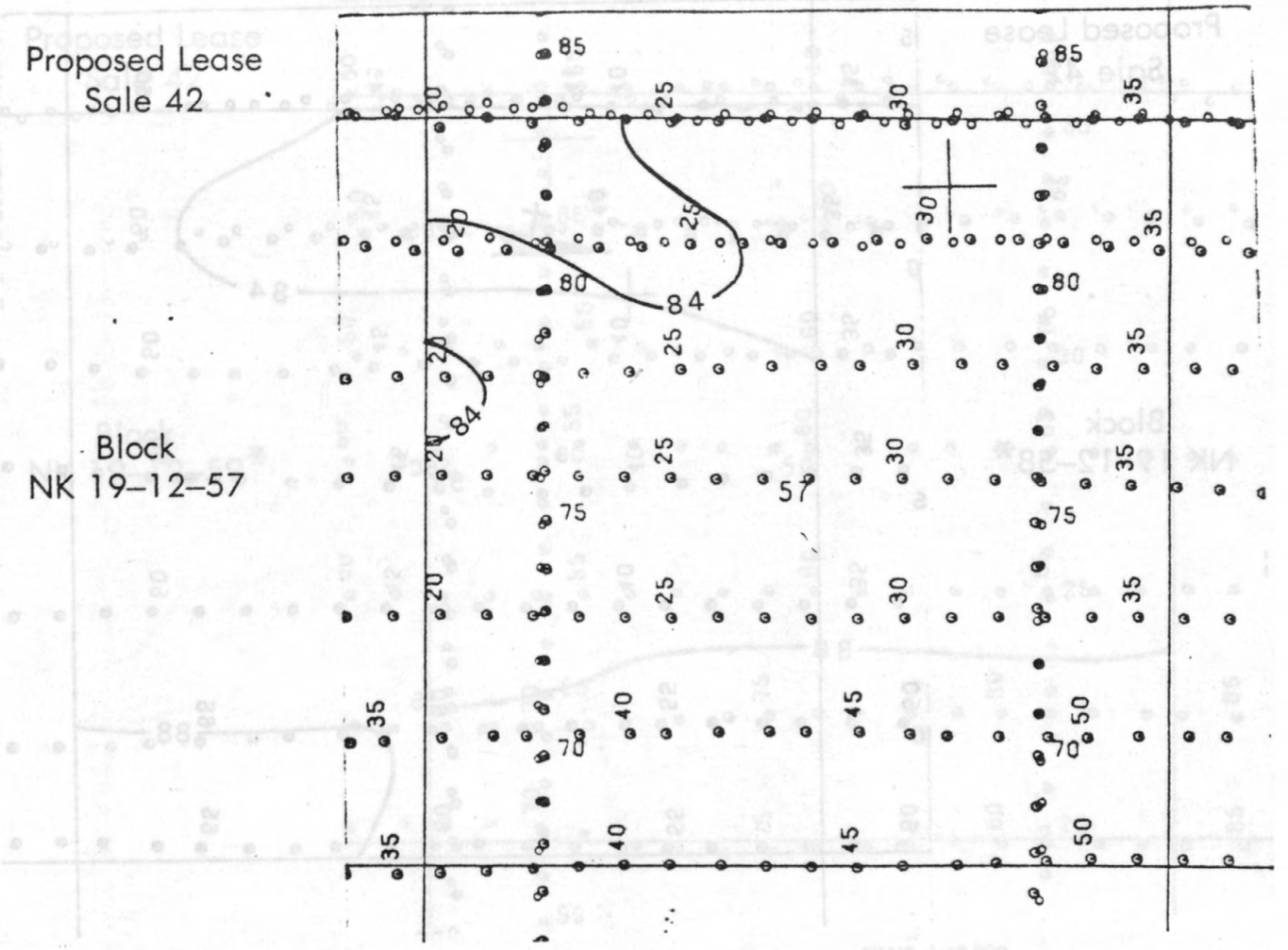


Water Depth: max. 87 m, min. 81 m
Slope Gradient: 1.3 m/km, Direction: S
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

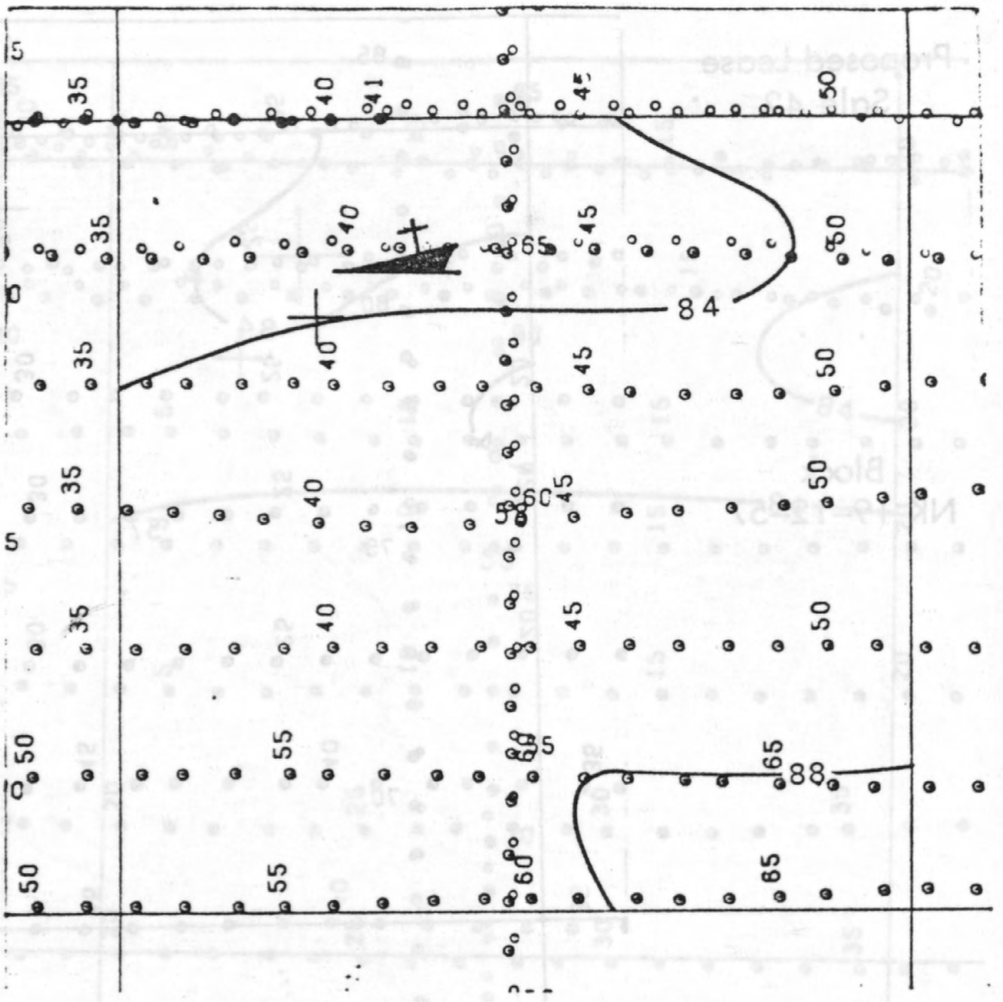
ISOBATHS IN METERS



Water Depth: max. 87 m , min. 83 m
Slope Gradient: 0.8 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–58*



Water Depth: max. 89 m , min. 84 m
Slope Gradient: 1 m/km, Direction: S
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

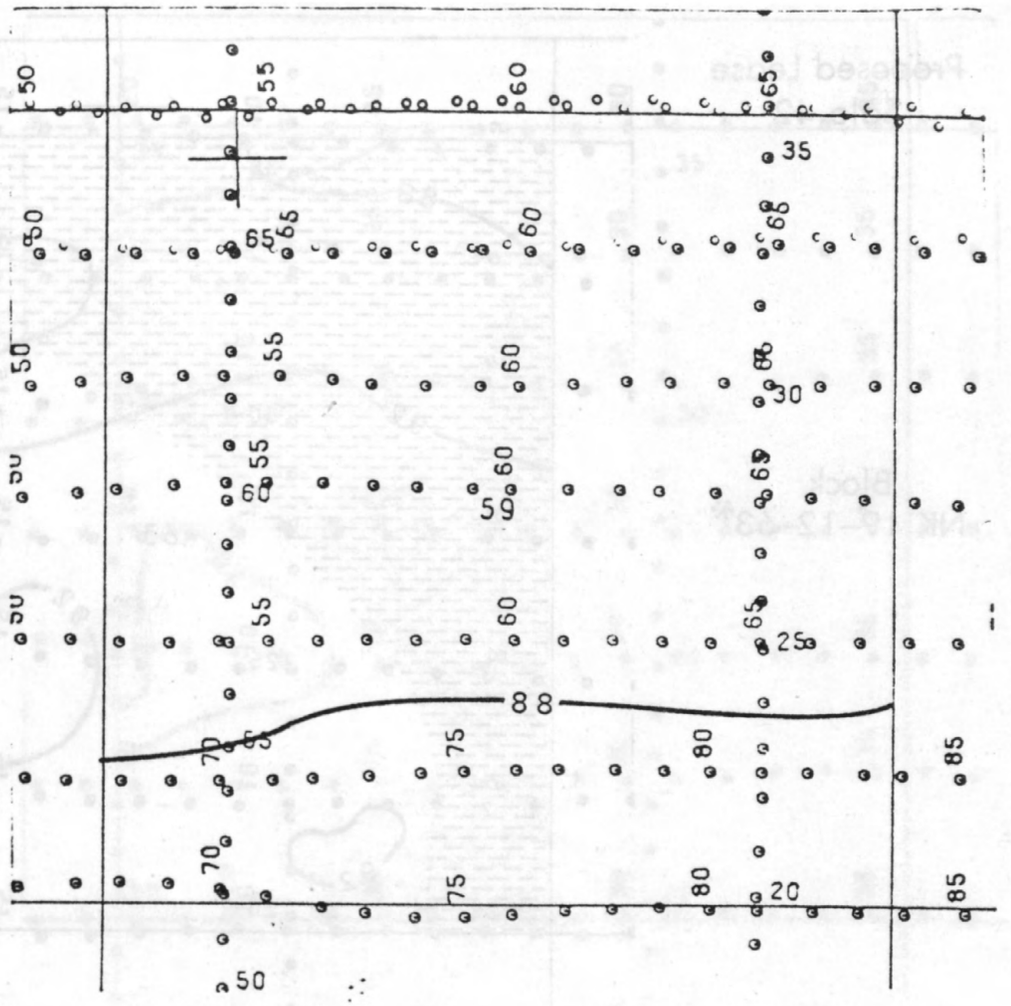
CONSTRAINT

Shipwreck

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–12–59*



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

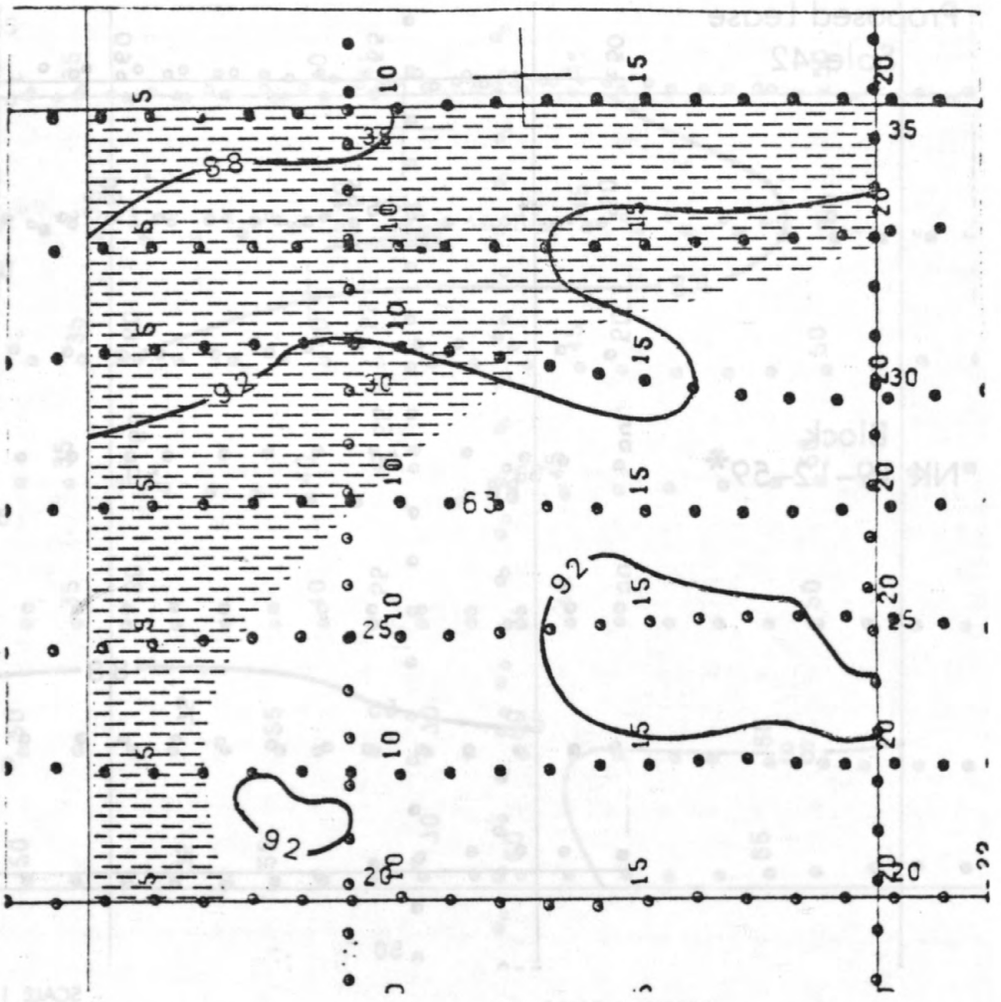
ISOBATHS IN METERS

Water Depth: max. 90 m , min. 85 m
Slope Gradient: 1 m/km, Direction: S
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–12–63*

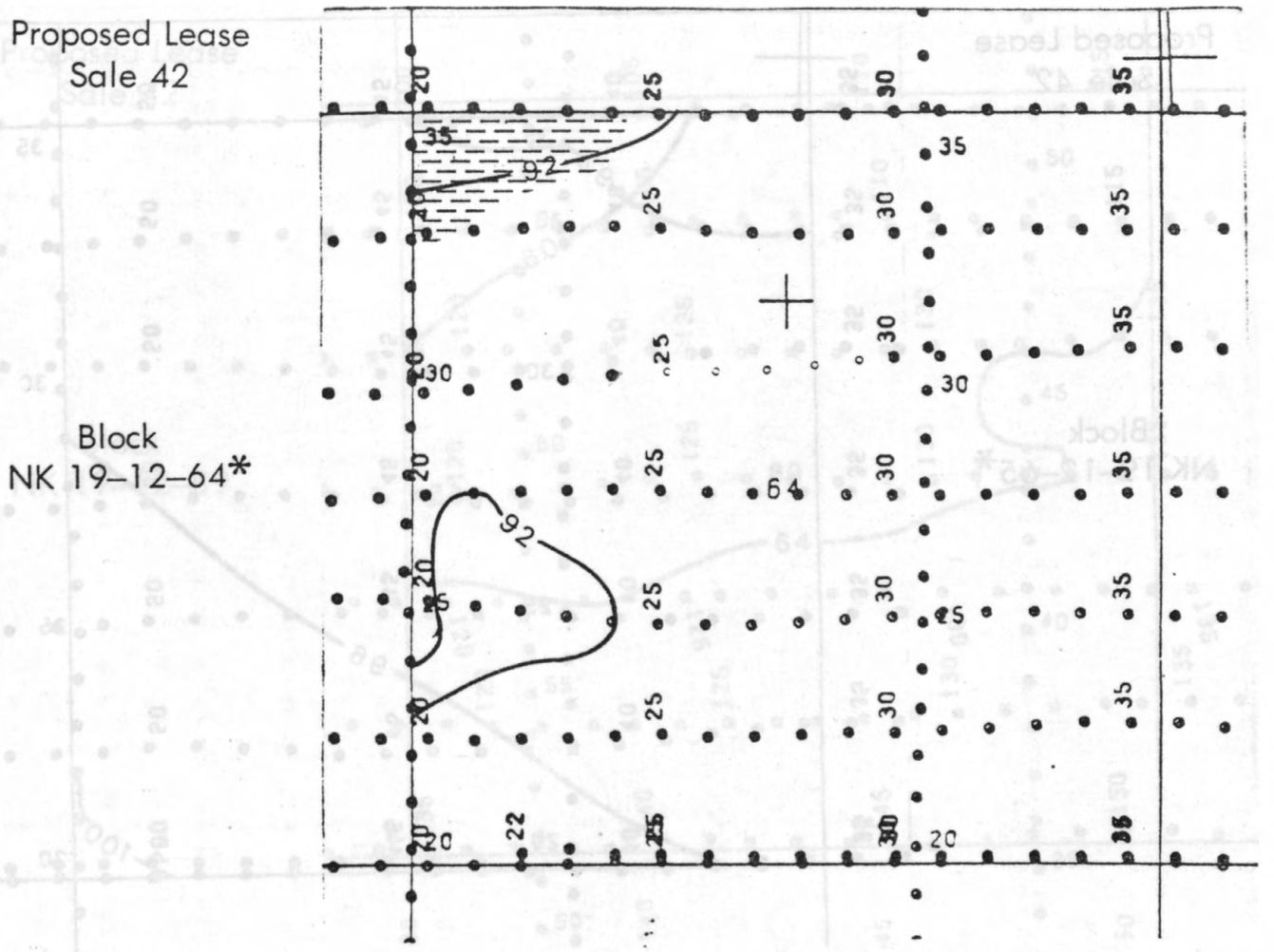


Water Depth: max. 94 m , min. 87 m
Slope Gradient: 1.5 m/km, Direction: SSE
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 95 m , min. 91 m
Slope Gradient: 0.8 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

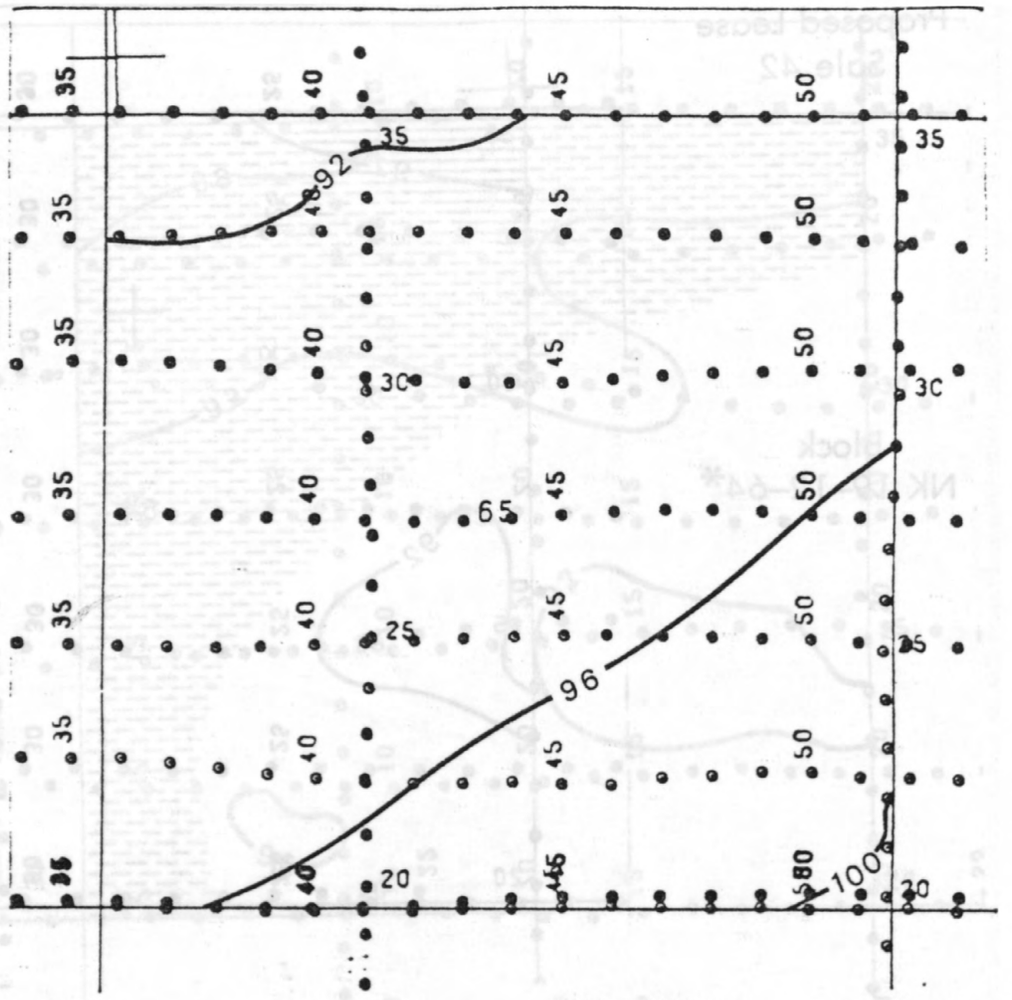
SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42



Block
NK 19–12–65*

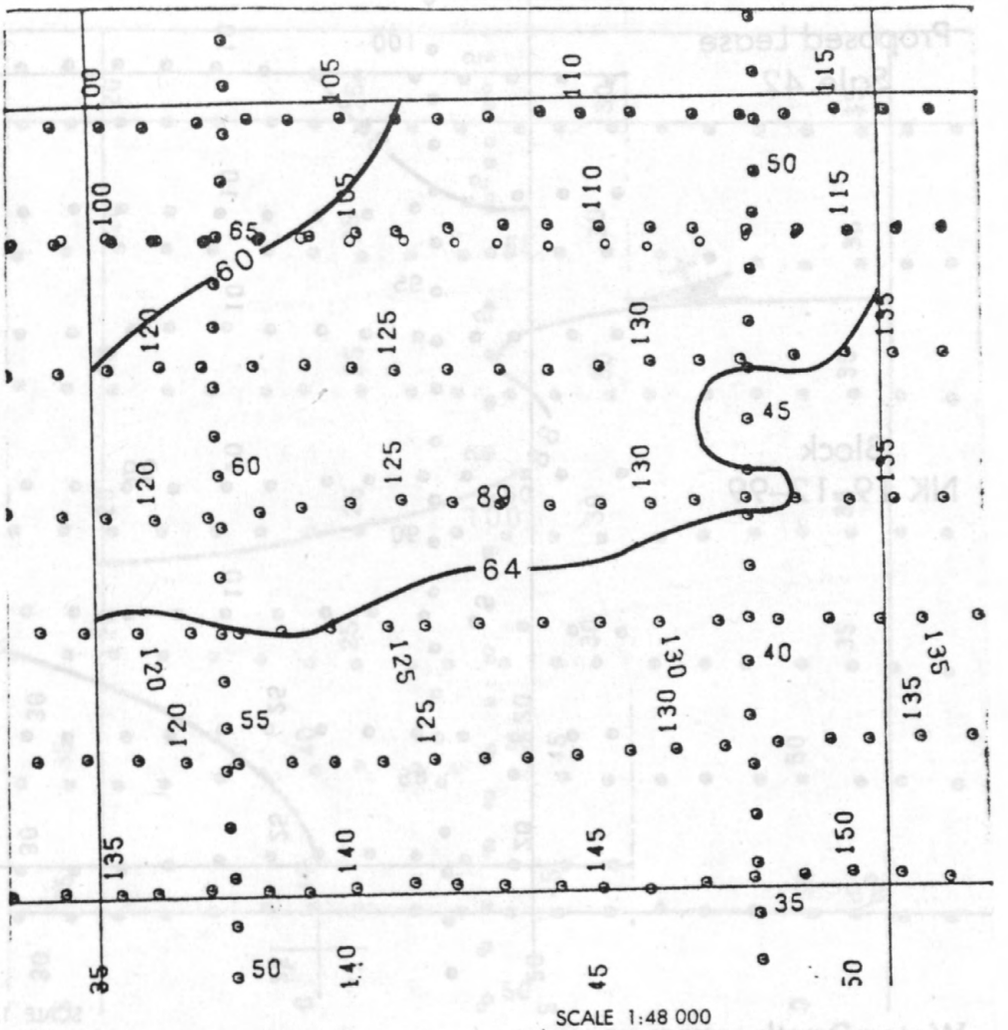
Water Depth: max. 101 m , min. 92 m
Slope Gradient: 1.9 m/km, Direction: SSE
Surface Sediment Type: Gravelly Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

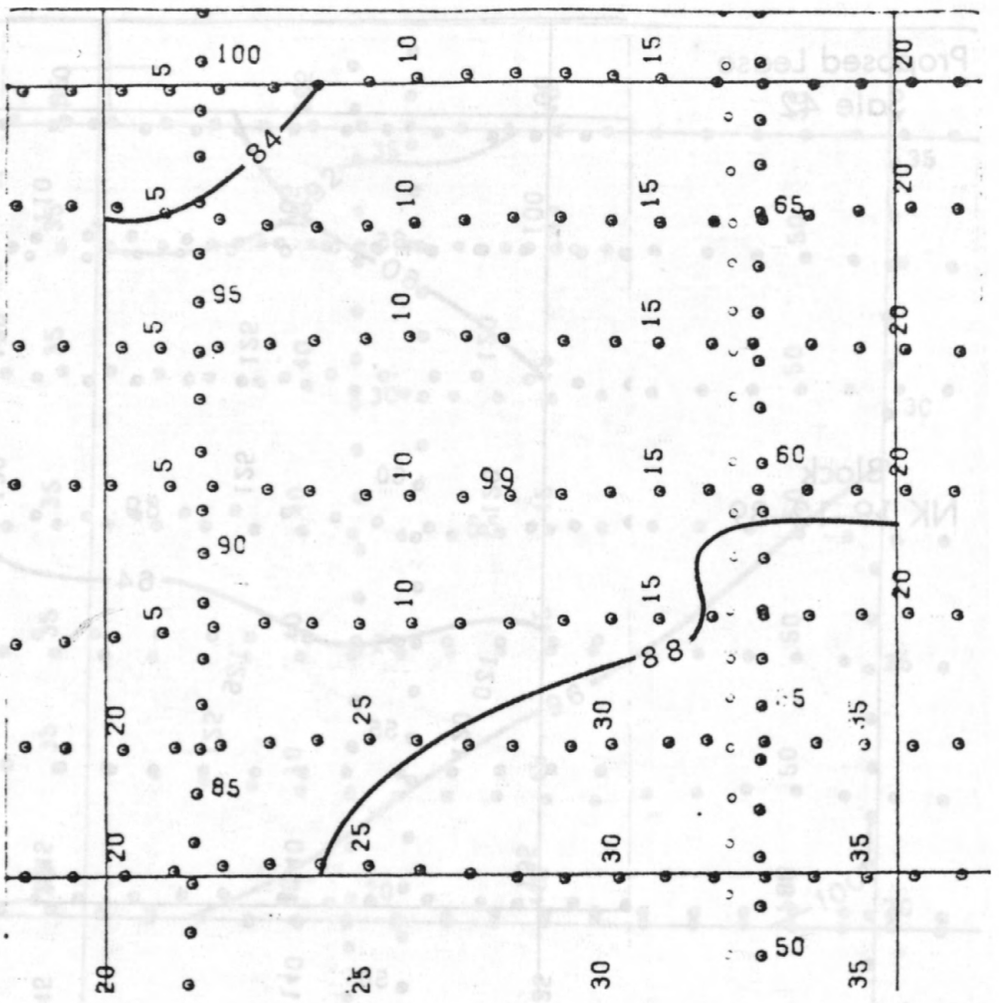
Block
NK 19–12–89



Water Depth: max. 66 m , min. 57 m
Slope Gradient: 1.3 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–99



SCALE 1:48 000

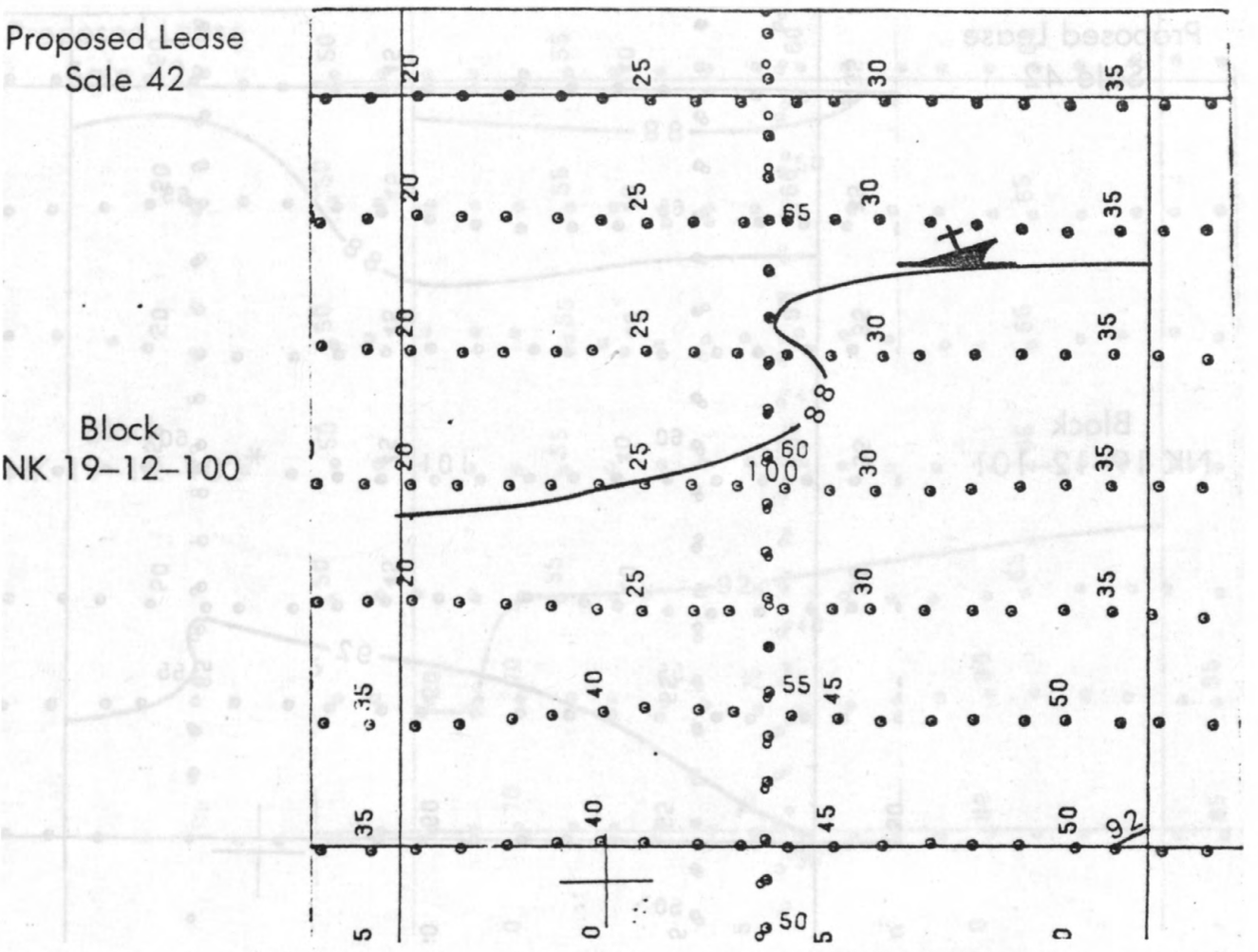
0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 89 m , min. 83 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand

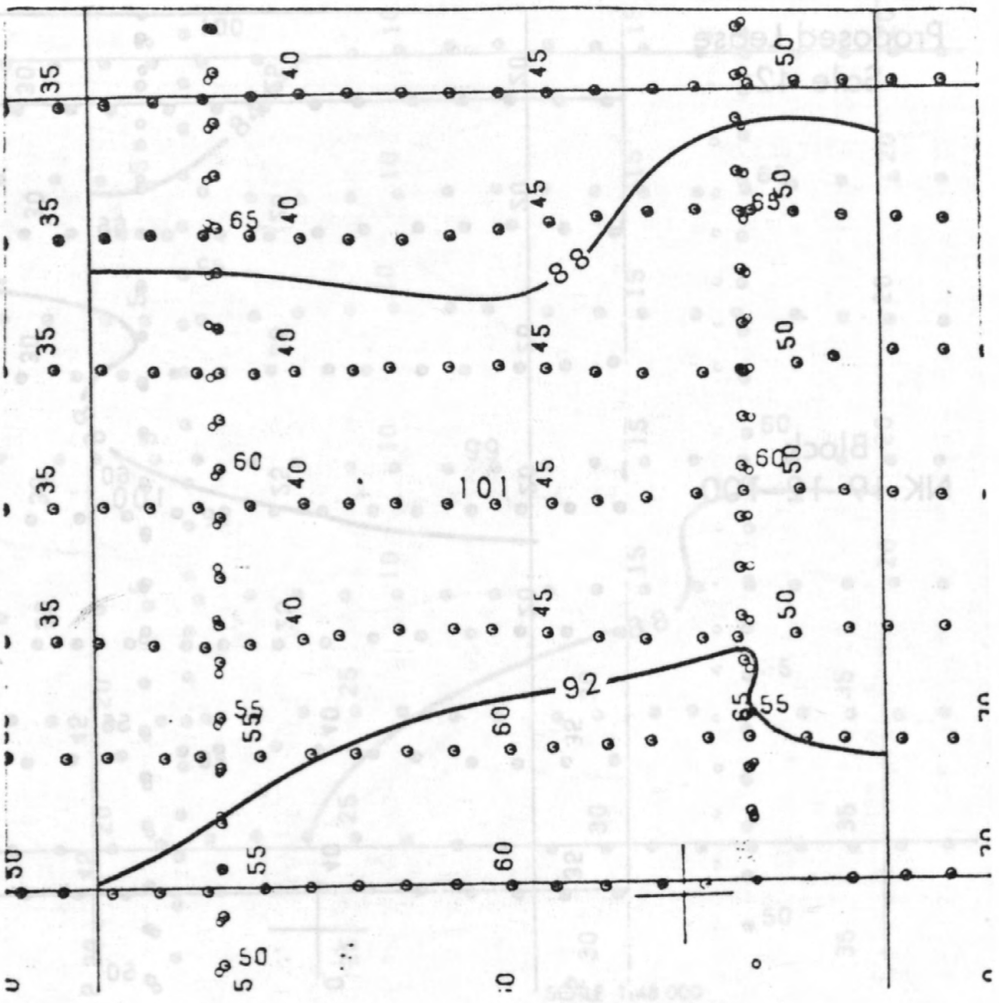


Water Depth: max. 92 m , min. 86 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

Proposed Lease
Sale 42



Water Depth: max., 93 m , min. 87 m
Slope Gradient: 1.3 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

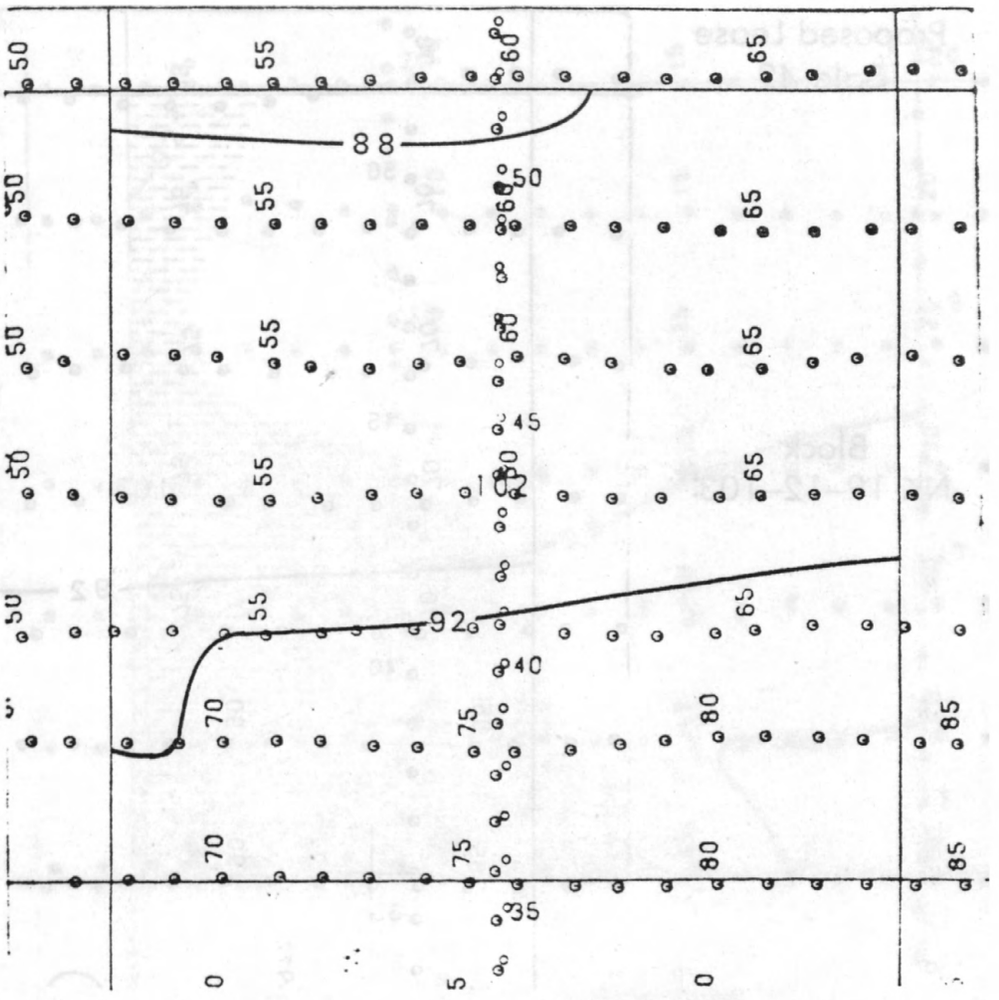
0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–12–102*



Water Depth: max. 94 m , min. 87 m
Slope Gradient: 1.5 m/km, Direction: S
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

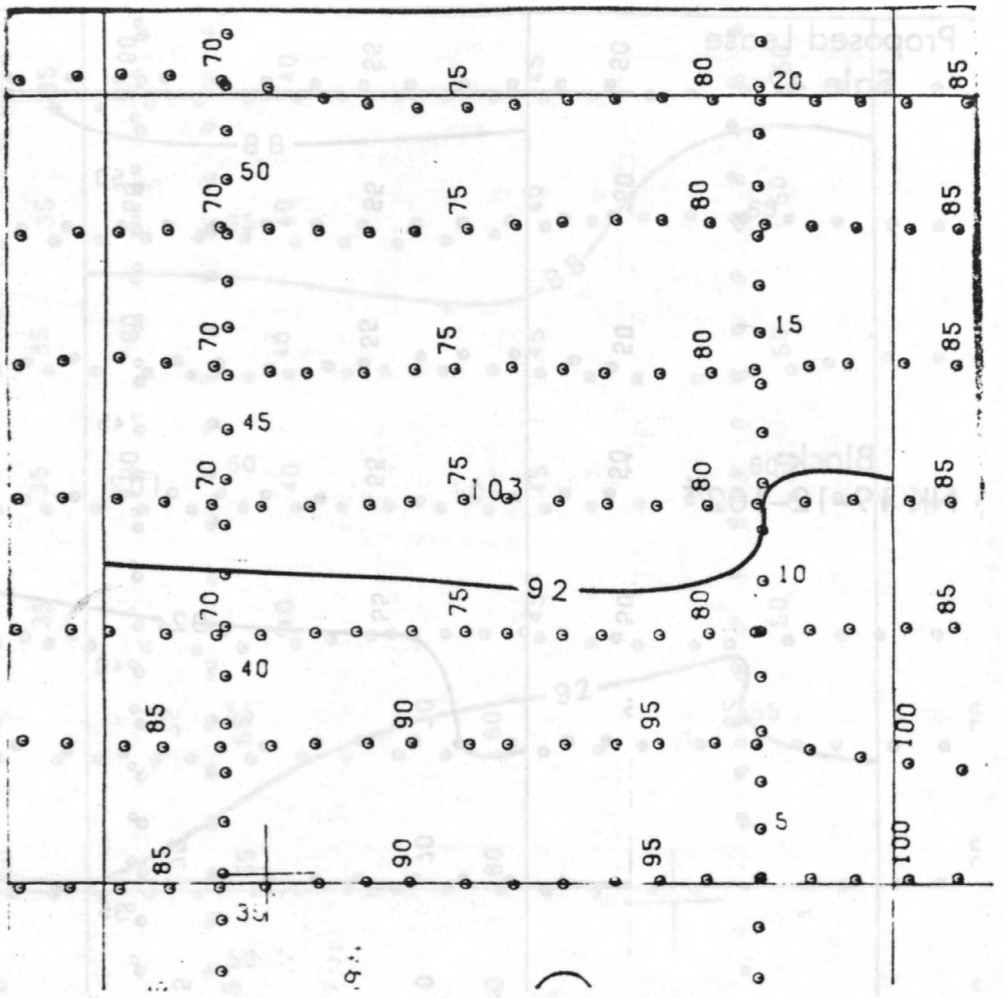
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

* NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

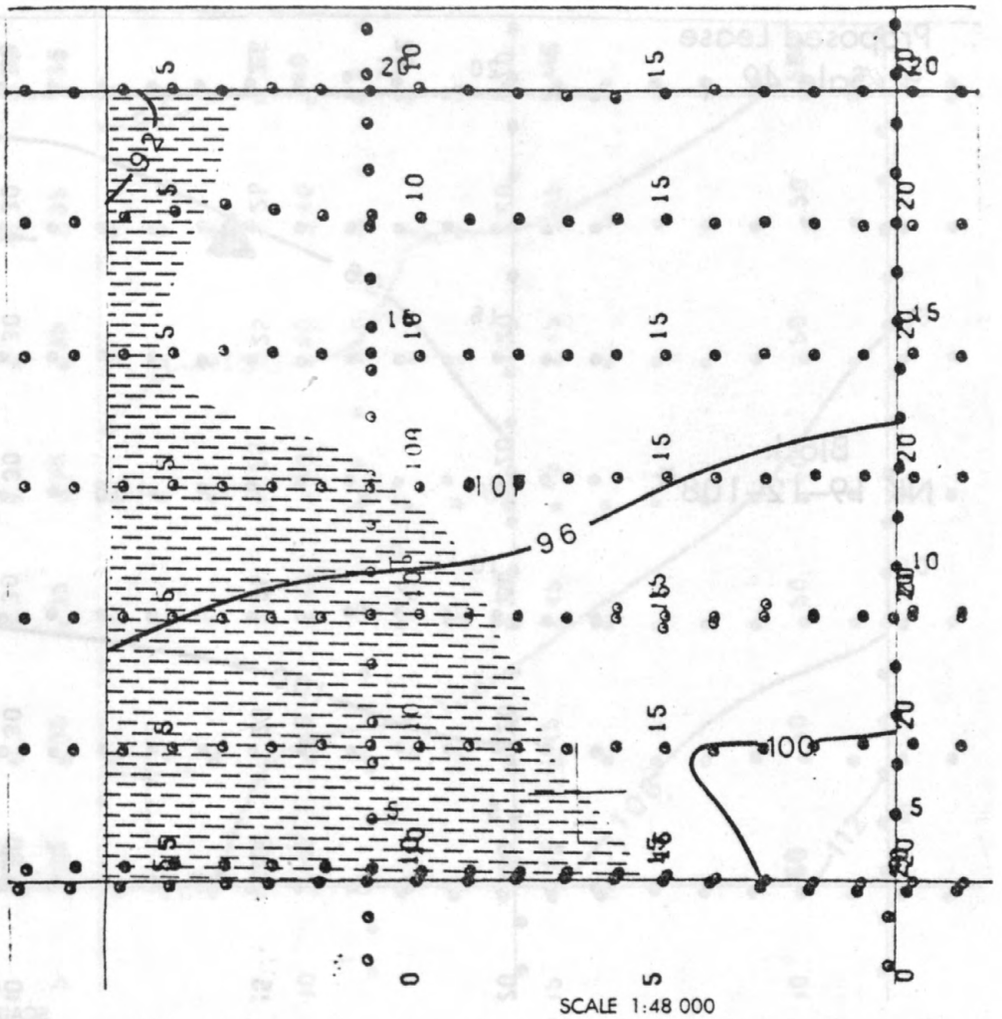
Proposed Lease
Sale 42

Block
NK 19–12–103*



Water Depth: max. 94 m , min. 89 m
Slope Gradient: 1 m/km, Direction: S
Surface Sediment Type: Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

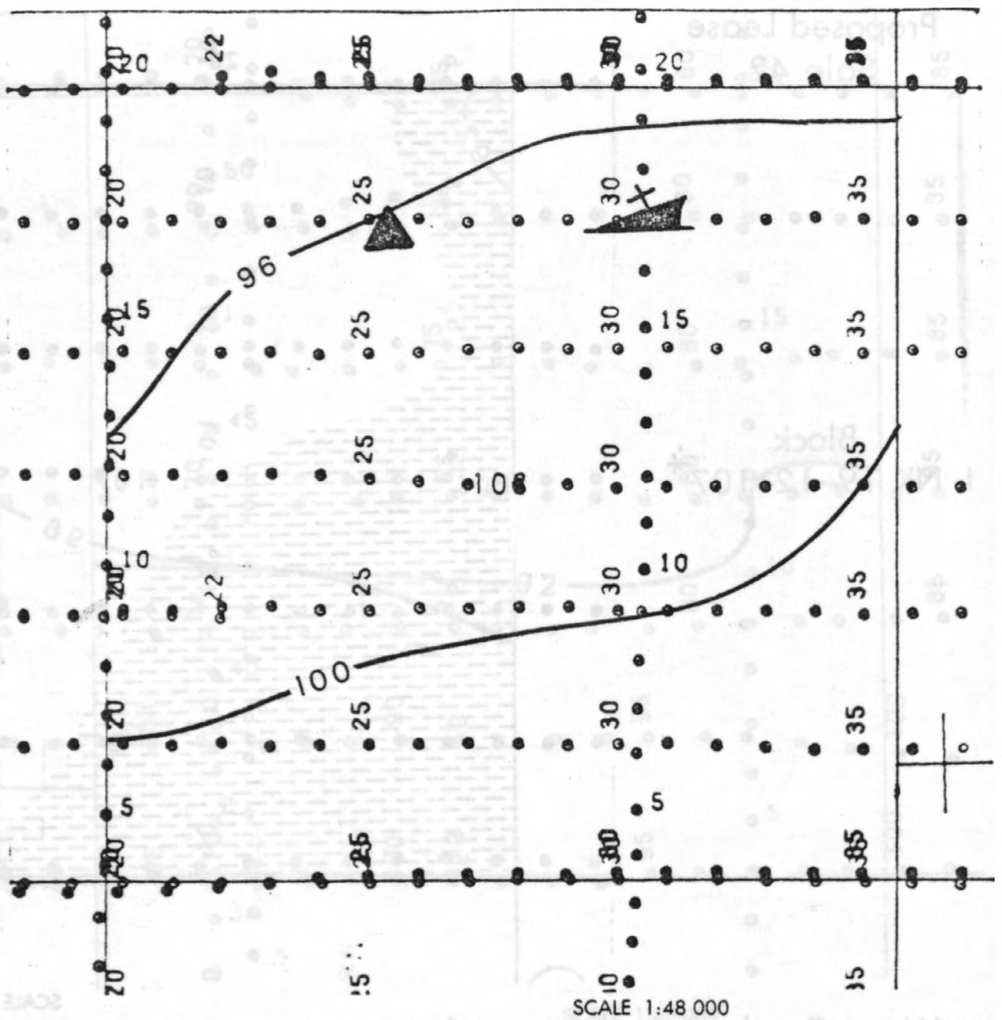


Water Depth: max. 101 m , min. 92 m
Slope Gradient: 1.9 m/km, Direction: SSE
Surface Sediment Type: Gravelly Sand

CONSTRAINT

Filled Channel

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.



Water Depth: max. 103 m, min. 94 m
Slope Gradient: 1.9 m/km, Direction: S
Surface Sediment Type: Gravelly Sand

CONSTRAINTS

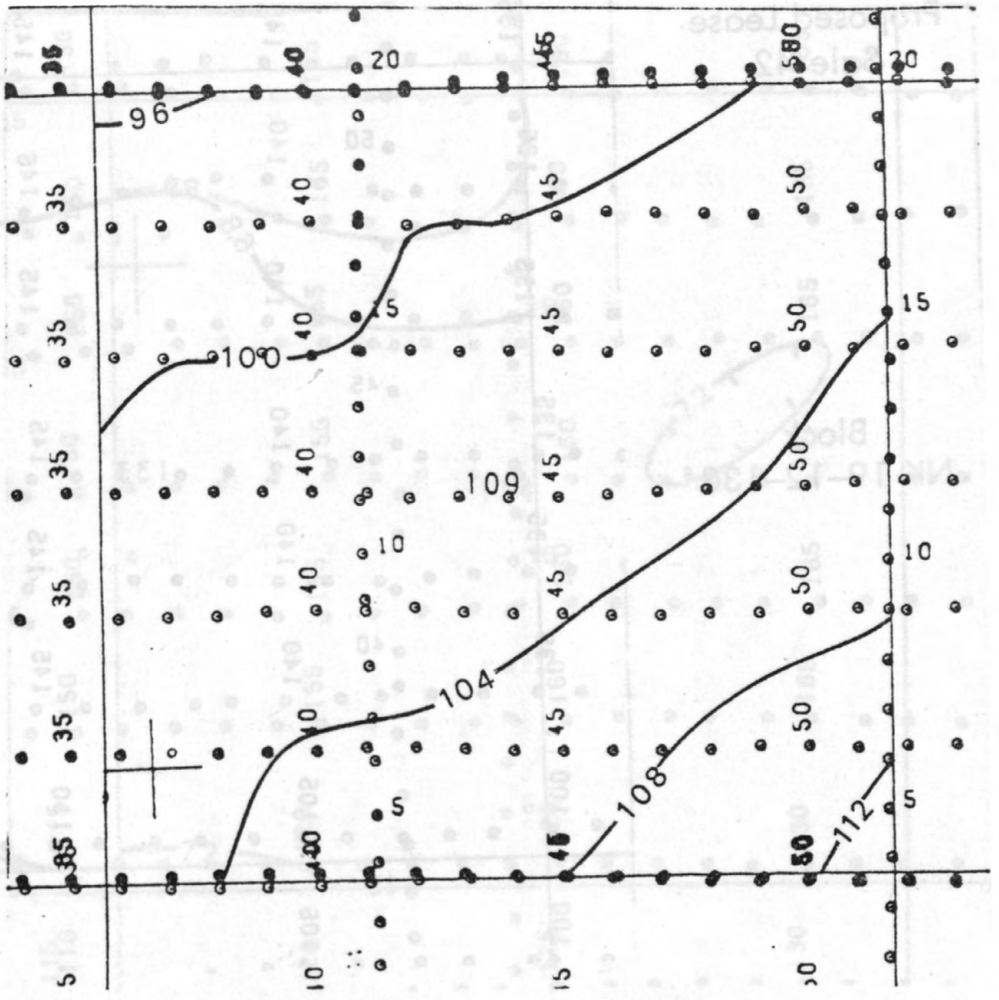
Shipwreck

Bottom Object

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

Block
NK 19–12–109*

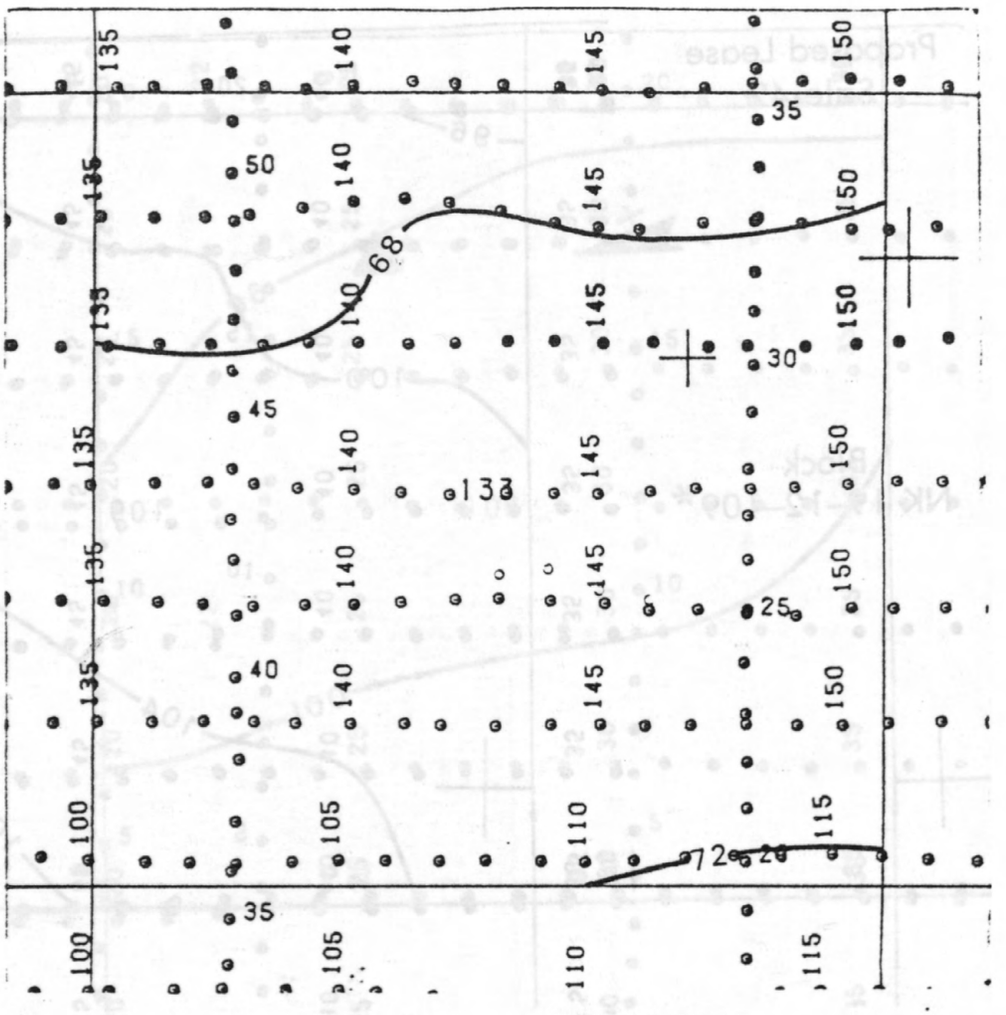


Water Depth: max. 113 m, min. 95 m
Slope Gradient: 3.8 m/km, Direction: SSE
Surface Sediment Type: Gravelly Sand

*NOTE: THIS BLOCK HAS BEEN WITHDRAWN FROM PROPOSED LEASE SALE 42 BY THE DEPARTMENT OF THE INTERIOR.

Proposed Lease
Sale 42

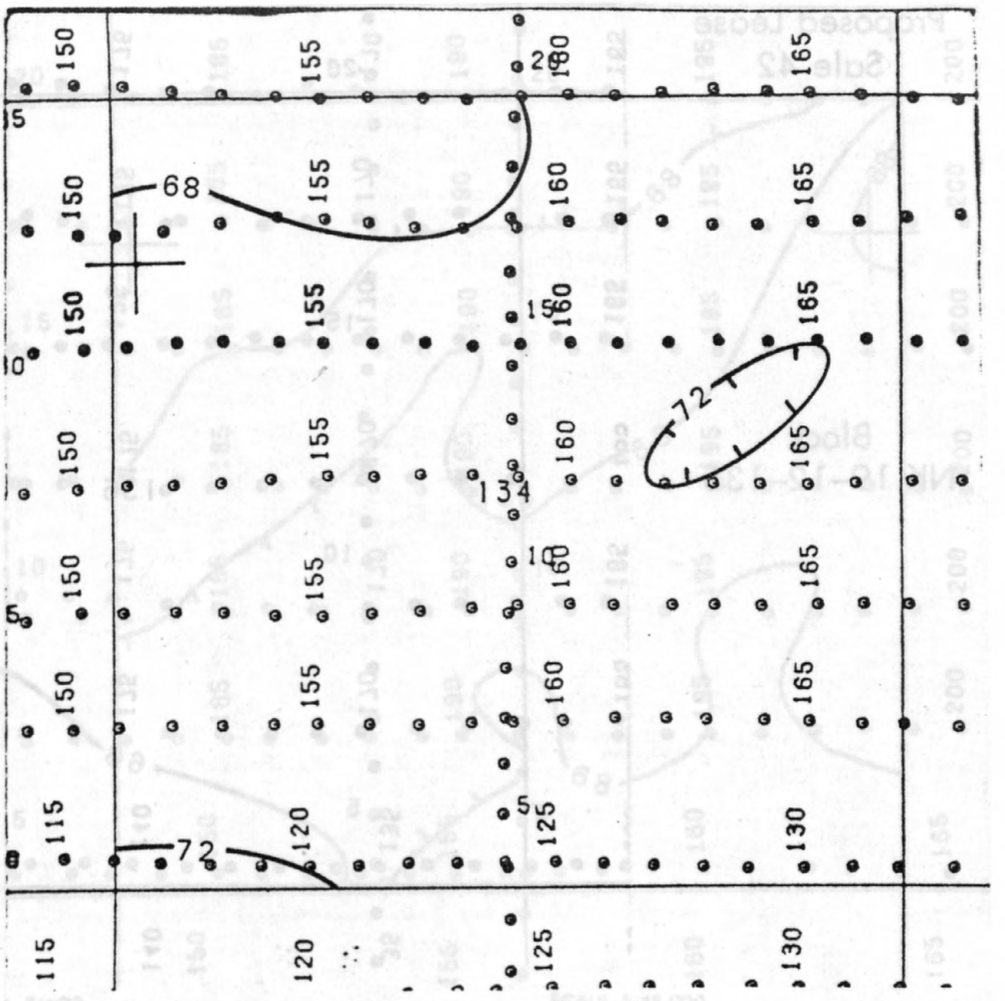
Block
NK 19–12–133



Water Depth: max. 72 m , min. 65 m
Slope Gradient: 1.5 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42

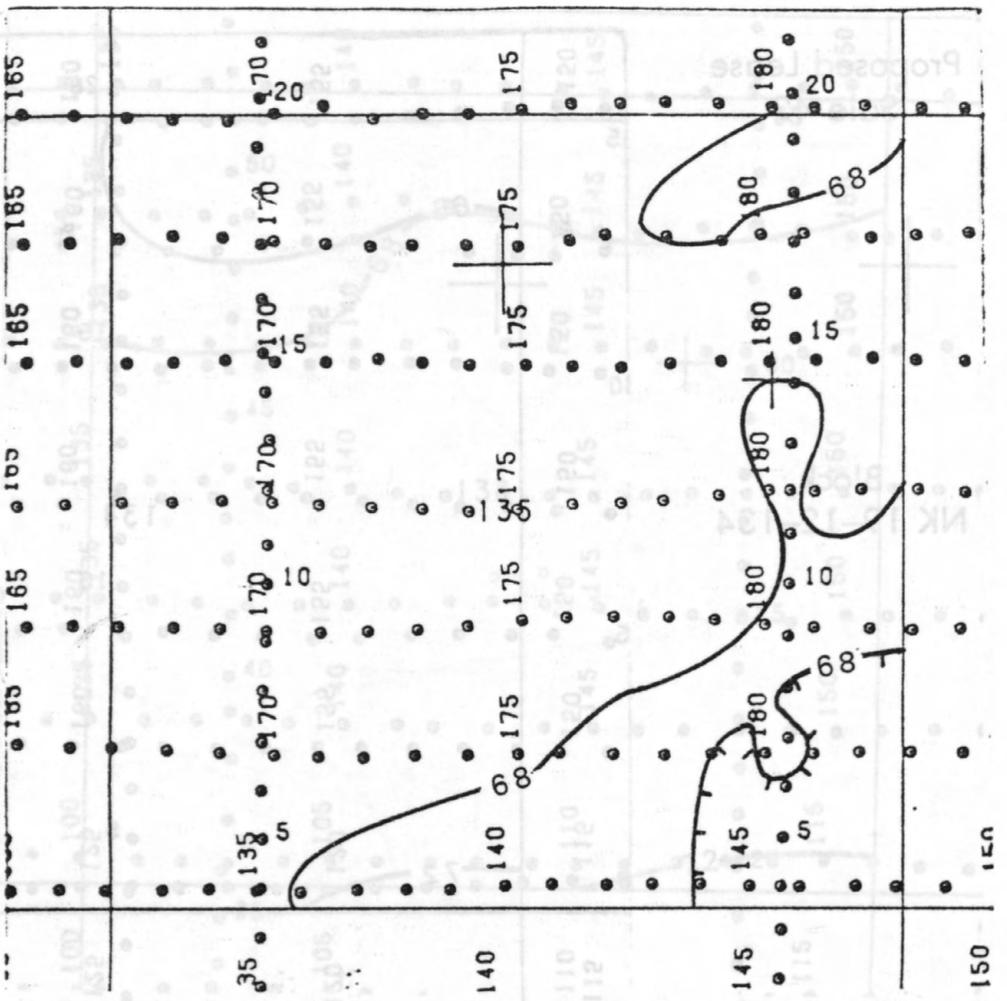
Block
NK 19–12–134



Water Depth: max. 72 m , min. 66 m
Slope Gradient: 1.5 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–135



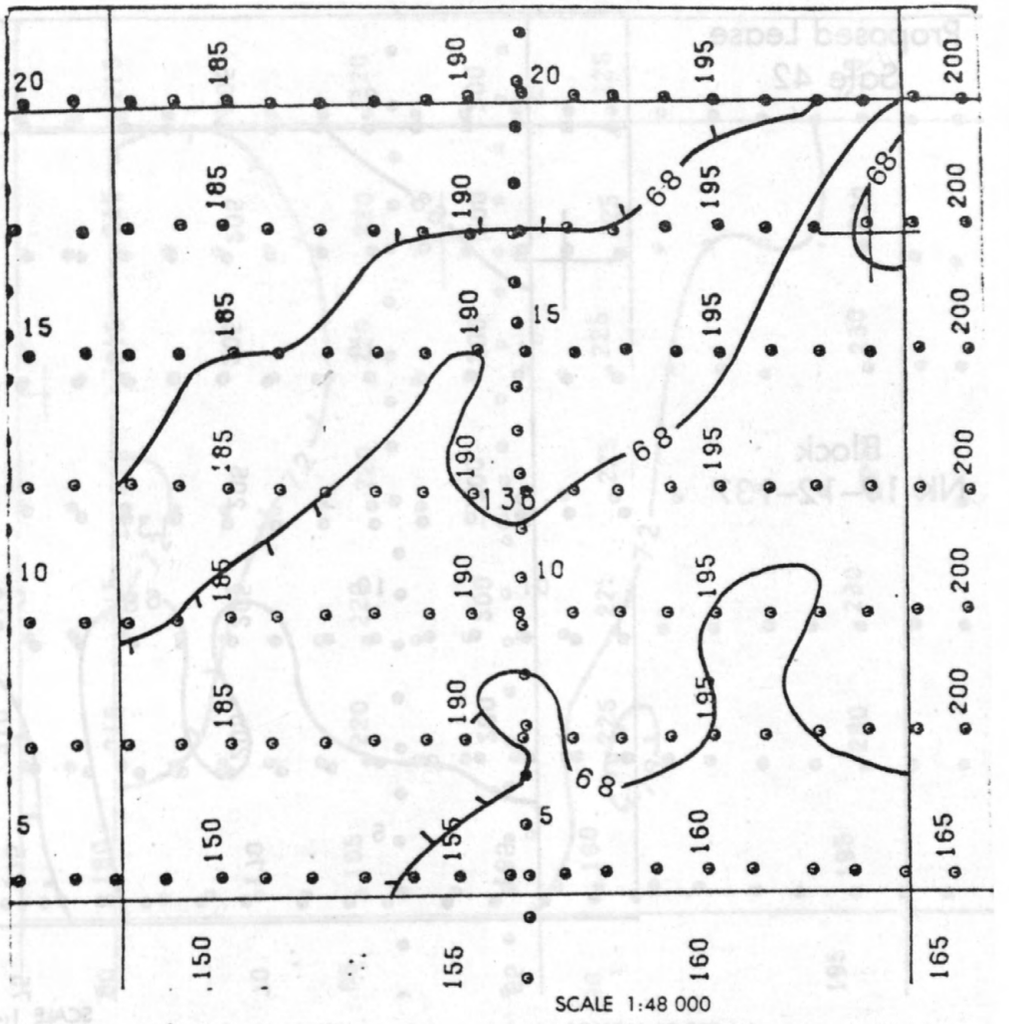
SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

Water Depth: max. 71 m , min. 66 m
Slope Gradient: 8 m/km, Direction: NW and SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–136



SCALE 1:48 000

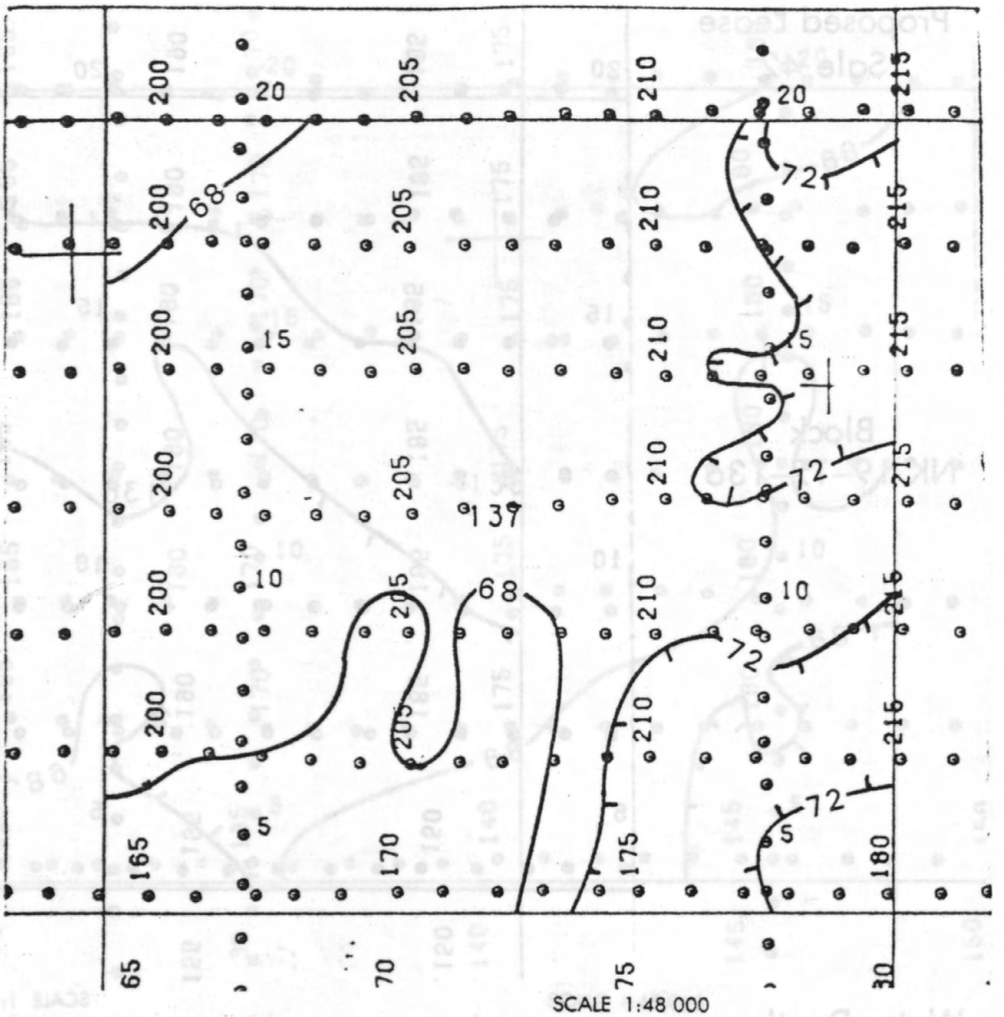
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 71 m , min. 66 m
Slope Gradient: 10 m/km, Direction: NW and SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–137



SCALE 1:48 000

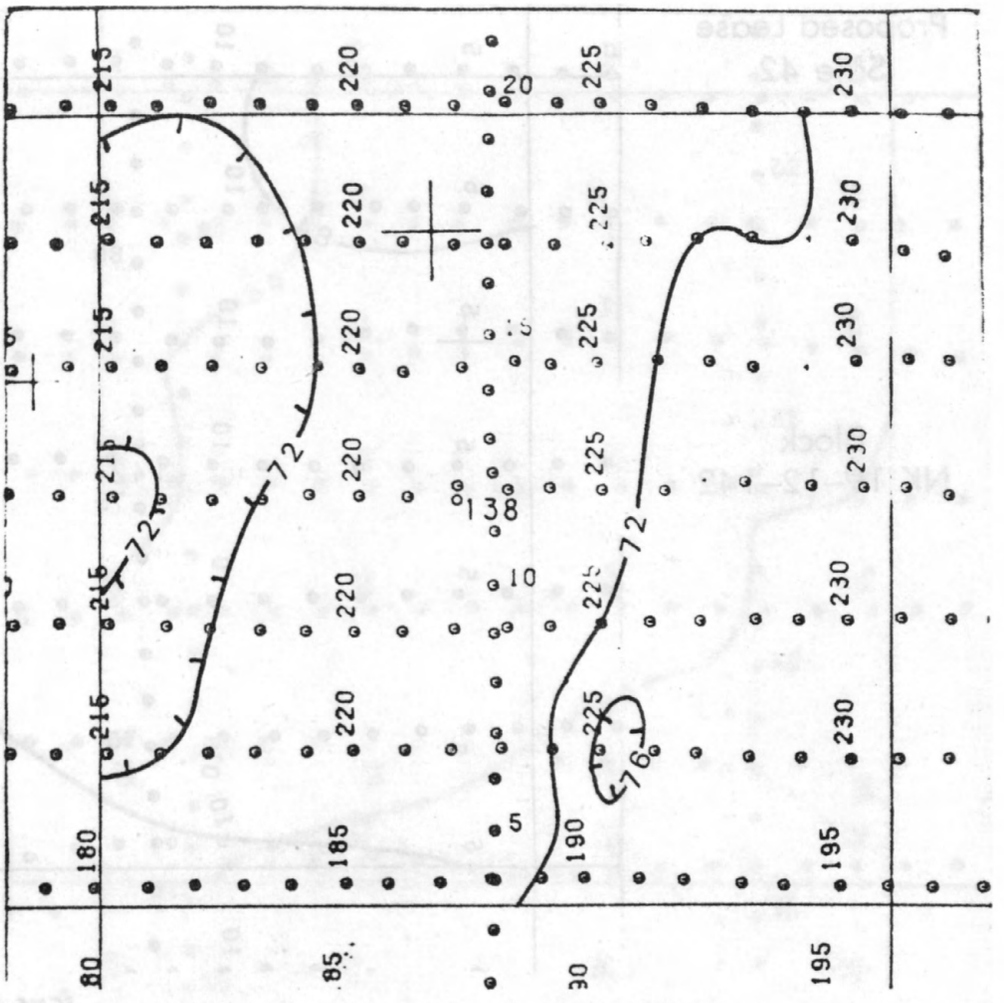
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 74 m , min. 66 m
Slope Gradient: 13 m/km, Direction: E
Surface Sediment Type: Sand

Proposed Lease
Sale 42

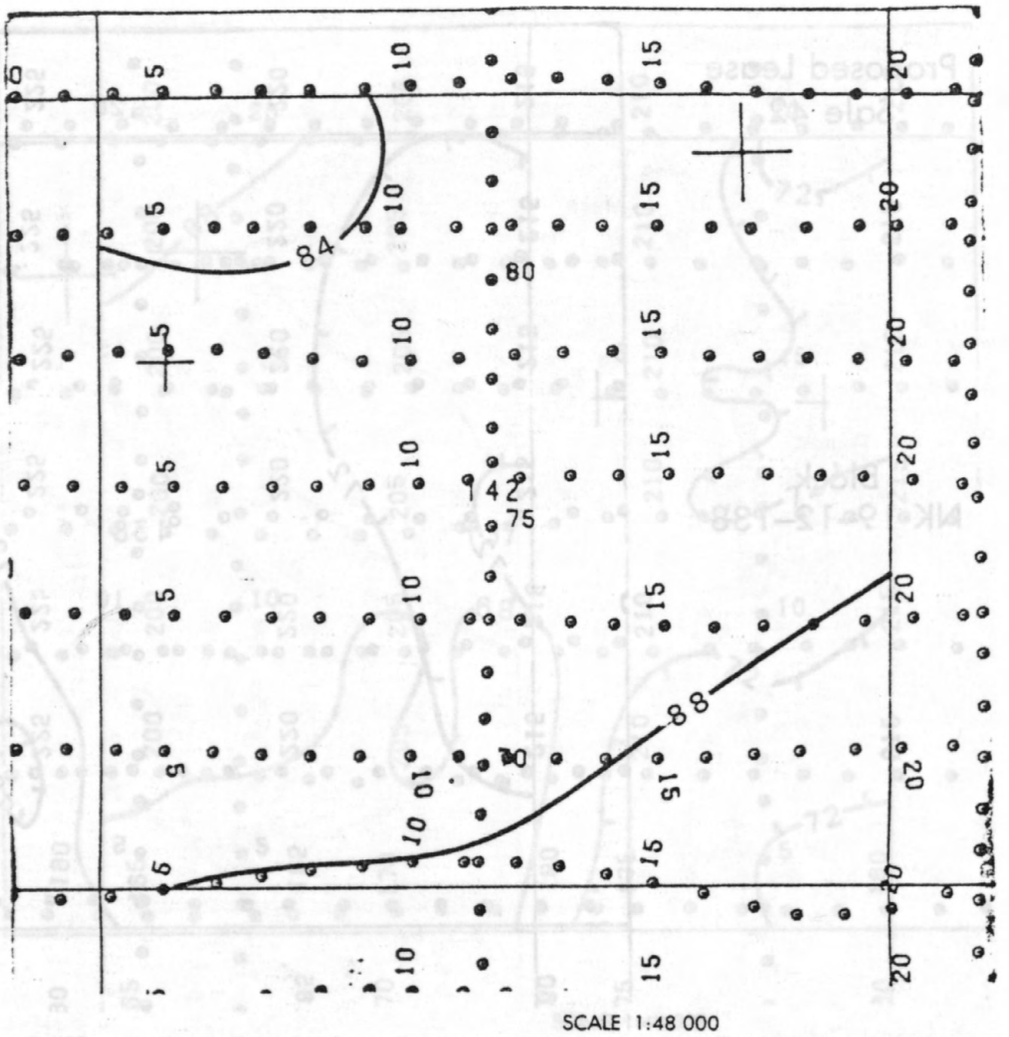
Block
NK 19–12–138



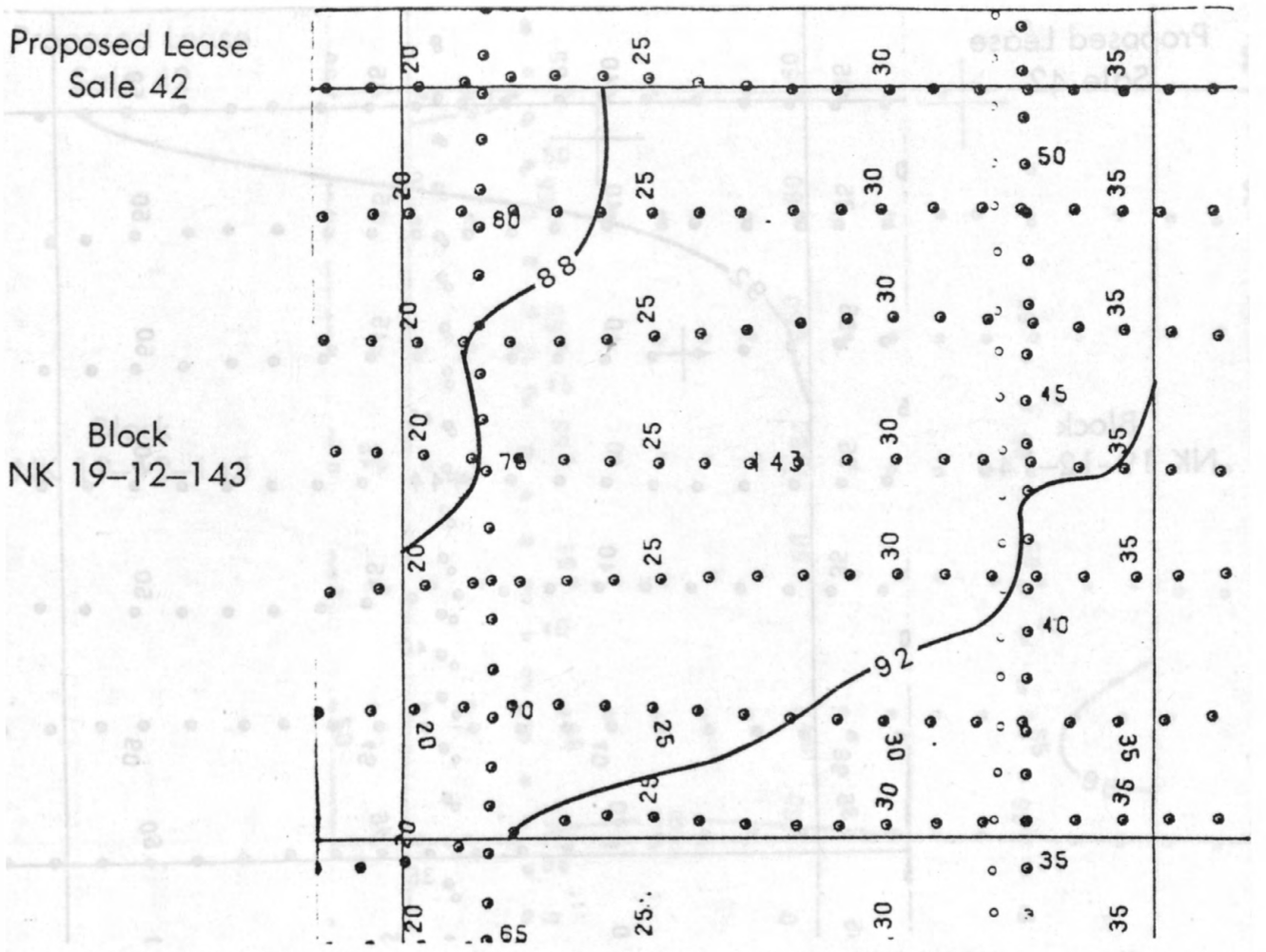
Water Depth: max. 76 m , min. 69 m
Slope Gradient: 13 m/km, Direction: E
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–142



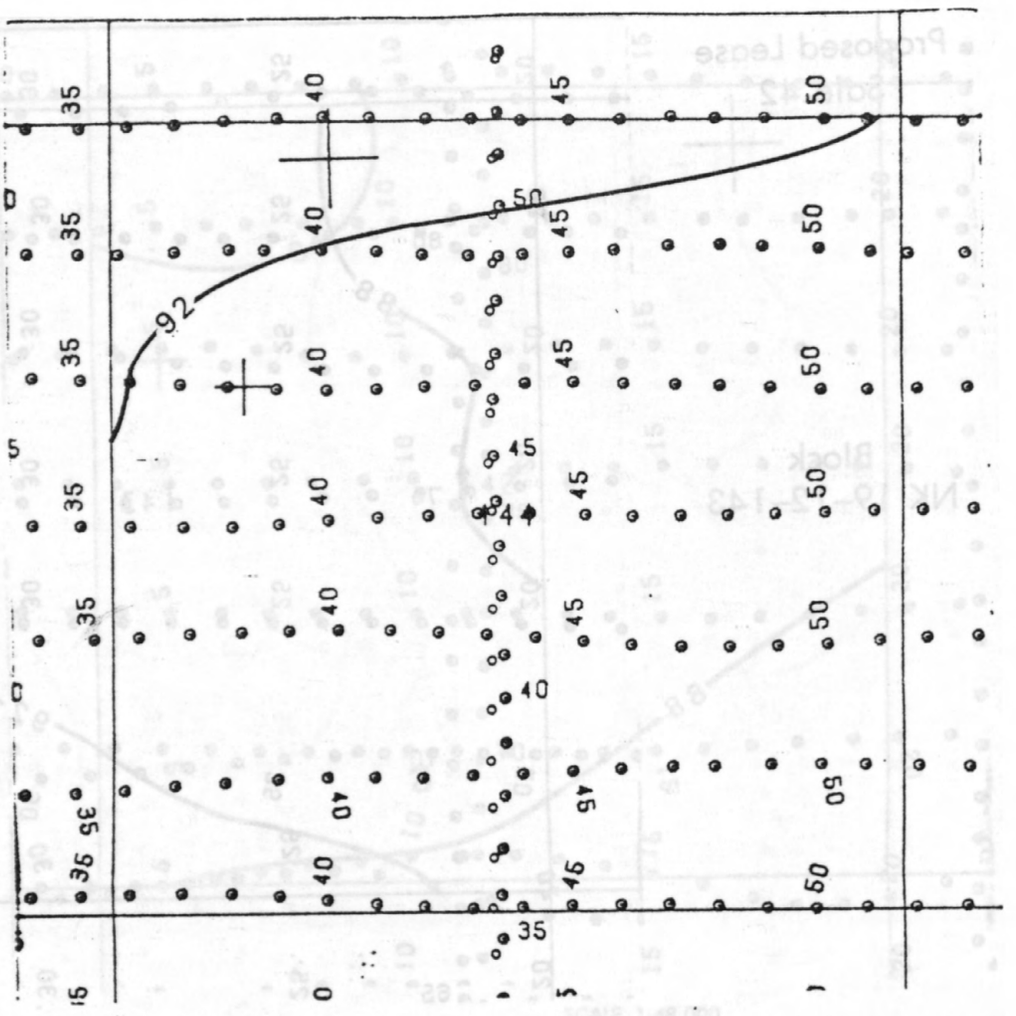
Water Depth: max. 90 m , min. 84 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand



Water Depth: max. 94 m , min. 87 m
Slope Gradient: 1 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–144



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

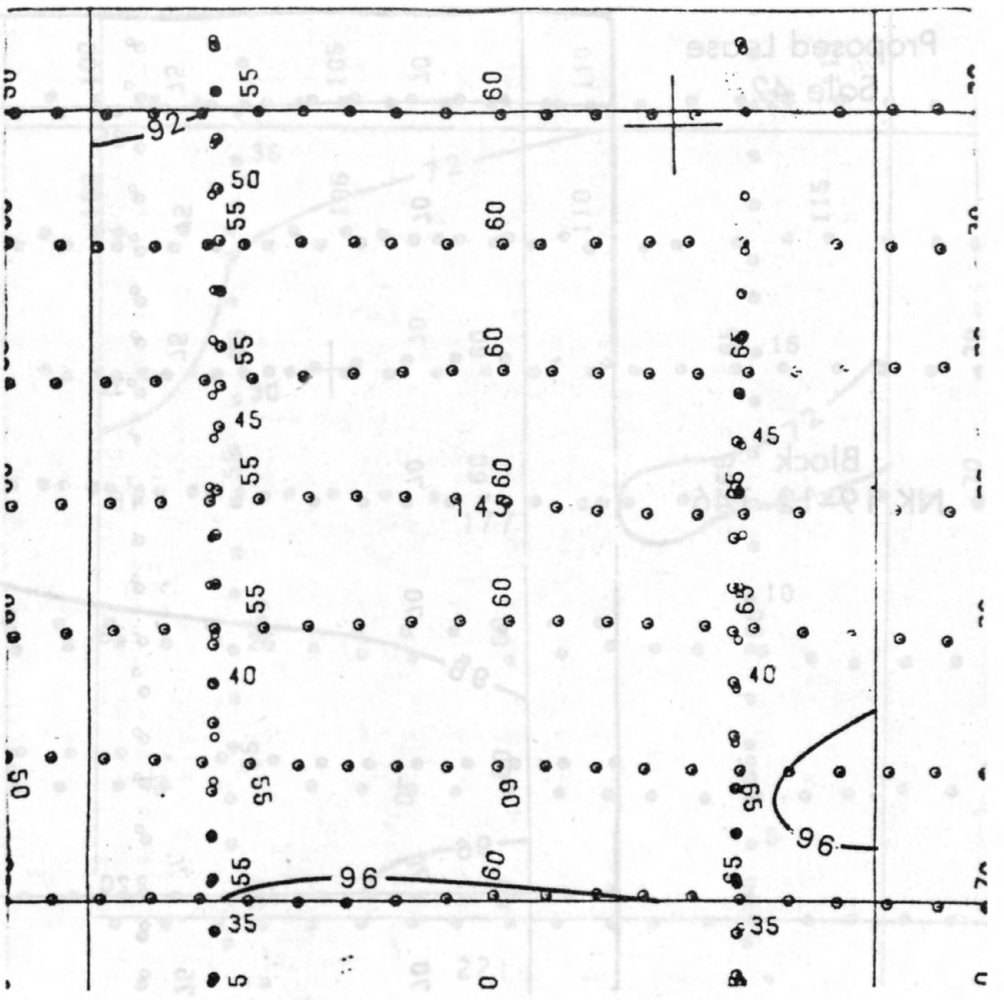
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 95 m , min. 90 m
Slope Gradient: 0.7 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

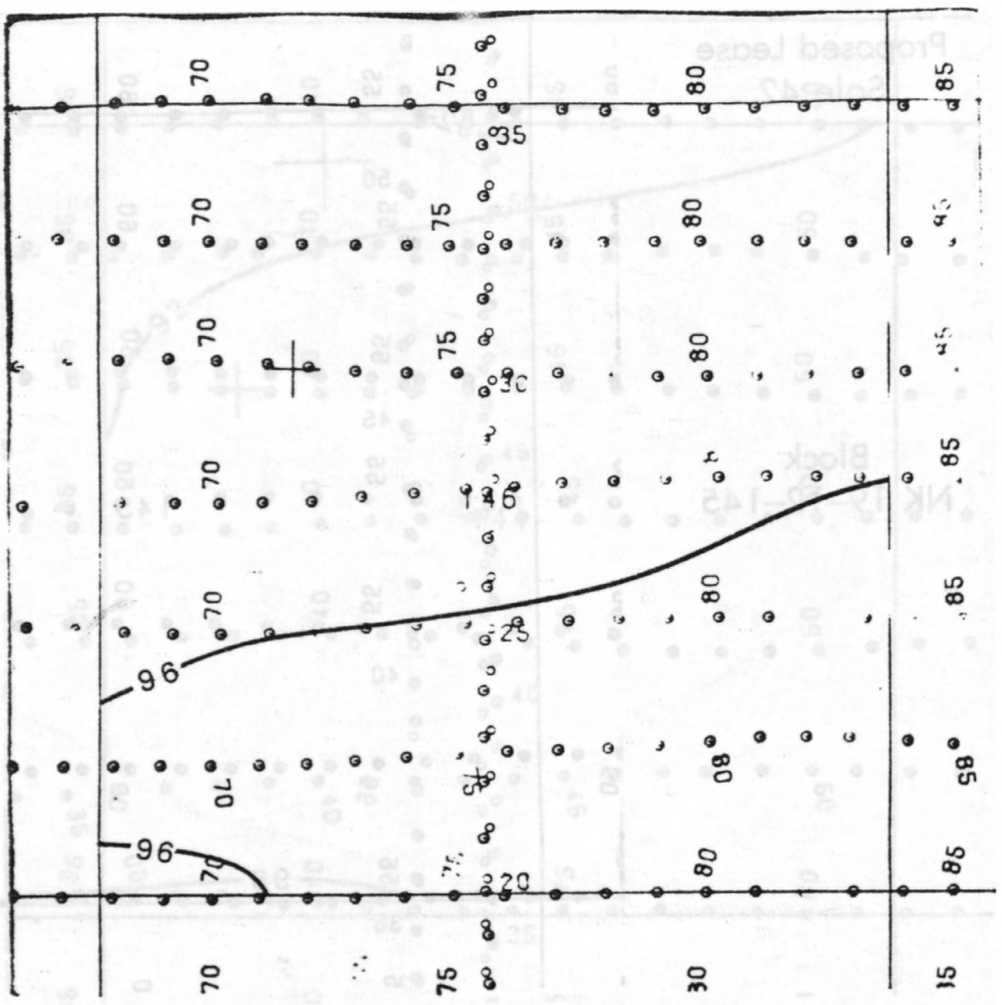
Block
NK 19–12–145



Water Depth: max. 96 m , min. 92 m
Slope Gradient: 0.4 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–146



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

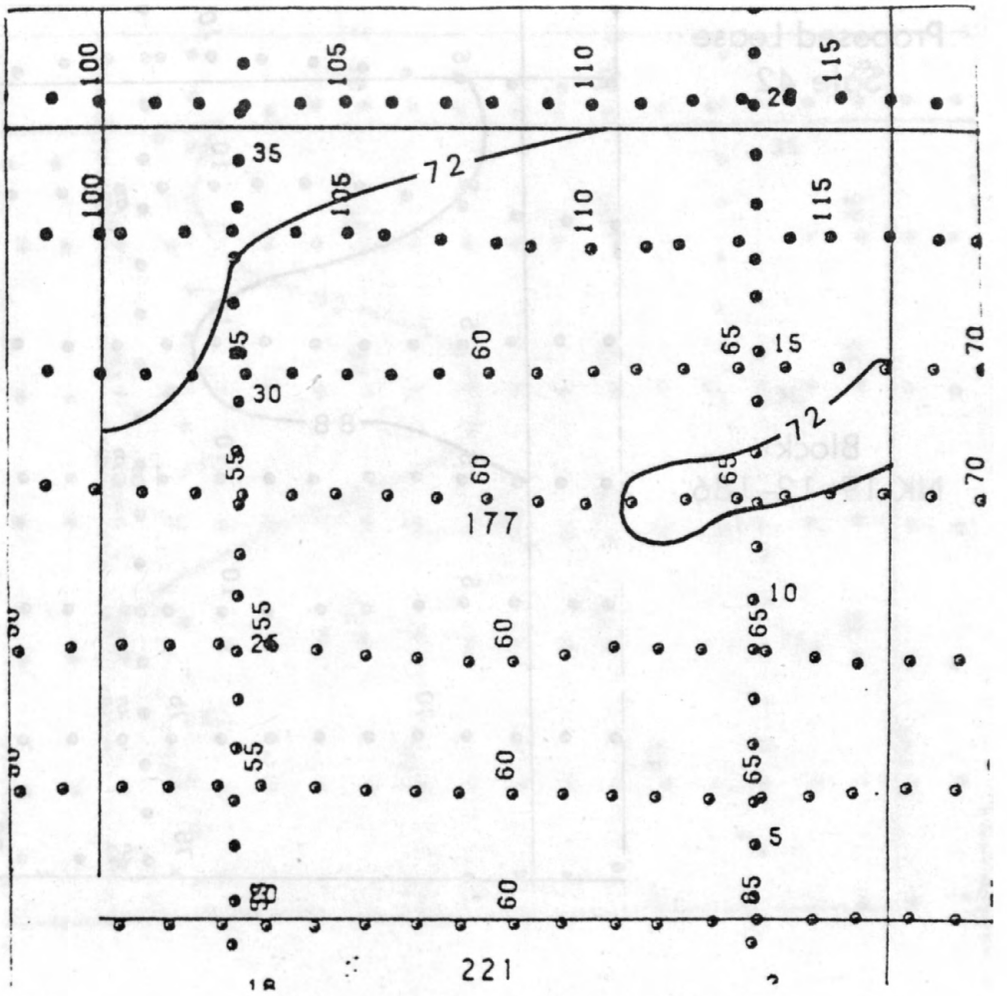
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

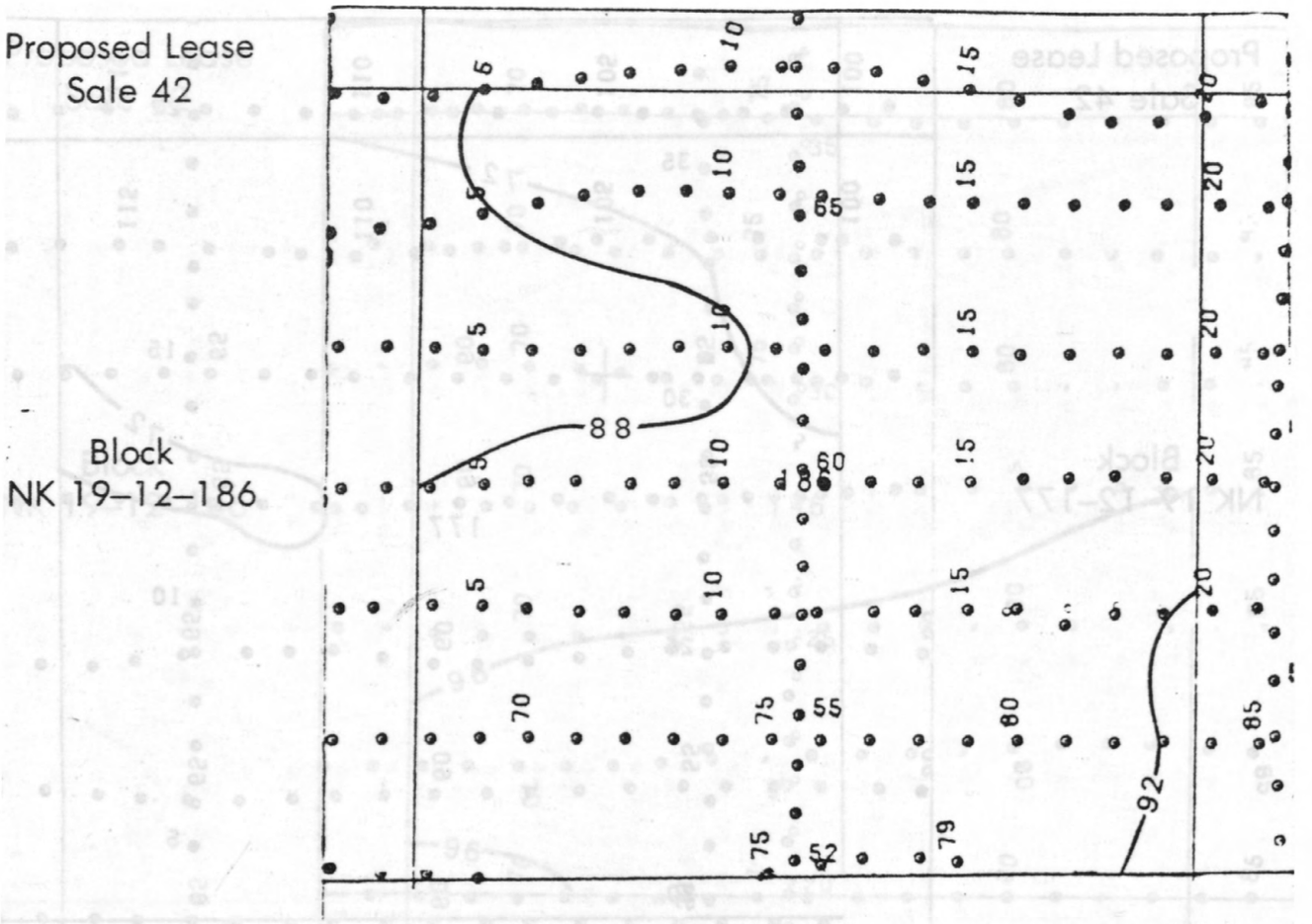
Water Depth: max. 97 m , min. 93 m
Slope Gradient: 0.6 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–177

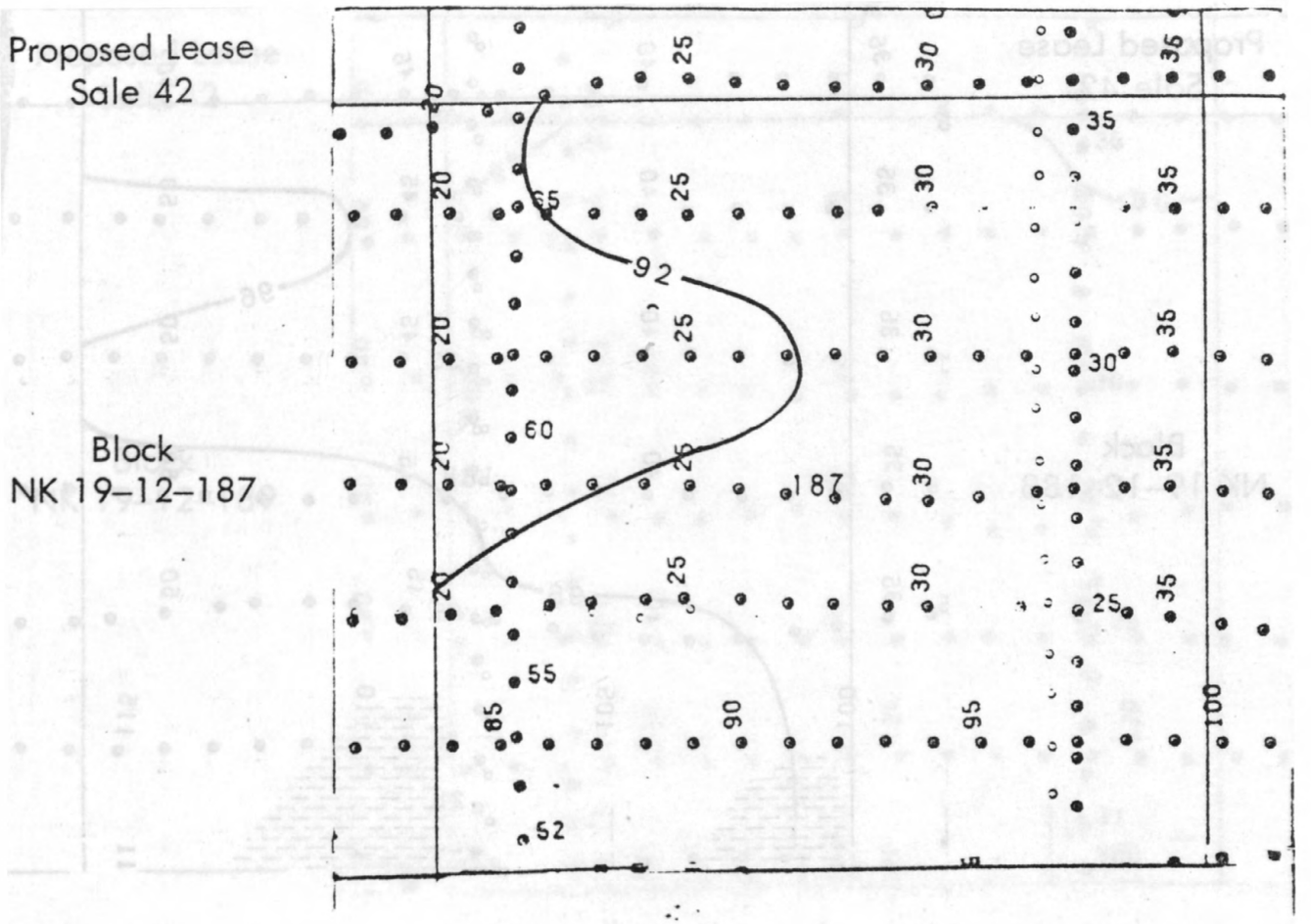


Water Depth: max. 75 m , min. 70 m
Slope Gradient: 1 m/km, Direction: S
Surface Sediment Type: Sand



Water Depth: max. 92 m , min. 87 m
Slope Gradient: 0.7 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS



Water Depth: max. 95 m , min. 91 m
Slope Gradient: 0.6 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

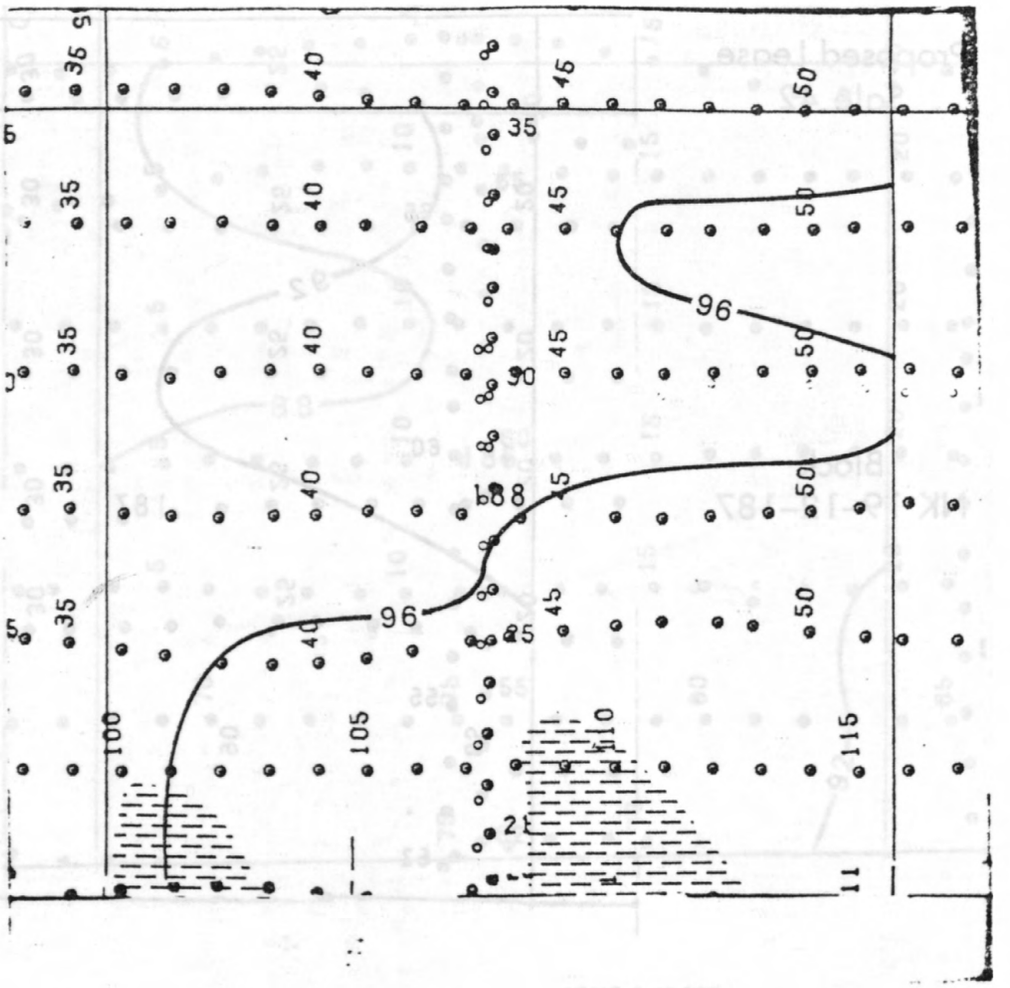
0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–12–188



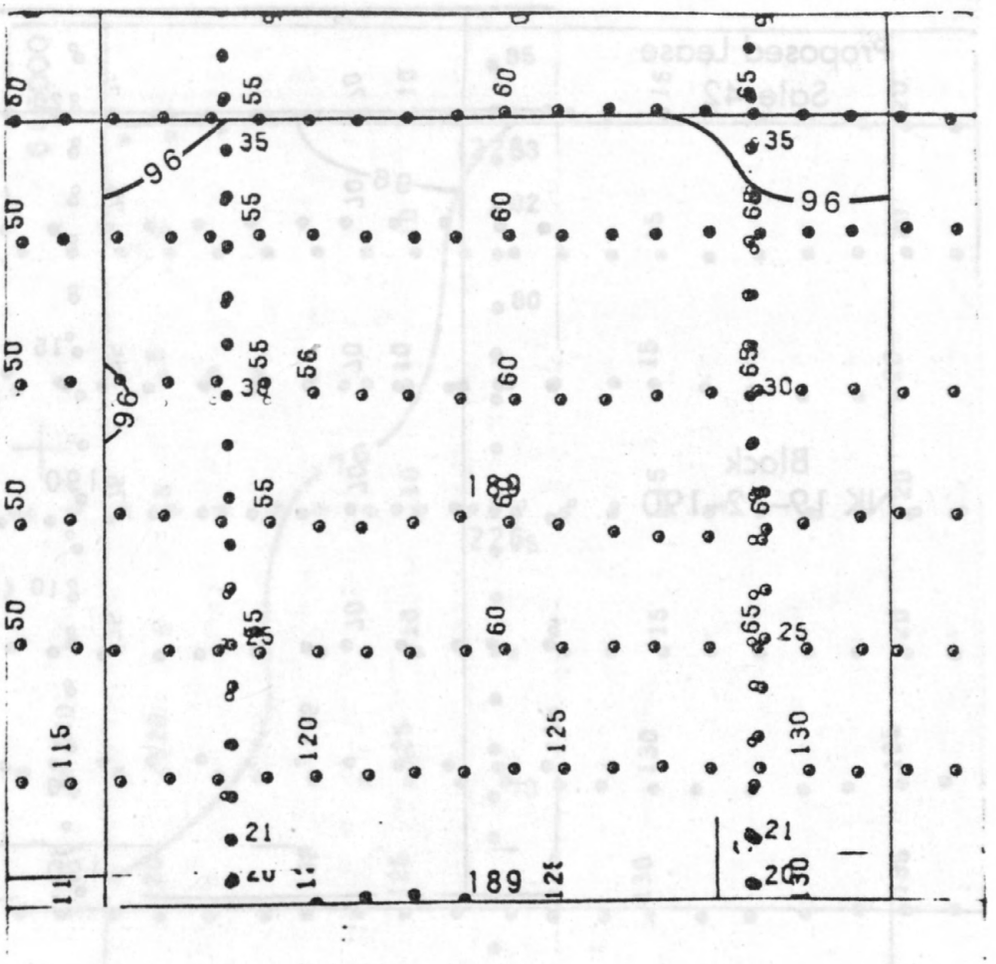
Water Depth: max. 97 m , min. 94 m
Slope Gradient: 0.4 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

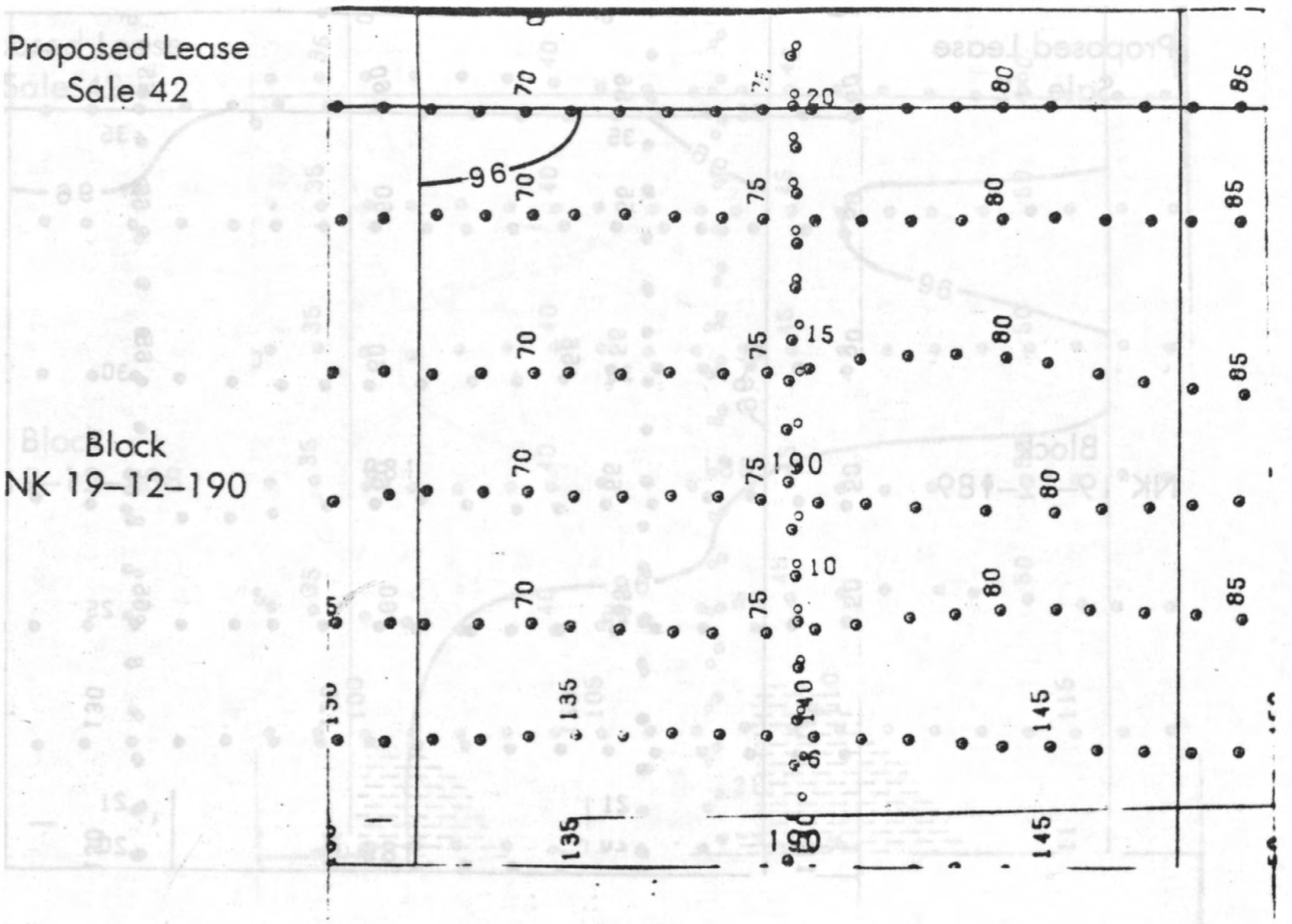
Filled Channel

Proposed Lease
Sale 42



Water Depth: max. 97 m , min. 95 m
Slope Gradient: 0.4 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

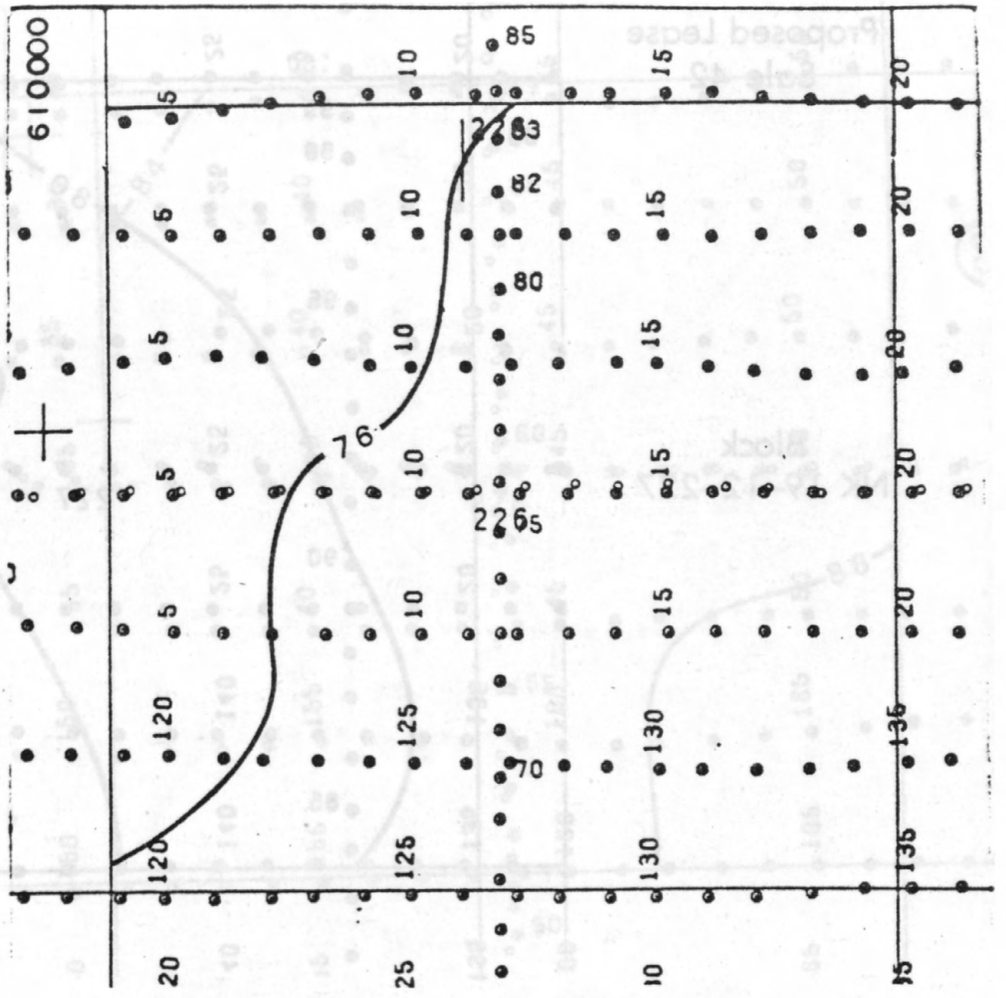


Water Depth: max. 97 m , min. 95 m
Slope Gradient: 1.4 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–12–226



SCALE 1:48 000

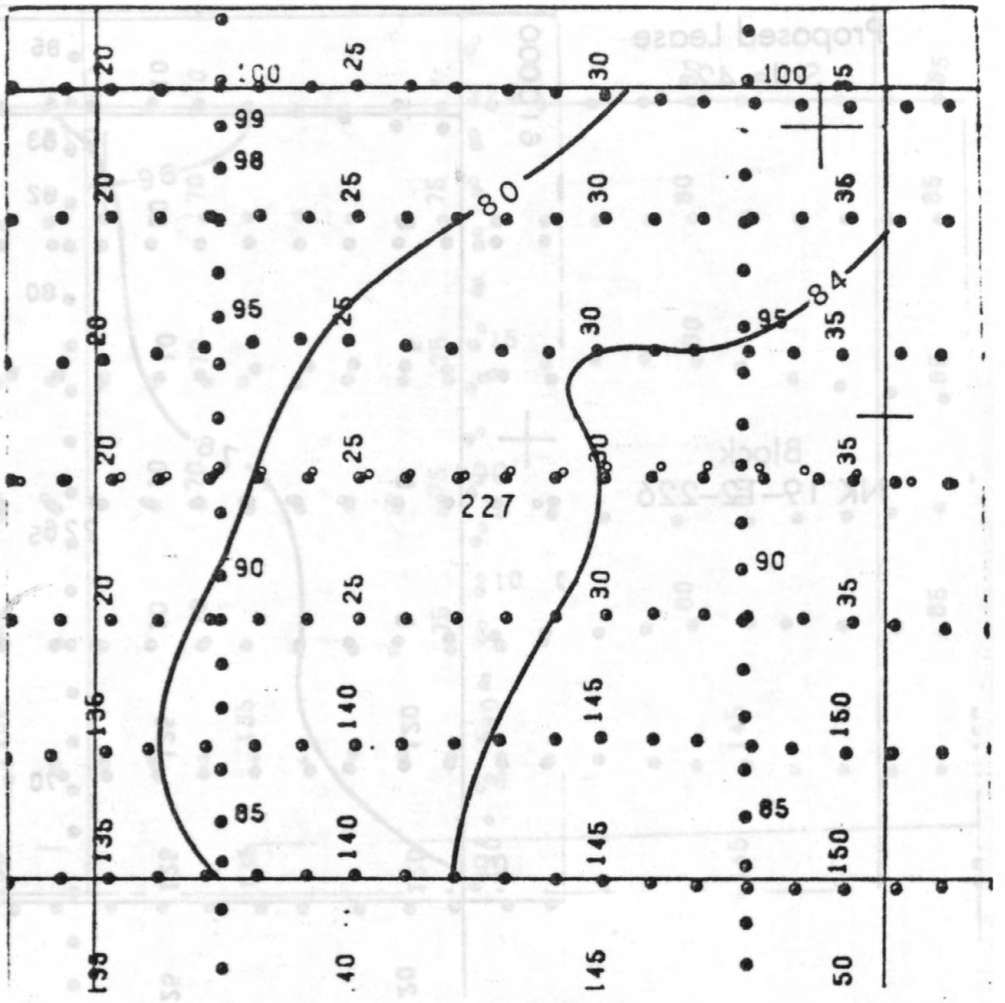
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

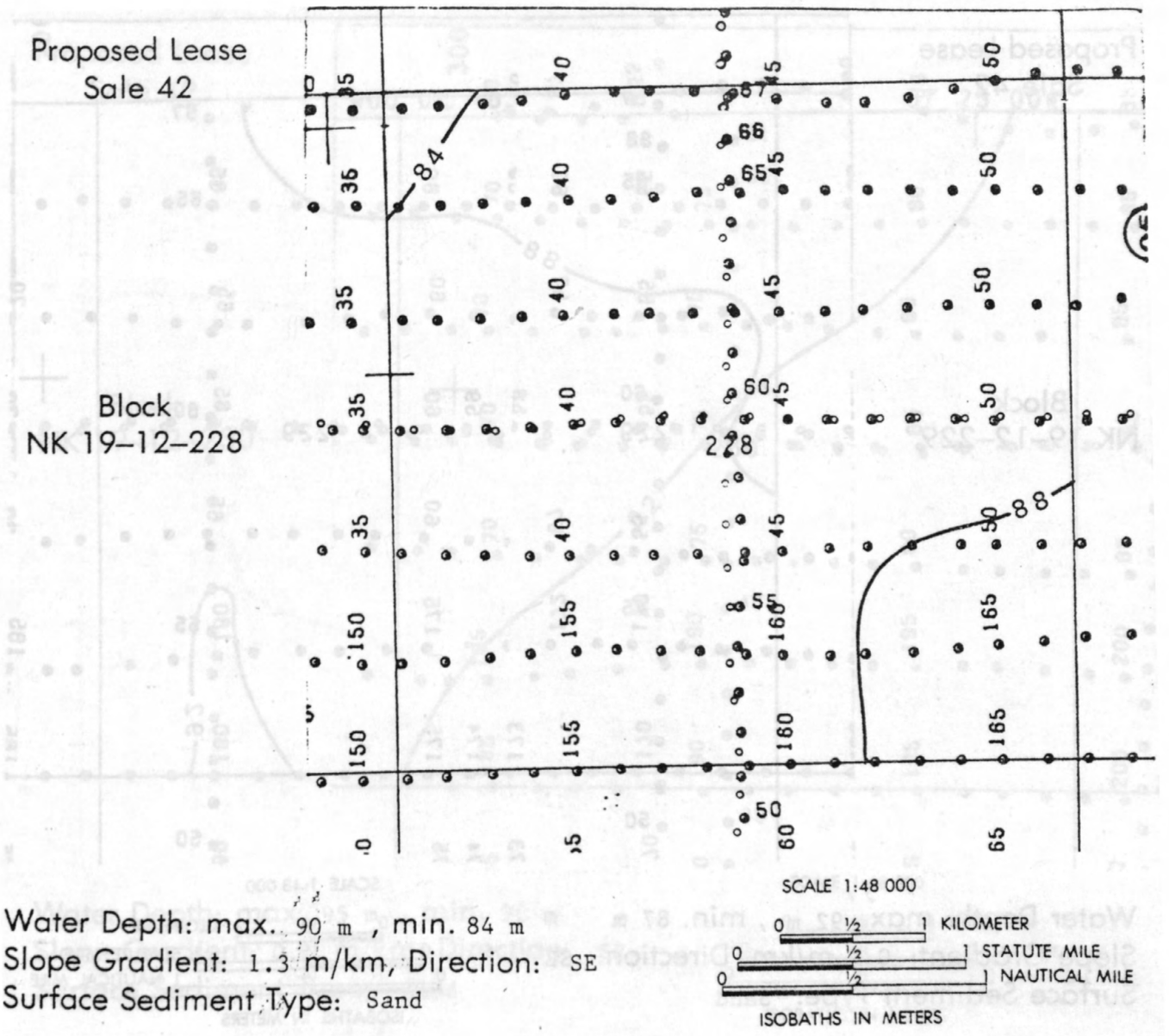
Water Depth: max. 79 m , min. 73 m
Slope Gradient: 1.3 m/km, Direction: E
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–227



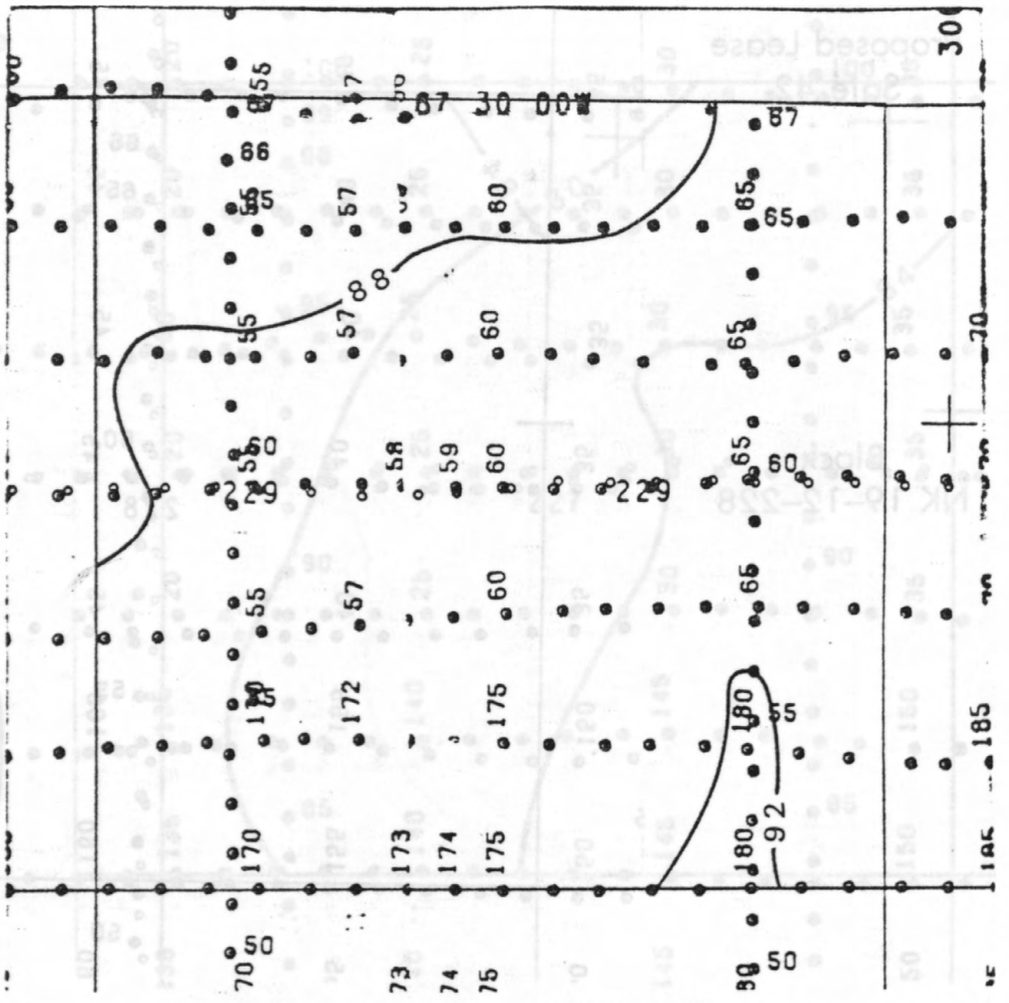
Water Depth: max. 85 m , min. 77 m
Slope Gradient: 1.7 m/km, Direction: SE
Surface Sediment Type: Sand



Water Depth: max. 90 m , min. 84 m
Slope Gradient: 1.3 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

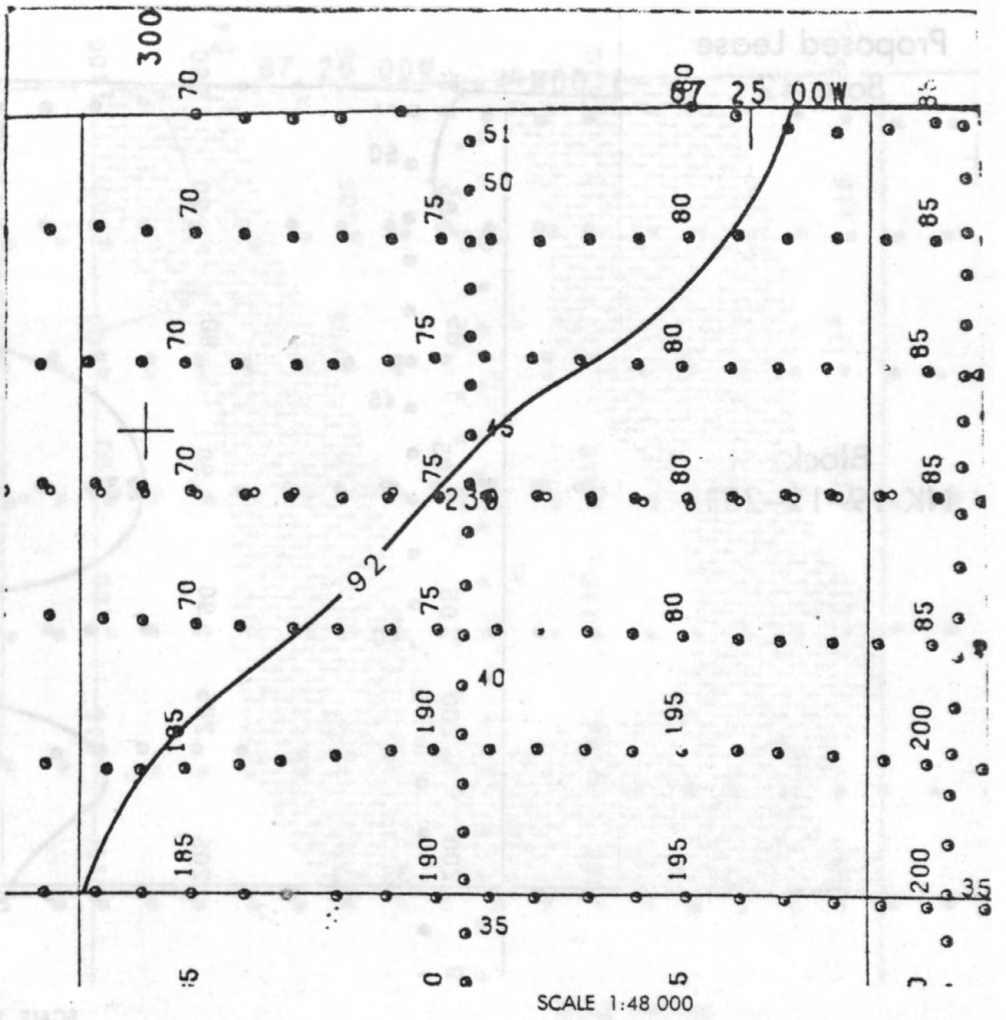
Block
NK 19–12–229



Water Depth: max. 92 m , min. 87 m
Slope Gradient: 0.7 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

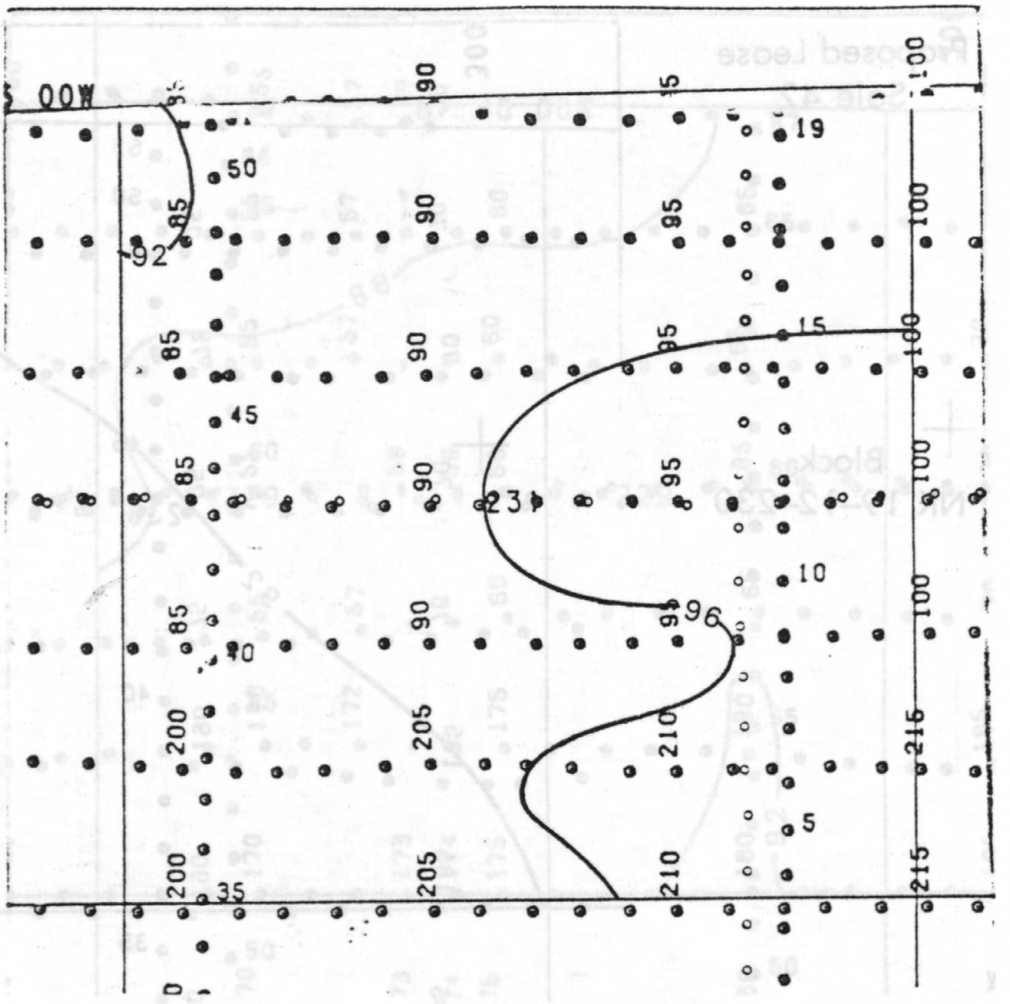
Block
NK 19–12–230



Water Depth: max. 95 m , min. 90 m
Slope Gradient: 0.7 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–231



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

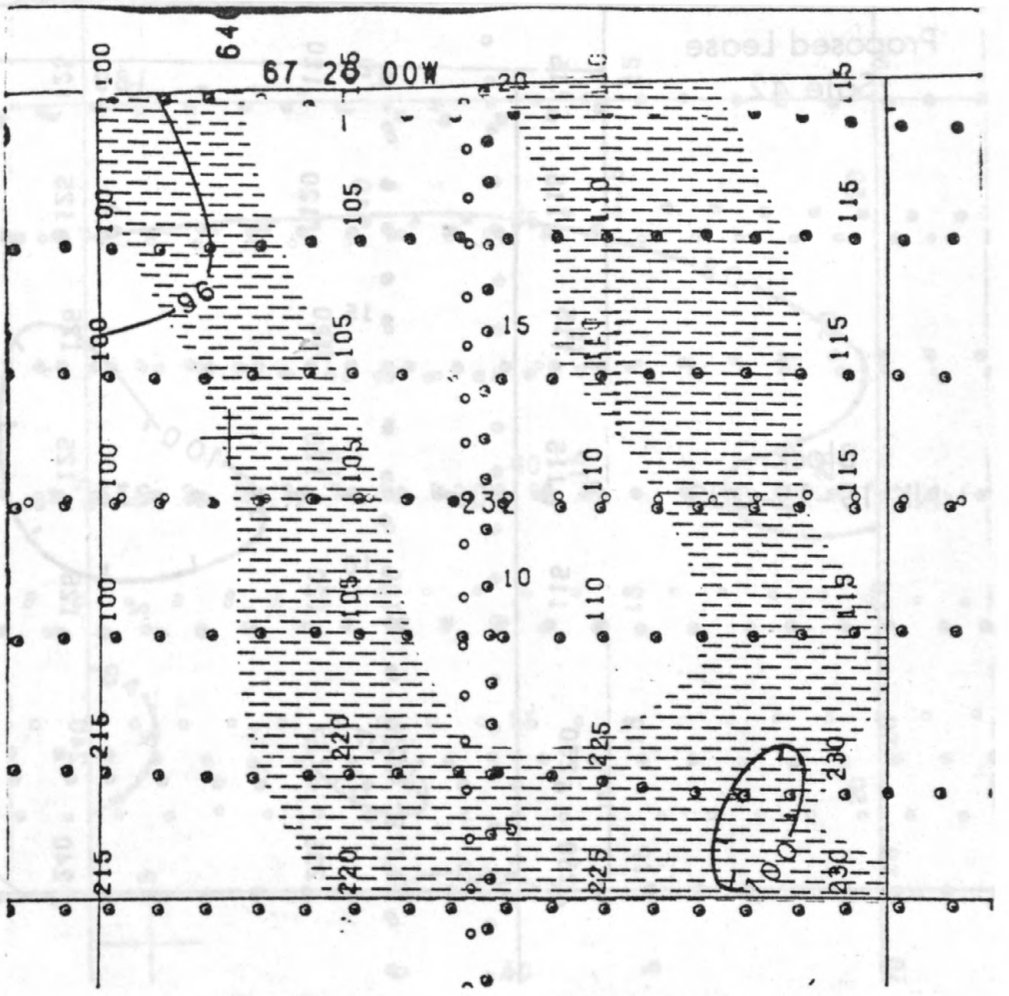
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max 98 m , min. 92 m
Slope Gradient: 0.6 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–232



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

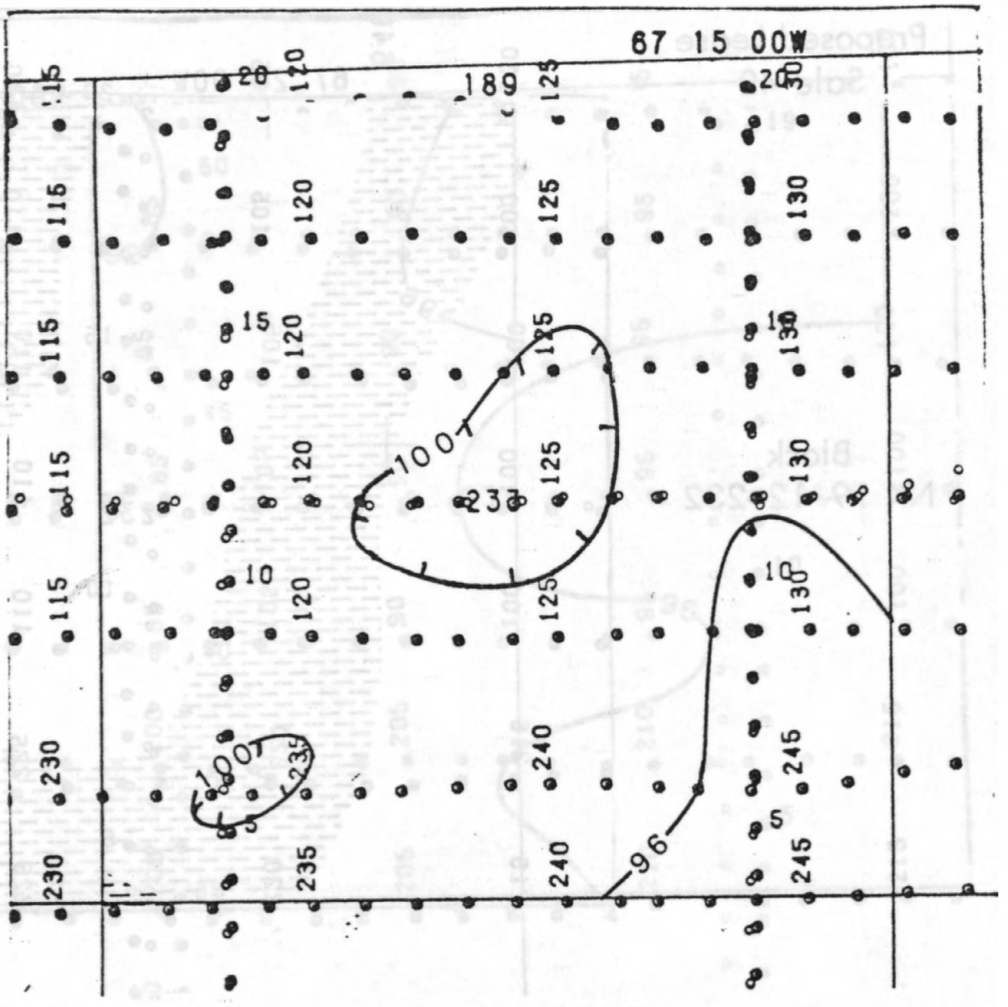
Water Depth: max. 100 m , min. 95 m
Slope Gradient: 0.7 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–12–233



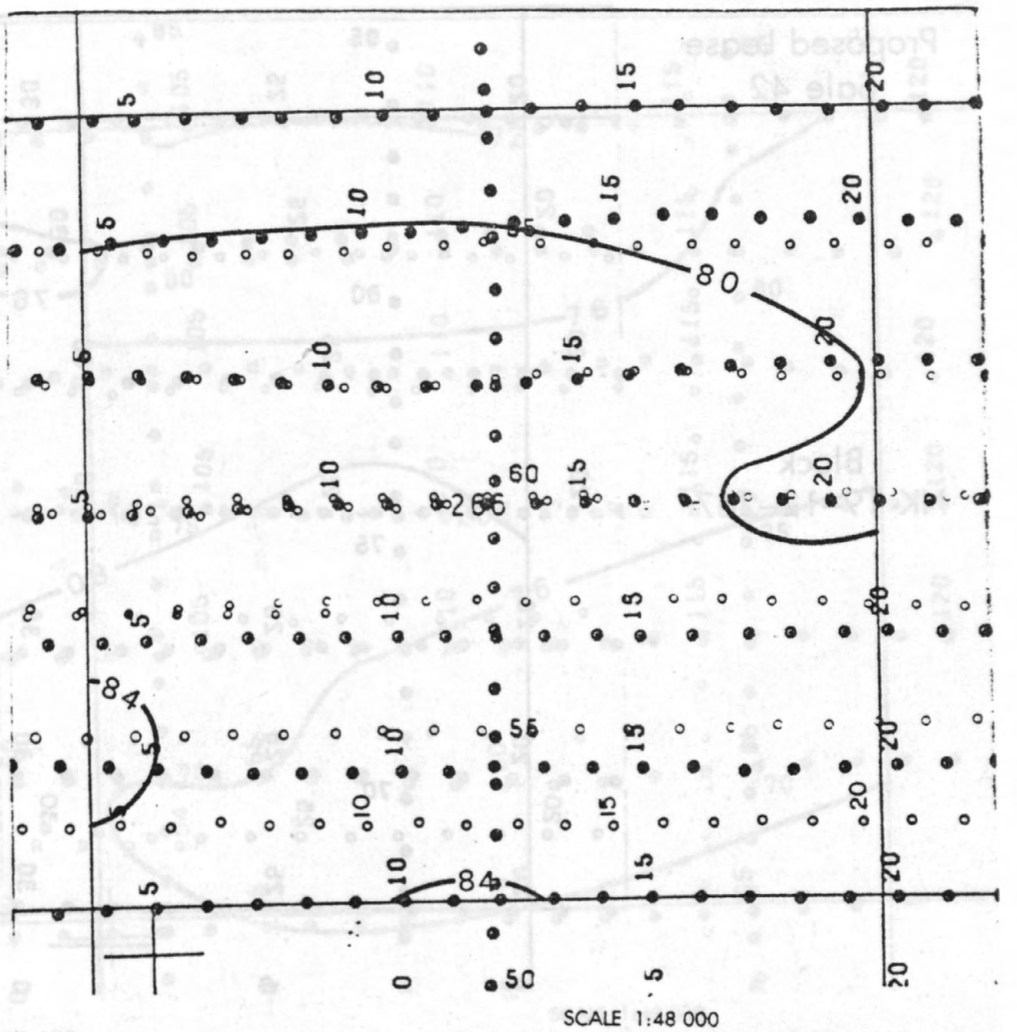
Water Depth: max. 101 m , min. 94 m
Slope Gradient: 2.1 m/km; Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–12–266



SCALE 1:48 000

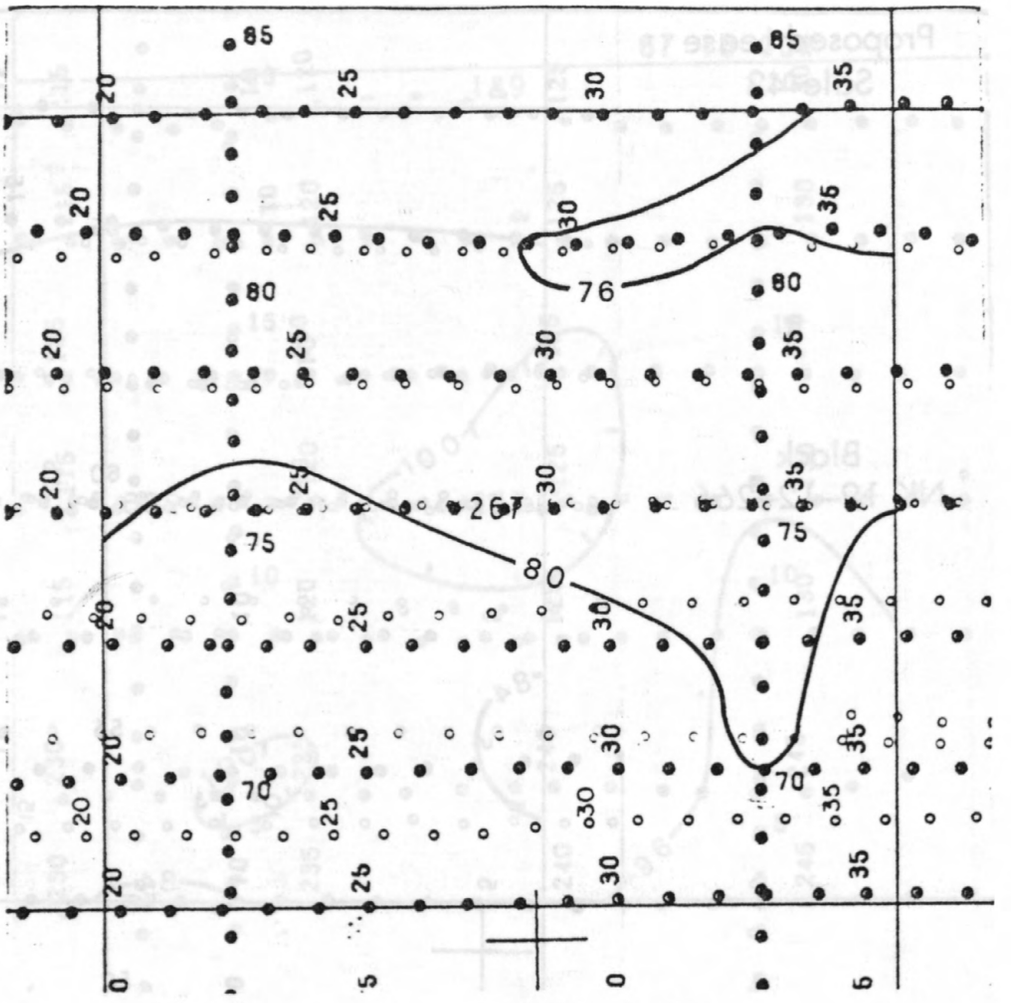
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 84 m , min. 77 m
Slope Gradient: 1.5 m/km, Direction: SW
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–267

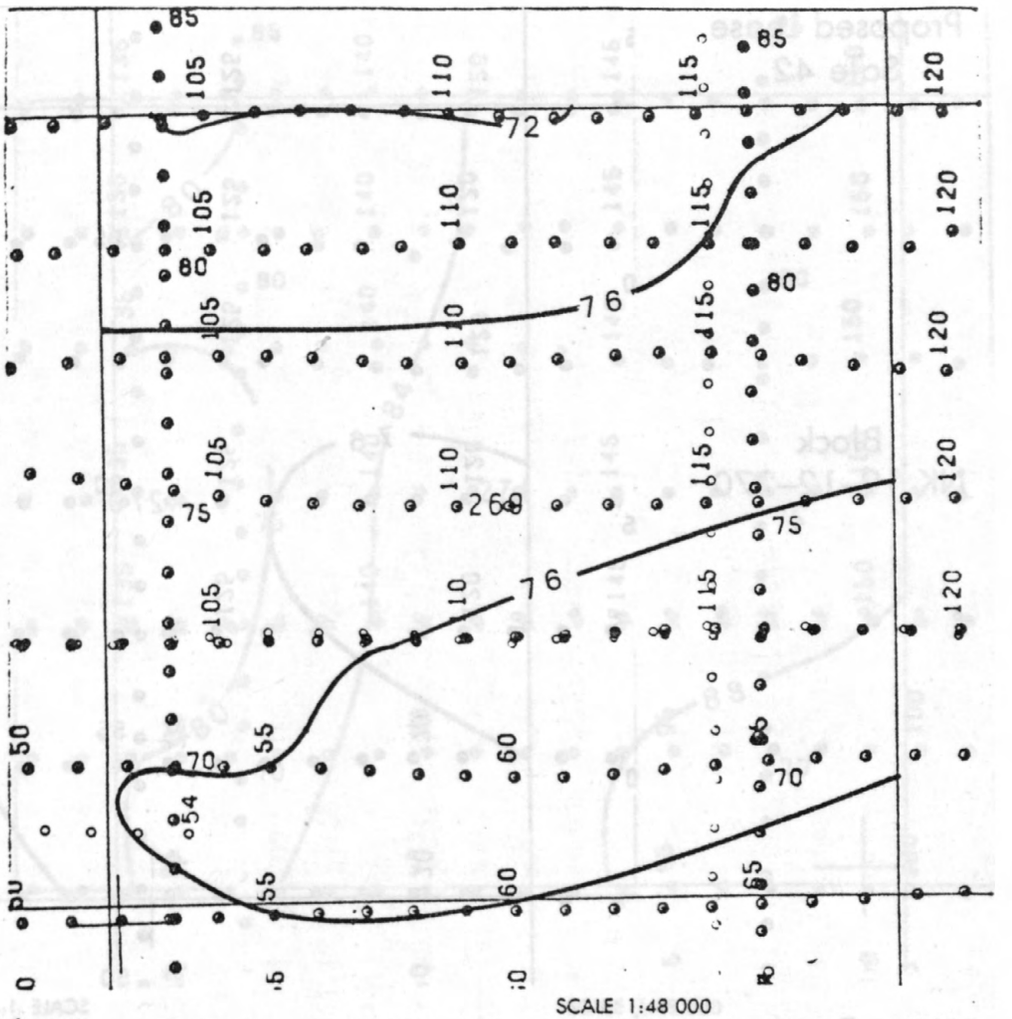


Water Depth: max. 83 m , min. 76 m
Slope Gradient: 1:6 m/km, Direction: SW
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

Proposed Lease
Sale 42

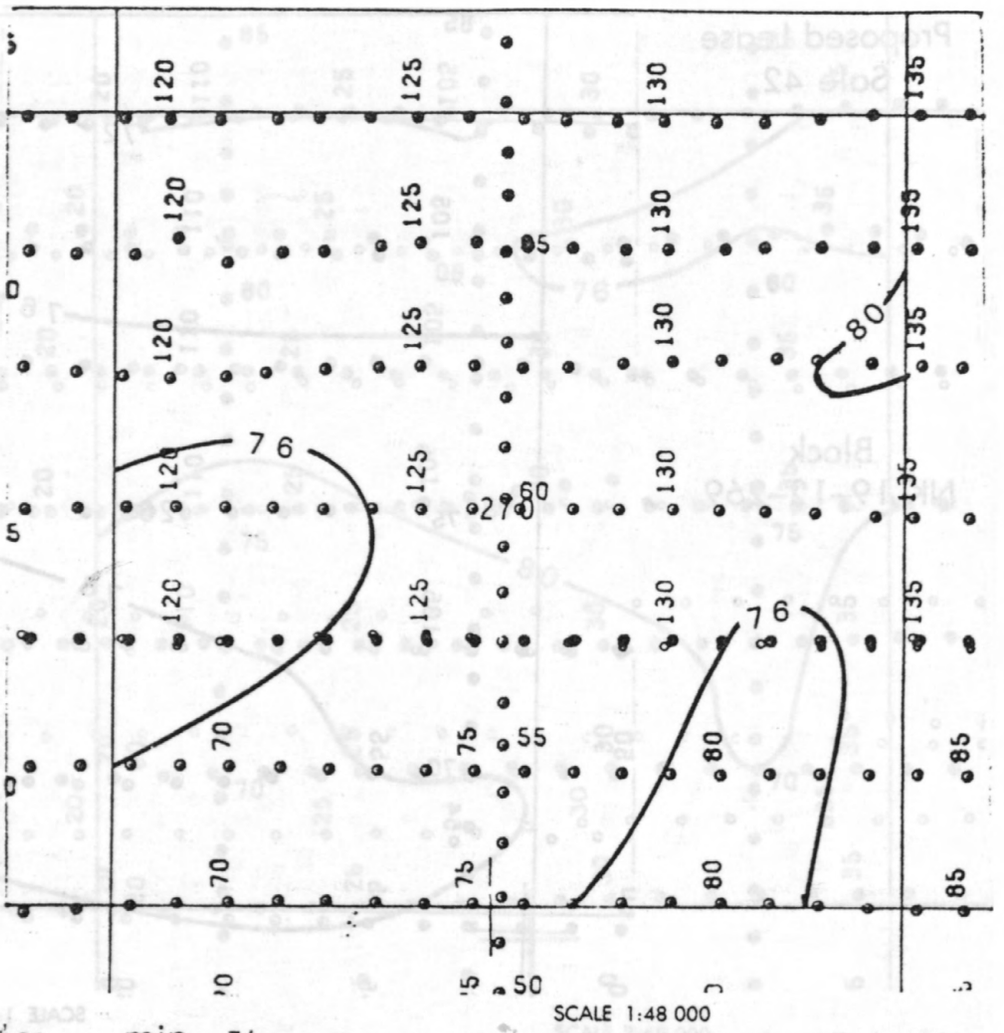
Block
NK 19–12–269



Water Depth: max. 79 m , min. 72 m
Slope Gradient: 1.5 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

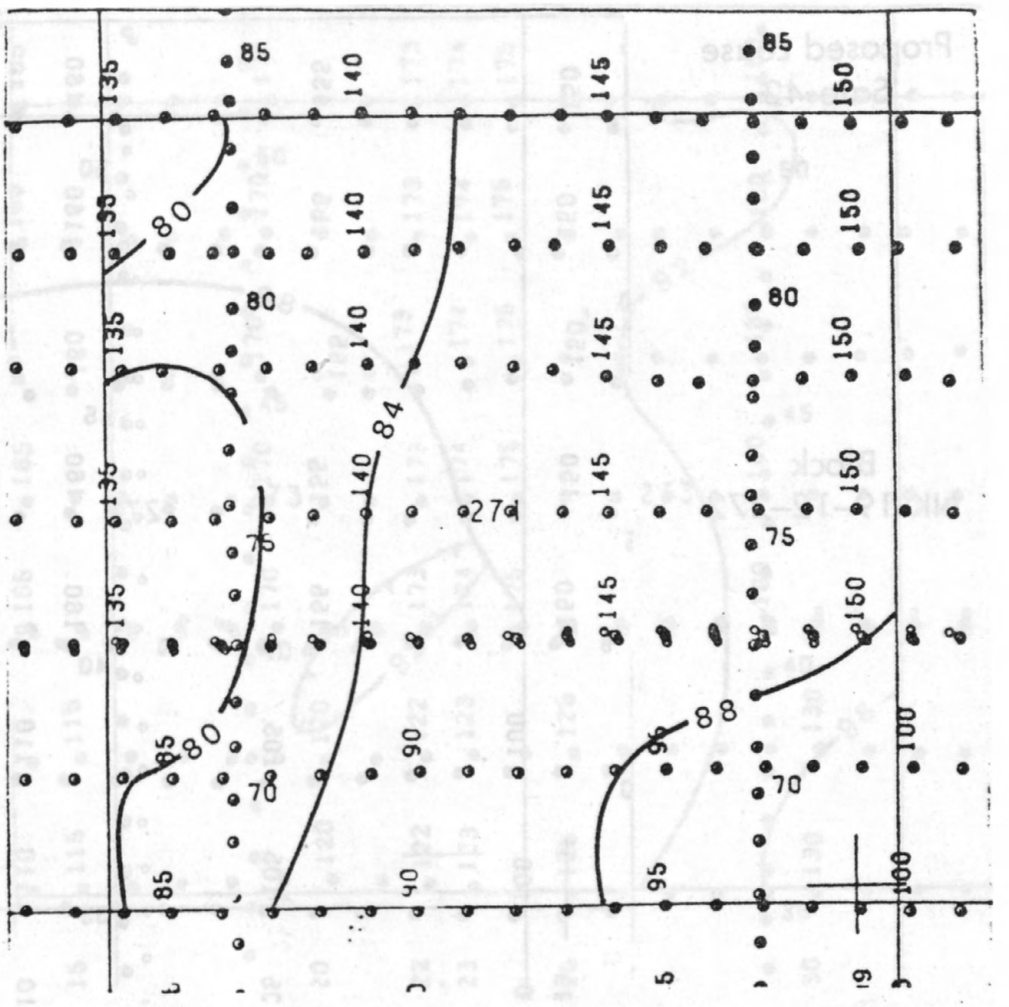
Block
NK 19–12–270



Water Depth: max. 81 m , min. 74 m
Slope Gradient: 1.5 m/km, Direction: E
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–271

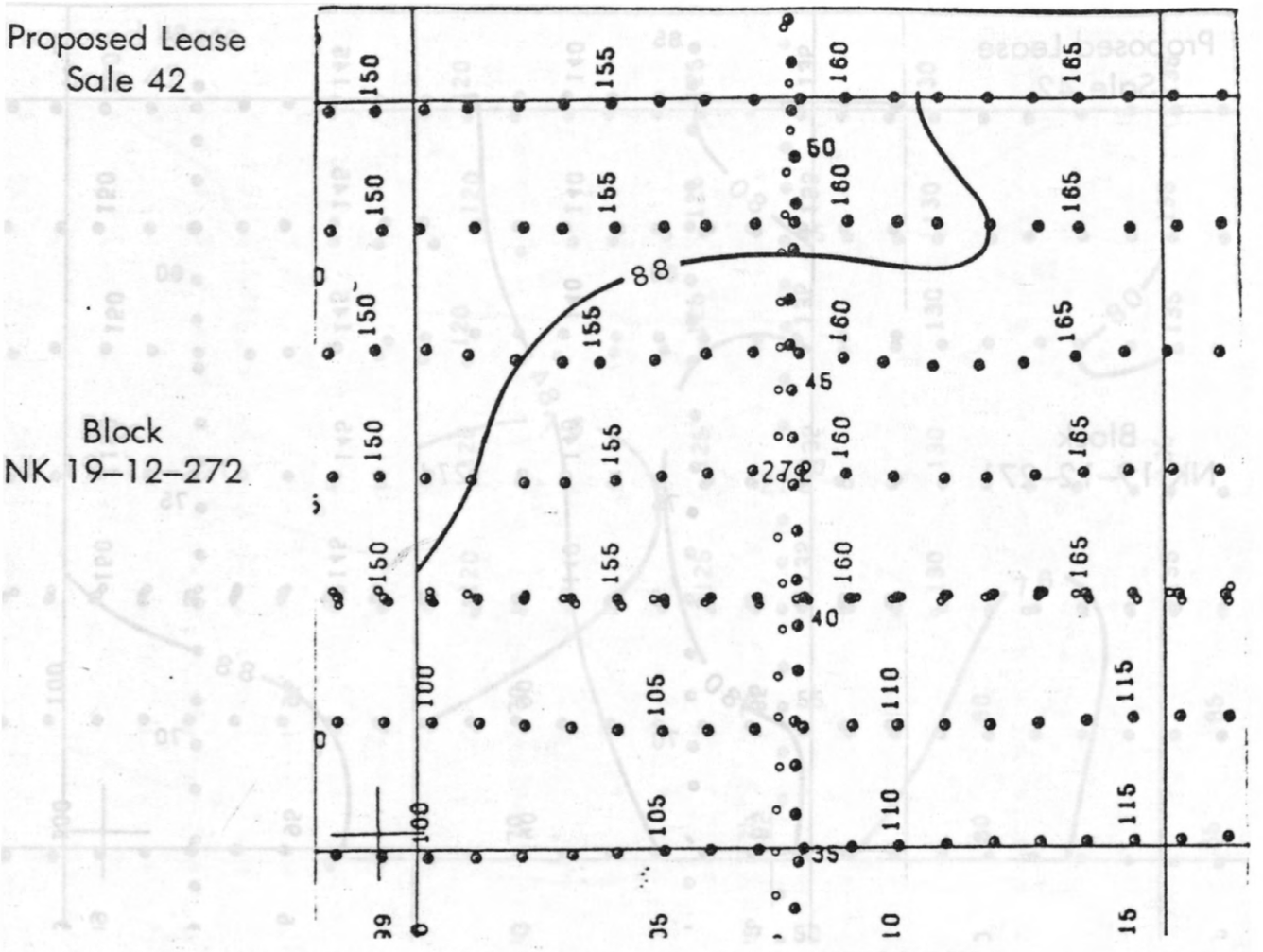


SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 89 m , min. 79 m
Slope Gradient: 2.1 m/km, Direction: E
Surface Sediment Type: Sand



Water Depth: max. 91 m , min. 85 m
Slope Gradient: 1.5 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER

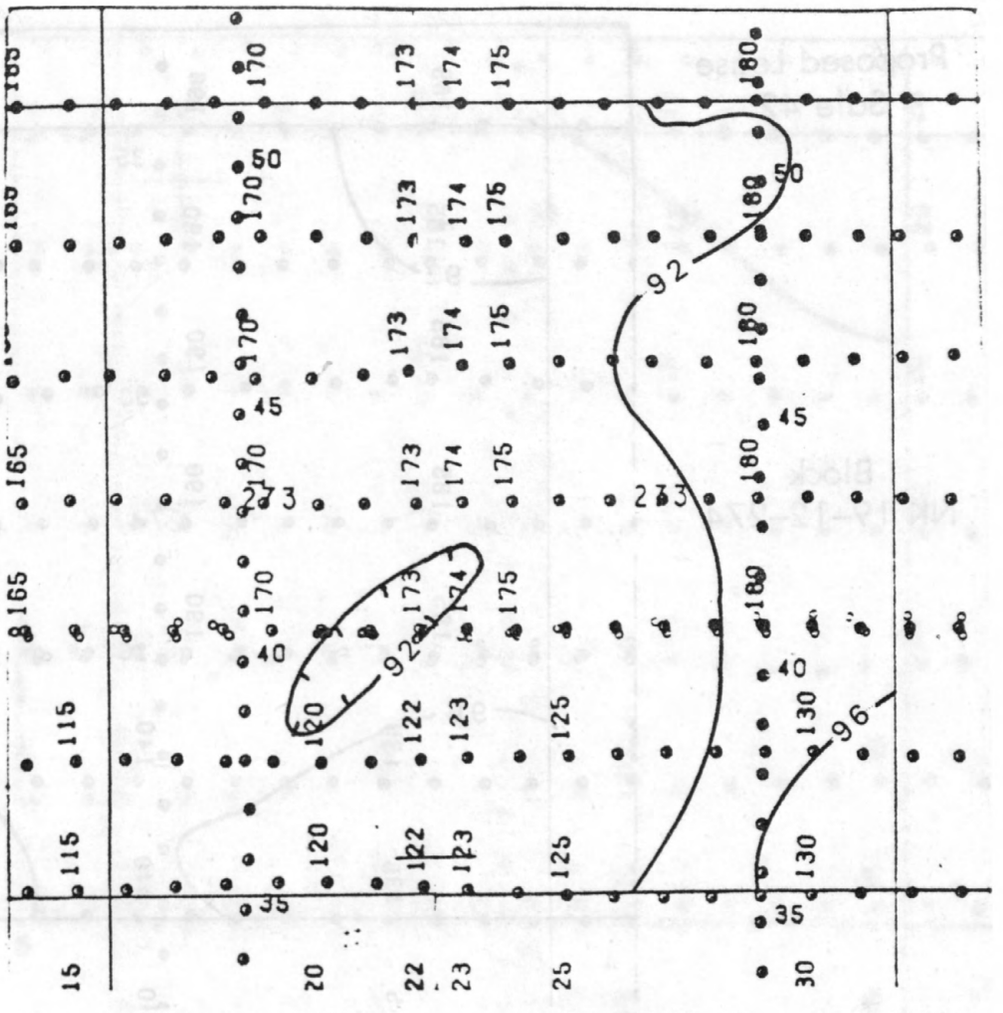
0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Proposed Lease
Sale 42

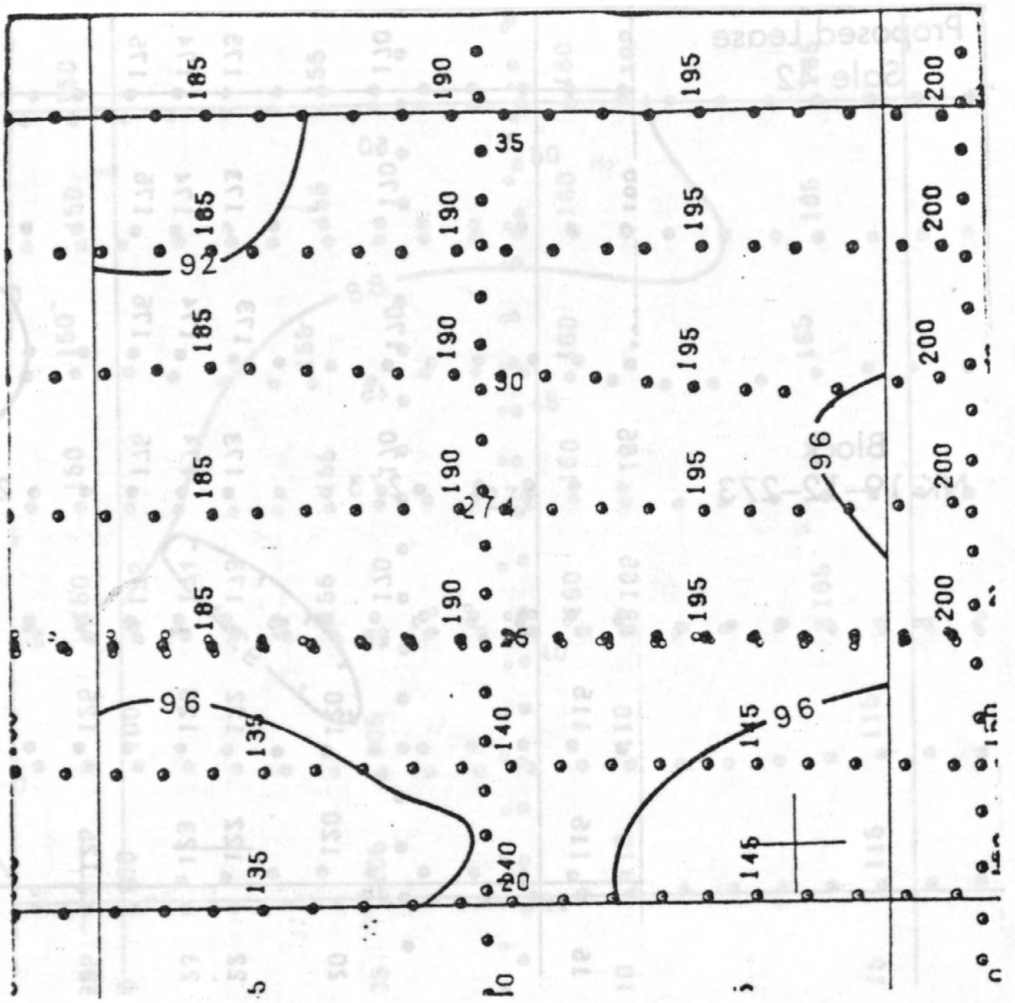
Block
NK 19–12–273



Water Depth: max. 97 m , min. 90 m
Slope Gradient: 1 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

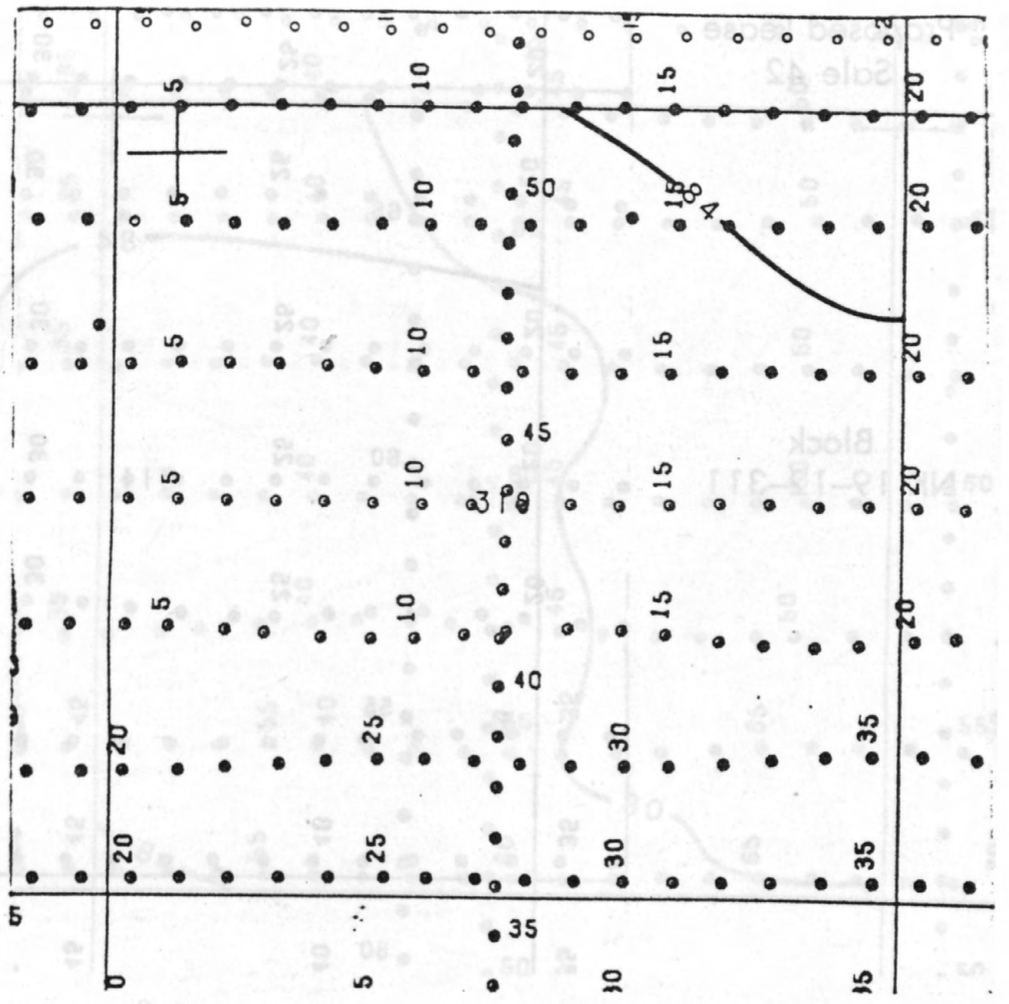
Block
NK 19–12–274



Water Depth: max. 98 m , min. 92 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

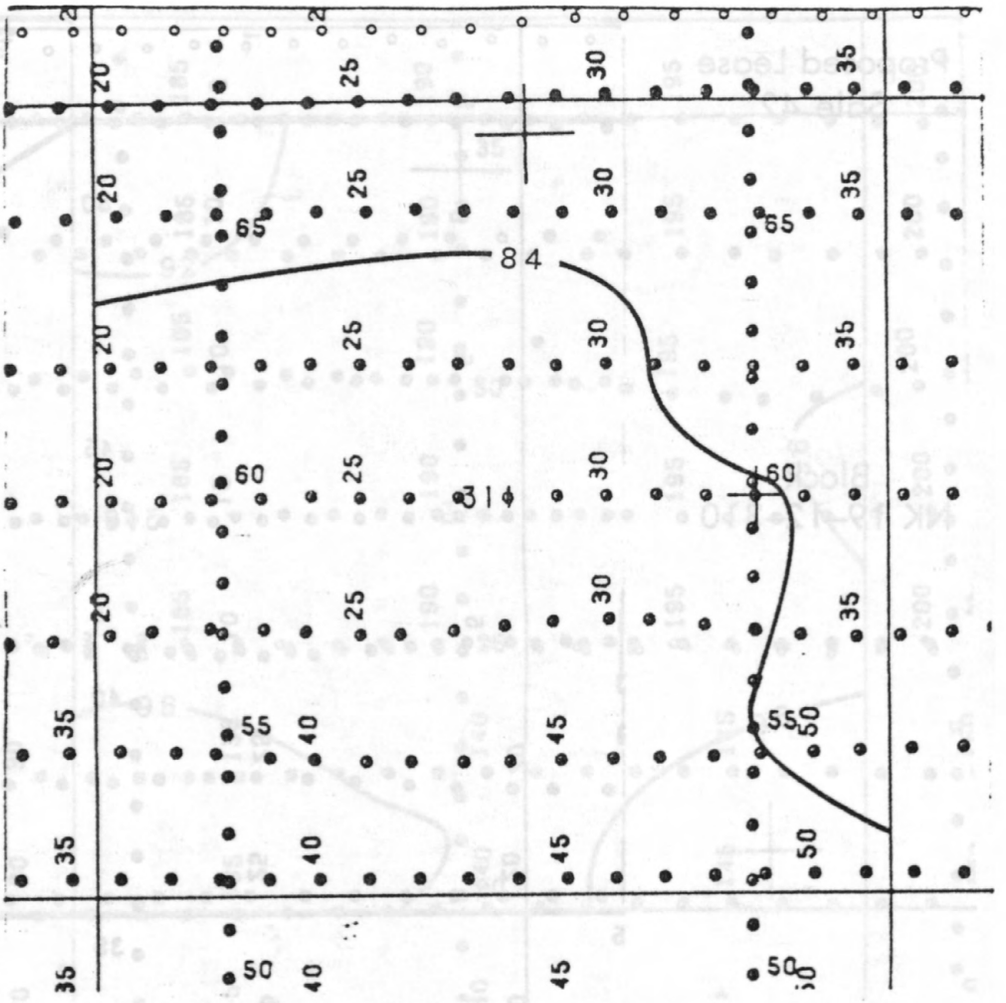
Block
NK 19–12–310



Water Depth: max. 87 m , min. 82 m
Slope Gradient: 1.1 m/km, Direction: SW
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–311



Water Depth: max. 85 m , min. 81 m
Slope Gradient: 1.1 m/km, Direction: SW
Surface Sediment Type: Sand

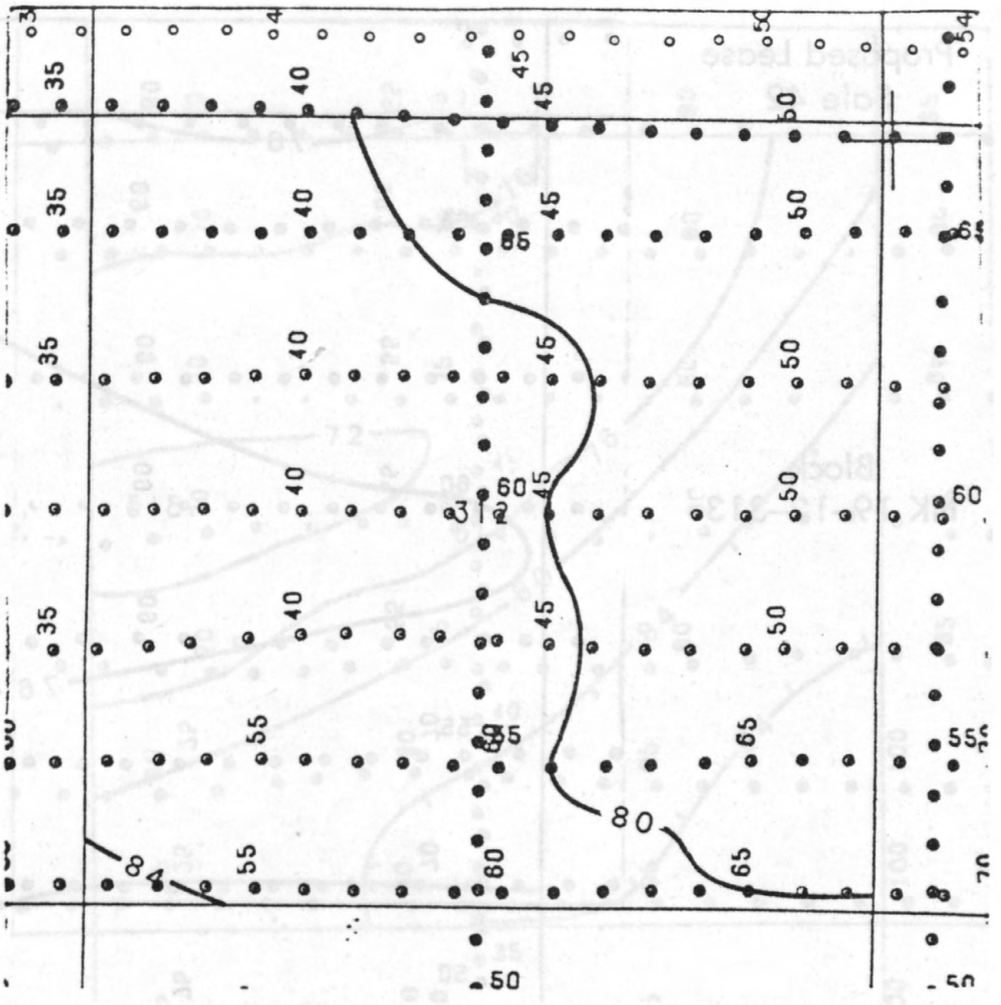
SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–12–312



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

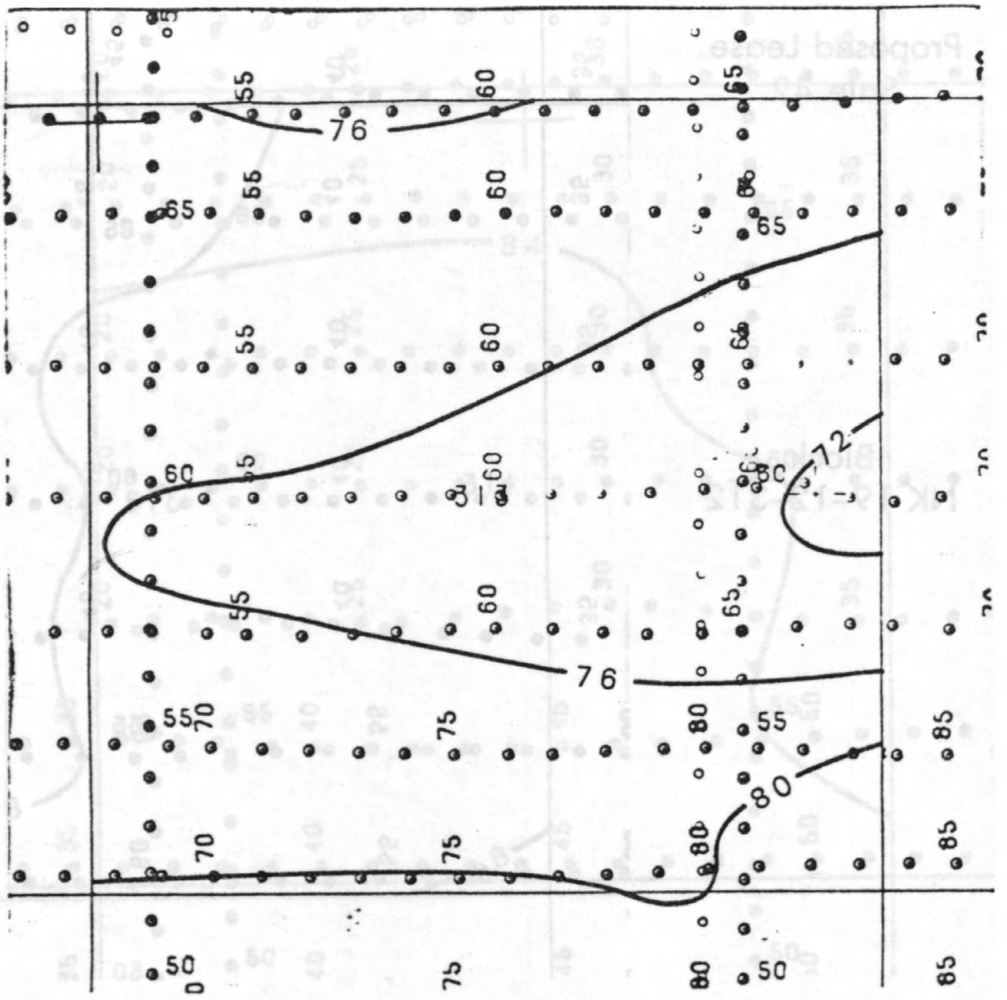
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 84 m , min. 77 m
Slope Gradient: 1.5 m/km, Direction: SW
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–313



SCALE 1:48 000

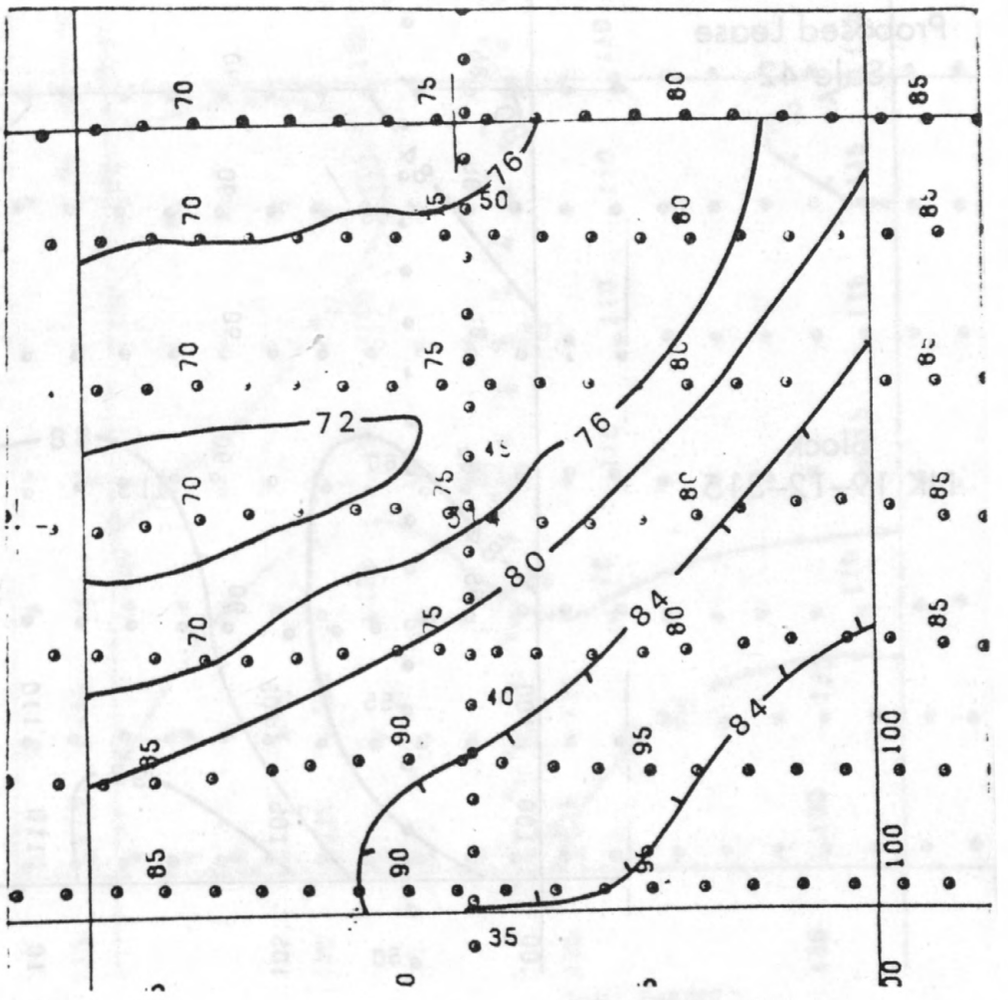
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 81 m , min. 72 m
Slope Gradient: 4.5 m/km, Direction: S
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–314



SCALE 1:48 000

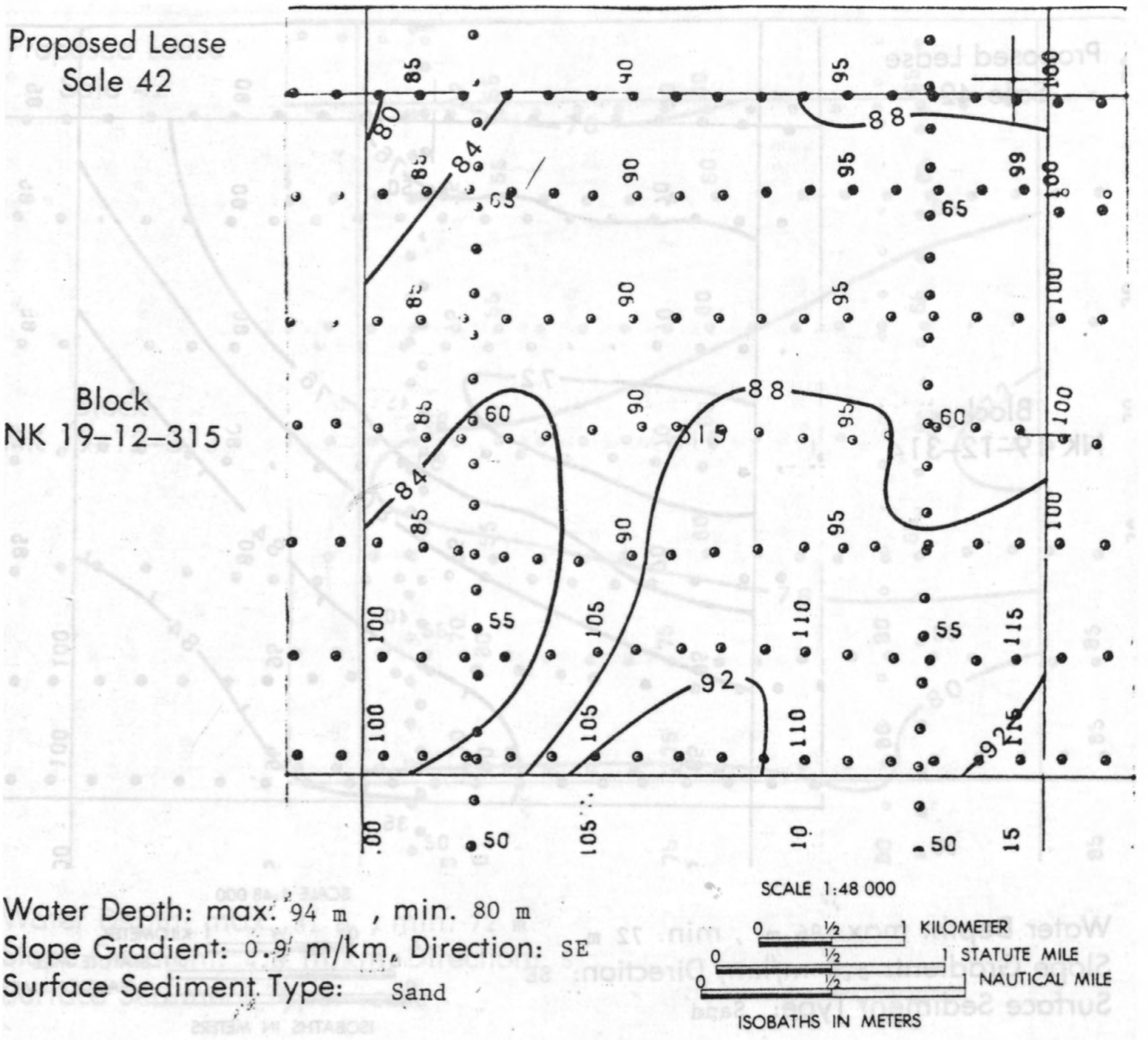
0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

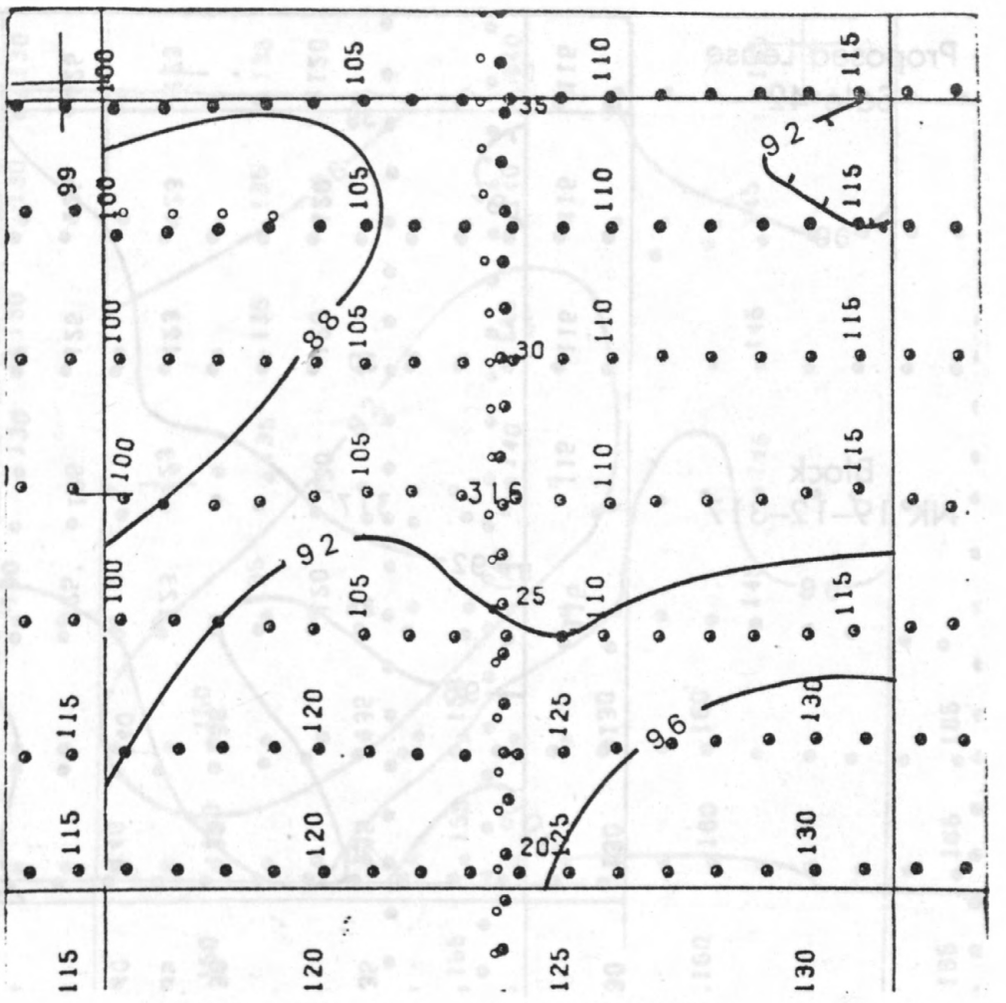
Water Depth: max. 86 m , min. 72 m
Slope Gradient: 5.6 m/km, Direction: SE
Surface Sediment Type: Sand



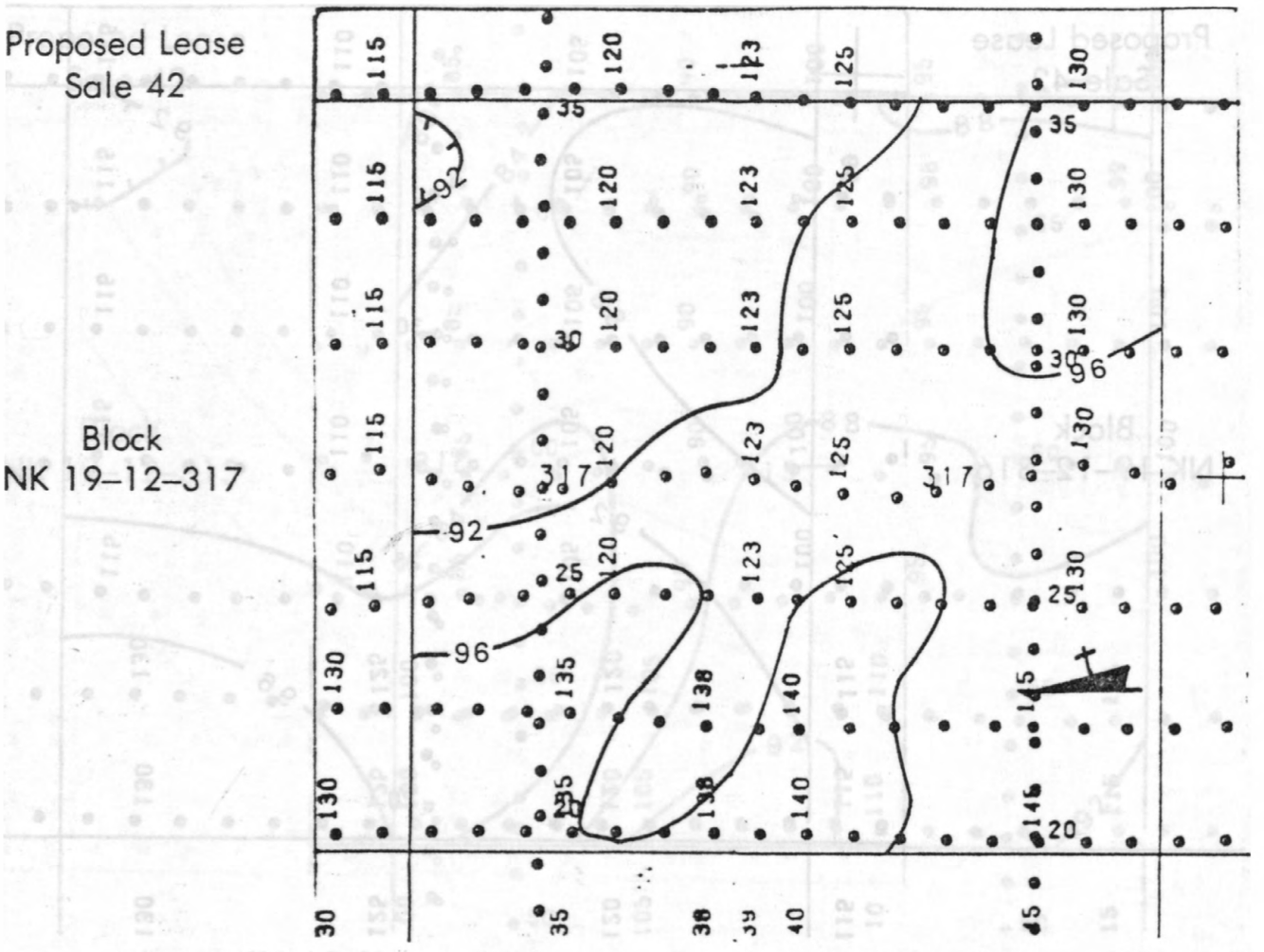
Water Depth: max. 94 m , min. 80 m
Slope Gradient: 0.9 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–316



Water Depth: max. 97 m , min. 87 m
Slope Gradient: 1.3 m/km, Direction: SE
Surface Sediment Type: Sand



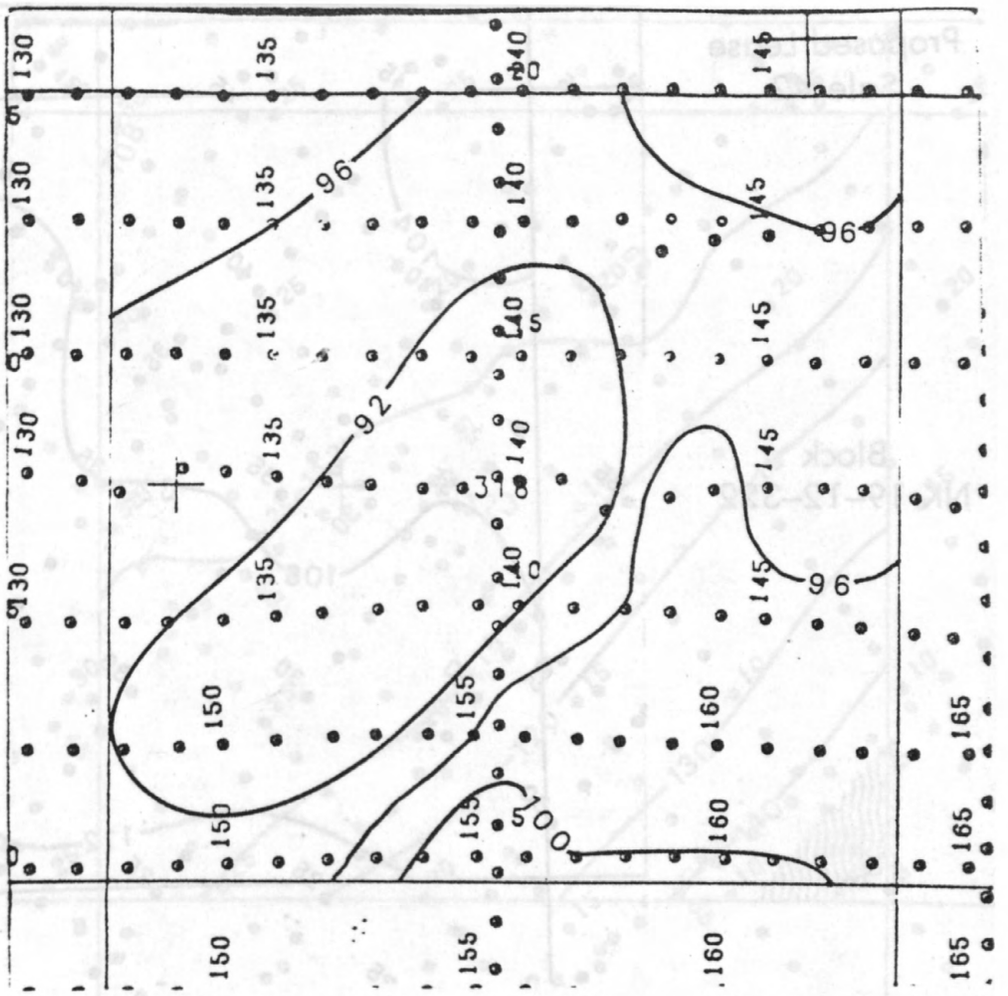
Water Depth: max. 97 m , min. 90 m
Slope Gradient: 1.8 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Shipwreck (from BLM, Final Environmental Statement, OCS Sale No. 42, Visual No. 1)

Proposed Lease
Sale 42

Block
NK 19–12–318

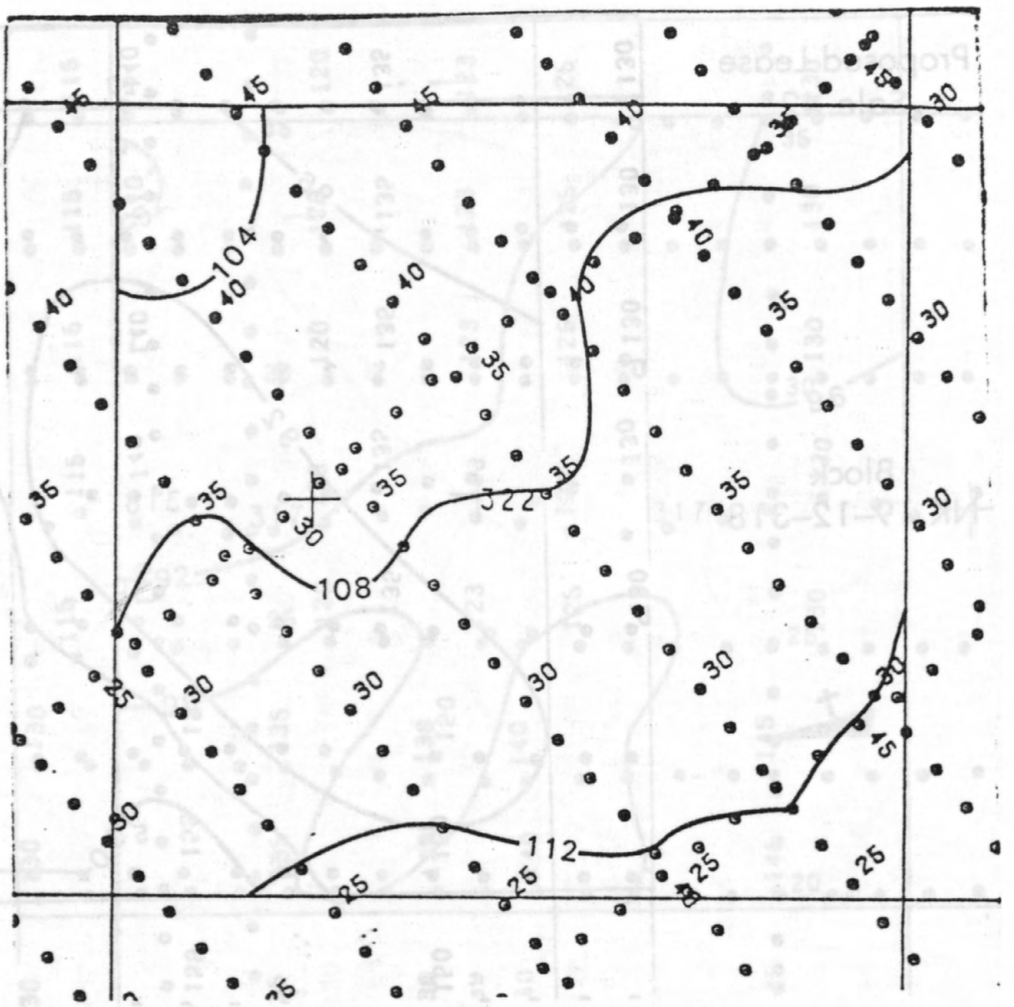


Water Depth: max. 101 m, min. 90 m
Slope Gradient: 7.3 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–12–322

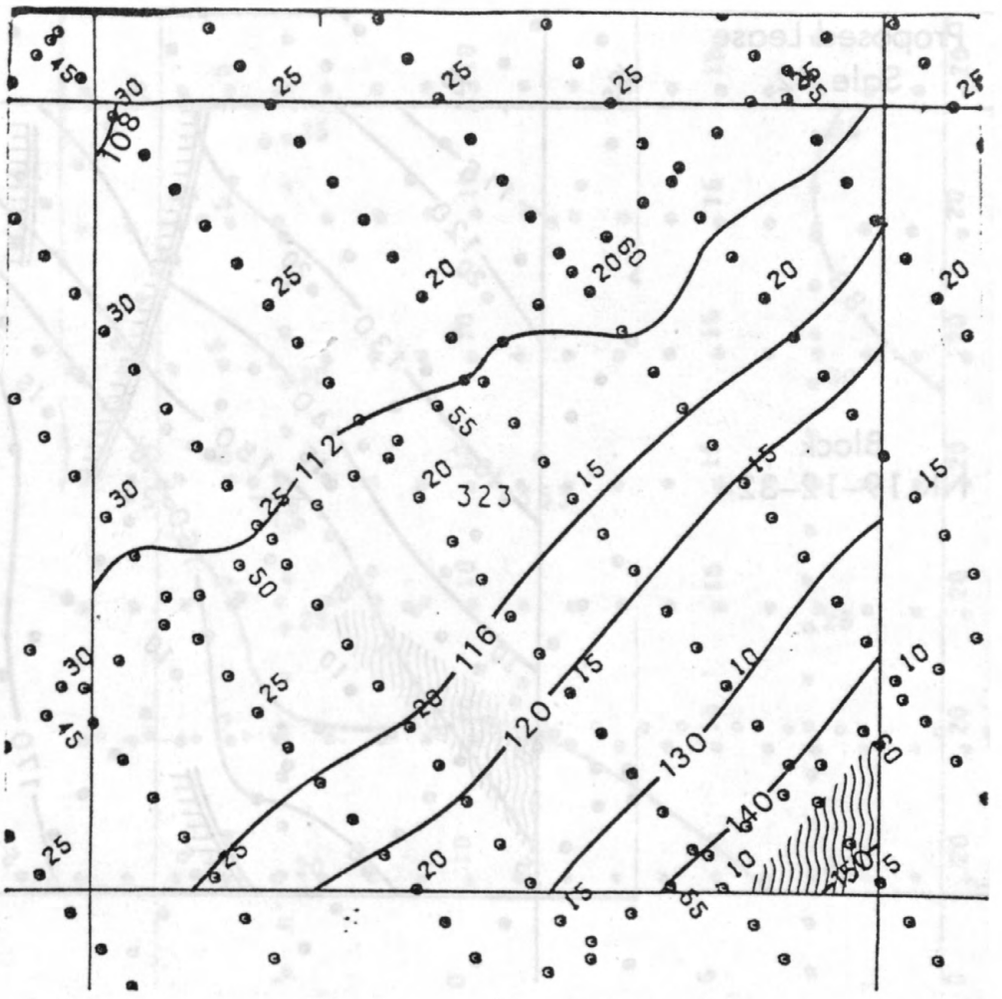


Water Depth: max. 113 m , min. 102 m
Slope Gradient: 1.6 m/km, Direction: SE
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

Proposed Lease
Sale 42

Block
NK 19–12–323



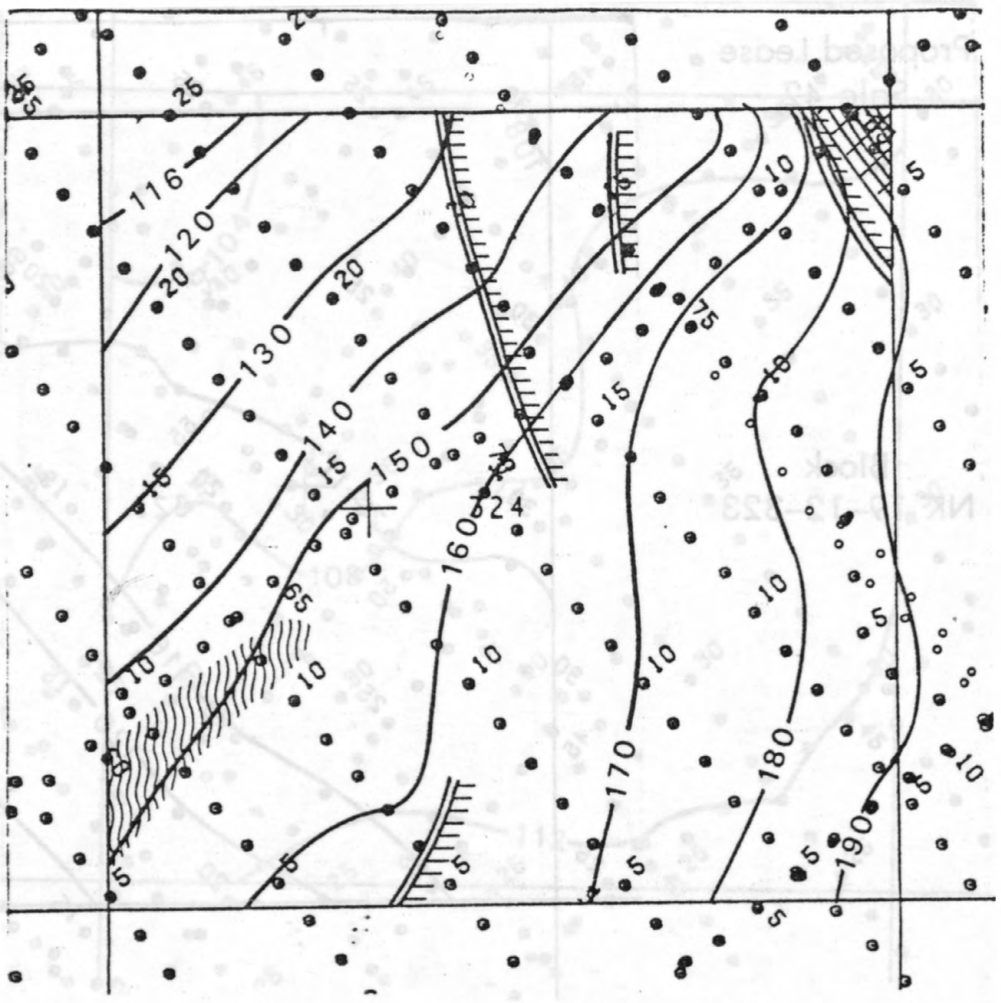
Water Depth: max. 154 m , min. 107 m
Slope Gradient: 2.7 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–12–324



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 195 m , min. 113 m
Slope Gradient: 12.1 m/km, Direction: SE
Surface Sediment Type: Sand

POTENTIAL HAZARD

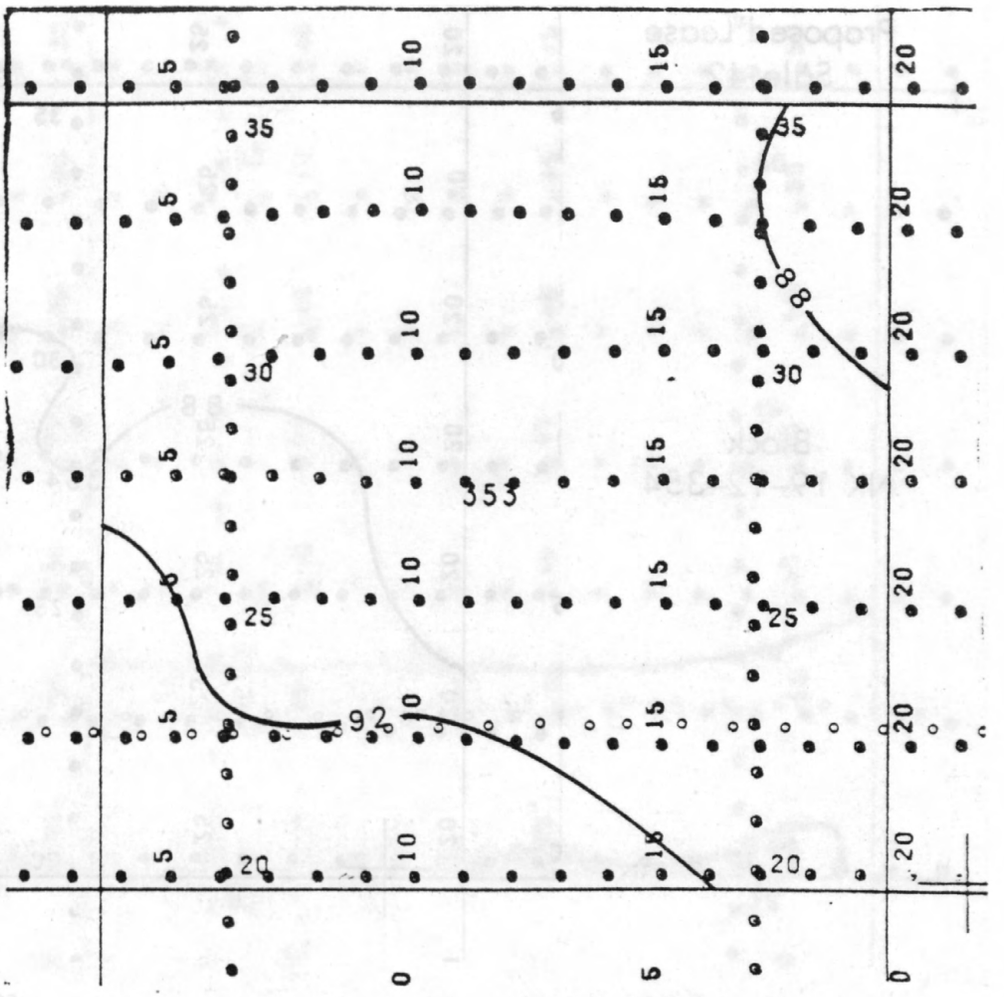
Fault at "I" Reflector

CONSTRAINTS

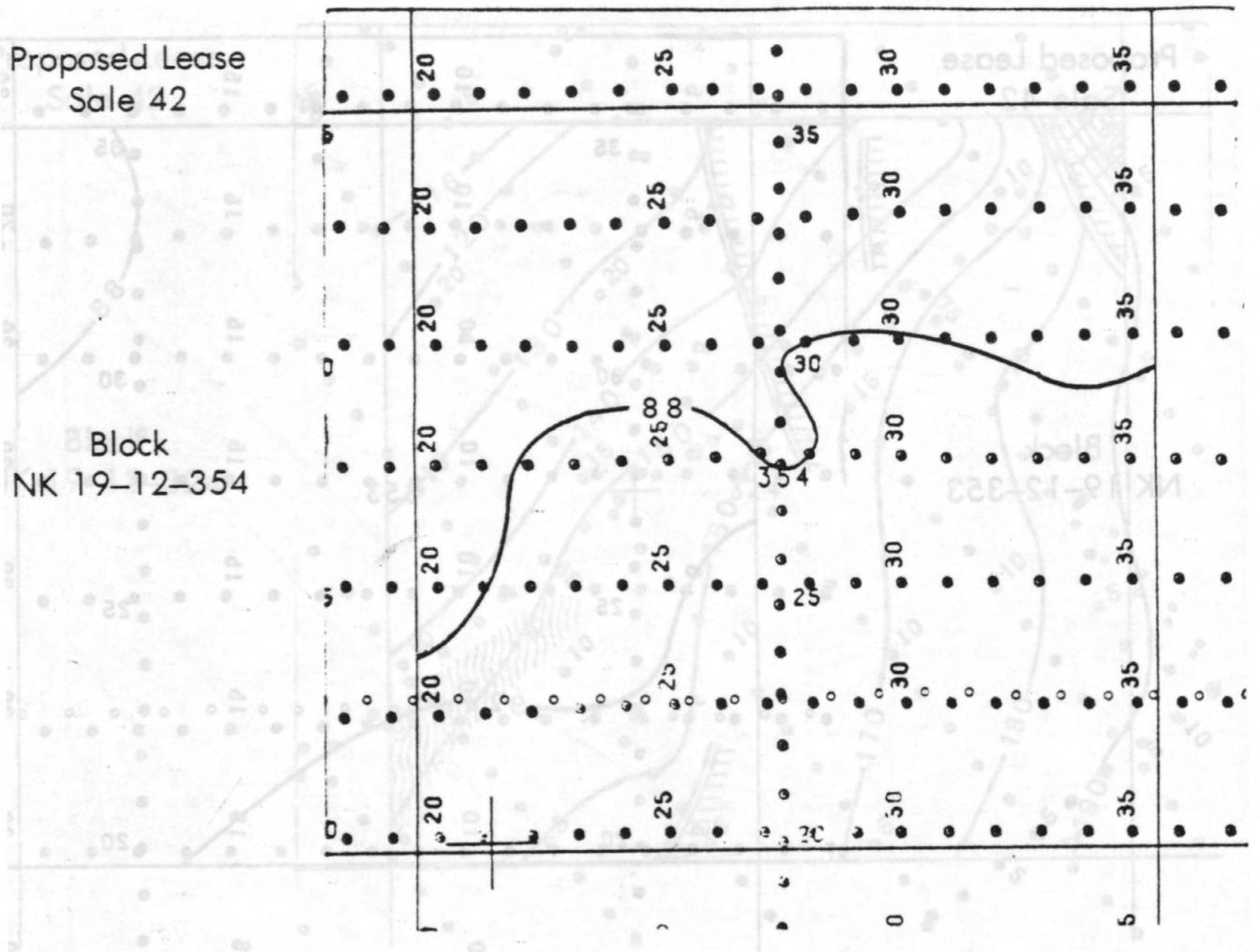
Potentially Unstable Slope

Sand Wave Field

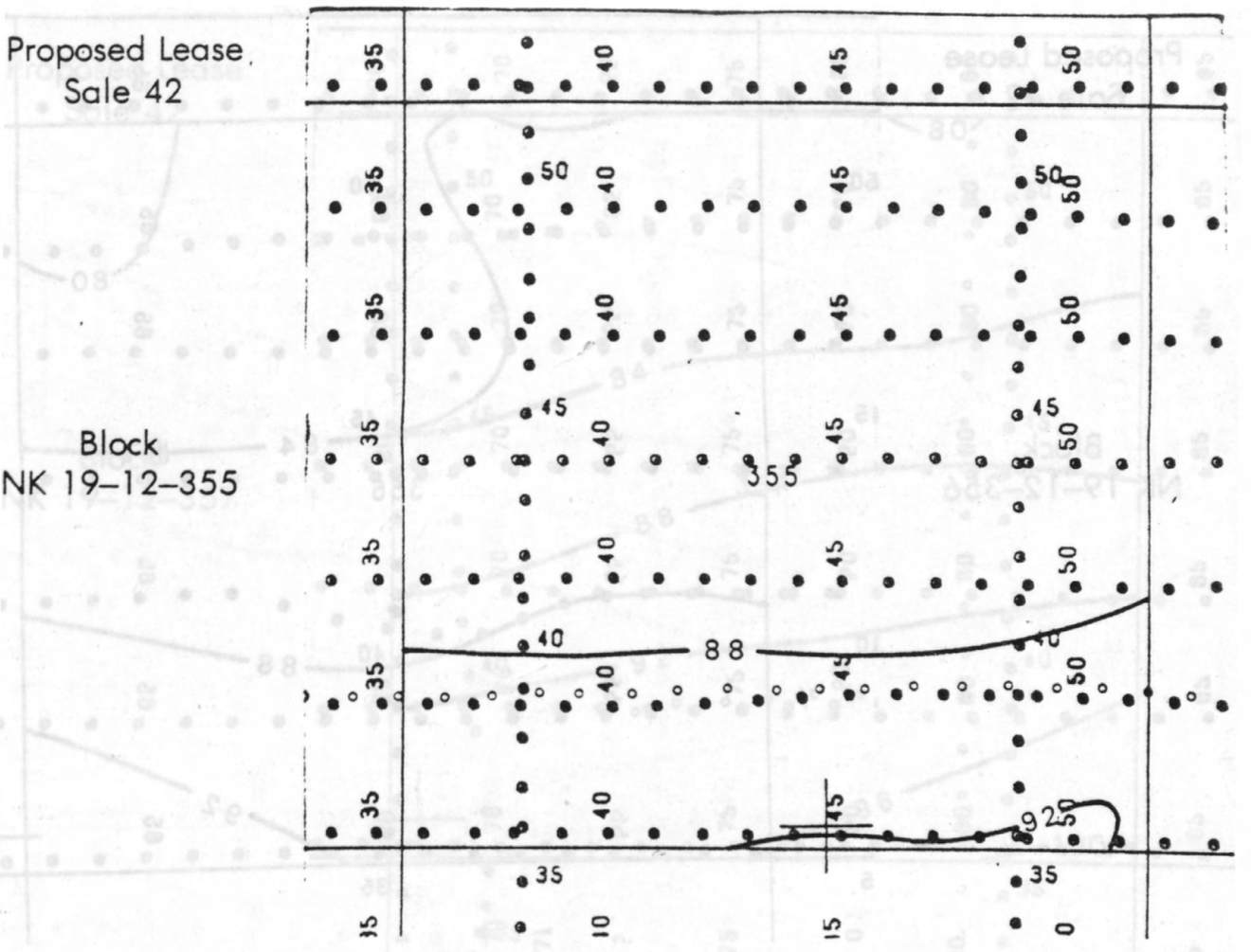
Proposed Lease
Sale 42



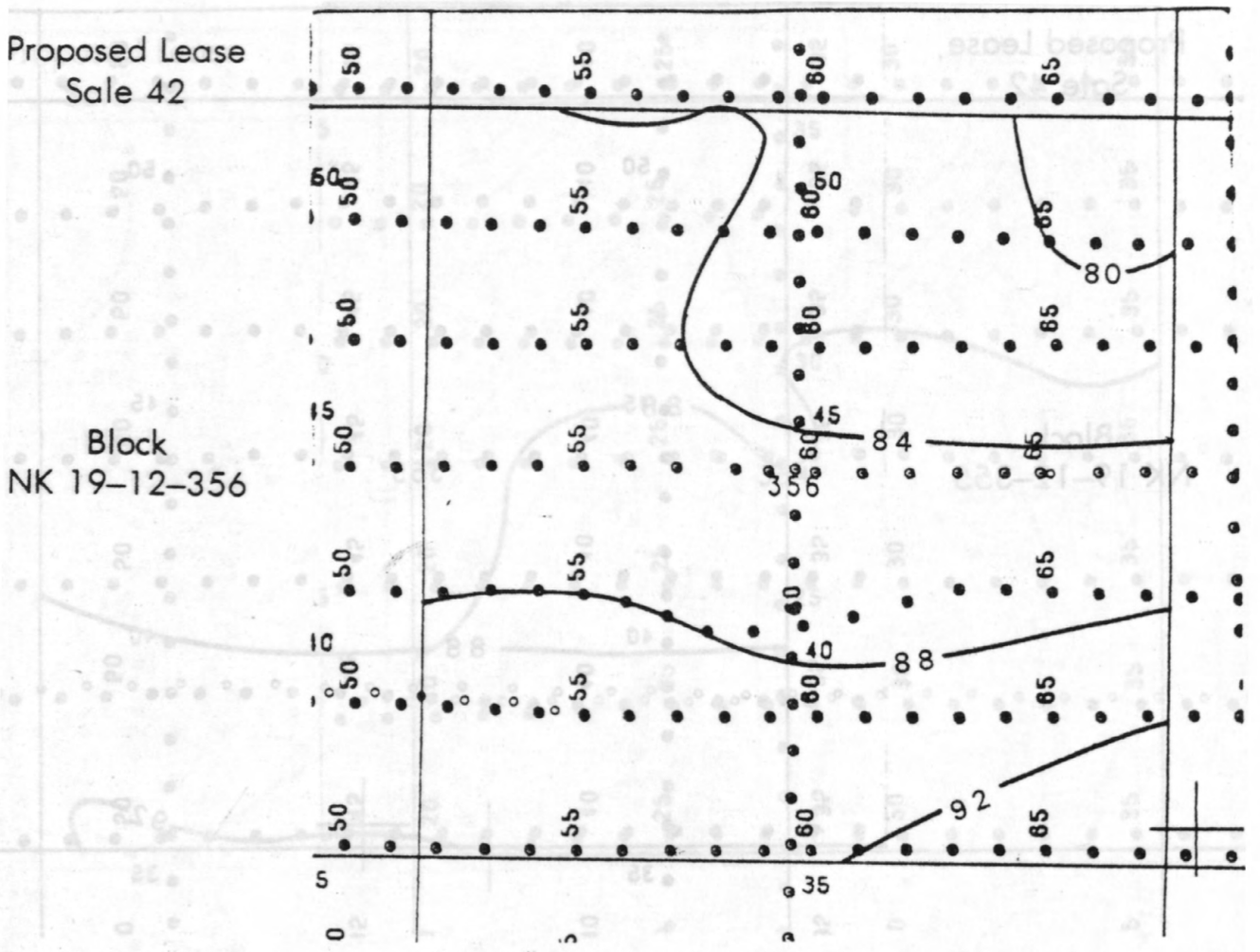
Water Depth: max. 94 m , min. 87 m
Slope Gradient: 1 m/km, Direction: SW
Surface Sediment Type: Sand



Water Depth: max. 91 m, min. 86 m
Slope Gradient: 0.7 m/km, Direction: SW
Surface Sediment Type: Sand

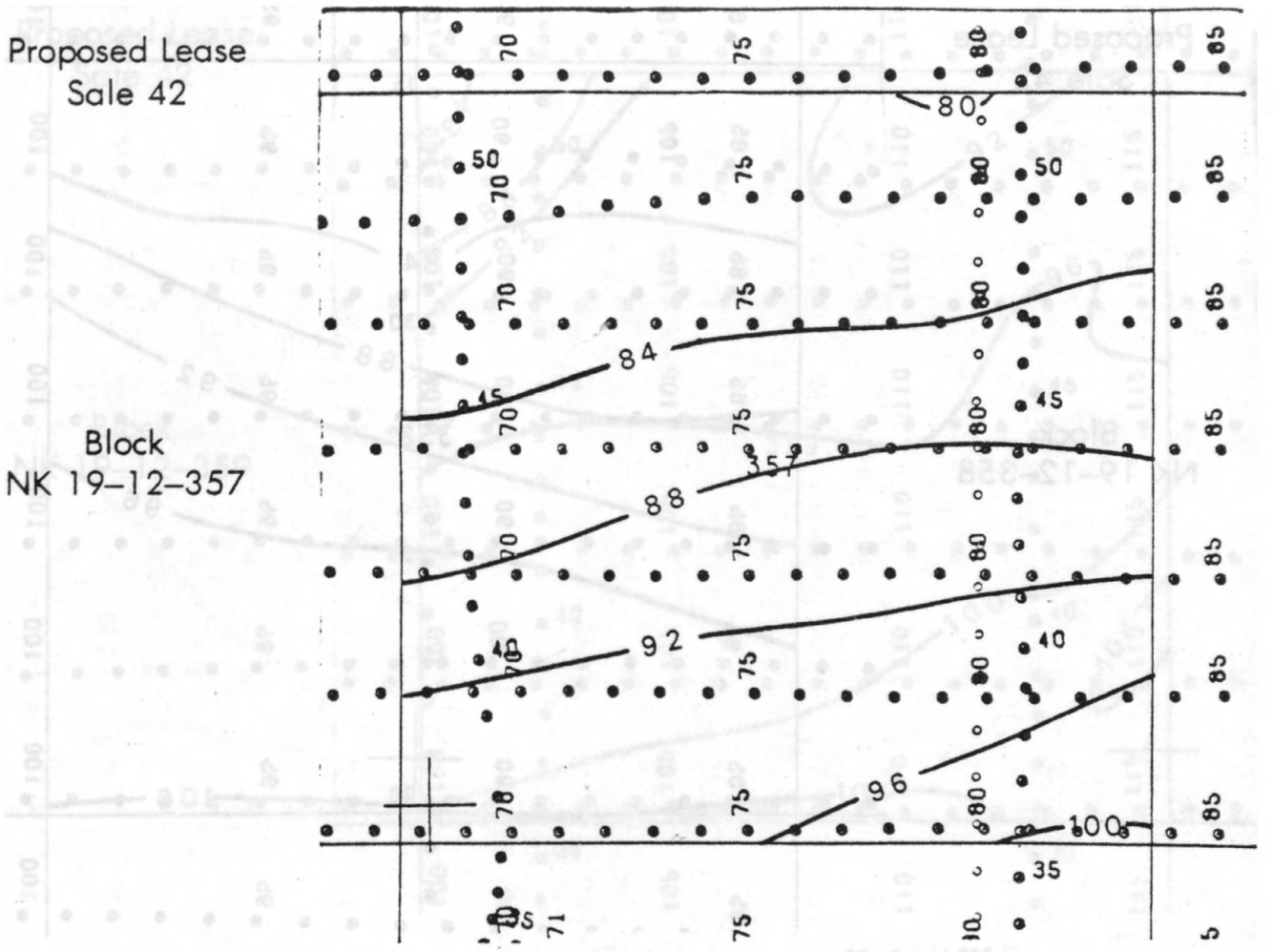


Water Depth: max. 92 m, min. 84 m
Slope Gradient: 1.7 m/km, Direction: S
Surface Sediment Type: Sand

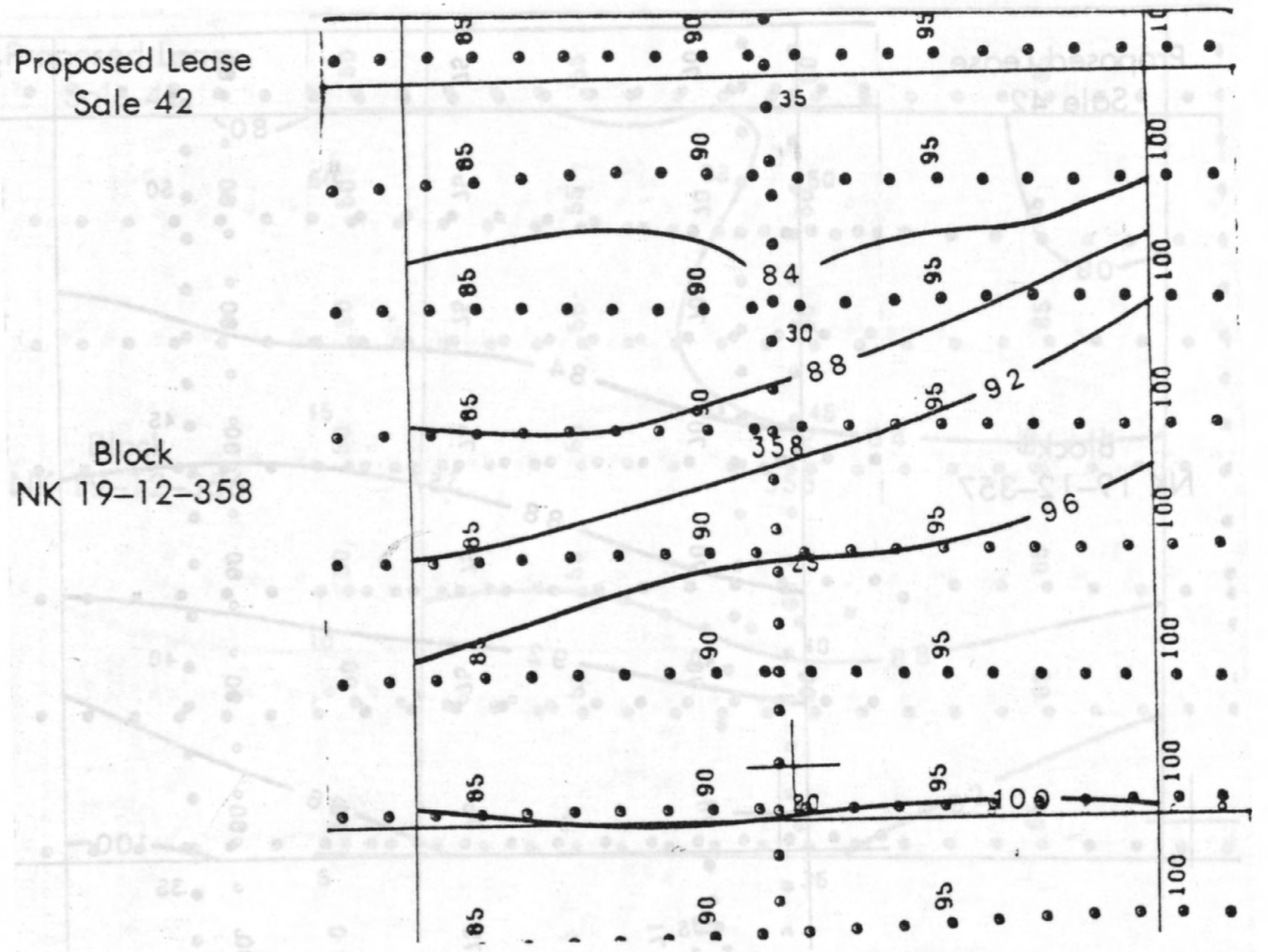


Water Depth: max. 95 m, min. 80 m
Slope Gradient: 3.1 m/km, Direction: S
Surface Sediment Type: Sand

SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS



Water Depth: max. 100 m, min. 80 m
Slope Gradient: 4.2 m/km, Direction: S
Surface Sediment Type: Sand



SCALE 1:48 000

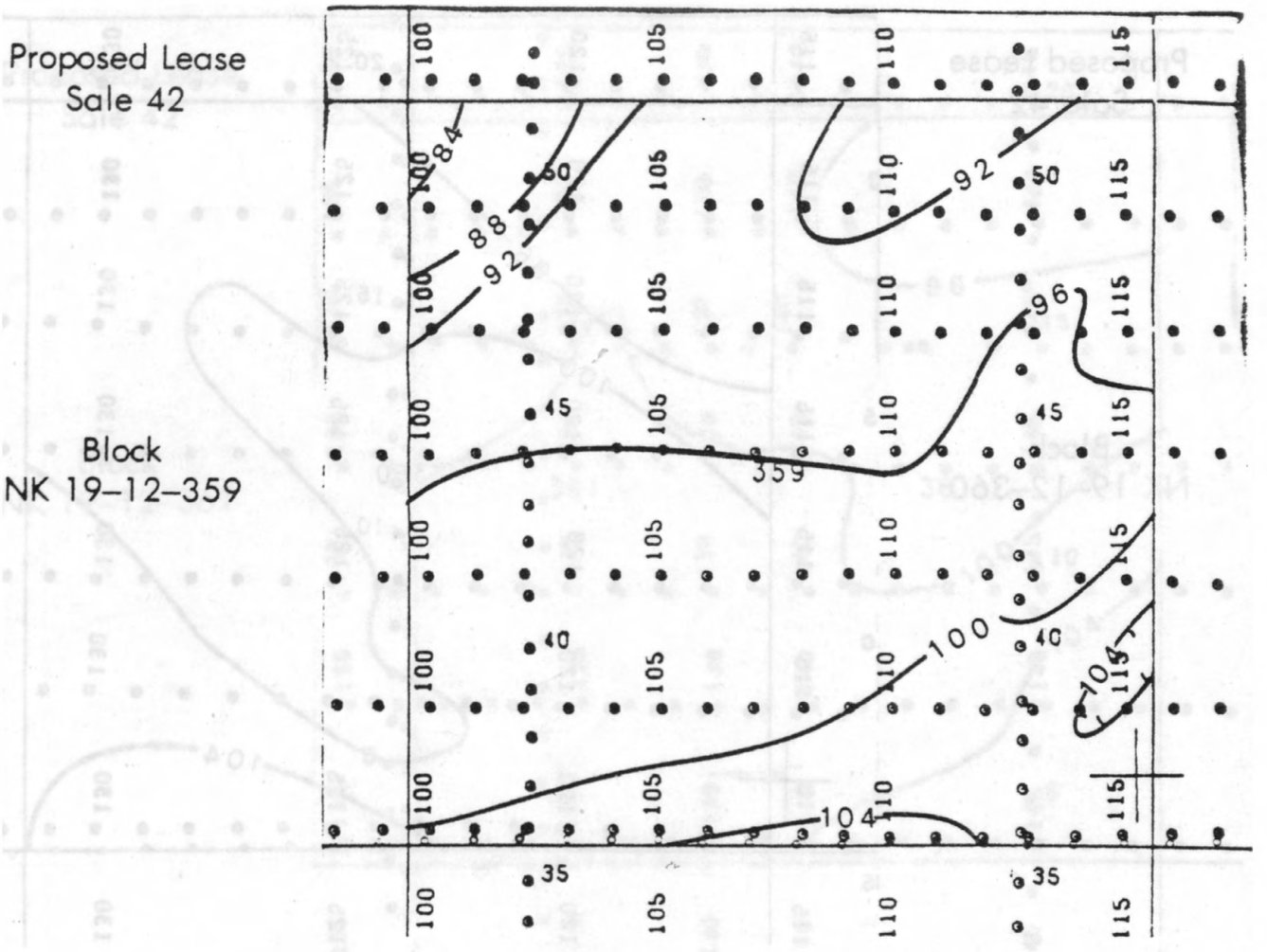
0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

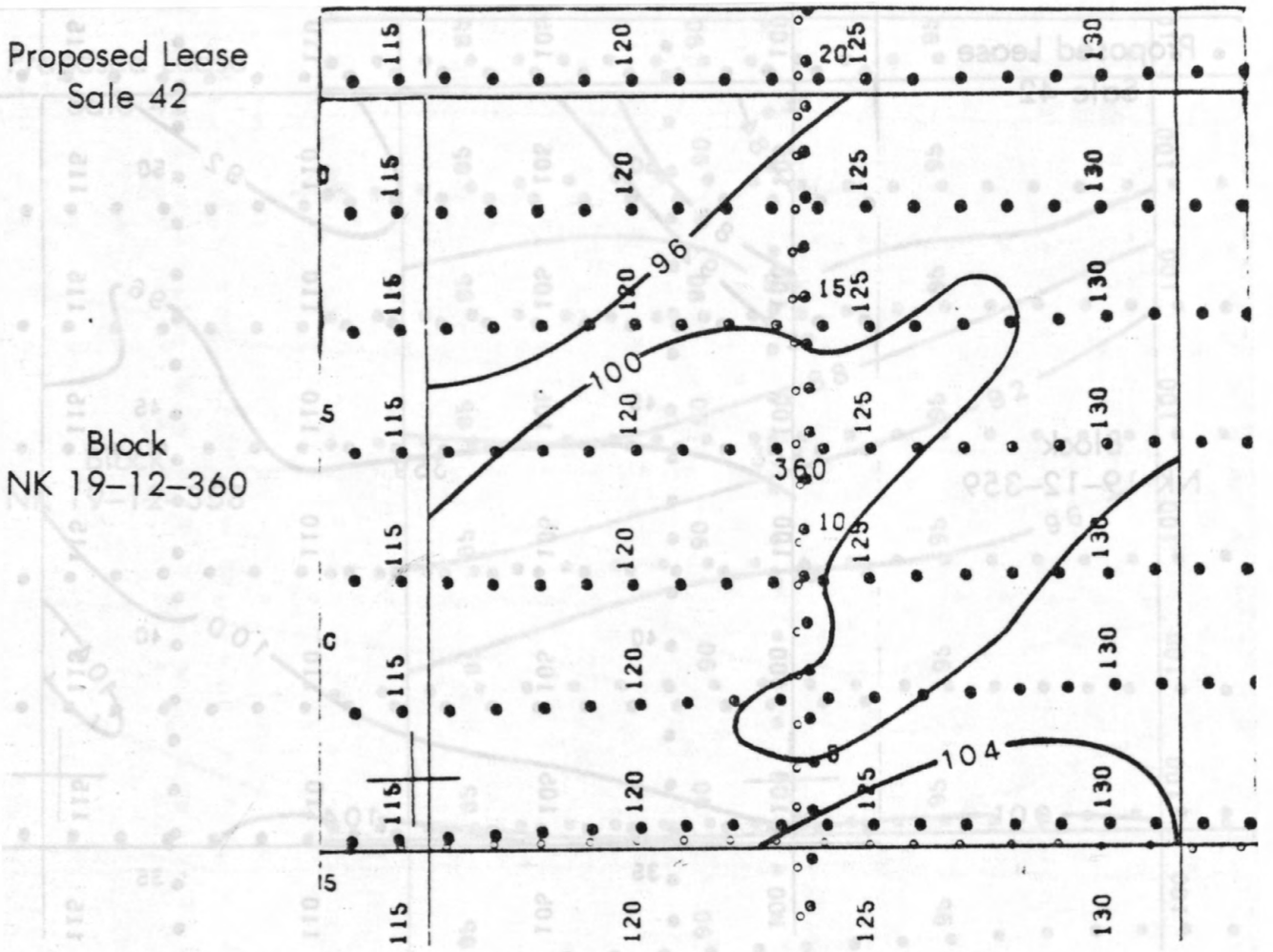
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

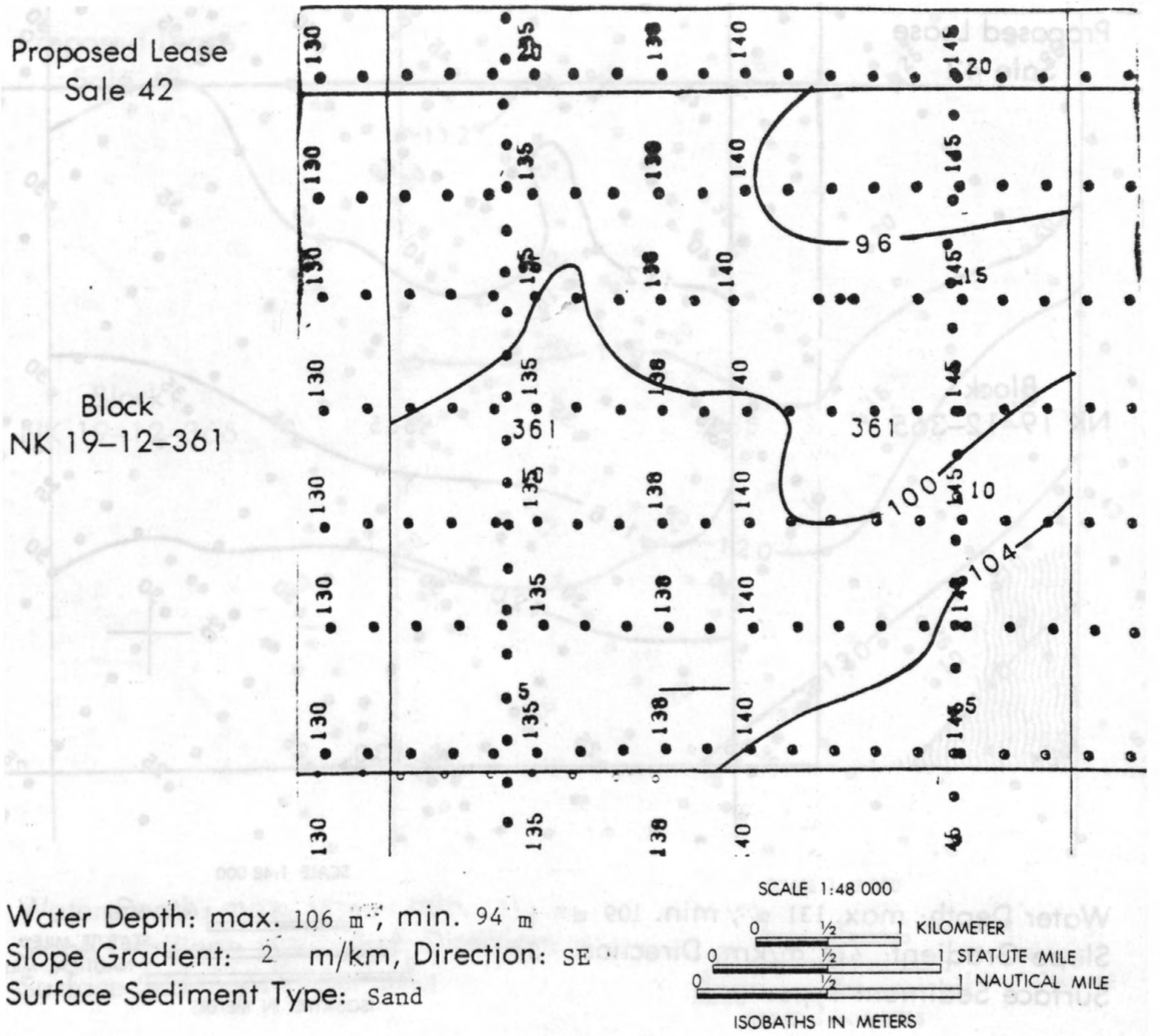
Water Depth: max. 100 m, min. 81 m
Slope Gradient: 4 m/km, Direction: S
Surface Sediment Type: Sand



Water Depth: max. 104 m, min. 83 m
Slope Gradient: 2.9 m/km, Direction: SE
Surface Sediment Type: Sand



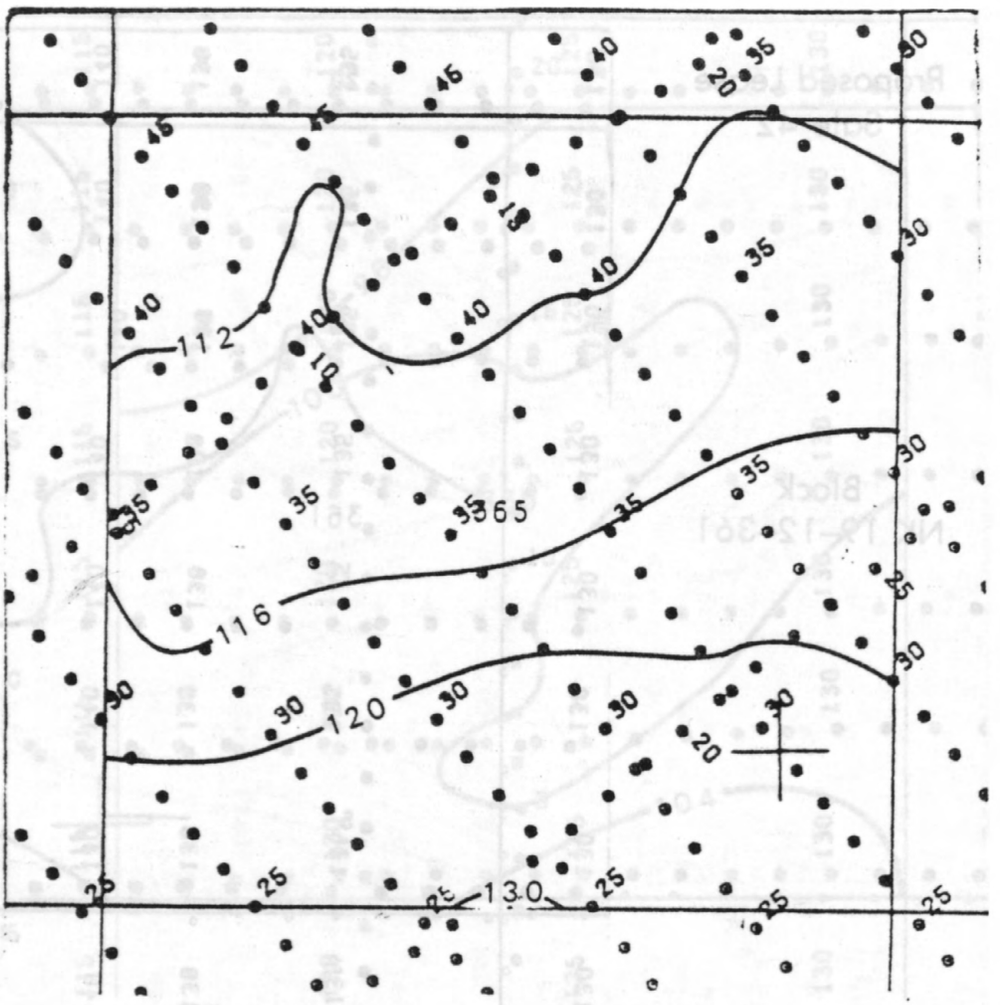
Water Depth: max. 106 m, min. 93 m
Slope Gradient: 2.6 m/km, Direction: SE.
Surface Sediment Type: Sand



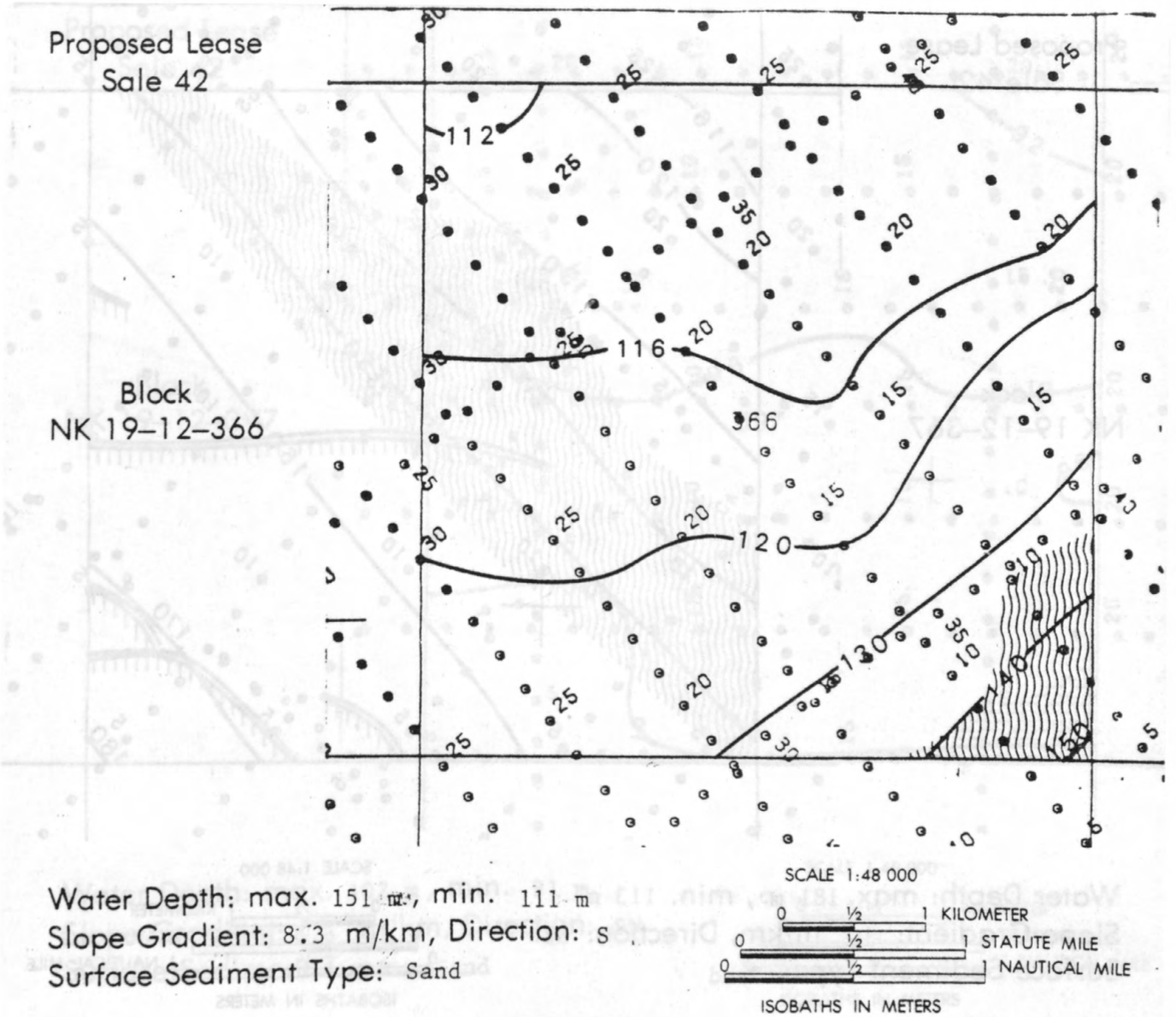
Water Depth: max. 106 m; min. 94 m
Slope Gradient: 2 m/km, Direction: SE
Surface Sediment Type: Sand

Proposed Lease
Sale 42

Block
NK 19–12–365



Water Depth: max. 131 m, min. 109 m
Slope Gradient: 4.8 m/km, Direction: S
Surface Sediment Type: Sand



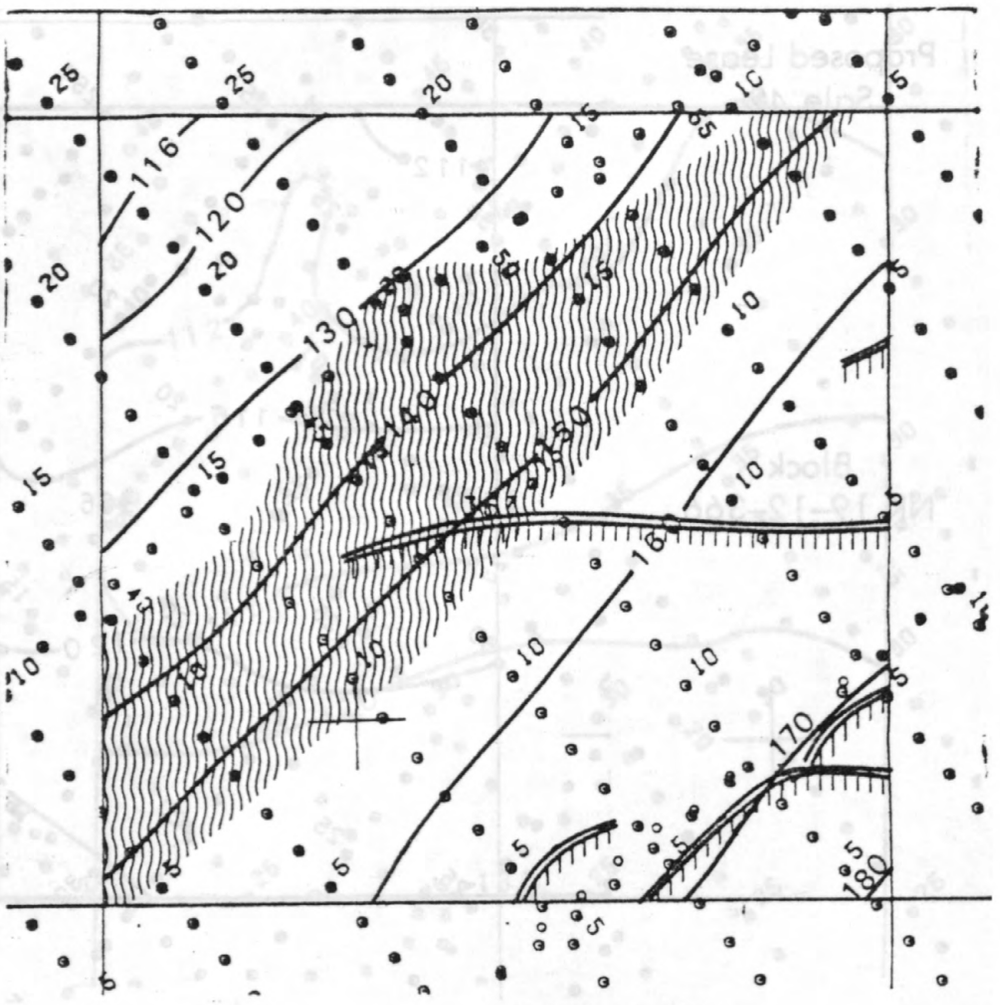
Water Depth: max. 151 m, min. 111 m
Slope Gradient: 8.3 m/km, Direction: S
Surface Sediment Type: Sand

CONSTRAINT

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–12–367



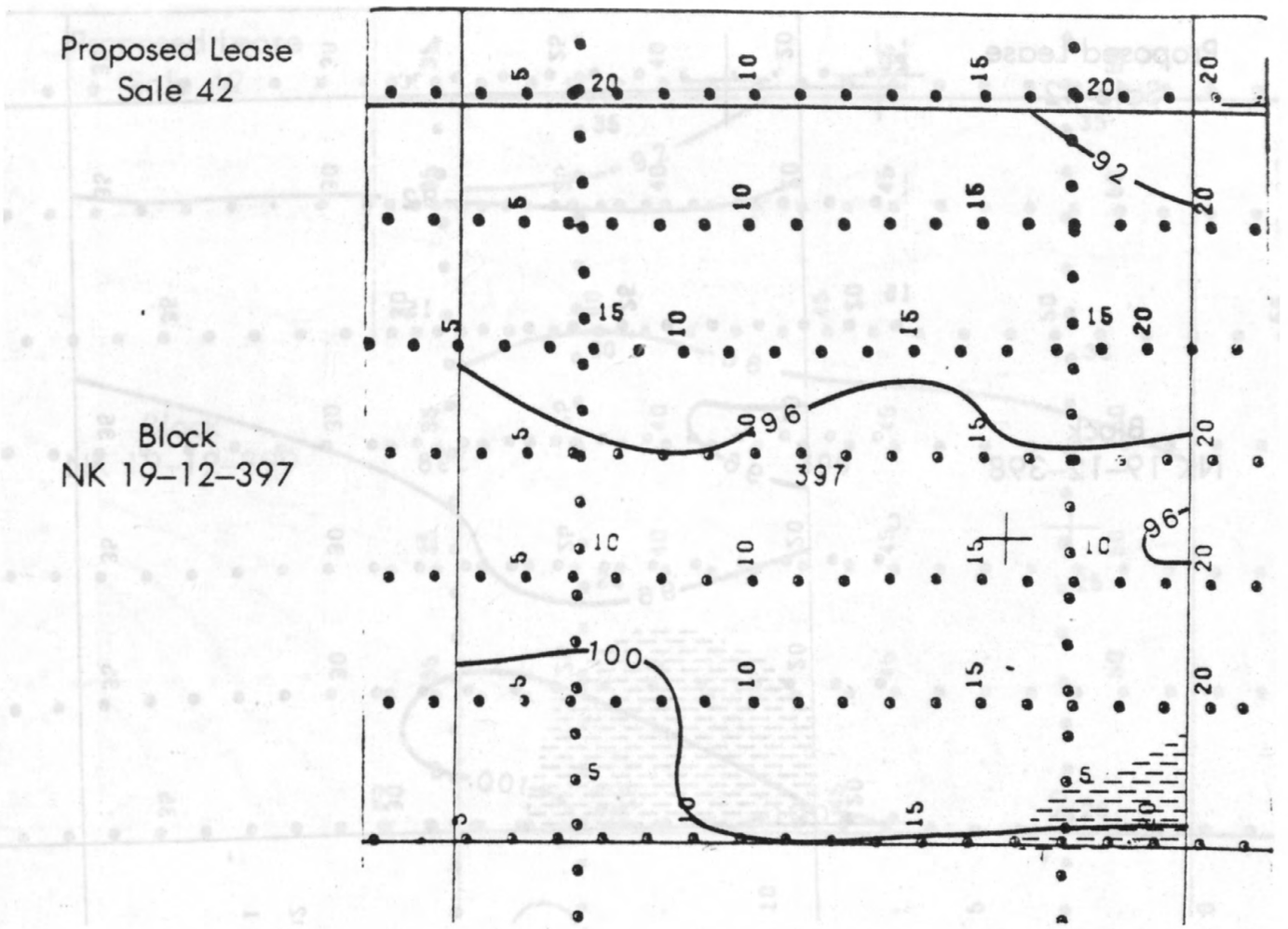
Water Depth: max. 181 m, min. 113 m
Slope Gradient: 10 m/km, Direction: SE.
Surface Sediment Type: Sand

POTENTIAL HAZARD

Fault at "I" Reflector

CONSTRAINT

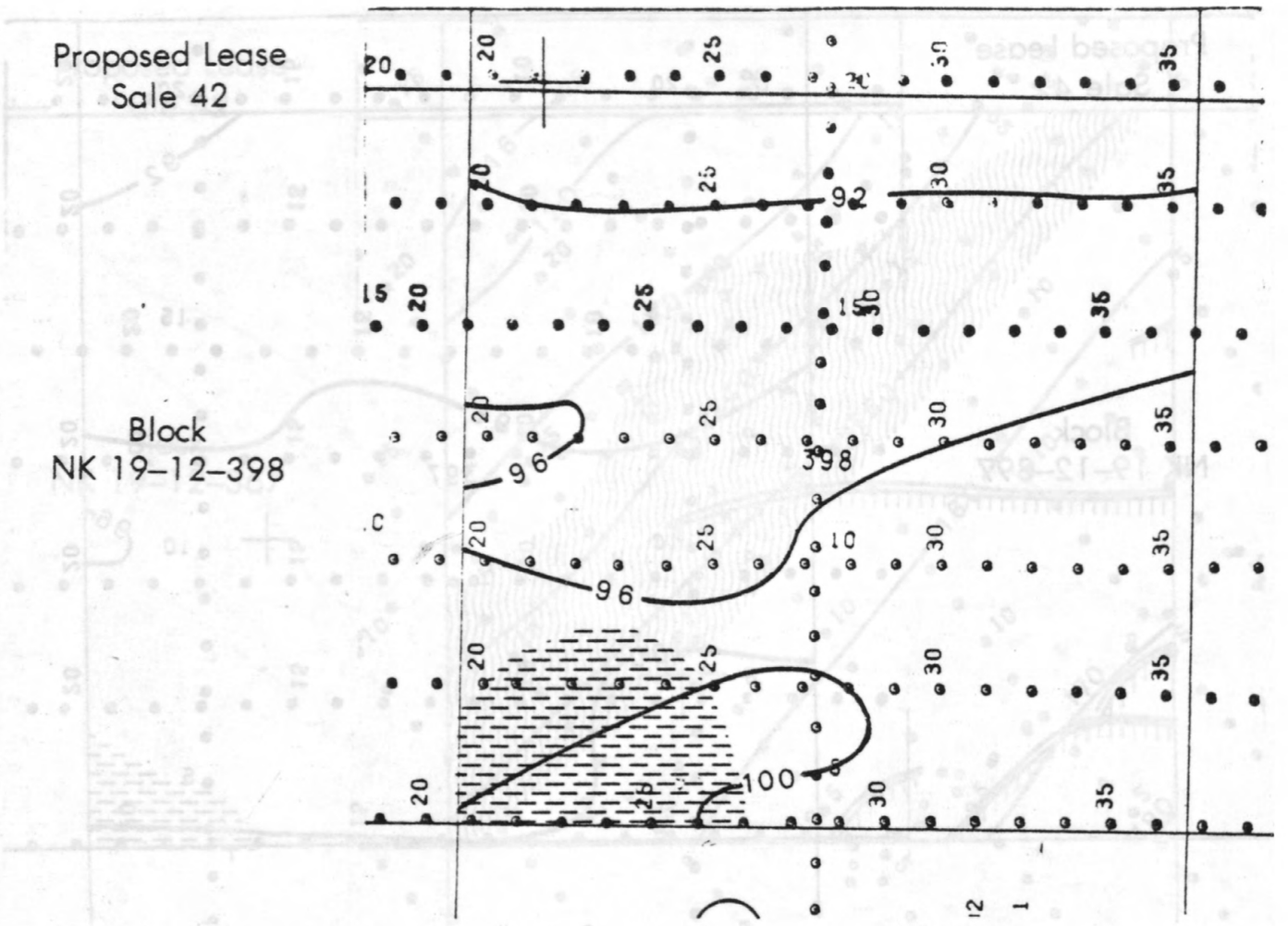
Sand Wave Field



Water Depth: max. 102 m, min. 91 m
Slope Gradient: 1:6 m/km, Direction: SW
Surface Sediment Type: Sand

CONSTRAINT

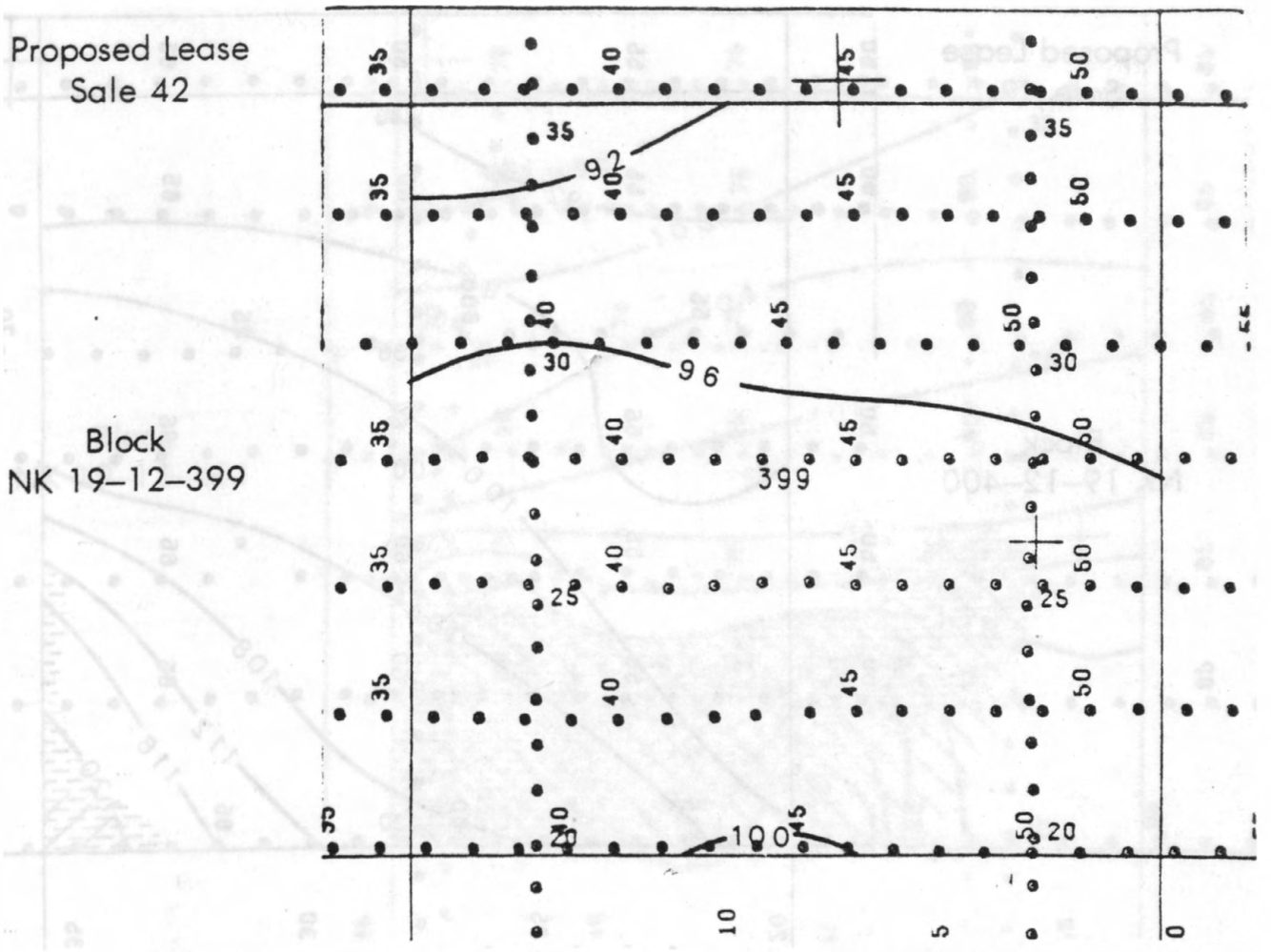
Filled Channel



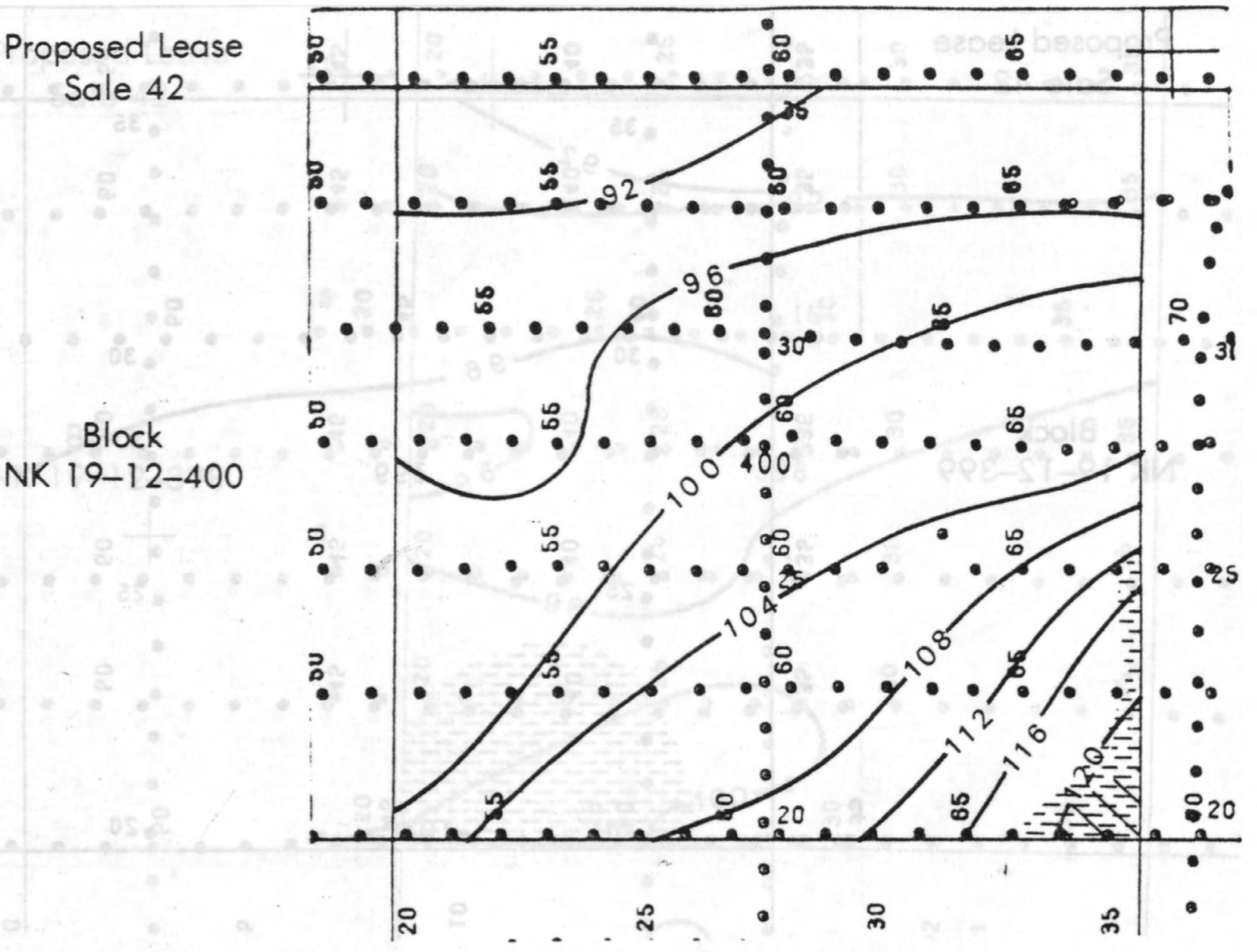
Water Depth: max. 102 m, min. 90 m
Slope Gradient: 2.5 m/km, Direction: S
Surface Sediment Type: Sand

CONSTRAINT

Filled Channel



Water Depth: max. 101 m, min. 90 m
Slope Gradient: 2.3 m/km, Direction: S
Surface Sediment Type: Sand

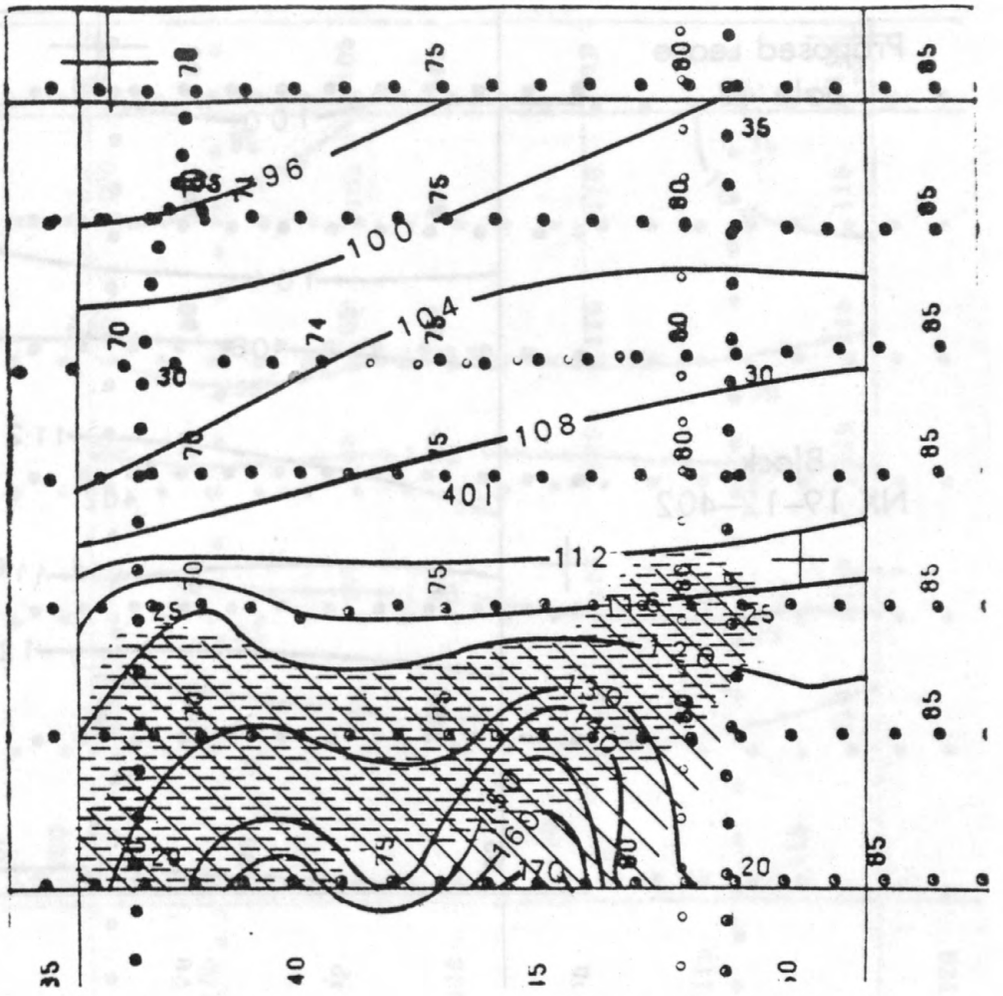


Water Depth: max. 126 m, min. 91 m
Slope Gradient: 2.2 m/km, Direction: SE
Surface Sediment Type: Sand

CONSTRAINTS

Potentially Unstable Slope

Filled Channel

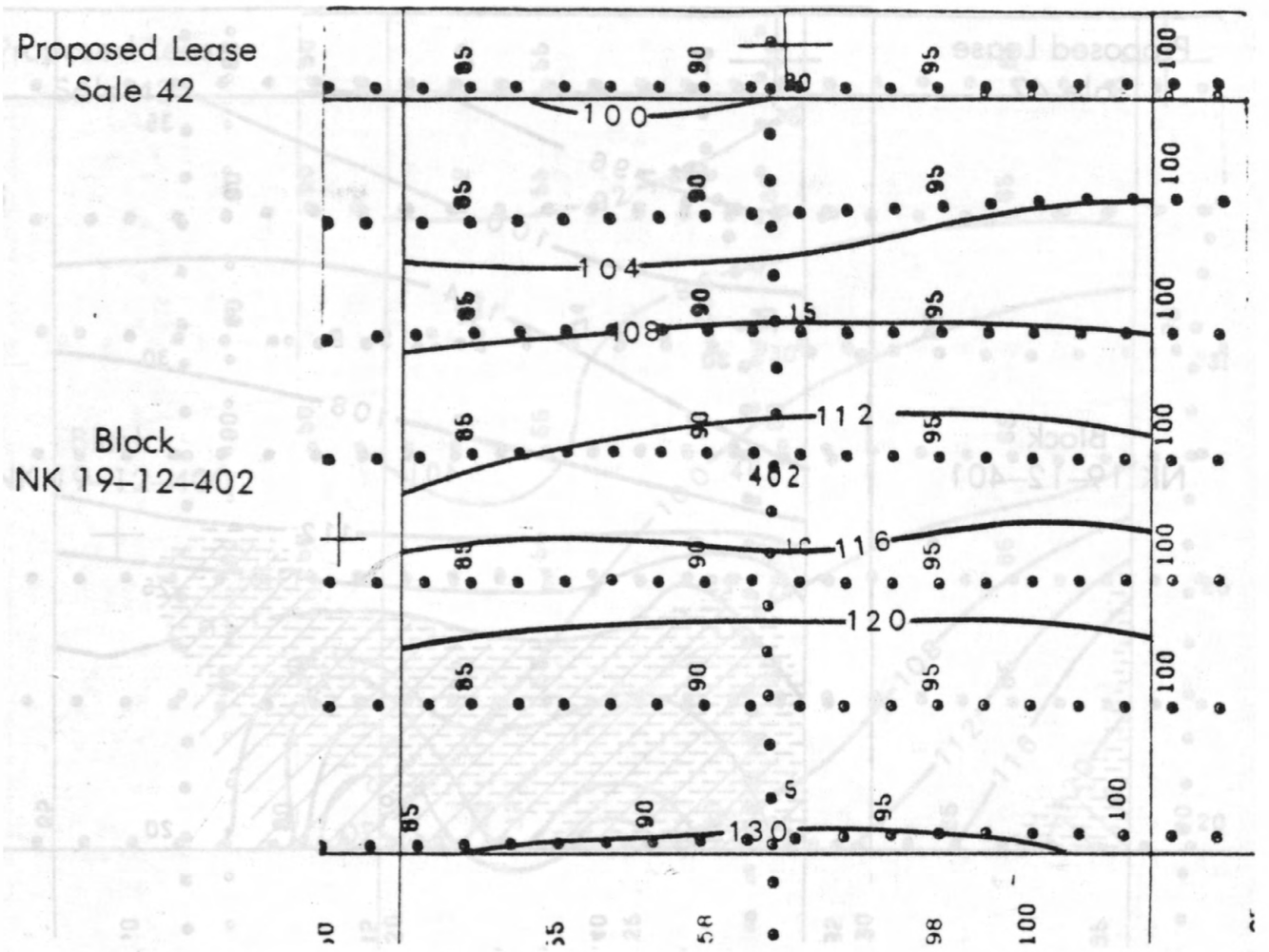


Water Depth: max. 173 m , min. 95 m
Slope Gradient: 35.3 m/km, Direction: S
Surface Sediment Type: Sand

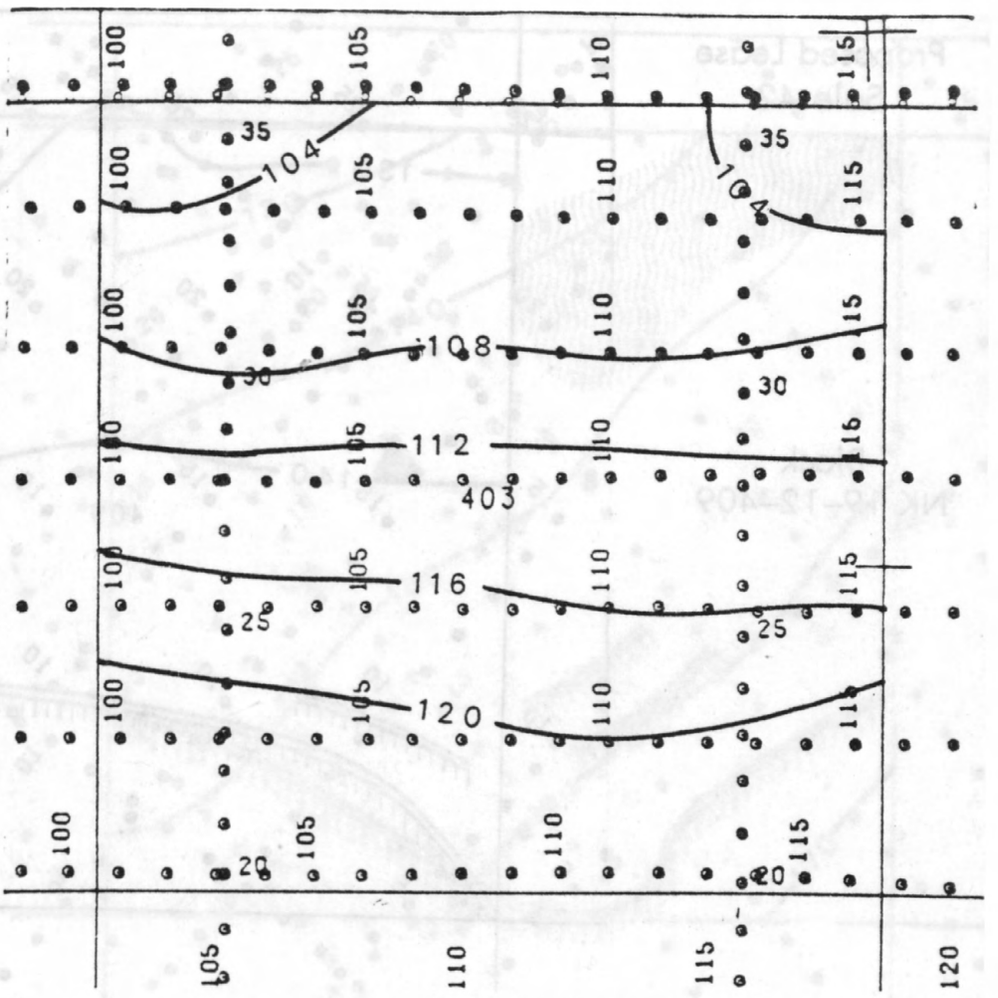
CONSTRAINTS

Potentially Unstable Slope

Filled Channel



Water Depth: max. 130 m, min. 99 m
Slope Gradient: 6.5 m/km, Direction: S
Surface Sediment Type: Sand



Water Depth: max. 129 m, min. 101 m
Slope Gradient: 6 m/km, Direction: S
Surface Sediment Type: Sand

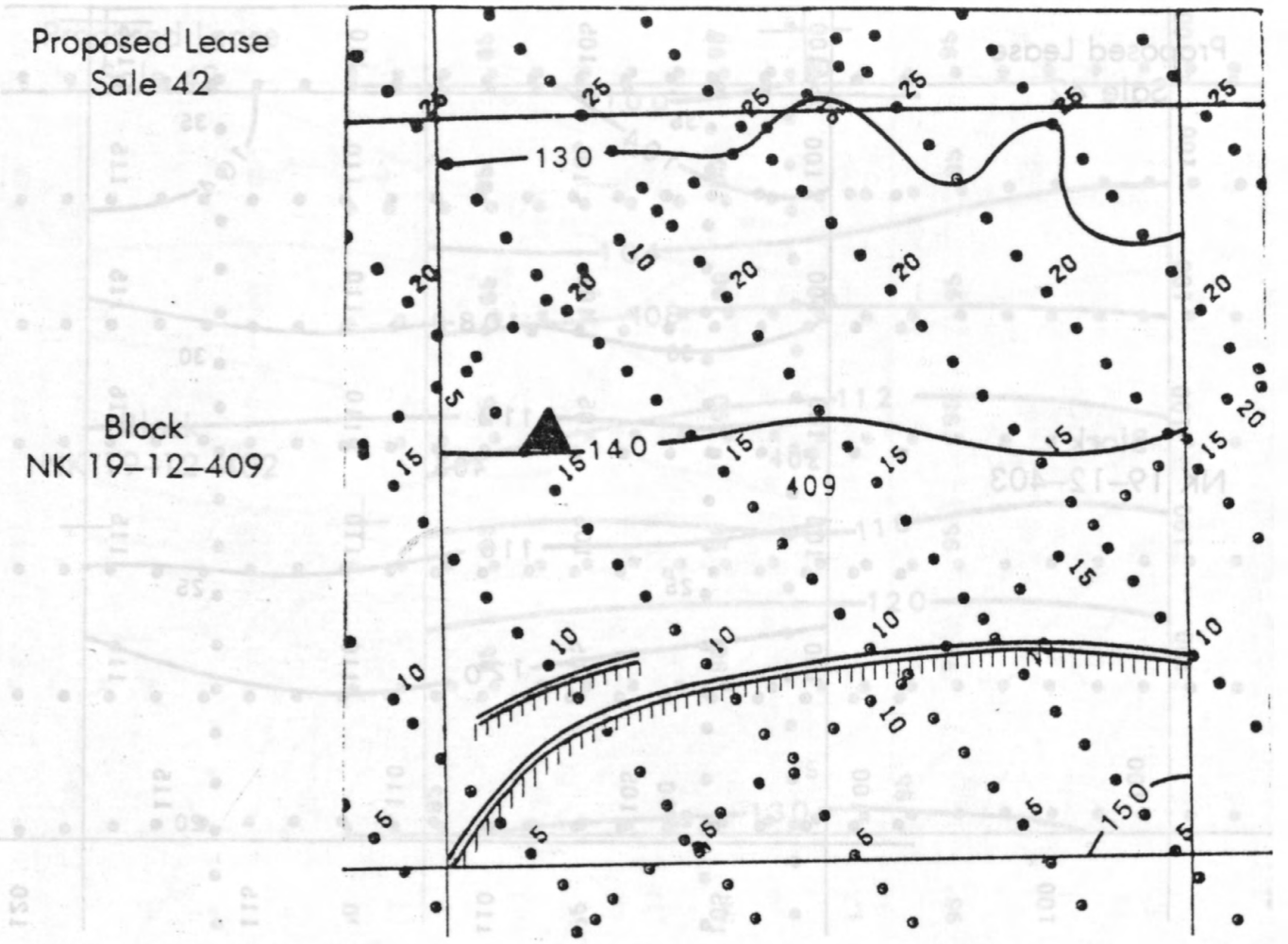
SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS



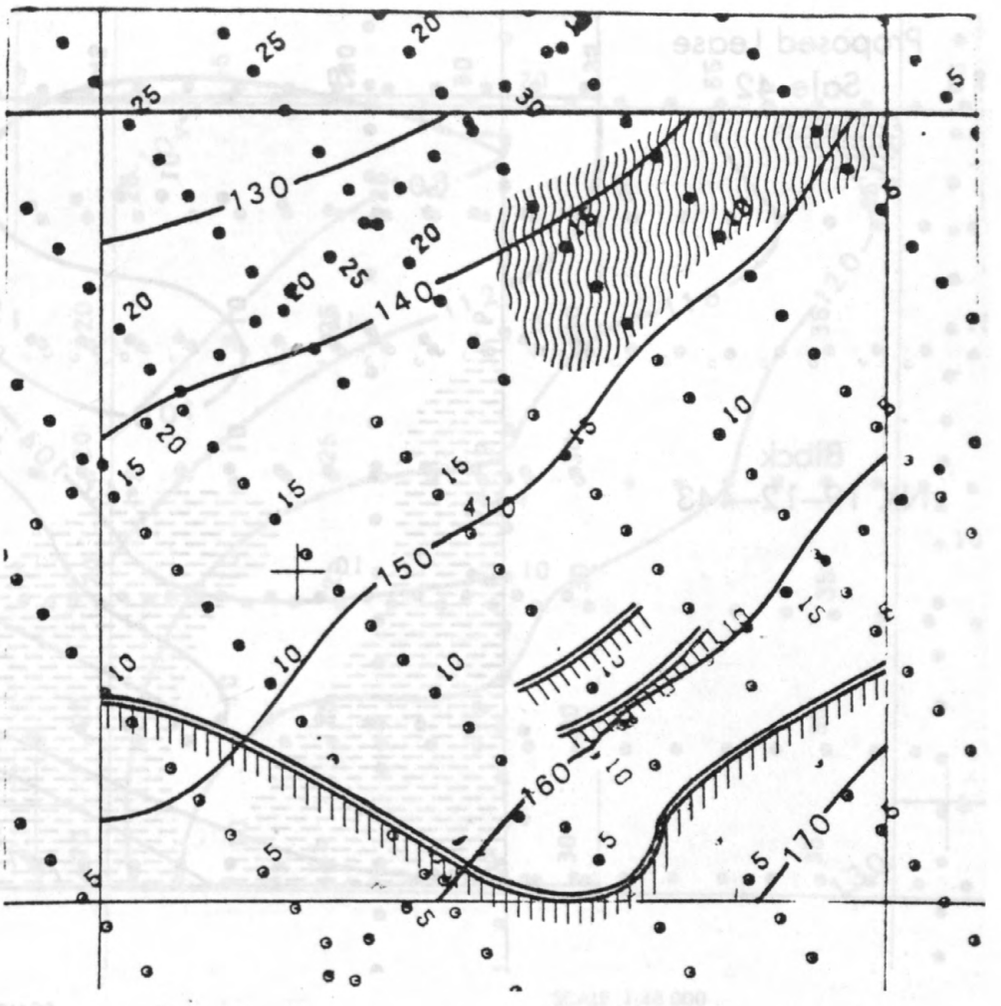
Water Depth: max. 153 m, min. 127 m
Slope Gradient: 5.4 m/km, Direction: S
Surface Sediment Type: Sand

POTENTIAL HAZARD

Fault at "I" Reflector

CONSTRAINT

Bottom Object



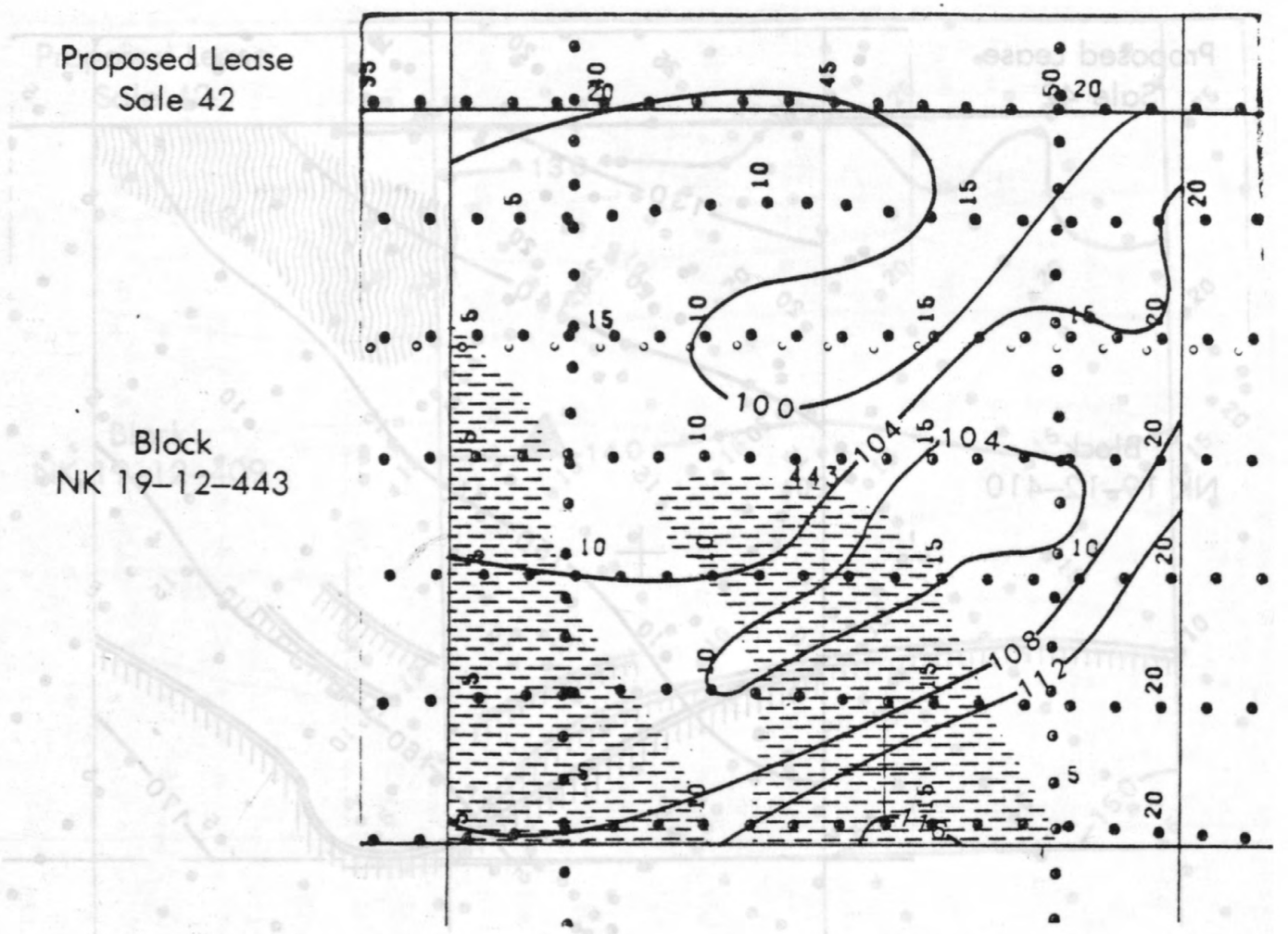
Water Depth: max. 174 m, min. 124 m
Slope Gradient: 7.4 m/km, Direction: SE
Surface Sediment Type: Sand

POTENTIAL HAZARD

Fault at "I" Reflector

CONSTRAINT

Sand Wave Field



Water Depth: max. 116 m, min. 98 m
Slope Gradient: 3.5 m/km, Direction: SE
Surface Sediment Type: Sand

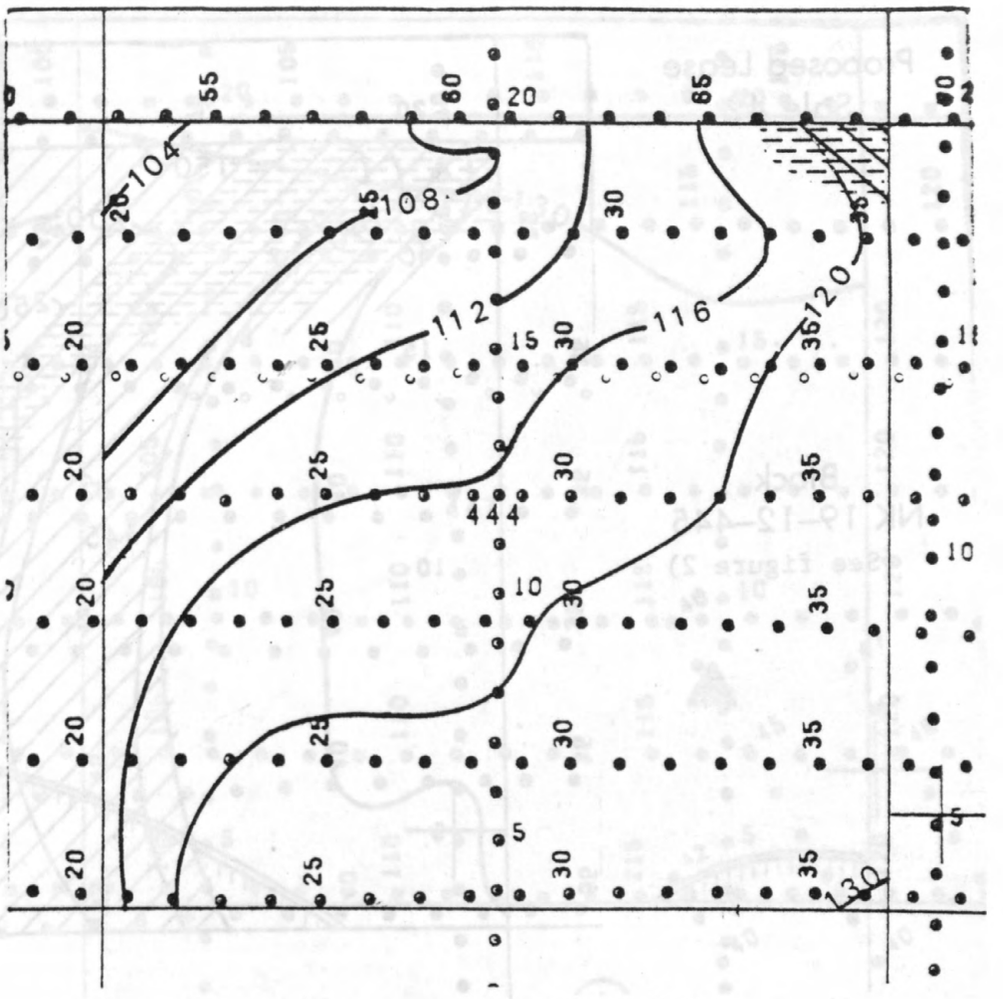
SCALE 1:48 000
0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

CONSTRAINT

Filled Channel (See figure 8)

Proposed Lease
Sale 42

Block
NK 19–12–444



SCALE 1:48 000

0 ½ 1 KILOMETER

0 ½ 1 STATUTE MILE

0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

Water Depth: max. 130 m , min. 101 m
Slope Gradient: 4,3 m/km, Direction: SE
Surface Sediment Type: Sand

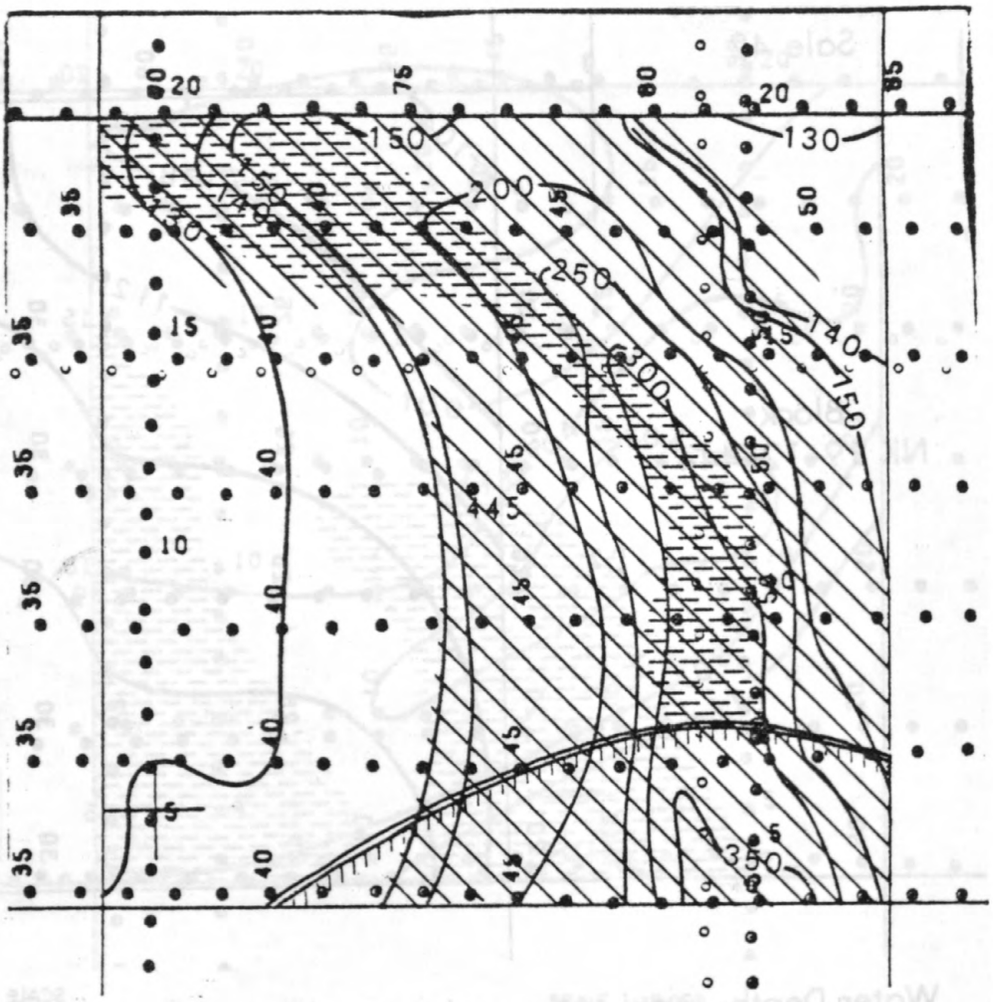
CONSTRAINTS

Potentially Unstable Slope

Filled Channel

Proposed Lease
Sale 42

Block
NK 19–12–445
(See figure 2)



Water Depth: max. 367 m, min. 123 m
Slope Gradient: 14.5 m/km, Direction: E and W
Surface Sediment Type: Sand

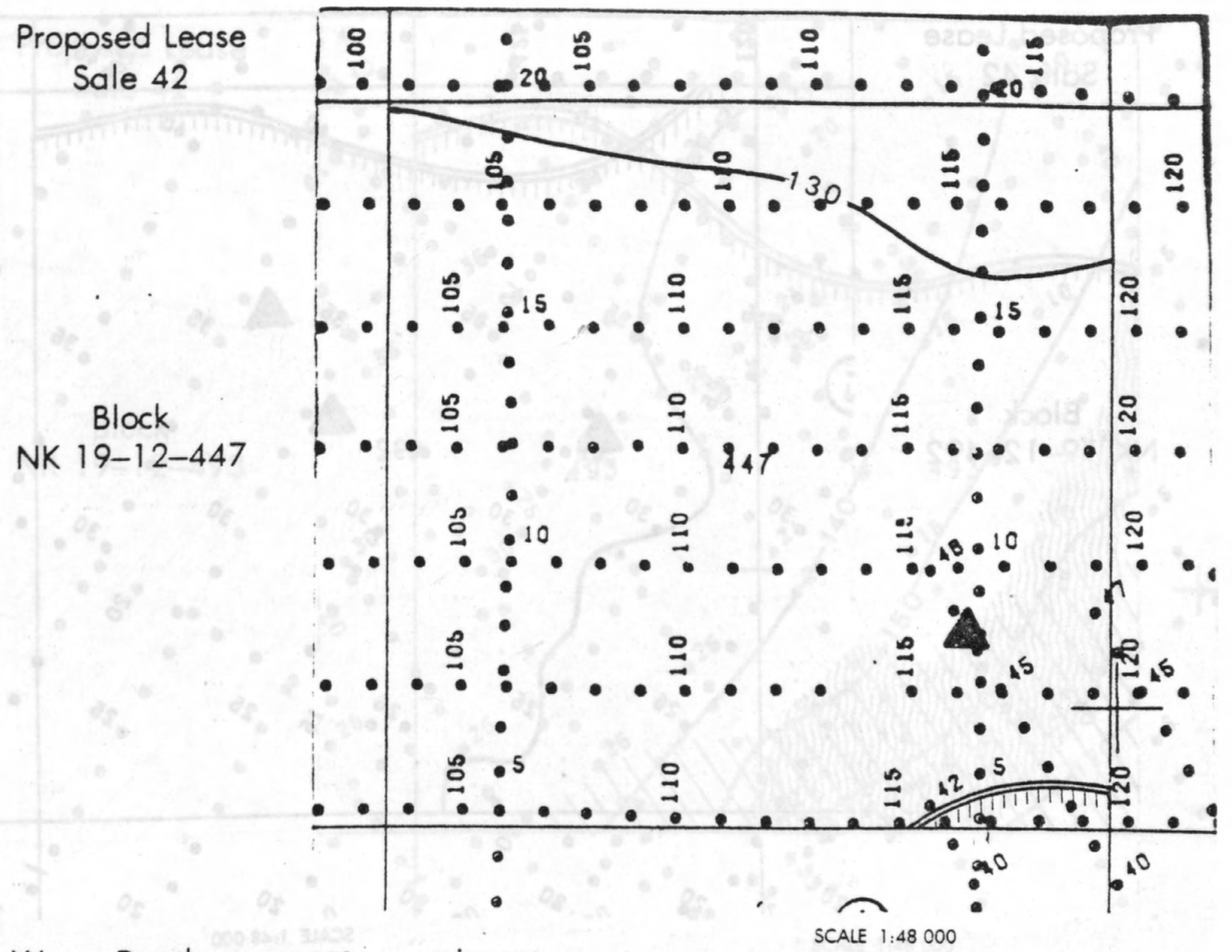
POTENTIAL HAZARD

Fault at "I" Reflector

CONSTRAINTS

Potentially Unstable Slope

Filled Channel



Water Depth: max. 139 m., min. 124 m
Slope Gradient: 3:1 m/km, Direction: S
Surface Sediment Type: Sand

POTENTIAL HAZARD

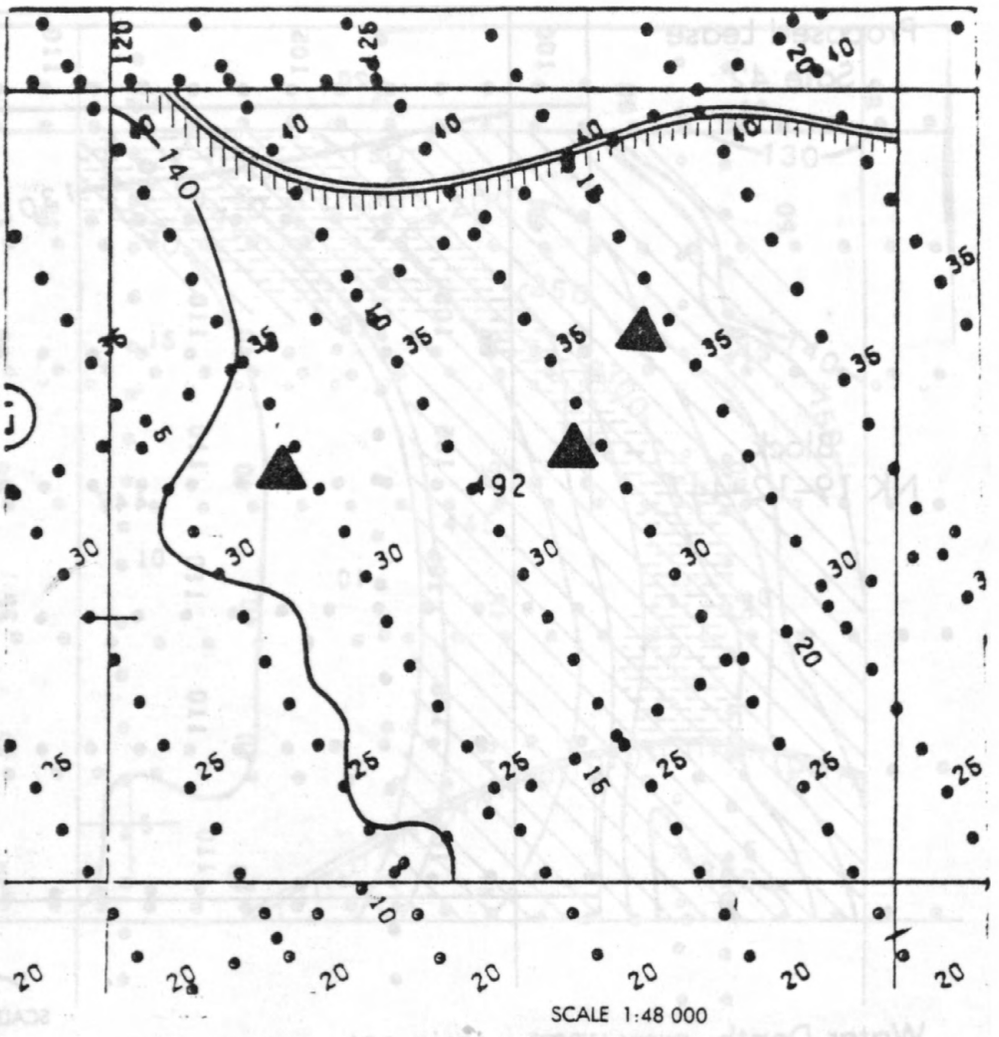
Fault at "I" Reflector

CONSTRAINT

Bottom Object

Proposed Lease
Sale 42

Block
NK 19–12–492



Water Depth: max. 143 m, min. 133 m
Slope Gradient: 1.5 m/km, Direction: SW
Surface Sediment Type: Sand

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE
ISOBATHS IN METERS

POTENTIAL HAZARD

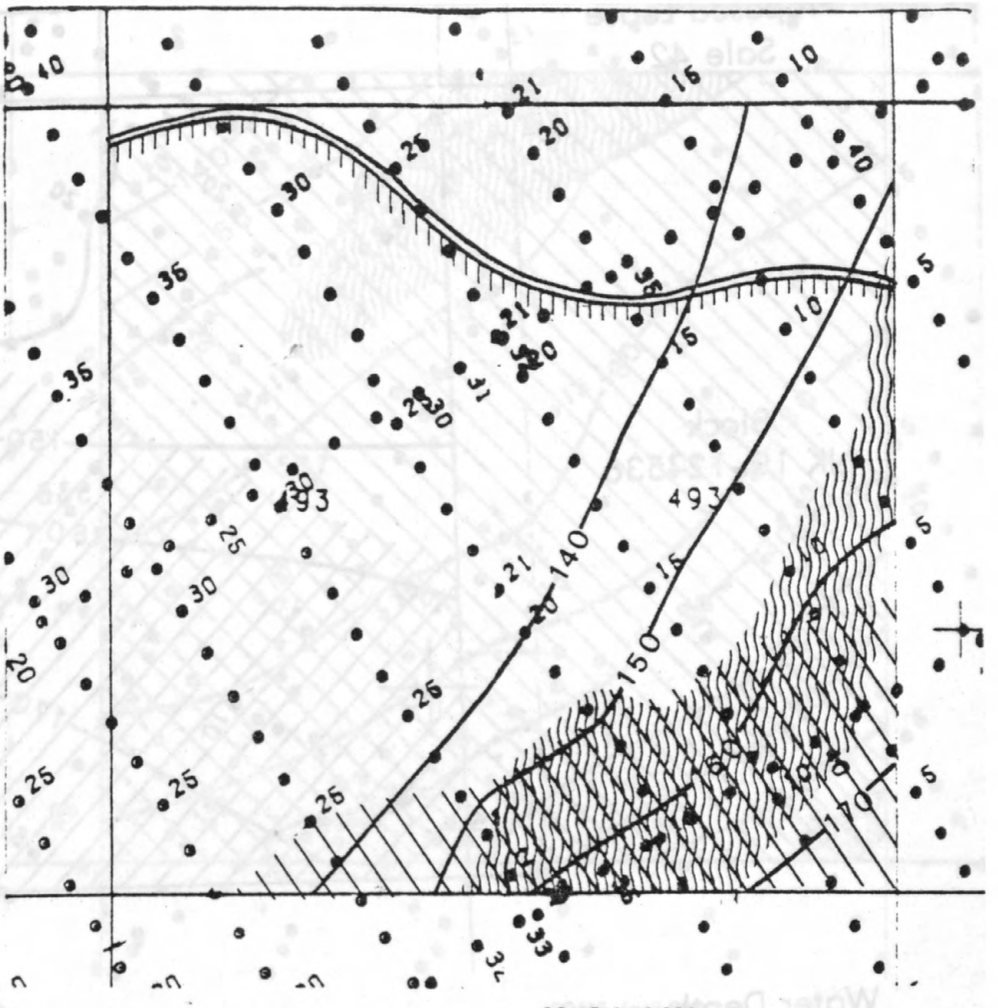
Fault at "I" Reflector

CONSTRAINT

Bottom Object

Proposed Lease
Sale 42

Block
NK 19–12–493



Water Depth: max. 175 m, min. 131 m
Slope Gradient: 6.5 m/km, Direction: SE
Surface Sediment Type: Sand

POTENTIAL HAZARD

Fault at "I" Reflector

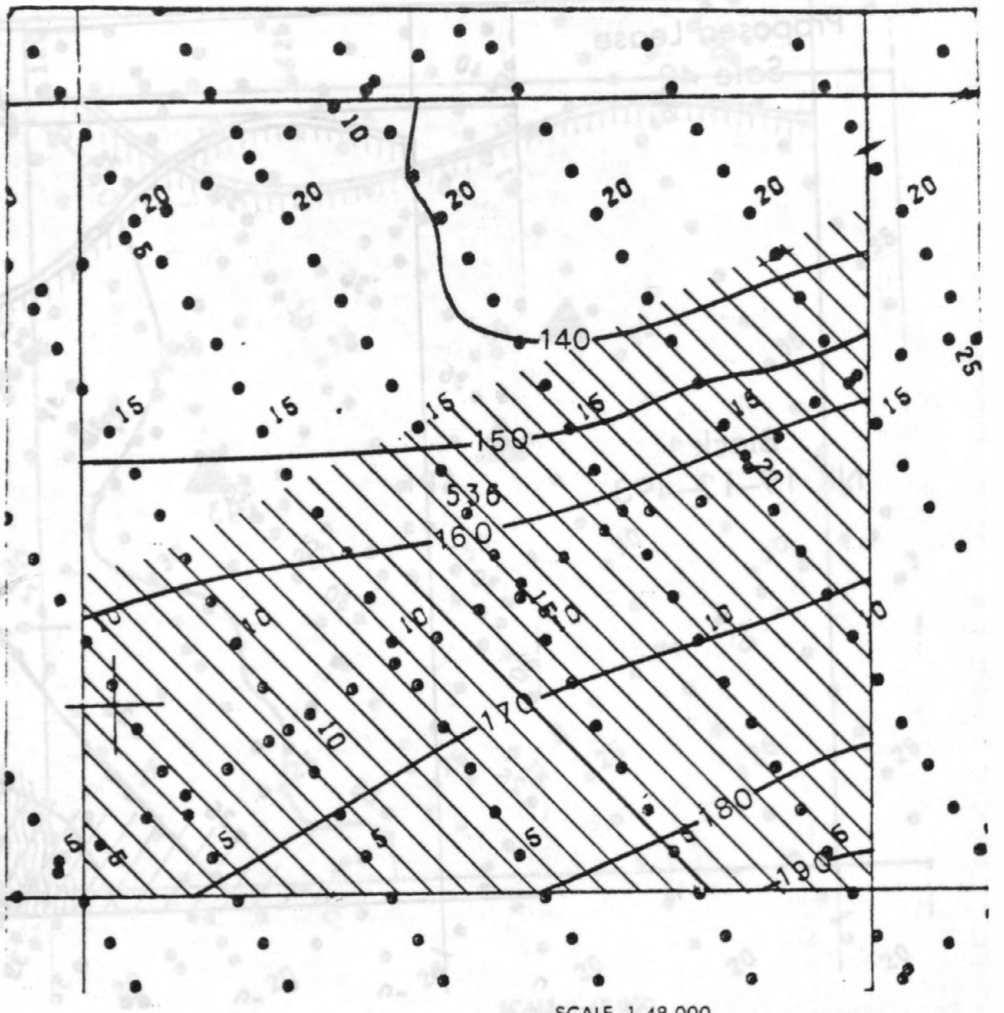
CONSTRAINTS

Potentially Unstable Slope

Sand Wave Field

Proposed Lease
Sale 42

Block
NK 19–12–536



SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

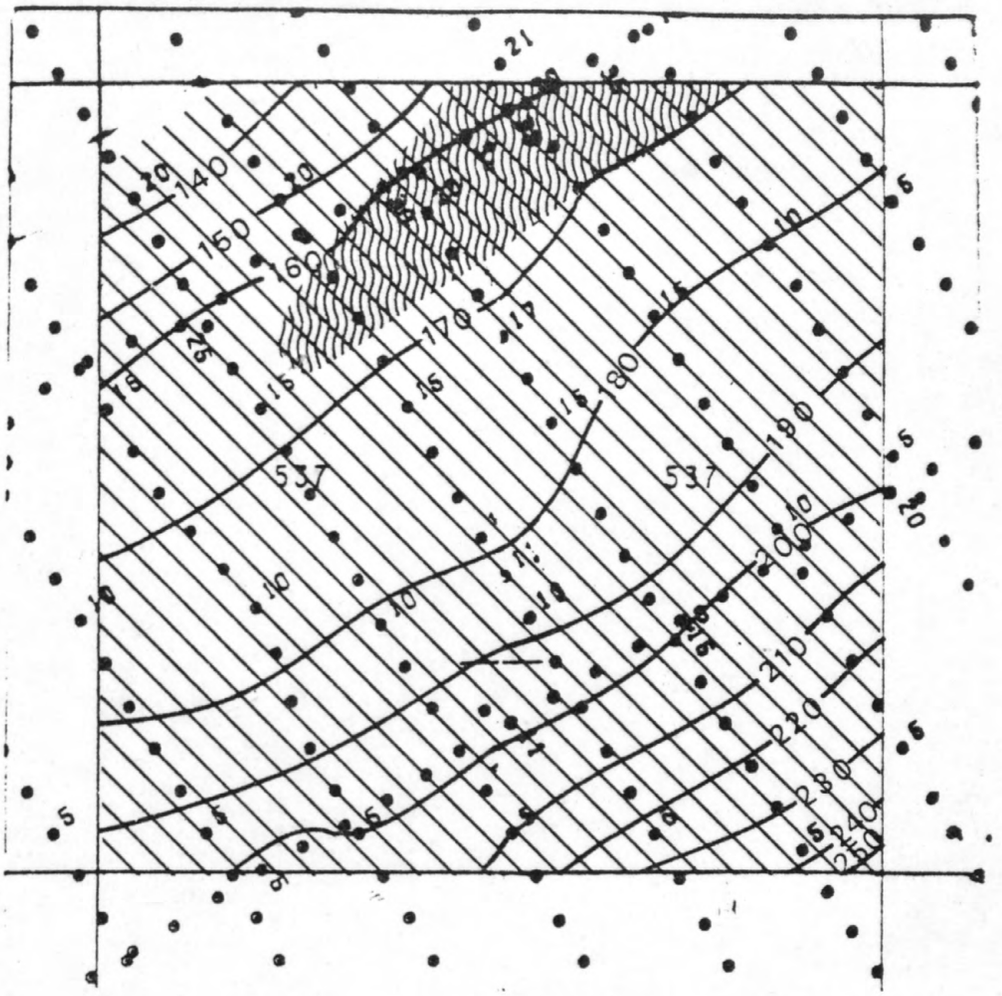
Water Depth: max. 195 m , min. 133 m
Slope Gradient: 12.2 m/km, Direction: SSE
Surface Sediment Type: Sand

CONSTRAINT

Potentially Unstable Slope

Proposed Lease
Sale 42

Block
NK 19–12–537



Water Depth: max. 256 m., min. 132 m
Slope Gradient: 18.2 m/km, Direction: SSE
Surface Sediment Type: Sand

SCALE 1:48 000

0 ½ 1 KILOMETER
0 ½ 1 STATUTE MILE
0 ½ 1 NAUTICAL MILE

ISOBATHS IN METERS

CONSTRAINTS

Potentially Unstable Slope

Sand Wave Field

Pocket contains
1 item

Ha.
3950.50

294

338

382

426

470

514

558

60

64

6