
GEOMORPHOLOGICAL, GEOECOLOGICAL, GEOARCHEOLOGICAL, AND SURFICIAL MAPPING STUDY OF MCGREGOR GUIDED MISSILE RANGE, FORT BLISS, NEW MEXICO

VOLUME II

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STUDY OF MCGREGOR GUIDED MISSILE RANGE,
FORT BLISS, NEW MEXICO**

VOLUME II

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PART I INTRODUCTION

BACKGROUND

While Defense Mapping Agency maps at 1:25,000 scale were originally planned as basemaps for the mapping phase of this study, complete coverage for McGregor Range was unavailable when mapping commenced. Consequently, rather than produce a set of geomorphic maps with mixed scales, a decision was made to use U.S. Geological Survey (USGS) topographic 7.5-minute series quadrangle maps at 1:24,000 scale for which complete coverage exists (the switch was coordinated with and approved by Fort Bliss DOE personnel). Further, mapping originally was to be augmented by and structured around use of NASA flown Atlas Multiband Imagery, but this imagery was not georeferenced, and much proved to be of insufficient quality for detailed mapping purposes.

The decision to switch to 7.5-minute topographic maps proved to be a boon because it was later learned that matching black and white USGS orthophotoquads (26) and orthophotomosaics (2) covered the McGregor Range, as did White Sands Missile Range color air photos, both at the same scale as the topographic maps (1:24,000). Having maps and air photos at the same scale makes surface mapping several orders of magnitude easier than without them. Color infrared (CIR) air photos at 1:40,000 scale were also acquired, as were black and white air photos at both 1:40,000 and 1:80,000 scales. The combination of contoured topographic maps, the georeferenced and accurate orthophotoquads and orthophotomosaics, and color, CIR, and black-and-white air photos greatly improved the accuracy, detail, and integrity of the geomorphic maps produced for this report.

MAPS PRODUCED

Of the 30-plus maps produced for this report, 29 are in and comprise most of Volume II, while the remainder are presented as figures in the text of Volume I. The 29 maps in Volume II include: (1) an index map that places the 28 maps in the context of the McGregor Range (Figure 1); and (2) 28 topographic-geomorphic maps at 1:24,000 scale that are modified USGS 7.5-minute topographic quadrangle maps.

Maps produced as figures in Volume I include a general color-shaded (selected contour) relief map for the entire southern Tularosa Basin that is a collage of multiple USGS 15 minute (1:62,500 scale) topographic maps. The 15-minute relief map served as a base map for another that shows long-term (prevailing) surface wind directions in the Tularosa Basin. Wind directions were determined by orientations of playa lake lunettes, by ripples and rounded fronts of slowly advancing dune trains, and by the location of dune trains and dune piles in general.

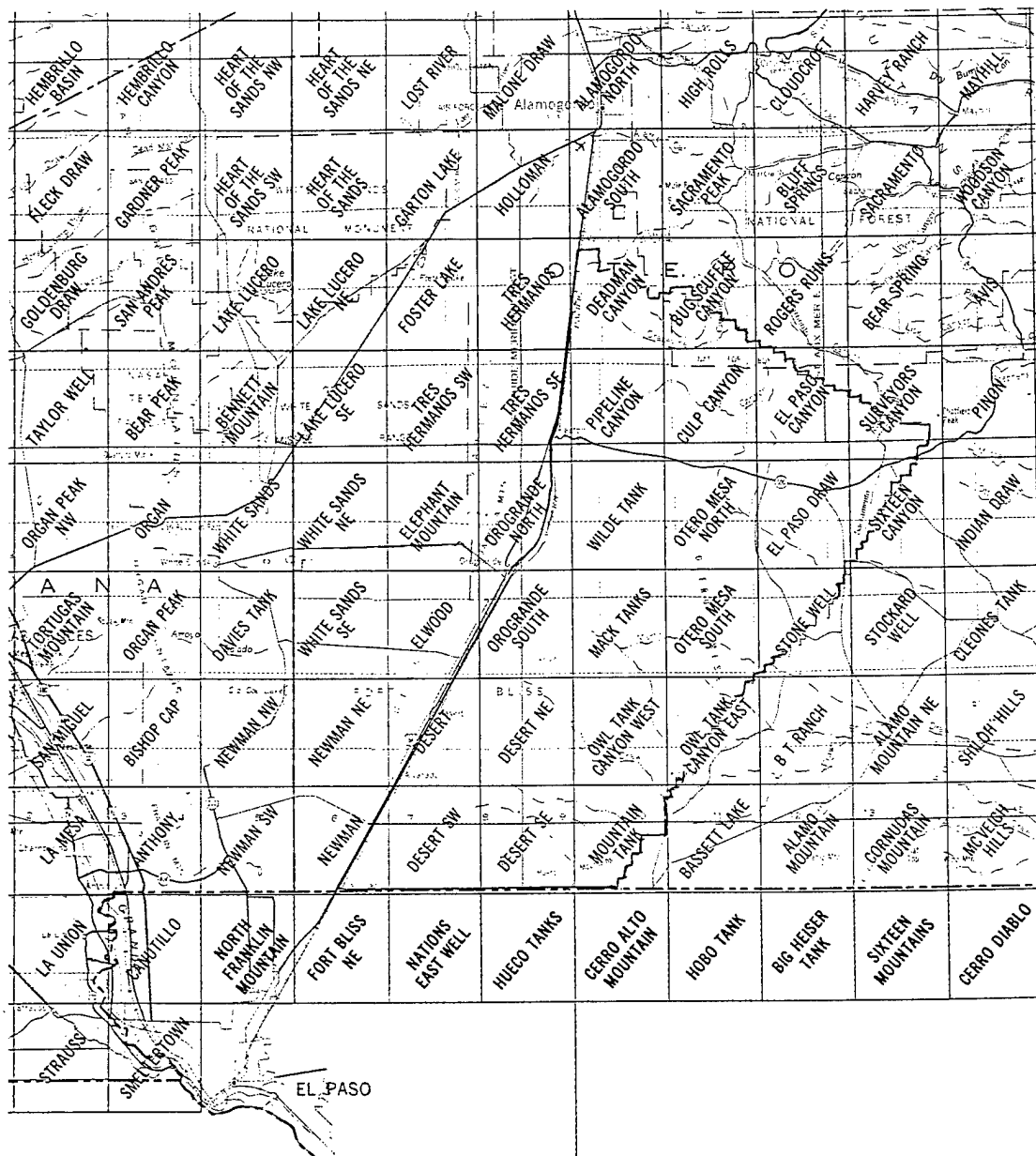


Figure 1. Index map for the 7.5-minute geomorphic-topographic (quadrangle) maps produced for this report.

METHODS OF MAP CONSTRUCTION

Topographic-Geomorphic Maps at 1:24,000 Scale

A set of 28 USGS 7.5-minute topographic maps and an equivalent set of 26 USGS 7.5-minute orthophotoquads and two orthophotomaps were acquired from the USGS. Inasmuch as each orthophotoquad was made from a single 1:80,000-scale, high-altitude air photo enlarged to 1:24,000, each serves as an excellent minimum-distortion basemap on which to genetically differentiate and map landforms (playas, alluvial fans, pediments, etc.). (The two orthophotomaps were made from two orthophotomosaics of air photos). Inasmuch as the orthophotoquad base air photos, the color air photos, and the CIR air photos used in this report were taken at different months and years, and are at different scales, the relative amounts and detail of useful geomorphic information vary among them. All the maps and air photos used—including the scale of each, map dates of execution, and when the air photos were taken—are listed at the beginning of Part II of this volume.

Once mapping on the 26 orthophotoquads and two orthophotomaps was reasonably complete, the color and CIR air photos were used where necessary to modify and refine mapping boundaries. In those cases where the 1:24,000 color air photos revealed more mapping detail than the orthophotoquads, they too were used as underlays for the topographic master maps. To produce the master topographic-geomorphic maps, the 7.5-minute topographic maps were first photocopied onto translucent vellum using a large format copier. Using a light table, the vellum copies were then used as tracing overlays on the orthophotoquads and, in some cases, the 1:24,000 color air photos. The final maps are paper copies of the vellum topographic-geomorphic master maps. Accuracy of landform differentiation was enhanced by constant checking against the color and infrared air photos, and by several periods of extensive field reconnaissance on the ground. Accuracy was also aided by a two-hour helicopter overflight. Most mapped features such as landforms, mapping units, cultural features, and most faults were defined on the basis of direct map and air photo interpretation augmented by ground truthing, but several, such as the Camp Rice sediments and Hot Well and Lake Tank faults, were partly based on previously published materials by Seager et al. (1987). All field sites mentioned in the text are located on the topographic-geomorphic maps.

Index Map of the Topographic-Geomorphic Maps

An index map that shows all 28 topographic-geomorphic maps in a regional context was produced by modifying the USGS Primary Map Series, 1:24,000 scale, Index Map for New Mexico. The outline of McGregor Range is overprinted on the index map, showing the locations of the 28 pertinent maps.

General Elevation-Drainage Color Map of Southern Tularosa Basin, NM, at 1:62,500 Scale

To facilitate fieldwork, a general elevation field map for the southern Tularosa Basin and adjacent uplands was produced by piecing together multiple USGS 15 minute (1:62,500 scale) topographic maps (see Volume I, Figures 10 and 31). Select elevations were then color-shaded to show local and regional relief. The resulting large map-collage measured 4-x-6 ft, and proved invaluable as a field aid. Its coverage extends from the Alamogordo-White Sands National Monument-Lake Lucero latitude south to the Texas-New Mexico border (the latter coincident with the southern border of the McGregor Range). The collage very usefully shows the intrabasinal drainage relationships of the Tularosa Basin, including its lowlands, playas, mega-depressions, pluvial lake basins, and alluvial fans relative to their upland runoff-sediment source areas. It also shows locally and regionally where surface runoff accumulates during great storms and wet periods (e.g., 1941), and where water ultimately ended up during wet periods of the Quaternary. Inasmuch as it shows many regional things that 7.5-minute quads simply cannot because of their larger scale, it was photo-

reduced and included with this report, even though it was initially intended only for field use. A copy of it was also used to show prevailing wind patterns for the southern Tularosa Basin based on orientation and locations of dune forms (lunettes, dune piles, dune trains).

MAPPING UNITS: PHILOSOPHY AND RATIONALE

Early in this project thought was given to age assessing and mapping McGregor Range sediments and surfaces using the Desert Project as a model. That highly respected study was conducted in and around the Organ Mountains over many years by L. Gile, J. Hawley, R. Grossman and their colleagues (Gile et al. 1981; Hawley 1975b). We planned to correlate the McGregor soils and surfaces to those of the Desert Project, as Monger had done in his recent study of the Fort Bliss Maneuver Areas (Monger 1993). After fieldwork and mapping commenced, however, it gradually became clear that such a strategy would be inadvisable to pursue for several reasons. One is that far more time and resources would be needed for soil-geomorphic work, age dating surfaces, and map ground truthing to enable useful correlations to the Desert Project than was available for the McGregor Range project. The McGregor Range is much larger than the Desert Project theater of study, and that study absorbed many years' work and enormous federal and state resources involving many people and support staff. Further, the Desert Project area was selected for study because the sediments are derived from both carbonate and noncarbonate rocks, especially the latter, whereas McGregor sediments are almost exclusively carbonate derived (Camp Rice fluvial facies excepted). Hence the two areas are not exactly comparable. Paleargids, for example, are common in the Desert Project area, but less so on McGregor alluvial units, pediments, and uplands (Camp Rice fluvial sediments, some Jarilla fans, and old dunal terrains excepted). Also, biotic landscape disturbance vectors (ants, termites, other insects, ground squirrels, gophers, kangaroo rats, badgers, etc.) significantly impact the McGregor landscape, but these processes are accorded far less genetic significance, and therefore, are much less stressed in the Desert Project areas. Further, the philosophical underpinnings of USDA, SCS (now known as the Natural Resources Conservation Service), soil geomorphic work are the 'five factors approach' (cf., Simonson 1997), and, while viable as a framework, it is fundamentally different from the unified 'soil evolution, biomantle, dynamic denudation' process approach employed here (Johnson 1990, 1993). It is a fundamental fact in science that different frameworks yield different views and different results. Applying the Desert Project model to McGregor would mean locking most aspects of the mapping and soil-geomorphic work into an existing structured framework—regardless of that framework's justifiably exalted status—that could limit intellectual and interpretive flexibility. Reference and comparison were, nevertheless, readily made to the Desert Project throughout this study, though not necessarily through emulation of emphasis and procedure. Finally, since in the first instance this is a geomorphic, geoecologic, and geoarcheologic assessment and mapping study, it was deemed important to produce maps and mapping units that would be both simple and reasonably accurate, and at the same time optimally useful to a wide field of specialists in resource allocation, management, planning, and mitigation. The mapping strategy and units adopted below should fulfill these user-friendly goals. The landform mapping units used in this report are as follows:

<u>Landform/Material</u>	<u>Mapping Unit</u>	<u>Landform/Material</u>	<u>Mapping Unit</u>
Alluvium (recent)	A1	Dune Pile	DP
Alluvium (relict)	A2	Dune Sheet	DS
Alluvium (older relict)	A3	Dune Sheet, Coppiced	DSC
Bedrock	B	Dune Sheet, Gypsiferous	DSG
Bolson Floor Complex	BFC	Fault	---
Camp Rice (Rio Grande) Sediments	CR	Pediment	P
Dune, Local	DL	Playa	PI
		Playa Lunette	PIL

The first element of any mapping complex on the topographic-geomorphic maps in this report is the most common surface geomorphic element observed in that unit. For example, in the mapping unit DSC/P/A1-A2, coppice dunes formed on sheet sand are most common, but shallow pediments that are overlain by

alluvial pedis sediment in which weak to moderately strong calcic soils have formed also occur within the complex. This mapping unit would apply along bedrock outliers that front the Tularosa Basin where coppiced dune sheets have migrated up onto pediment slopes of the bedrock outliers. A mapping unit designated A1 means that only recent alluvium is present at the surface.

The reader should know that these mapping units are placed on the maps as best judgements as established by air photos, contour maps, orthophotomaps, and ground truthing. By their very nature, most mapping boundaries are informed estimates or inferred approximations of what is actually there. Centers of mapping units have the highest accuracies, boundaries least (hopefully *all* are accurate). Such are the problems that attend efforts to spatially delimit natural phenomena on maps.

Mapping Unit A1 (Recent Alluvium)

This alluvium, like essentially all alluvial units of McGregor—excepting original Camp Rice Rio Grande sediments—is highly calcareous and consists dominantly of gravelly and or nongravelly limestone derived sediment, though minor amounts of sandstone and shale sediments are sometimes present. Recent Alluvium, which derives from upland, mainly carbonate-rich rocks of late Paleozoic age, has been deposited during the last several hundreds to several thousands of years and is still deposited during storm flow periods. Soils in the A1 mapping unit range from those that show minimal development (no secondary or pedogenic carbonate), to minor or modest development (filamentous and or thin surface caliche coatings on grains, bridges between grains, etc.). On orthophotoquads and air photos this unit shows up conspicuously as both darkish vegetation-rich and whitish vegetation-free zones in active washes, gullies, and barrancas, especially where they debouch onto alluvial toeslope flats and bolson floors. Such areas have received recent alluvium and therefore recent moisture, and have produced recent plant growth.

The A1 Recent Alluvium mapping unit is present in most areas of the McGregor Range, except on the Newman quad and on the western and central portions of Desert and Desert SW quads that are underlain by Camp Rice Rio Grande (CR) sediments. The A1 unit merges with the Bolson Floor Complex (BFC) of the Tularosa Basin, and in places makes up part of it. In some areas the A1 mapping unit is combined with A2, A3, DSC, P, and/or other mapping units, to form mapping complexes such as A1-A2, A1-A3, P/A1-A3, DSC/A1-A2, etc.

Because pedogenic carbonate is variable in the A1 unit, it is difficult to correlate it, and for that matter the A2 and A3 mapping units and their variably expressed soils, to the mapping units and soils of the Desert Project sequence centered around the Organ Mountains. It is also daunting to correlate these units to the Fort Bliss maneuver areas south and west of McGregor that were studied by Monger et al. (1993). Reasons are given in sections below.

Mapping Unit A2 (Relict Alluvium)

This alluvium, like A1 alluvium, was also highly calcareous when deposited, and consists of both gravelly and nongravelly sediment from limestone and carbonate rich sandstones and shales derived from upland rocks of mainly late Paleozoic age. The relict alluvium that makes up the A2 mapping unit may range in age from several to many thousands of years old, and probably spans the age range of the Organ II-Isaacks Ranch surfaces of the Desert Project. In addition to original primary calcium carbonate deposited with the lime-rich sediments across most of the McGregor Range (Camp Rice Rio Grande sediments excepted), relict surfaces of A2 alluvium, like A1 surfaces, regularly receive infalls of calcareous dust from winds and dust devils, and possibly carbonate from occasional overbank floods from nearby, slightly lower lying washes and stream channels. A2 surfaces thus have variable caliche (pedogenic carbonate) expressions that range from none where badgers have recently burrowed, to thick continuous envelopes and bridges across grains, to partially

and even wholly cemented subsoils (in some pedons). Where subsoils are cemented, cementation is less than that expressed by soils in the less common and older A3 alluvium mapping unit.

It should be emphasized that, apart from Camp Rice Rio Grande sediments, the amount of pedogenic carbonate expressed in any relict alluvial unit on the McGregor Range may vary significantly on surfaces of the same or similar age. Reasons are several. One is that McGregor alluvial fans and pediments are carbonate-rich, the latter often shallow to limestone rock (pediment). Soils appear to form rapidly in terms of pedogenic carbonate accumulation, though not uniformly. Pedogenic carbonate on similar or equivalent McGregor fan segments may range from slight carbonate accumulations to cemented calcic horizons. Further, badgers and other vertebrate bioturbators on McGregor often disturb calichified subsoils, even petrocalcic horizons, sometimes to the point of locally destroying them in one, several, or even many adjacent pedons. Such disturbance may slightly, largely, or completely reset the pedogenic carbonate clock, so to speak (e.g., site 2 at Sulphur, Orogrande S quad). Finally, Gile (1995) recently reported that pedogenic carbonate, the main age indicator in soils developed on Isaacks Ranch surfaces in the Las Cruces area, may vary as much as fivefold depending on landscape position and texture of sediment. For these collective reasons correlation of McGregor fan surfaces with the Desert Project sequence based on pedogenic carbonate accumulation—other than in very general terms—could be misleading. If strength of caliche development on McGregor fan segments is used as an index of time, tight chronometric control must be established for each fan segment studied.

The A2 mapping unit on the McGregor alluvial fans commonly occurs in three situations: as relict island surfaces a meter or two above active stream washes in upper toeslope and lower midslope-alluvial fans; as pediment on pediments; and as fanglomerate aprons downslope from pediments and bedrock outcrops. Examples are on west-directed footslope-toeslope fans emanating from the Otero Escarpment (Wilde Tank quad), on the south-directed mid and lower slopes on the north side of El Paso Draw (El Paso Draw quad), and along the mid-lower slope pediment-fanglomerate aprons emanating from bedrock highs east and west of Lake Tank Playa (Desert SE quad). In some areas the A2 mapping unit is combined with A1 and or A3 mapping units as A1-A2, A1-A3, or A2-A3 complexes. Other combinations are P/A1, DSC/A1, and so on.

Mapping Unit A3 (Older Relict Alluvium)

As with the A1 and A2 mapping units, this originally calcareous alluvium also derived mainly from late Paleozoic upland limestones, but also from limited sources of redbed sandstones and shales. The relict alluvium that makes up this mapping unit ranges in age from tens to hundreds of thousands of years, and probably spans the ages of earliest Isaacks Ranch to earliest Jornada (Jornada I) surfaces of the Desert Project. Where the pedogenic clock is not reset via badger and rodent bioturbation, old relict surfaces of A3 alluvium are strongly overprinted by pedogenic carbonates, with subsoils characterized by caliche stages III and IV, including laminar and plugged caliches that approach the La Mesa (Doña Ana) soil caliches in strength of expression.

On the other hand, the caliche clock is indeed commonly reset by badgers and rodents on many A3 and younger surfaces, within and between pedons, as evidenced at various McGregor sites (site 1, Sulphur, near Sulphur Tank, Orogrande S quad).

The A3 mapping unit usually, though not always, occurs at higher topographic and higher fan positions than A2 surfaces, though they are commonly associated with the latter. They are most frequent at mid and upper slope positions on dissected alluvial fans and pediment-fanglomerate aprons, with good examples on the Wilde Tank, El Paso Draw, and Desert SE quads. In some areas the A3 mapping unit is combined with A1 and/or A2 mapping units as A1-A3, or A2-A3 complexes. Other complexes may be P/A1-A3, P/A3, and DSC/P/A1-A3, and so on.

Mapping Unit B (Bedrock)

This unit is common to predominant in most of the McGregor Range except the Tularosa Basin lowlands (Bolson Floor Complex). The criteria for mapping bedrock is almost exclusively whether bedrock structure (stratigraphy, bedding, etc.) is visible on the orthophotoquads and/or air photos. If visible it means that soil cover is nonexistent or so thin that bedrock structure easily shows through. In several cases where structure could not be observed because of optical aberrancies or shading on air photos but where slopes were so steep that bedrock is almost certain, it was mapped as bedrock.

Mapping Area, Bolson Floor Complex

This mapping area was defined exclusively for the Tularosa Basin portion of McGregor because it is a complex of sediments and geomorphic surfaces, and it should be viewed as a complex. Its boundary is set off by a *dashed*, heavier than usual line weight that is labeled Bolson Floor Complex. The boundary very generally coincides in most places with the 4,100-foot contour line in the McGregor portion of the Tularosa Basin. An exception is northeast of the Jarilla Mountains where it is slightly lower than 4,100 ft. The Bolson Floor Complex dashed boundary is in a few cases a delimiter for certain mapping units. Camp Rice fluvial facies are a special part of the Bolson Floor Complex, and are themselves set off by a *dotted* line of heavier than usual line weight.

Mapping symbols do not identify the Bolson Floor Complex as such except along its boundary where, as indicated, it is spelled out as Bolson Floor Complex. It is also, as indicated, a complex of various surfaces and sediments, so that depending on location it may include Camp Rice gravels (CR), playa depressions and sediments (PI), playa lunettes (PIL), distal toeslope sediments (A1), coppice dunes and associated dune sheets (DSC), dune sheets alone (DS), and dune piles (DP). Typical mapping designator symbols may be, for example, DSC/A1/PI, or DS/A1, or DP/PI, and so on.

Mapping Unit CR (Camp Rice [Rio Grande] Sediments)

The Camp Rice fluvial sediments, as noted above, are a special element in the Bolson Floor Complex. The sediments, which were originally largely noncalcareous, consist of both high energy sands and gravels and low energy slack water clays and silts. The high energy clasts have mixed lithologies of fluvially rounded and polished exotic elements, such as basalt, pumice, and other extrusive and intrusive igneous clasts, plus other rock types. According to Strain (1966) they were deposited by the ancestral Rio Grande in early-mid Pleistocene time when it flowed through the Franklin-Organ mountains (Fillmore) gap area and meandered across the southern Tularosa Basin. They are thus relict, unlike most other sediments on McGregor that are on actively evolving fans and slopes. For these reasons Camp Rice fluvial facies sediments are fundamentally different from other sediments on the McGregor Range.

Camp Rice (Rio Grande) fluvial sediments occur only in the southwestern Tularosa Basin portion of the McGregor Range, specifically on Desert, Desert NE, Desert SE, Desert SW, Elwood, and Newman quads. Except for Newman, the eastern boundary of the Camp Rice fluvial facies is present on these quads and is indicated by a continuous dotted line labeled 'Camp Rice (Rio Grande) Sediments' at select places (the CR symbol is used as a mapping unit within the Camp Rice boundary). The northeastern boundary of Camp Rice gravels north of Three Buttes (east side of easternmost butte, Desert quad) was taken from Seager et al. (1987), but its southern boundary in this study was placed on top of the Lake Tank fault-line scarp (Desert SE and Desert SW quads) rather than at its base, as was indicated on the Seager et al. map: Geologic Map 57, Sheet 1). The changed position was based on the intuitive reasoning that any Camp Rice Rio Grande sediments on the downthrown side of Lake Tank Fault would now be buried under an unknown thickness of calcareous playa and A1 toeslope fan sediments derived from the eastern escarpments.

The strongly developed, petrocalcic horizon-bearing soil (La Mesa soil, Doña Ana Series) that has formed in Camp Rice sediments in the southern Tularosa Basin has been correlated to the La Mesa surface, whose type locality is on the high mesa above the Rio Grande in the Las Cruces area (Gile et al. 1981; Monger 1993; Seager et al. 1987). The general natures of the La Mesa soil and the Camp Rice sediments are observed in backhoe-dressed borrow pits along the McGregor Entrance Blacktop and along Meyer Range Road (north side of both roads). The calcium carbonate that has overprinted the originally (mainly) noncalcareous Camp Rice unit, and which forms the petrocalcic horizon of the La Mesa soil, is largely owed to airborne carbonate-rich dust (Gile et al. 1981; Monger 1993). The insoluble residue of the dust has left residual sediment in some playas (e.g., Vertisol Playa), but in others it has been removed or partly removed by deflation (many playas on the La Mesa surface have lunettes formed on their downwind NE borders, indicating eolian scour).

As with all other alluvial surfaces of the McGregor Range, badgers and other vertebrates have left significant bioturbational signatures on the La Mesa (Doña Ana) soil. Borrow Pit 1 at the Missile Gate entrance to McGregor Base Camp, for example, shows abundant evidence of bioturbation, which has resulted in caliche expressions that range from strong petrocalcic horizons to almost none where it has been destroyed by badgers. Quantitative estimates of the role of vertebrate bioturbators in regressing calcic horizons of desert soils that might be used for comparative purposes are, unfortunately, largely lacking. In fact, bioturbation processes have received scant attention in models of desert soil genesis.

Mapping Unit DL (Dune, Local)

This mapping unit is different from other dunal units in that the reddish colored dunes defined are localized and of limited areal extent. They are also relatively thin, usually a meter or two, or less. The mapping unit is mainly along the lower reaches of El Paso Draw (Otero Mesa N and El Paso Draw quads), though such dune patches do occur elsewhere on the Mesa. In El Paso Draw the brownish-reddish dunes cover distal toeslopes of alluvial fans emanating from the Sacramento Mountains and surrounding west and south parts of Otero Mesa, or occur as small dunes along the floor of the draw. This unit is important archeologically because artifacts were (are) observed on nearly every local dune encountered in the draw, some mixed with caliche on badger burrow spoils and obviously cycled up from below. Sandy areas occur elsewhere on Otero Mesa, for example near Camaleche Tanks south of Bassett Lake. According to Charlie Lee, proprietor of Hat Ranch, the sand is blown out of the Tularosa Basin by strong southwest and west winds. Some readers may doubt the ability of saltating sand grains to move long distances up canyons and headlands under strong winds, sometimes without leaving a trail of sand dune patches to document the process. However, abundant literature on dune-forming processes, and wide personal experience along coasts and deserts, confirms the ease by which such 'up escarpment' sand migration can be accomplished.

The ultimate source of dune sands on the McGregor Range and the Tularosa Basin, however, are Paleozoic redbeds, many of which are paleosols, some of which outcrop on Otero Mesa (e.g., Bassett Lake). They derive mainly from the reddish Abo and Yeso formations of Permian age, and the reddish Bliss Sandstone of Cambrian-Ordovician age. They locally and regionally outcrop here and there in the surrounding uplands, including the Sacramento Mountains-Otero Escarpment and Mesa-Hueco Mountains, the Franklin-Organ-San Andres mountains, and the westernmost of the Tres Hermanos Buttes (Twin Buttes). Conspicuous Permian redbeds outcrop for several miles all along the lower midslopes of the Otero Escarpment east of Jarilla Bolson, from Rough Canyon north to County Road 506. Red silt and sand weathered from the outcrops are visible as in transit sediment along washes that drain from such areas. In fact, the entire area downslope of the redbeds has a pinkish hue, from the old McGregor Ranch north to and beyond Wilde Well.

Reddish sands eroded from these rocks can be observed in transit in many small washes draining into El Paso Draw from both the Sacramento Mountains and Otero Escarpment. Reddish sands also erode from the Otero Escarpment and wash west into the Jarilla Bolson. Fieldwork confirmed these redbed source areas, and it

is clear that enormous quantities have washed into the Tularosa Basin during the Tertiary and Quaternary. The process is active today as a visit to any redbed outcrop will attest. It is a fundamental fact worth underscoring that the reddish color of the Tularosa Basin sands is, in the first instance, due to pedogenic weathering, originally and primarily in Paleozoic soils, but also color augmented by additional pedogenetic iron oxide overprints in modern oxic soils.

Mapping Unit DP (Dune Pile)

Dune piles are either thick (many meters) accumulations of sand, *or* multiple buried sand sheets (distinguished in that each has experienced a degree of pedogenesis prior to burial), *or both*. They often exhibit lobate geometries on air photos, which apparently reflect their recent historic development and movement downwind (they are in slow transit). They also often exhibit a rippled or mega-rippled appearance on air photos, a further indication of recent movement by wind. Examples are the thick dune piles which occur intermittently from the BLM site on the Tres Hermanos quad (mile markers 44-45, Hwy 54) south of Escondida Siding east to the Sacramento Mountains escarpment on the Grapevine-Sand-Culp canyon fans (Pipeline and Culp Canyon quads), and which even extend up onto the escarpment above the fanheads. Such dune piles also occur extensively in the Jarilla Bolson, from Jarilla Gap through the Benton-Wilde-Cox wells areas north onto Culp Canyon fan (Orogrande N & S, Wilde Tank, and Pipeline Canyon quads), and in the Davis Dome area (Desert SE quad).

Some dune piles are shown on air photos as sandy areas with vegetation-free light-colored spots, almost whitish in some cases. Ground truthing has confirmed that many of these are active or formerly active mounds of harvester ants (*Pogonomyrmex apache* [Wheeler] and *P. rugosa* [Emery]). The ants typically harvest (remove) vegetation from around their mounds, and may armor them with sand-sized pieces of whitish caliche bioturbated up from a residual subjacent (buried) soil. As a consequence, the mound and surrounding vegetation-free areas are clearly visible on color air photos as ant spots. Many of the dune piles in and adjacent to the Bolson Floor Complex, and those associated with the Lake Tank Fault scarp near Davis Dome, exhibit ant spots. Possibly the presence of ants in thick dune piles reflects their preference for deep sand as habitat. So, ant spots, in addition to ripples and lobate forms, are another diagnostic criterion for recent dune piles. Such vegetation harvesting activity by ants may keep dune piles destabilized and augment wind deflation and dune migration.

As indicated, dune piles can be differentiated from sand sheets on air photos by their ant spots and by their large scale ripples and crescentic-lobate forms. Mega-ripples and crescentic lobate forms are particularly common in the sand piles of the Jarilla Bolson and lower midslopes of the Grapevine Canyon fan (Orogrande N-S Wilde Tank and Pipeline Canyon quads).

Dune piles and dunes in general are extremely important though complicating elements in the geomorphology of the McGregor Range. Their concentration on the east side of Tularosa Basin, and the strong paleosols formed in the lower sedentary (nonmobile) dune sheets, proves that they have been accumulating for long periods of the late Quaternary (at least) and that the wind pattern has been mainly SW to NE. In fact, to fully appreciate the rationale behind the Dune Pile (DP) and other dune mapping units (DS, DSC) requires an understanding of the age and origin of the sand in the Tularosa Basin, and the age and origin of the dune piles that form part of the sand. First, as noted, the ultimate sources for Tularosa Basin sands are Paleozoic redbeds in bordering uplands, mainly Bliss Sandstone and Yesso Formation rocks, which doubtless have been shedding sand into the basin for as long as exposures have existed. Indeed, dune sheets and dune piles were accumulating here long before Europeans or Native American ever arrived in North America. When the Rio Grande abandoned the lower Tularosa Basin in mid Pleistocene time and left Camp Rice river sediments behind, soil began forming in them, and has been forming in them since. Sediment from upland redbeds made its way onto the margins of this early La Mesa surface via stream wash, and ultimately onto playas.

When basin footslopes and playas dry out after storms, the fluviially deposited sediment is deflated by wind. Dust is blown away, and dunes form from the coarse fraction left behind. The process has occurred repeatedly in many basins and plains of western North America, and occurs in many of these same areas today, including the Tularosa Basin.

Dunes tend to accumulate on basin floors because that is where sediment is ultimately washed, and from which dune sand derives. If unanchored, dunes migrate in the prevailing wind direction, which in the Tularosa Basin is southwest to northeast. Dune sand consequently forms from basin sediments as eolian lag, then migrates downwind—sometimes upslope onto escarpments—and piles up. It has long done this along the east side of the Tularosa Basin, but it received a huge impetus by overgrazing stock animals in the period 1886-1900, a process which destabilized formerly stabilized dune sheets across much of the Tularosa Basin (Kenmotsu [1977] documented the process on McGregor). Its ultimate destination is in downwind areas, either where wind is strongest, as in the Culp-Grapevine canyons fanhead area, or where topographic obstructions like the Jarilla Mountains create lee side windshadows, like the Jarilla Bolson (most all are historic).

But, primary sand washes into the Jarilla Bolson from extensive Yeso redbeds exposed below the Otero Escarpment. Most sand, however, is secondary and blows into the bolson from the southwest around the Jarillas, through the Jarilla Gap (a wind gap) on the south and the Moody Lowlands wind gap on the north. Both wind gaps have significant SW-NE attenuated lobate and mega-rippled historic dune piles that are migrating over polygenetic sedentary basal dunal soils (e.g., the BLM site). The basal pedogenetized dunes indicate that dunes have long been accumulating, though episodically, probably during much of the mid-late Quaternary, if not earlier. These dune accumulations, however, were probably dune sheets, and nowhere near the magnitude of historic dune pile accumulations that we witness today. Historic dune piles migrate downwind as slowly moving dune trains. Ironically, and interestingly, their ultimate common destination is high ground on and between the Grapevine-Culp canyons fanheads. A Venturi effect has apparently channeled winds and sand up into this part of the Sacramento Mountains for a long time back into the Quaternary. Eventually the sand is washed back down into the basin, some of which is re-entrained by the wind and blown back up to renew the cycle, a process made evident by abundant reddish fluvial sand exposed in the channel and walls of Sand and Culp canyons. However, some sand is also buried by alluvium and removed from the cycle.

Exposures at the BLM site in the Moody Lowlands reveal the polygenetic and multiple dune sheet character of dune piles in that area (see Appendix D soil-sediment descriptions, and Tres Hermanos quad). Multiple dune sheets that form reddish dune piles also are apparent in borrow pits and road cuts along the Shorad Gate-Benton Well Blacktop.

A local historic source of the reddish sand on McGregor, but which of course also derives ultimately from Paleozoic redbeds, is the extensively eroded A horizon of the La Mesa soil upwind, west and southwest, of the McGregor Range, especially from the Doña Ana Range between Highway 54 and Old Coe Lake. This point was noted earlier, but should be stressed because much sand from eroded La Mesa (Doña Ana) soil does indeed contribute to McGregor sand dunes.

The difference between a dune pile and a dune sheet is that dune piles are thick, or consist of multiple dune sheets, or both, whereas dune sheets are thin. Dune piles and dune sheets invariably grade into one another and often occur together, and some dune piles are merely over-thickened dune sheets, and may or may not be coppiced.

Mapping Units DS (Dune Sheet) and DSC (Dune Sheet, Coppiced)

As defined here, a dune sheet is a dynamic layer of sand of variable thickness, but which is generally relatively thin, often less than 2 m (syn., sand sheet). Theoretically it may be as thin as a few centimeters, or even millimeters at its expanding downwind frontal edge where it is expressed primarily as saltating grains of sand. In practical terms of mapping, however, dune sheets are mapped only where they are apparent on color air photos, and where they do not exhibit mega-ripples or lobate forms (otherwise such are mapped as dune piles). Consequently the centimeter-to-millimeter thin frontal edge of a dune sheet, which may be areally extensive, is omitted from mapping units.

Dune sheets may or may not be coppiced. Coppiced dune sheets are more conventionally called coppice dunes, a practice followed here. A coppice dune is an accumulation of wind-deposited sand or sandy soil about the base of an anchoring shrub (syn., coppice mound). If a dune sheet is uncoppiced, the mapping unit is DS, whereas if coppiced it is DSC.

Mesquite is far and away the most common anchoring shrub for coppice dunes in the Tularosa Basin, and coppices anchored by them tend to be large. Creosotebush is a much less common anchoring species, and coppices anchored by them are smaller. A yucca-grass association, on the other hand, is more typical for uncoppiced dune sheets.

It is important to note that as defined here coppice dunes are a special manifestation of dynamic, on-the-move dune sheets. Inasmuch as the downwind distal front of a dune sheet often attenuates and expands via saltating sand blown from its leading edge, incipient coppicing often begins there and at scales only sand grains thick.

Coppice dunes vary significantly in their character and geometries. In fact, they span a spectrum from subtle sandy or sandy soil accumulations at the bases of creosotebush on the one hand, to spectacular, discrete, 3-5-m-high hemispherical mesquite-anchored mounds on the other. The latter may be surrounded by bare and eroded though thick and indurated caliche, and joined to one another only by the sand that saltates between them. Examples on McGregor occur on the Camp Rice (La Mesa) surface along the north-south Water Road between the McGregor Entrance Blacktop and Meyer Range Road. Maximal examples also typify parts of the Doña Ana Range west of McGregor that are underlain by the La Mesa (Doña Ana) soil. Beneath the mounds, intact sandy A horizon of the La Mesa soil is preserved, but stripped down to the petrocalcic horizon elsewhere, showing that much of the coppiced sand came from the nearby eroded intermound La Mesa topsoil itself. But while both minimal and maximal coppice mounds are present on the McGregor Range, intermediate members are the overwhelming rule.

As indicated earlier, multiple dune sheets with contained paleosols often make up dune piles. In such cases the mapping designation is DP. Also as indicated, dune sheets and dune piles invariably grade into each other and often occur together, and are thus difficult to precisely map.

Mapping Unit DSG (Dune Sheet, Gypsiferous)

This mapping unit is in the northwestern part of McGregor. It is the probable floor of intermittent Lake Jarilla, which when full stretched from near Wilde Well north to the Great Wall of China Playa and beyond. The area in between has been largely buried by mainly historic quartzose sand piles and dune sheets, with the exception of the area north of the Dunal Escarpment at mile marker 47 along Hwy 54, and a few dunal windows in between (e.g., Cox and Salt Cedar playas).

Faults

Faults are common on McGregor, and there are undoubtedly far more present than were recognized and mapped in this study. The Newman, Hot Well, Hueco Nos. 1 and 2, and Coyote Fan faults were mapped by Seager et al. (1987), and they and other faults were given names in this study to facilitate communication. New faults mapped in this study were based on one or more morphologic indicators: lineaments, offset bedrock spurs, offset streams, truncated fans, scarps, depressions, tonal differences and lineations on air photos, and or some combination of them. Normal faults are indicated by a ball on the downthrown side, and monoclinical axes are indicated by double arrows—for example, Hot Well Fault-Monocline (movement on most faults, however, is not inferred in this study). Faults are shown as a bold solid line where one or more of these criteria are met, and dashed where faults are inferred on or below the surface. Normally subsurface inferred faults are indicated by a dotted line, but to avoid confusing such with dotted lines that are used to indicate lobate dune fronts—Pipeline Canyon quad—and to indicate recent historic wind eroded lands—Mountain Tank quad—a dashed line indicates *both* inferred faults at the surface or in the subsurface.

Mapping Unit P (Pediment)

Pediments, as used and defined in this study, are solutional- and/or abrasional-bedrock surfaces generally overlain by a thin (1-3 m) veneer or mantle of soil and or sediment (so called pedisediment). Pediments occur as debris-mantled footslope aprons around bedrock areas, and along washes and other drainageways. Often the pedisediment that buries them is a mix of A1-A3 alluvium in which residual soil has formed. Pediments are widespread on Otero Mesa, along the broadly dissected Otero Mesa Escarpment, and in the Hueco and Sacramento mountains, being almost the rule in these areas where bedrock is not directly exposed at the surface. Conversely, pediments are absent in the Bolson Floor Complex of the Tularosa Basin, except as buried aprons around bedrock residuals (e.g., Desert and Orogrande S quads).

Mapping Unit PI (Playa)

Playas are common throughout the Tularosa Basin, as well as on Otero Mesa. Normally, though not always, depressional contours on topographic maps designate playas, and these are designated as either permanent or temporary. A permanent playa generally occurs in the lowest part of the landscape, either in a lowland site of the Tularosa Basin, or in an upland site on Otero Mesa. Permanent playas periodically collect runoff waters that contain suspended silts and clays, and salts in solution. When the water evaporates or slowly drains downward, or both, the fines and precipitates are left behind as a mix of playa sediment. Upon drying, this sediment often shrinks and cracks into playa curls, or puffs up owing to salt efflorescences, which the prevailing SW wind deflates, saltates, and comminutes to sand-sized pellets. These then often form lunettes on the downwind (lee) sides of playas, at least in the Tularosa Basin (most playas in the Tularosa Playa of McGregor have lunettes, a major exception being Lake Tank; most Otero Mesa playas also lack them). Many of these playas with bordering downwind lunettes are deflation playas. A permanent playa can thus also be a deflation playa. Some playas are precipitation-deflation, alkali-rich playas (described in next section).

Temporary playas, on the other hand, are flattish or low slope surfaces, often dune-dammed, in which water is temporarily stored during storm periods. During great storms water may overtop the dams, or seep through, and flow to another lower lying temporary playa, or eventually to a permanent playa at the lowest point locally or regionally on the landscape. Examples of temporary playas are the various sand-dammed, playas in the vicinity of Benton and Wilde wells in the Jarilla Bolson (Orogrande N quad), and the playa depressions along the eastern downthrown side of the Lake Tank fault (which coalesce and drain into Lake Tank Playa—a permanent playa—during great storms). The numerous small interdunal and very ephemeral

depressions in the various dune piles and dune sheets of the Tularosa Basin, which due to their small size and brief existence lack playa sediment, are not considered playas here.

Mapping Unit PIL (Playa Lunette)

Lunettes in this study were identified by air photo analysis and by depressional contours on topographic maps. Many were ground truthed. They range from prominent crescentic sediment plumes deposited by wind downwind of playas (and from which the sediment derived), that are very distinct, to low subtle ones that are barely perceptible on the ground. Both, however, may be apparent on color air photos. This mapping unit includes lunettes ranging from those that are gypsum-rich (calcium sulphate) and calcite-rich (calcium carbonate) to those composed largely of quartzose sands. The gypsum may be either massive or crystalline (selenite) in form. The gypsum dunes at White Sands National Monument are a classic example of the latter, the Great Wall of China the former. Gypsite lunettes form, among other places, on the downwind sides of precipitation-deflation playas. Examples are in far northwestern McGregor, east of Hwy 54 and downwind of the Great Wall of China and Lone Butte playas on the Tres Hermanos quad (mile marker 50, Hwy 54). In these playas shallow and/or artesian fed brackish ground water evaporates at the surface, causing a gypsum-calcite rich effloresced soil to form that is easily deflated by wind, especially if disturbed by ungulates. Over a long period the process removes considerable soil and sediment, causing slow lowering of the playa floor concomitant with the formation of a gypsiferous-calcareous soil dune on the downwind side. Such gypsum- and carbonate-rich soil dunes, doubtless containing a variable quartzose element, are called gypsite lunettes in this report, though they are not differentiated as such on the maps.

Gypsite lunettes also form when playas fill with gypsum-rich runoff waters, and when upon evaporation calcite and sulphate are precipitated as an efflorescence at the surface. Wind then piles the playa sediment downwind as a lunette.

Gypsum-rich runoff derives from gypsiferous late Paleozoic redbeds and other beds in upland rocks, and from gypsum dust deflated from gypsum-rich playas in the western Tularosa Basin (Lake Lucero, White Ranch Lake, Parker Lake, etc.) that periodically blows across McGregor. To this latter point, it is notable that several times during the spring and summer of 1996 large plumes of gypsiferous dust blown from the Tres Hermanos gypsite flats crossed northern McGregor. Twice the author drove through them. And during one day while driving from Alamogordo to El Paso, the entire central and southern Tularosa Basin was so dust-laden that the sky was noticeably darkened, whereupon the sun appeared as an indistinct yellowish and lustrous orb. Consequently, some of the playas in central and northern McGregor are gypsum-bearing, and all are calcareous. Examples are the lunettes on the northeast of Vertisol and Gypsum playas.

Under the right conditions, a low lobate type of gypsite lunette can form that may attenuate considerable distances downwind of the slowly deepening playa source area. Essentially these are gypsite longitudinal lunettes. Examples are in the north McGregor area, east and northeast of the Great Wall of China gypsite-quartzose lunette and north of the dunal escarpment at mile marker 47 on Hwy 54 (Tres Hermanos and Deadman Canyon quads). (cf., coppice dune, dune, dune sheet, lunette, alkali lunette, quartzose lunette in Glossary).

An example of a quartzose lunette is Benton Well Playa in the Jarilla Bolson (0.5 km north of the Shorad Gate-Benton Well Blacktop and 50 m east of the Benton Well-Sulphur Tank Road). (cf., coppice dune, dune, dune sheet, lunette, alkali lunette, gypsite lunette in Glossary).

PART II MAPS

LIST OF INDEX MAPS

Map Types, Scales, Names, and Dates of Maps and Orthophotos Used

Base Maps

Topographic (T) and orthophotoquad (O), both at 1:24,000 scale:

<i>Map Name</i>	<i>Type</i>	<i>Map Date</i>	<i>Constructed from Air Photos Taken</i>
Bassett Lake	T	1980	1974
Bassett Lake	O	1977	1977
Bug Scuffle Canyon	T	1981	1972
Bug Scuffle Canyon	O	1977	1977
Culp Canyon	T	1981	1972
Culp Canyon	O	1977	1977
Deadman Canyon	T	1981	1972
Deadman Canyon	O	1976	1976
Desert	T	1955	1954
Desert	O	1976	1976
Desert NE	T	1955	1954
Desert NE	O	1976	1976
Desert SE	T	1955	1954
Desert SE	O	1976	1976
Desert SW	T	1955	1954
Desert SW	O	1976	1976
El Paso Canyon	T	1965	1964
El Paso Canyon	O	1977	1977
El Paso Draw	T	1980	1974
El Paso Draw	O	1977	1974
Elwood	T	1955	1954
Elwood	O	1976	1976
Mack Tanks	T	1979	1974
Mack Tanks	O	1977	1977

<i>Map Name</i>	<i>Type</i>	<i>Map Date</i>	<i>Constructed from Air Photos Taken</i>
Mountain Tank	T	1980	1974
Mountain Tank	O	1977	1977
Newman	T	1955	1954
Newman	O	1976	1976
Orogrande N	T	1955	1954
Orogrande N	O	1976	1976
Orogrande S	T	1955	1954
Orogrande S	O	1976	1976
Otero Mesa N	T	1980	1974
Otero Mesa N	O	1977	1977
Otero Mesa S	T	1979	1974
Otero Mesa S	O	1977	1977
Owl Tank Canyon E	T	1980	1974
Owl Tank Canyon E	O	1977	1977
Owl Tank Canyon W	T	1980	1974
Owl Tank Canyon W	O	1977	1977
Pipeline Canyon ¹	O-T	1982	1971-72
Rogers Ruins	T	1965	1964-65
Rogers Ruins	O	1976	1976
Sixteen Canyon	T	1980	1974
Sixteen Canyon	O	1976	1976
Stone Well	T	1980	1974
Stone Well	O	1977	1977
Surveyors Canyon	T	1965	1964
Surveyors Canyon	O	1976	1976
Tres Hermanos	T	1982	1972
Tres Hermanos	O	1976	1976
Tres Hermanos SE	O-T	1982	1971-72
Wilde Tank	T	1980	1974
Wilde Tank	O	1977	1977

Air Photos

Color (C), Color Infrared (CIR), Black and White (BW)

<i>Photo Name</i>	<i>Type</i>	<i>Scale</i>	<i>Date(s) Flown</i>
White Sands MR	C	1:24,000	11/24/85, 11/28/85, 12/01/85, 12/07/85, 12/11/85, 12/13/85, 02/28/86, 03/01/86
NAPP ²	CIR	1:40,000	10/02/82, 06/20/83, 05/26/84, 06/09/84, 09/08/84, 07/12/86
NAPP	BW	1:40,000	03/03/91
NHAP ³	BW	1:80,000	03/03/91

¹ Pipeline Canyon and Tres Hermanos SE are USGS orthophotomaps-topographic (O-T) constructed from orthophotomosaics.

² NHAP = National High Altitude Photography Program.

³ NAPP = National Aerial Photography Program.

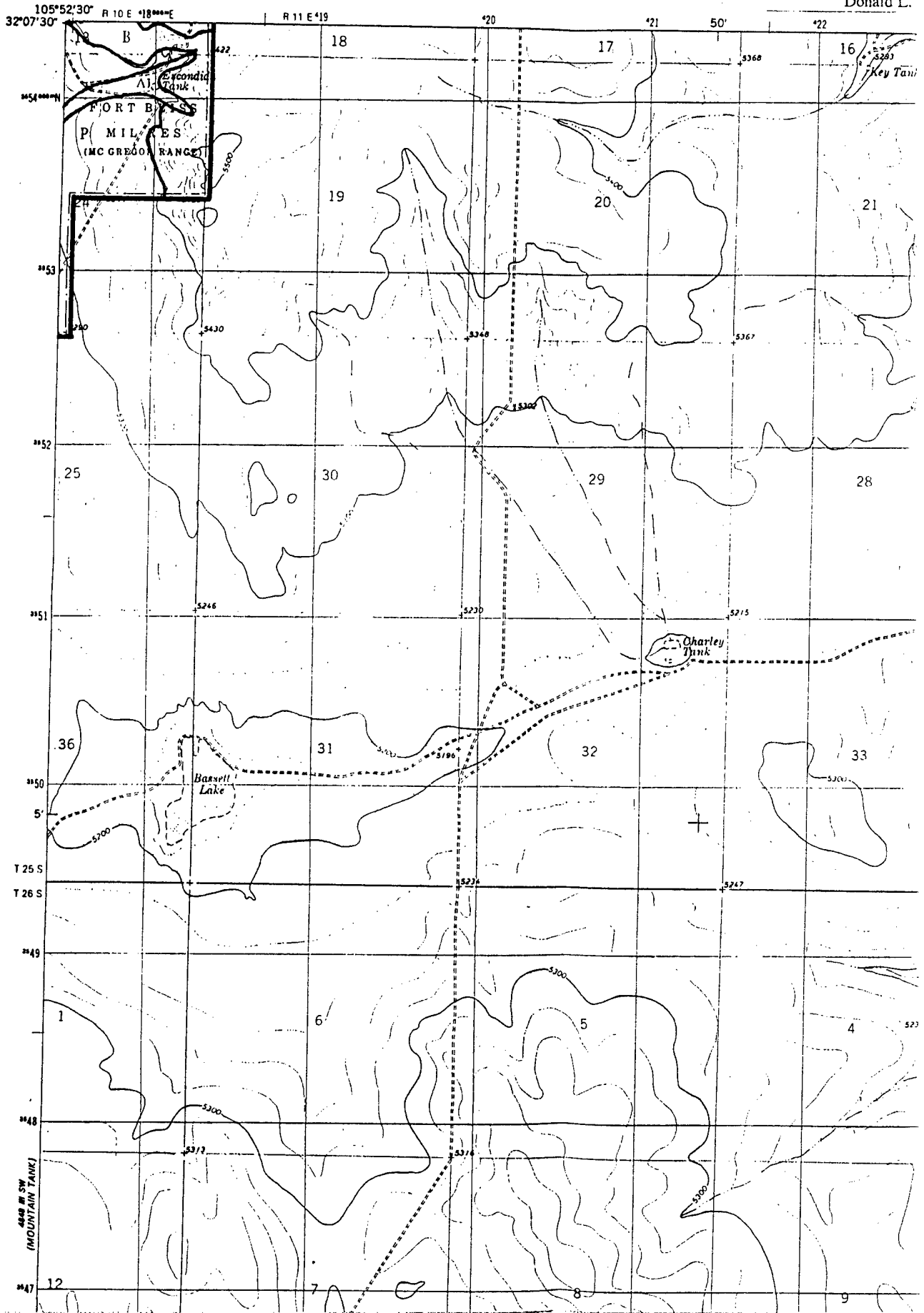
LIST OF GEOMORPHIC MAPS

Bassett Lake Quad
Bug Scuffle Canyon Quad
Culp Canyon Quad
Deadman Canyon Quad
Desert Quad
Desert NE Quad
Desert SE Quad
Desert SW Quad
El Paso Canyon Quad
El Paso Draw Quad
Elwood Quad
Mack Tanks Quad
Mountain Tank Quad
Newman Quad
Orogrande North Quad
Orogrande South Quad
Otero Mesa North Quad
Otero Mesa South Quad
Owl Tank Canyon East Quad
Owl Tank Canyon West Quad
Pipeline Canyon Quad
Rogers Ruins Quad
Sixteen Canyon Quad
Stone Well Quad
Surveyors Canyon Quad
Tres Hermanos Quad
Tres Hermanos SE
Wilde Tank Quad

4449 N NW
(LOW TANK
CANYON WEST)

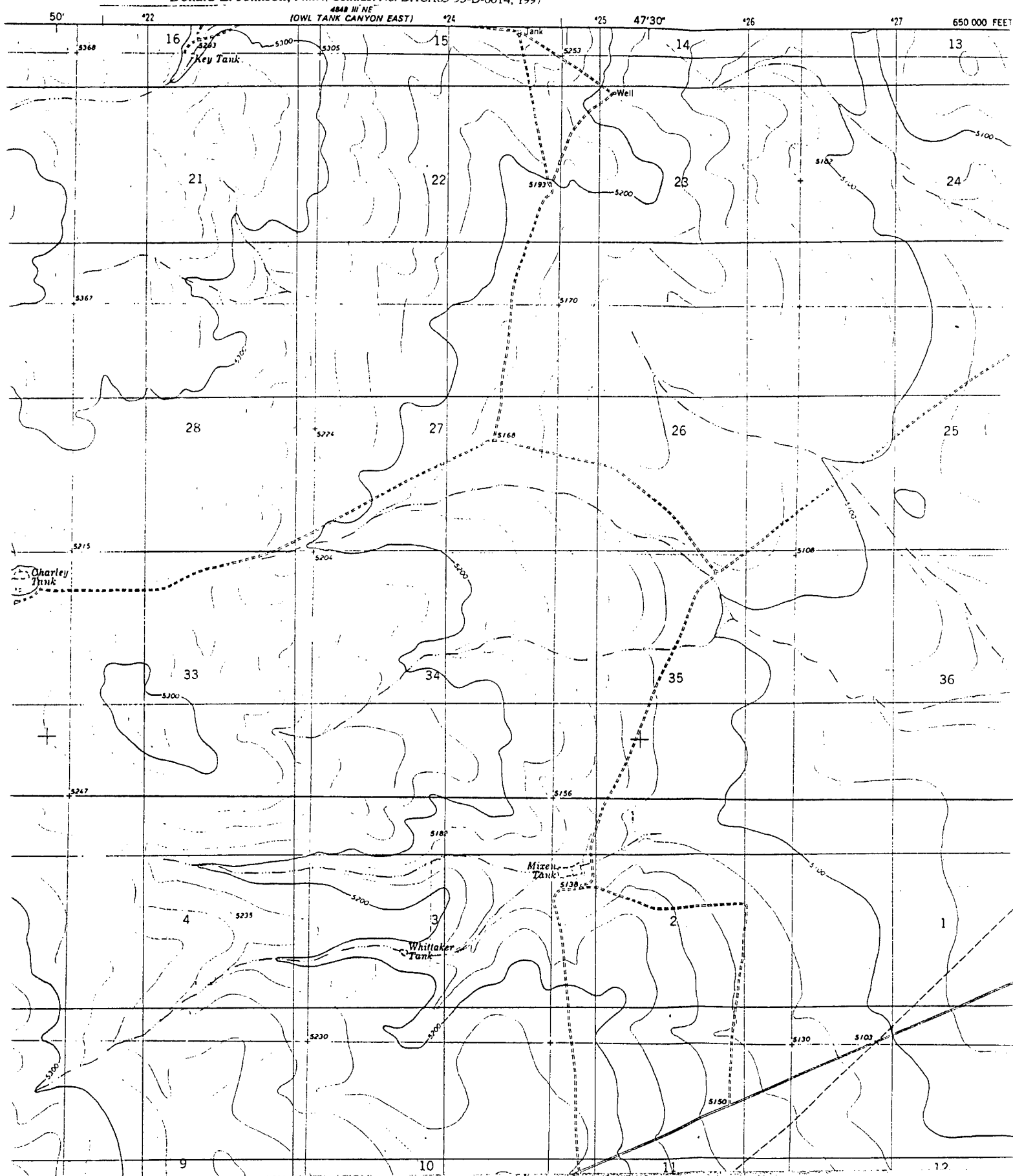
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Ge
Study of McGre
Donald L.



Donald L. Johnson, *Ph.D.*, Contract No. DACA63-93-D-0014, 1997

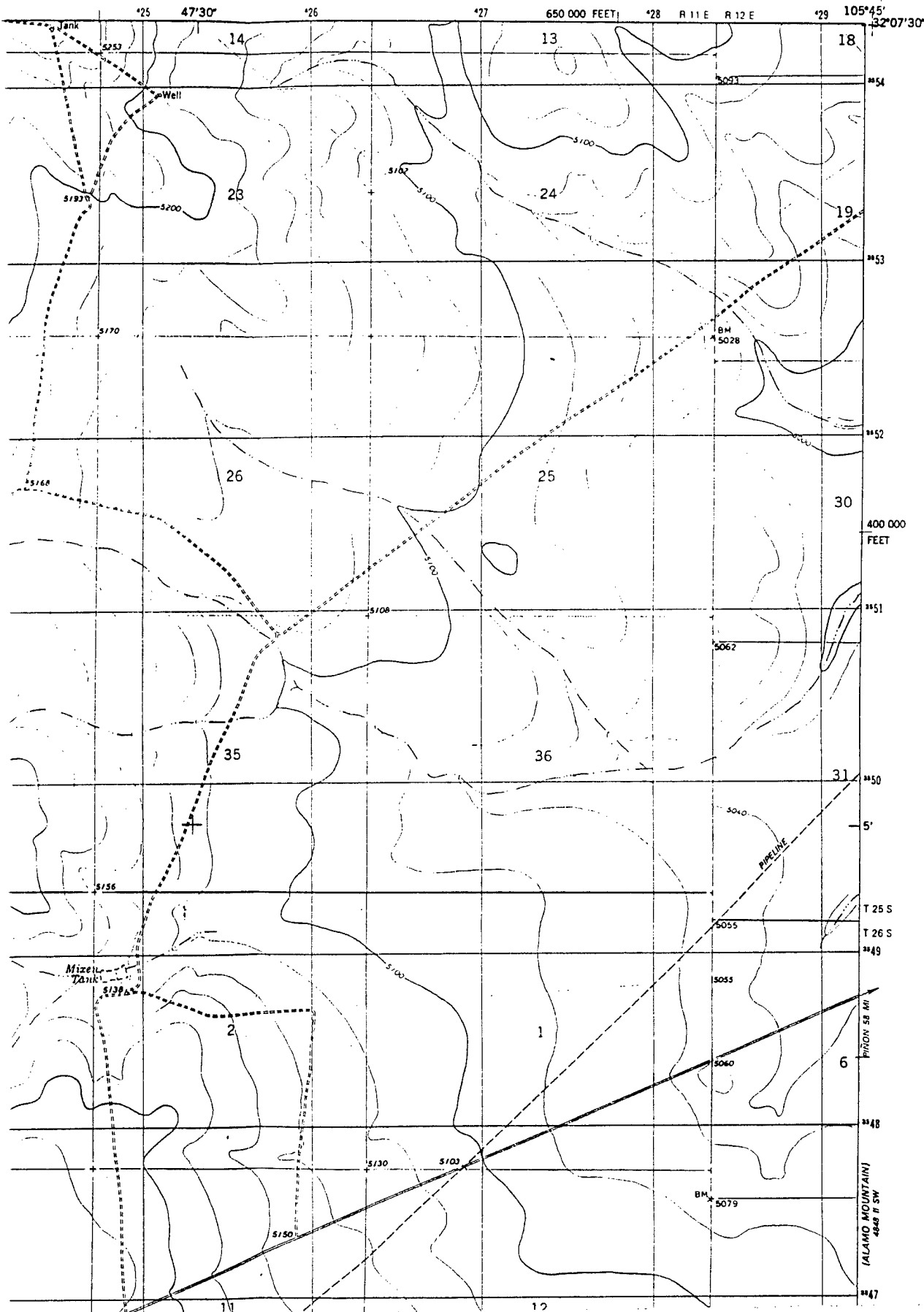
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

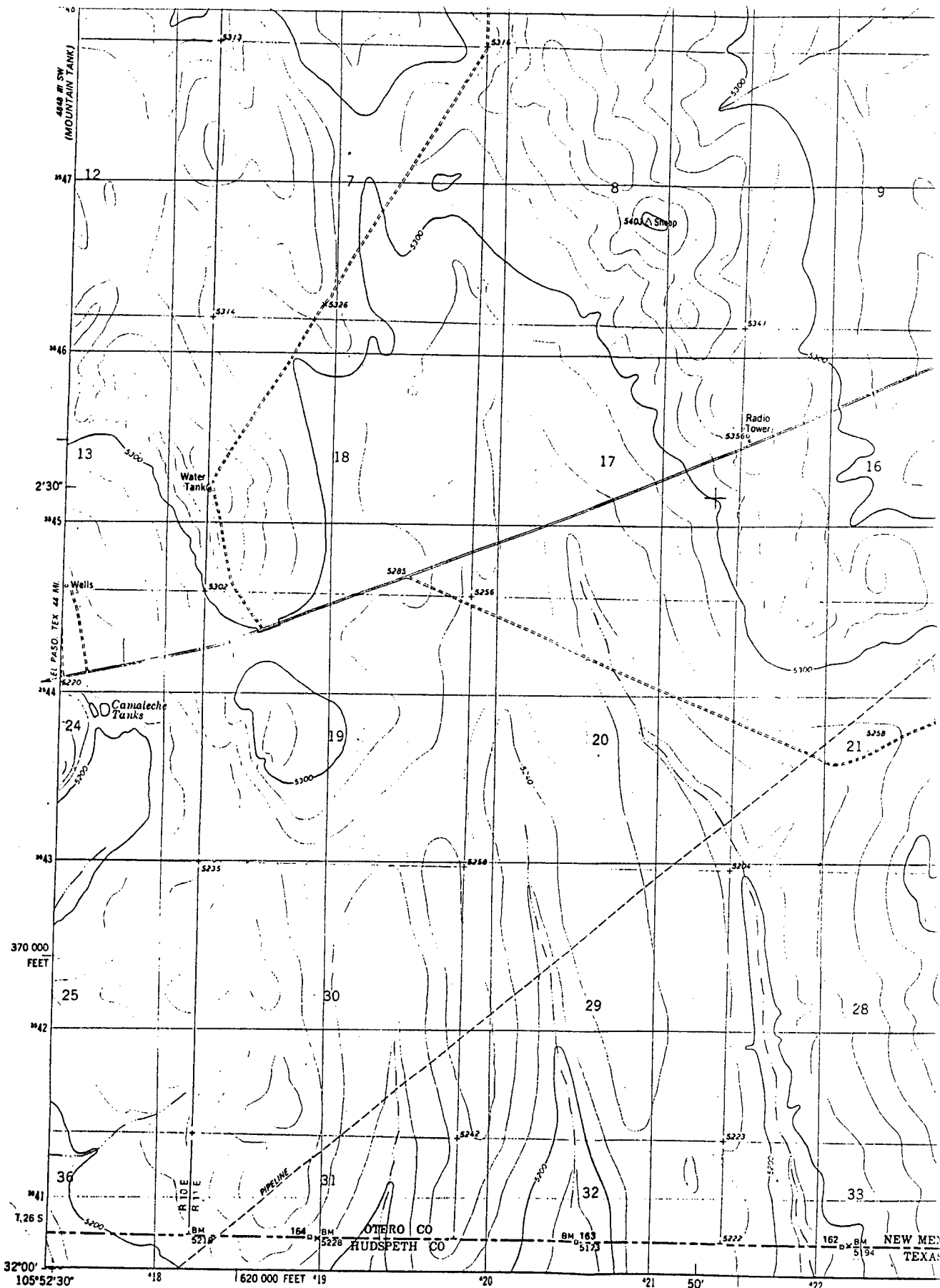


nd Surficial Mapping
Bliss, New Mexico
00014, 1997

BASSETT LAKE QUADRANGLE
NEW MEXICO—TEXAS
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 BASSETT LAKE 15' QUADRANGLE

400 000 FEET
18 T. RANCH





Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1974. Field checked 1975. Map edited 1980

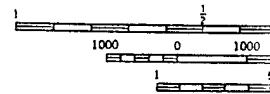
Projection and 10,000-foot grid ticks: New Mexico coordinate system, central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13 1927 North American datum

To place on the predicted North American Datum 1983 move the projection lines 8 meters south and 49 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

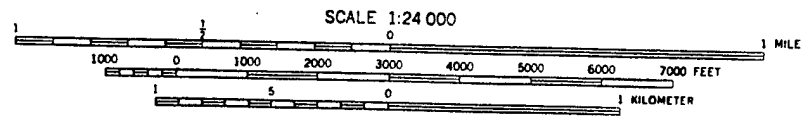
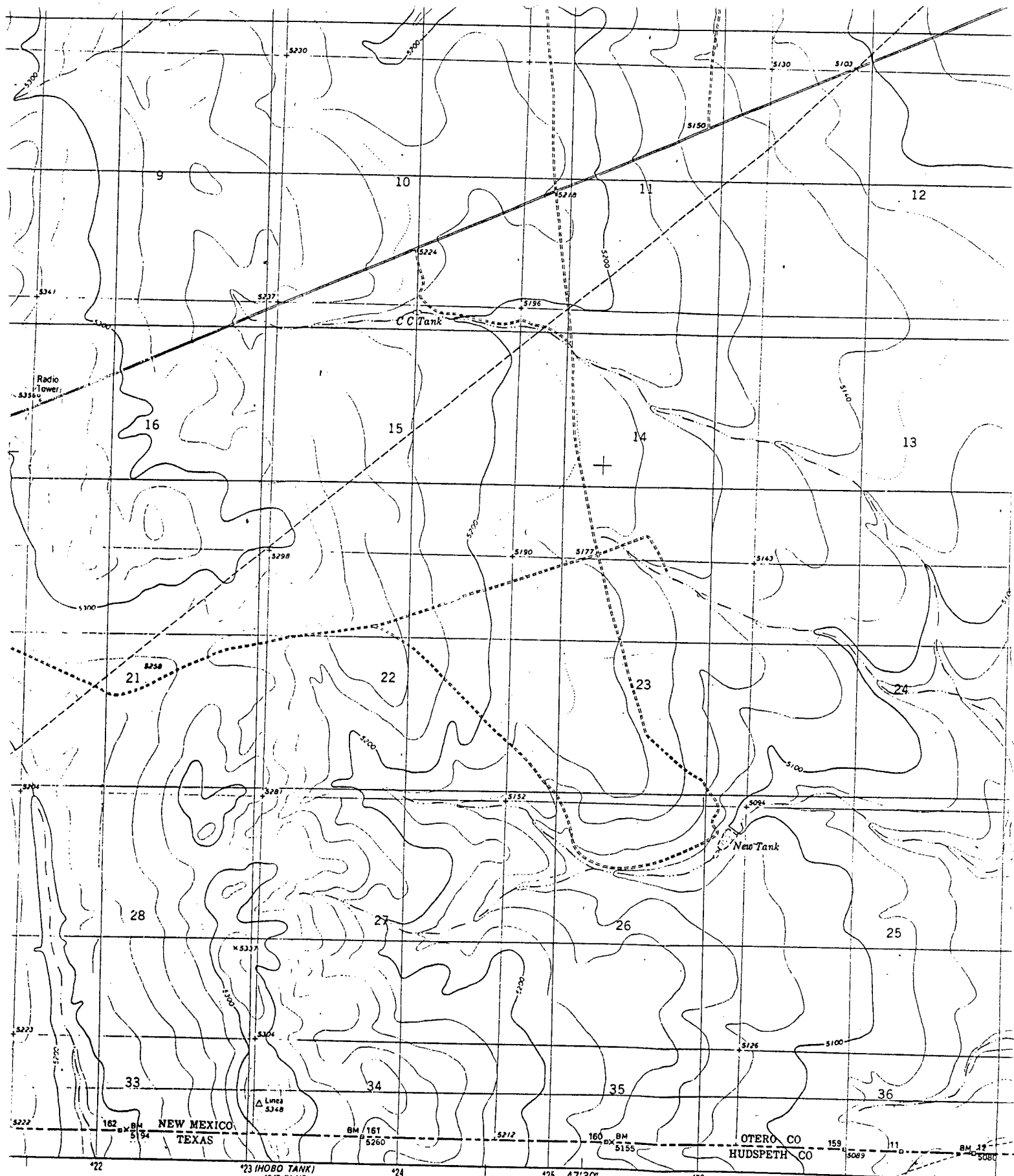
McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR...
Dune, Local	DL
Dune Sheet	DP
Dune Pile	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gyroform	DSC

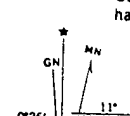


C
DOTTED L
NATIONAL

4
Cerro Alto
(Cerro Alto Mountain)

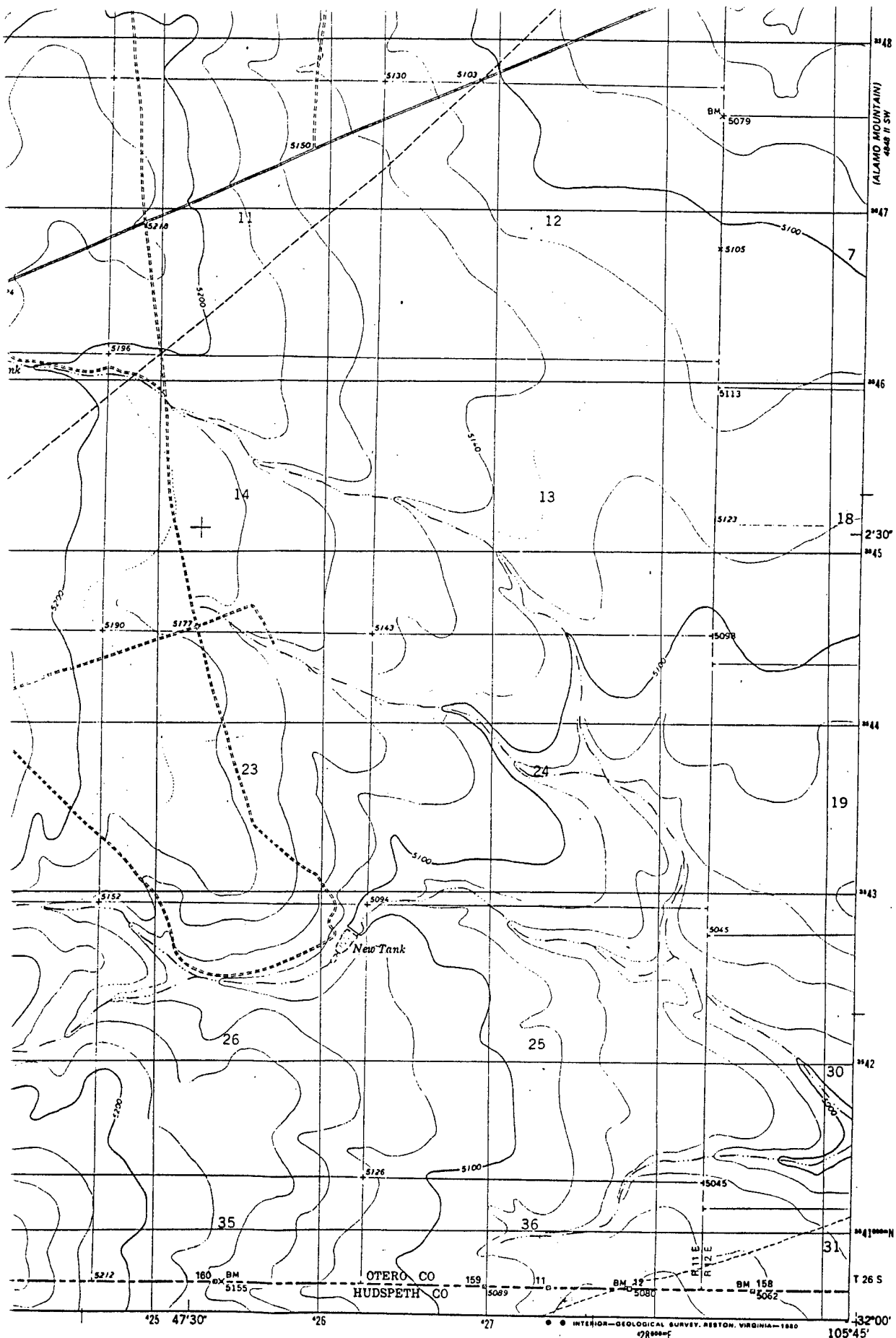


CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929



ROAD CLASS
Primary highway, hard surface
Secondary highway, hard surface
Interstate Route
U.S.

BASSETT LAI



1 MILE
7000 FEET
1 KILOMETER

6



ROAD CLASSIFICATION

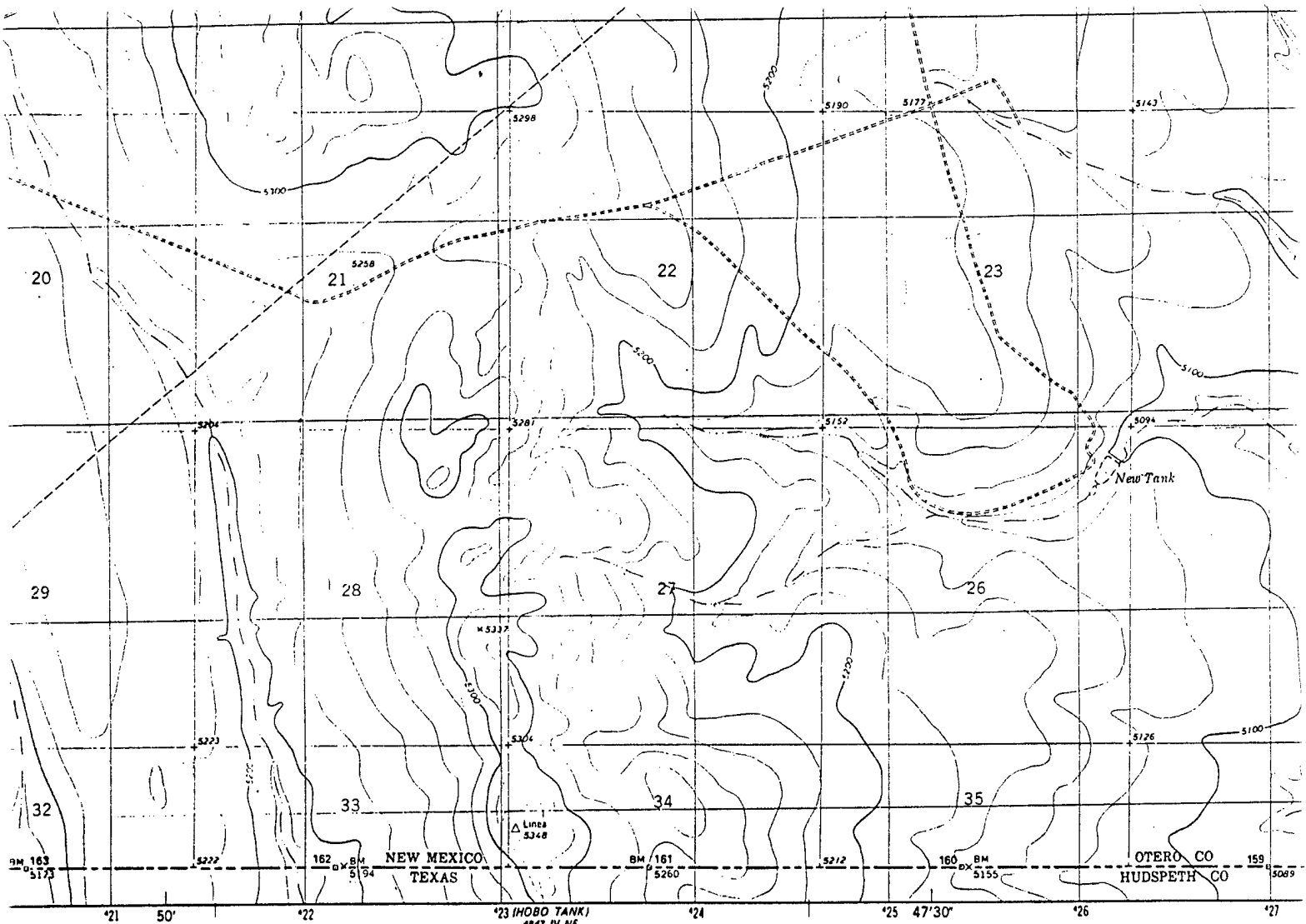
Primary highway, hard surface ——— Light-duty road, hard or improved surface ———

Secondary highway, hard surface ——— Unimproved road - - - - -

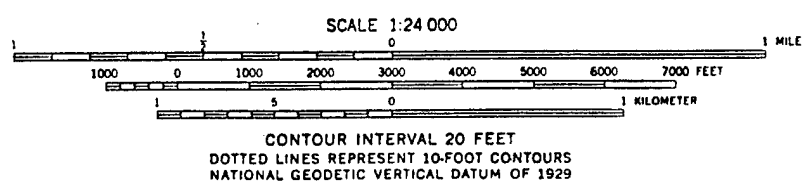
() Interstate Route () U. S. Route () State Route

BASSETT LAKE, N. MEX.-TEX

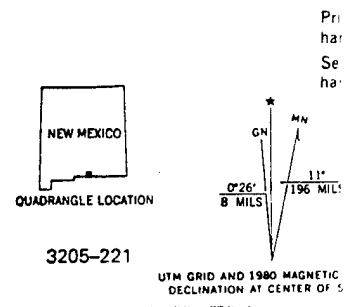
See 1 NW
16G 16E
16K 16L



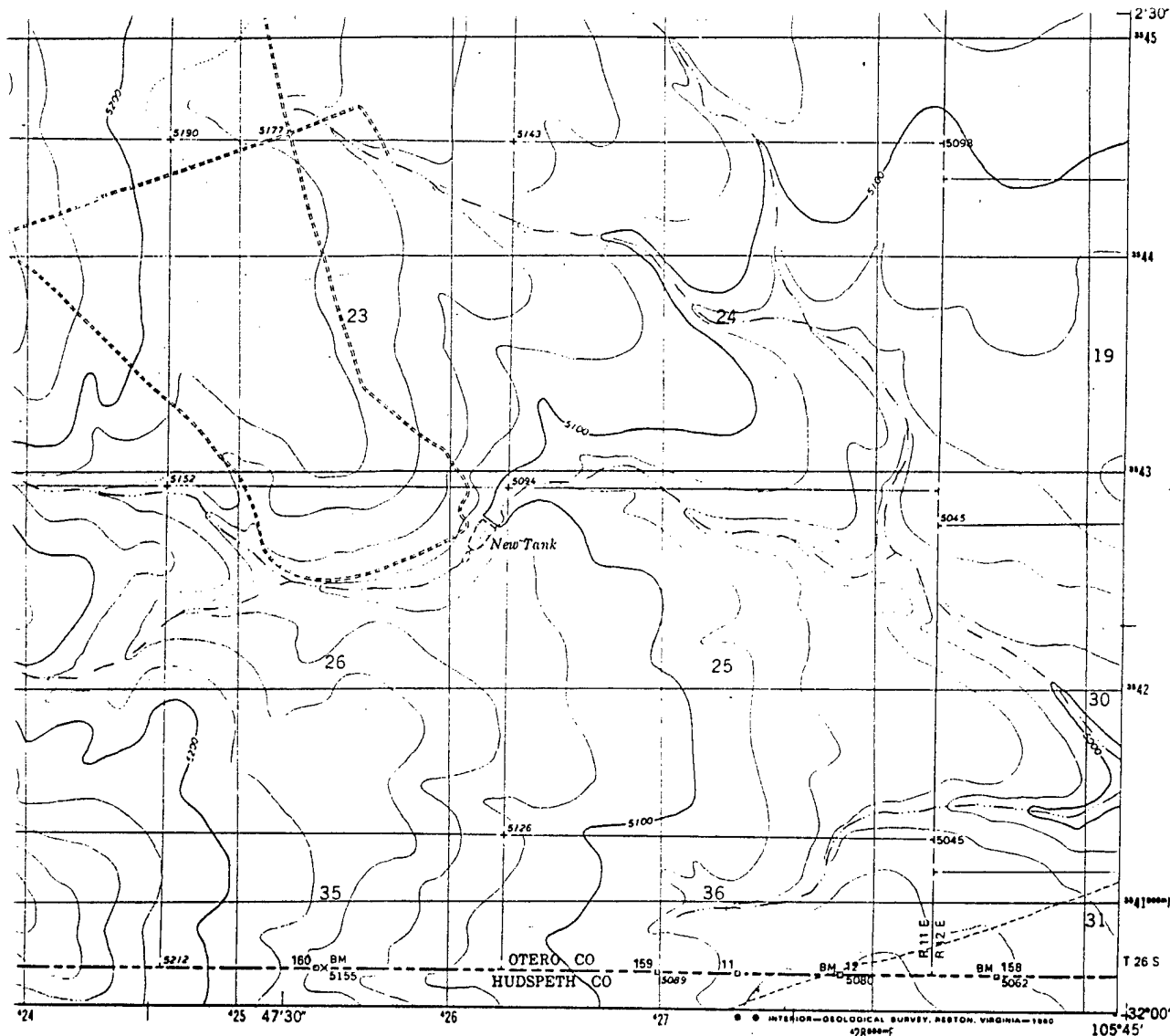
- Legend**
- Geomorphic Features and Symbols:**
- A1
 - A2
 - A3
 - B
- (1) Sediments**
- CR...
 - DL
 - DP
 - DS
 - DSC
 - DSG
- Other Symbols:**
- P
 - P1
 - PIL



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



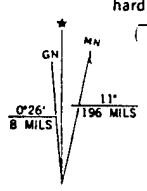
8



NDARDS
OR RESTON, VIRGINIA 22092
LABLE ON REQUEST



QUADRANGLE LOCATION
3205-221



UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U. S. Route
- State Route

BASSETT LAKE, N. MEX.-TEX.
SE/4 BASSETT LAKE 15' QUADRANGLE
N3200-W10545/7.5

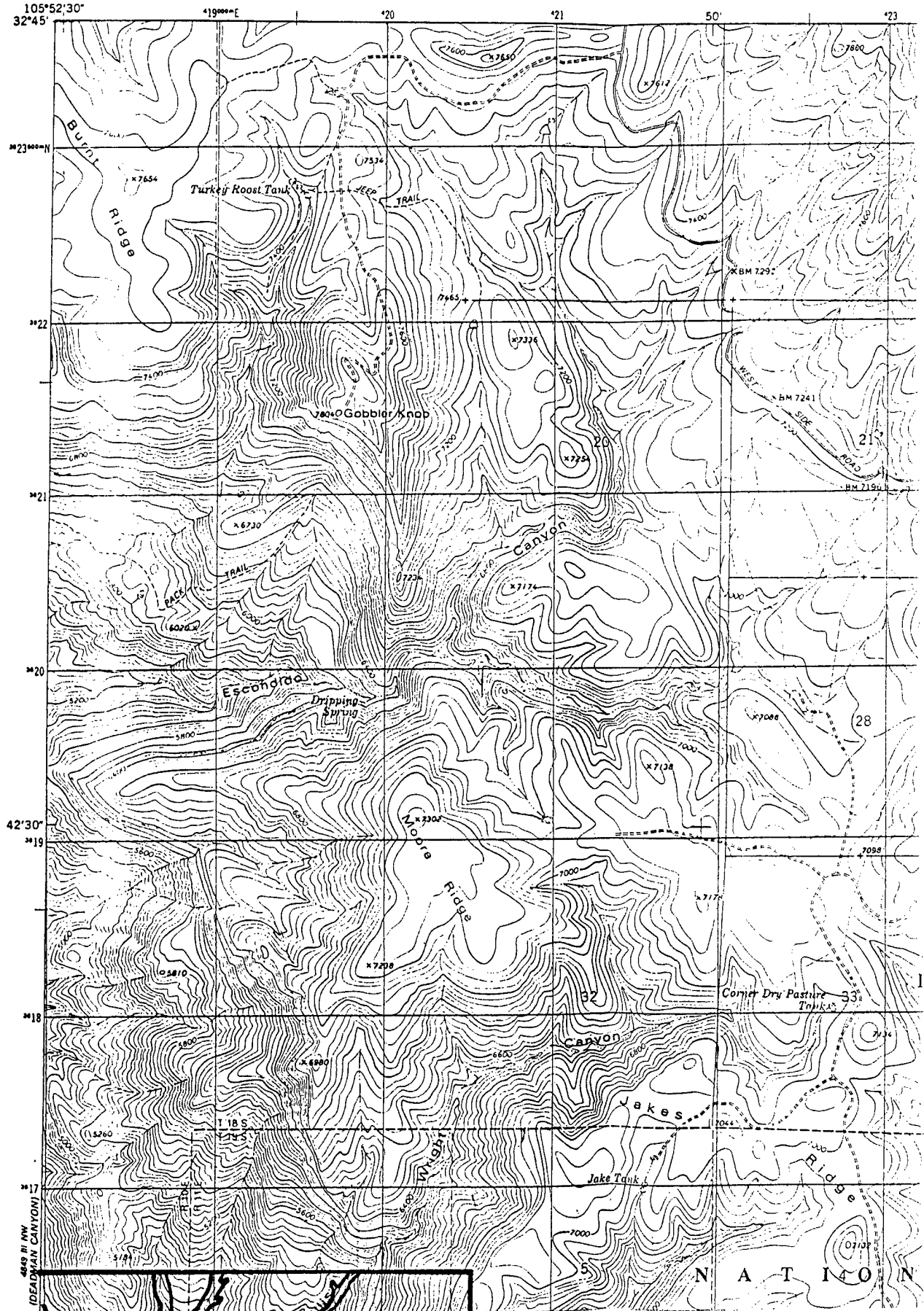
1980

DMA 4848 III SE-SERIES V881

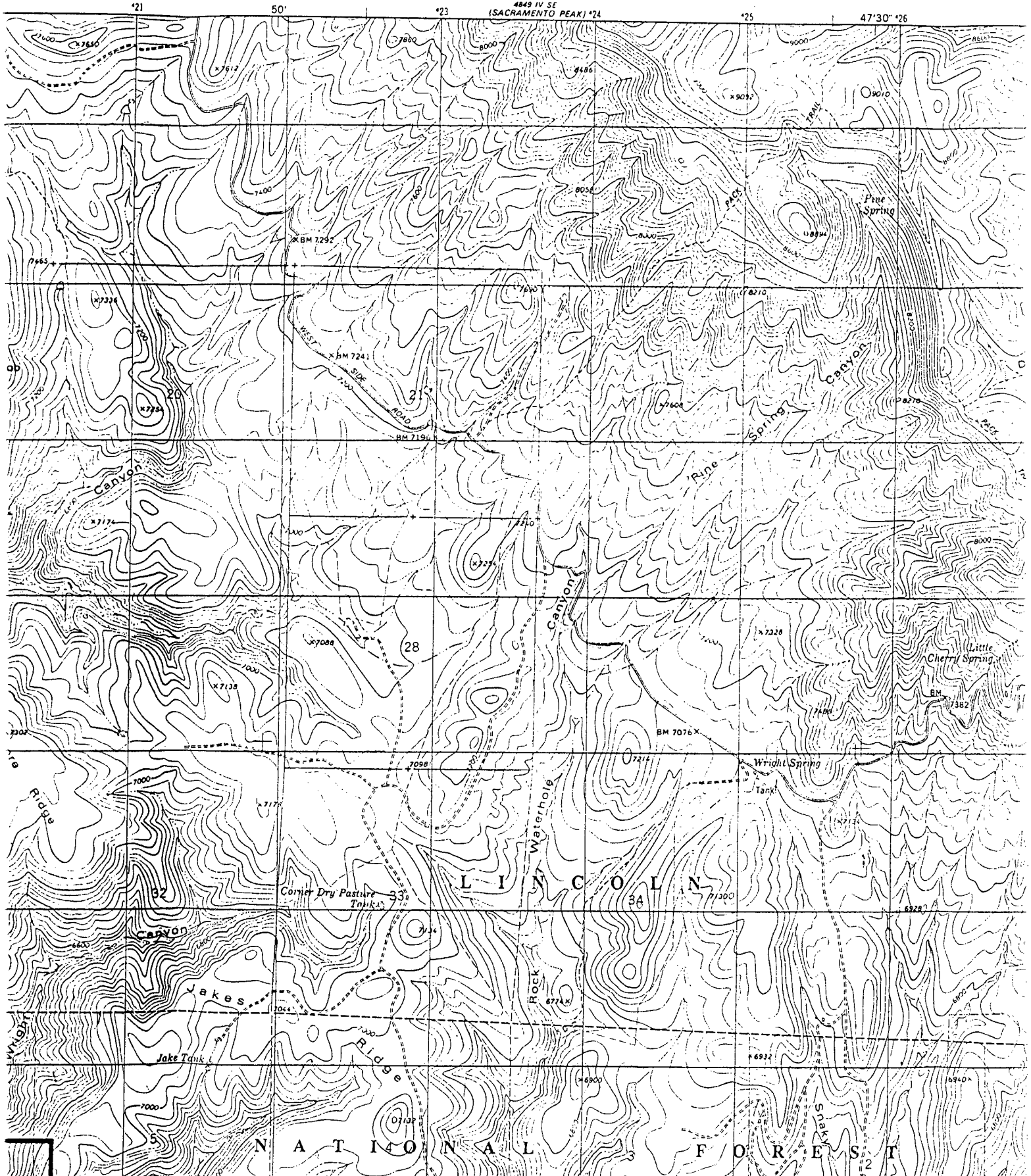
4449 N. 5th
(ALAMO GORGE
SOUTH)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geocological
Study of McGregor Gaid
Donald L. Johnson, /



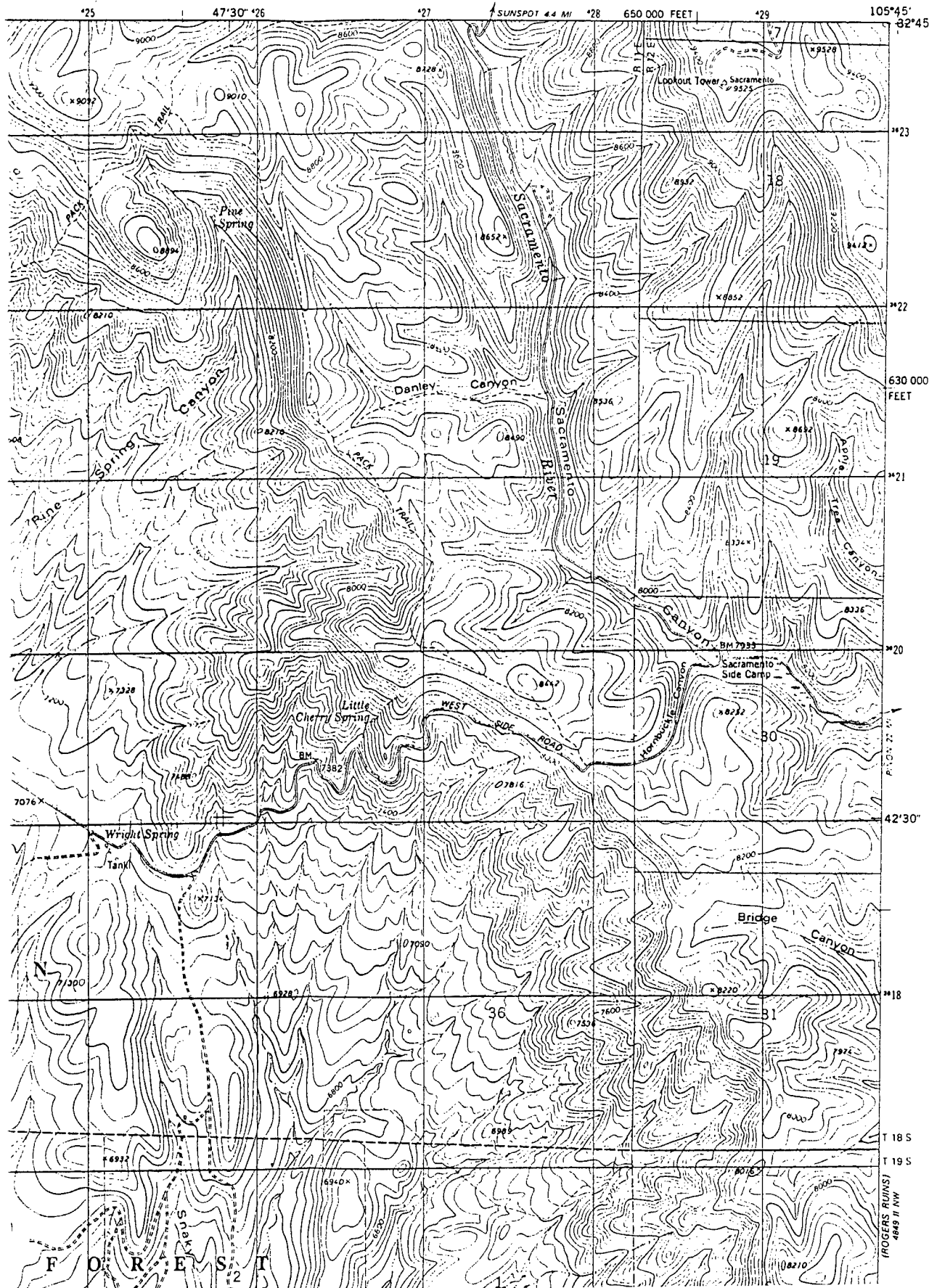
Geomorphological, Geoecological, Geoarchaeological and Surficial Mapping
 Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
 Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

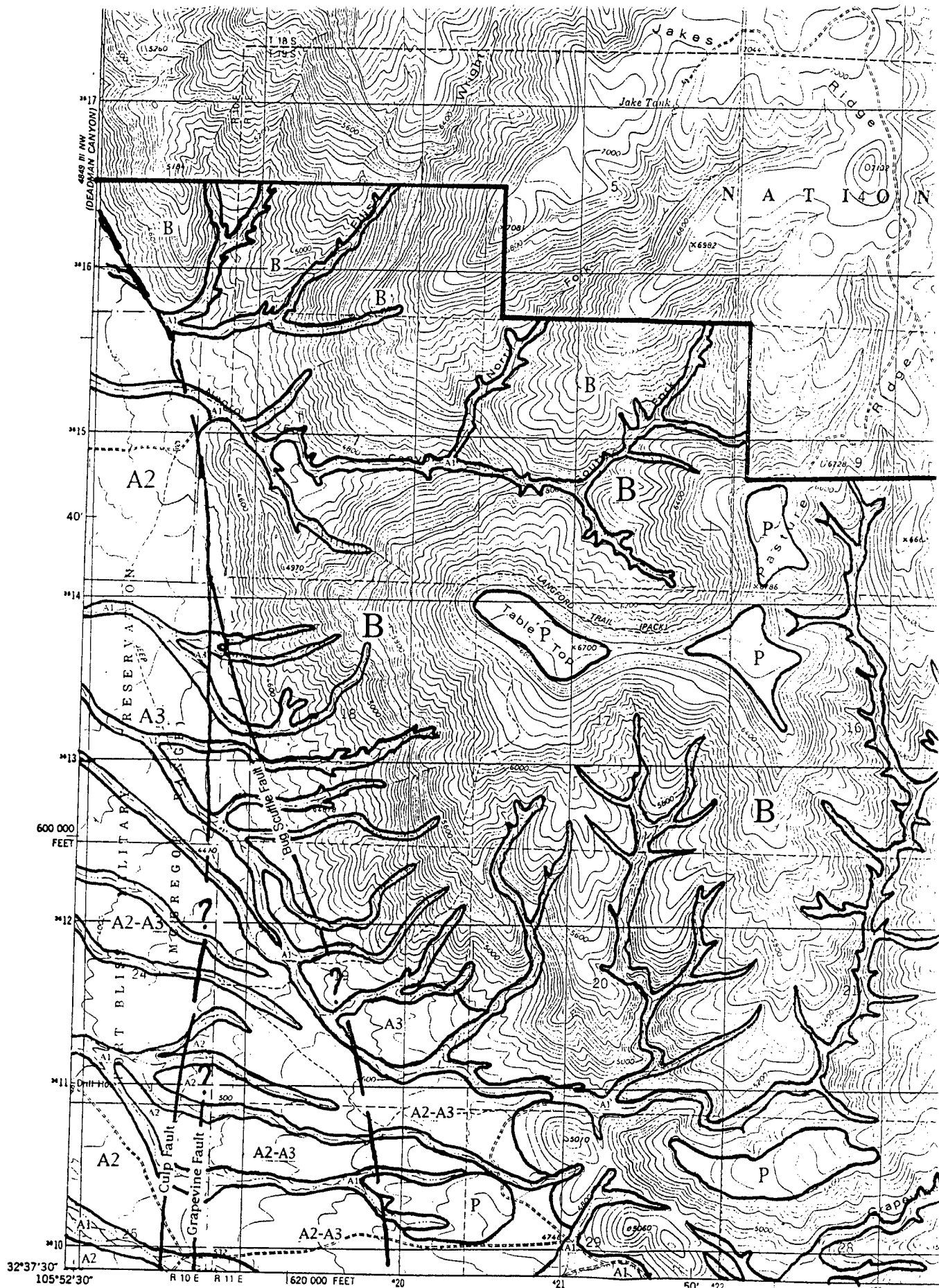


Surficial Mapping
s, New Mexico
14, 1997

BUG SCUFFLE CANYON QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 ESCONDIDO CANYON 15' QUADRANGLE

4849 1 SW
BLUFF SPRINGS





32°37'30"
105°52'30"

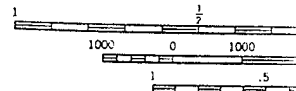
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1972. Field checked 1975. Map edited 1981

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
To place on the predicted North American Datum 1983

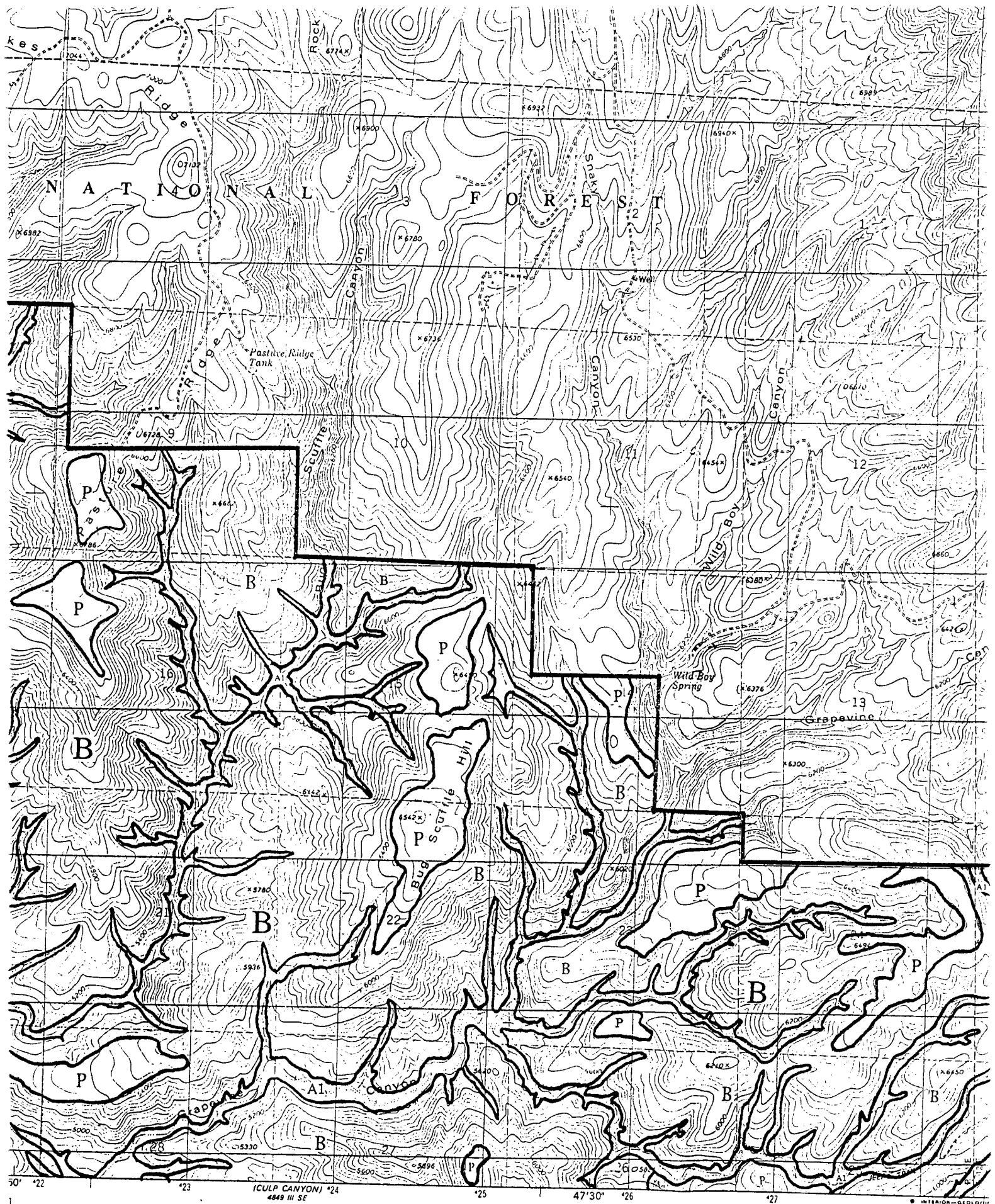
McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	—
Camp Rice (Rio Grande) Sediments	CR•••
Dune, Local	DL

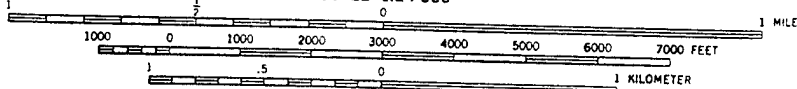


CONT
NATIONAL GE

4
(PIPELINE CANYON)
4849 ft NW



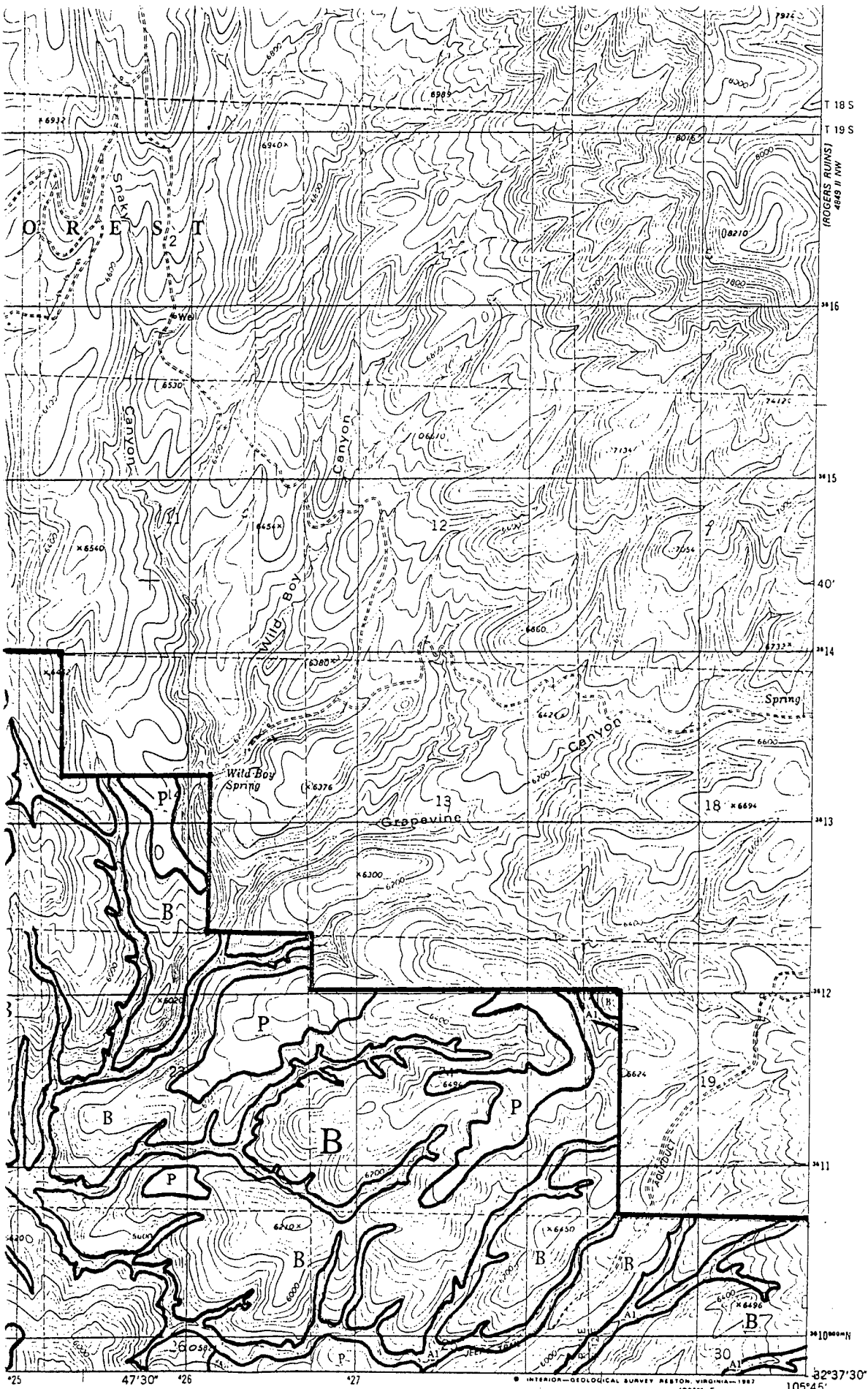
SCALE 1:24 000



CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD C

Primary highway,
hard surface
Secondary highway,
hard surface



1 MILE
1000 FEET
METER

ROAD CLASSIFICATION

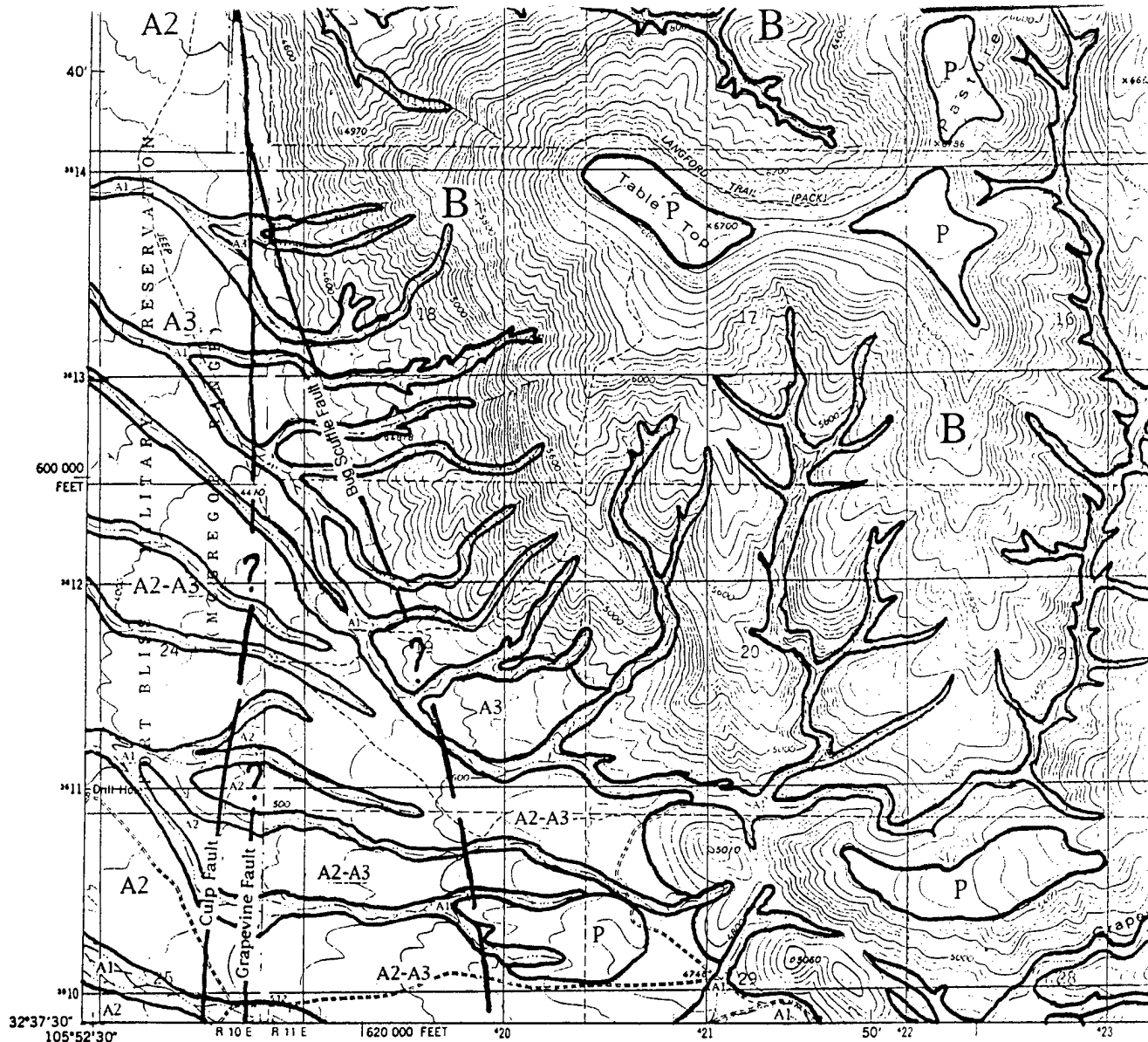
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U. S. Route
State Route

6
105°45'
32°37'30"

NEW MEXICO

MIN

(EL PASO CANYON)
4849 II SW



(PIPELINE CANYON)
449 ft SW

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1972. Field checked 1975. Map edited 1981

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks

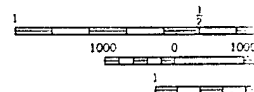
Fine red dashed lines indicate selected fence lines

Where omitted, land lines have not been established or
are not shown because of insufficient data

There may be private inholdings within the boundaries of
the National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

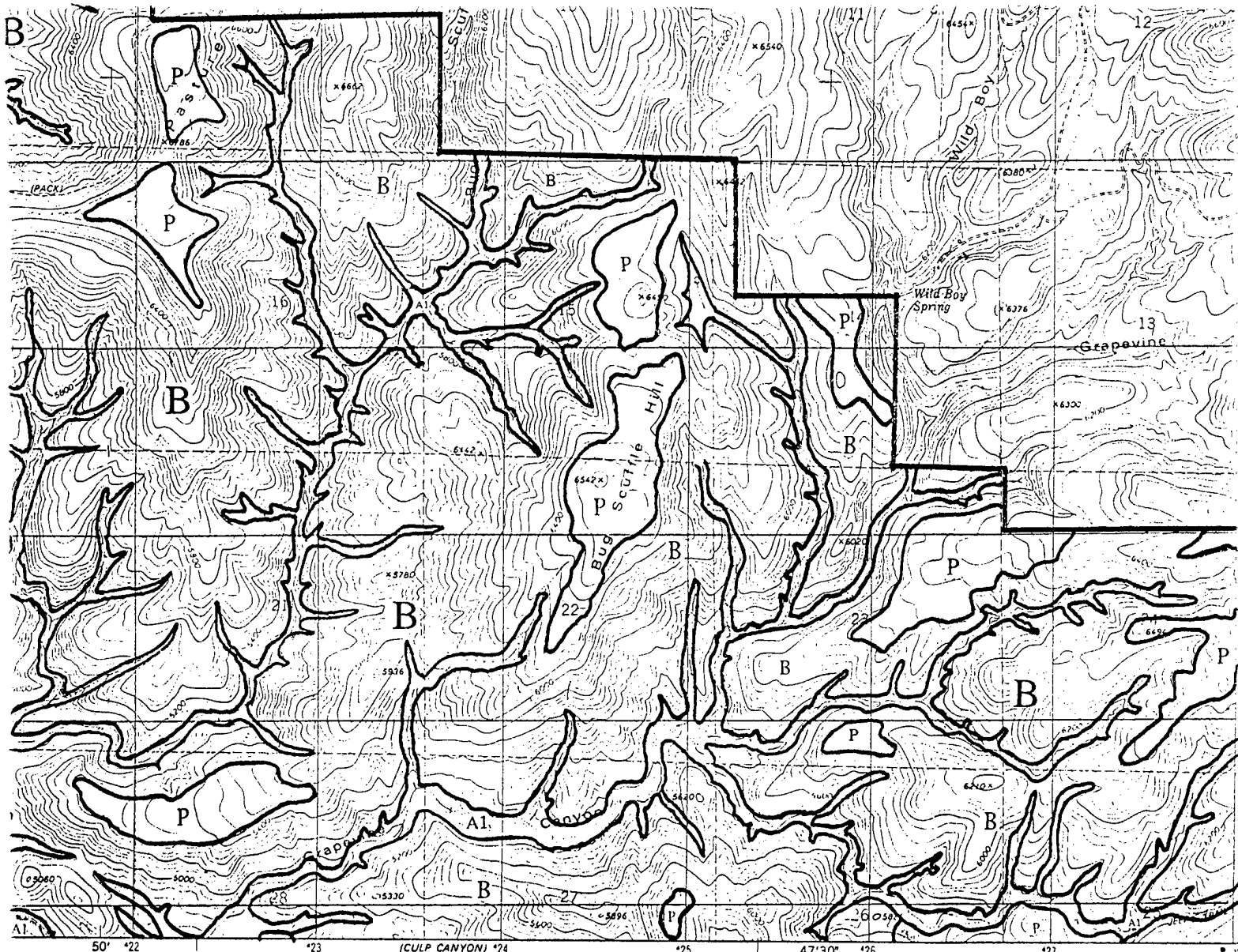
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	DL
Camp Rice (Rio Grande) Sediments	CR...
Dune, Local	DL
Dune Pile	DP
Dune Sheet	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	PIL
¹ See text for explanation	



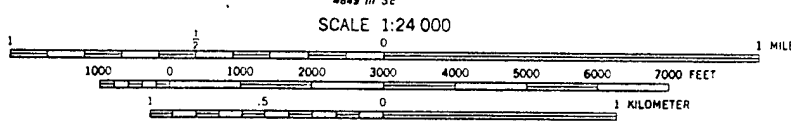
NATION

THIS MAP COM
FOR SALE BY U.S. GEOLOGICAL
A FOLDER DESCRIBING TO

7

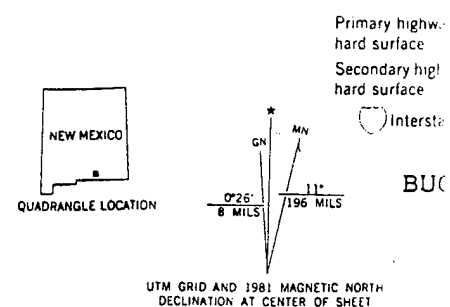


- orphic
nbols¹
- A1
 - A2
 - A3
 - B
 - CR
 - DL
 - DP
 - DS
 - DSC
 - DSG
 - P
 - P1
 - PIL

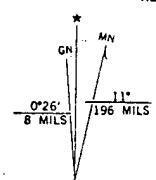
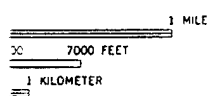
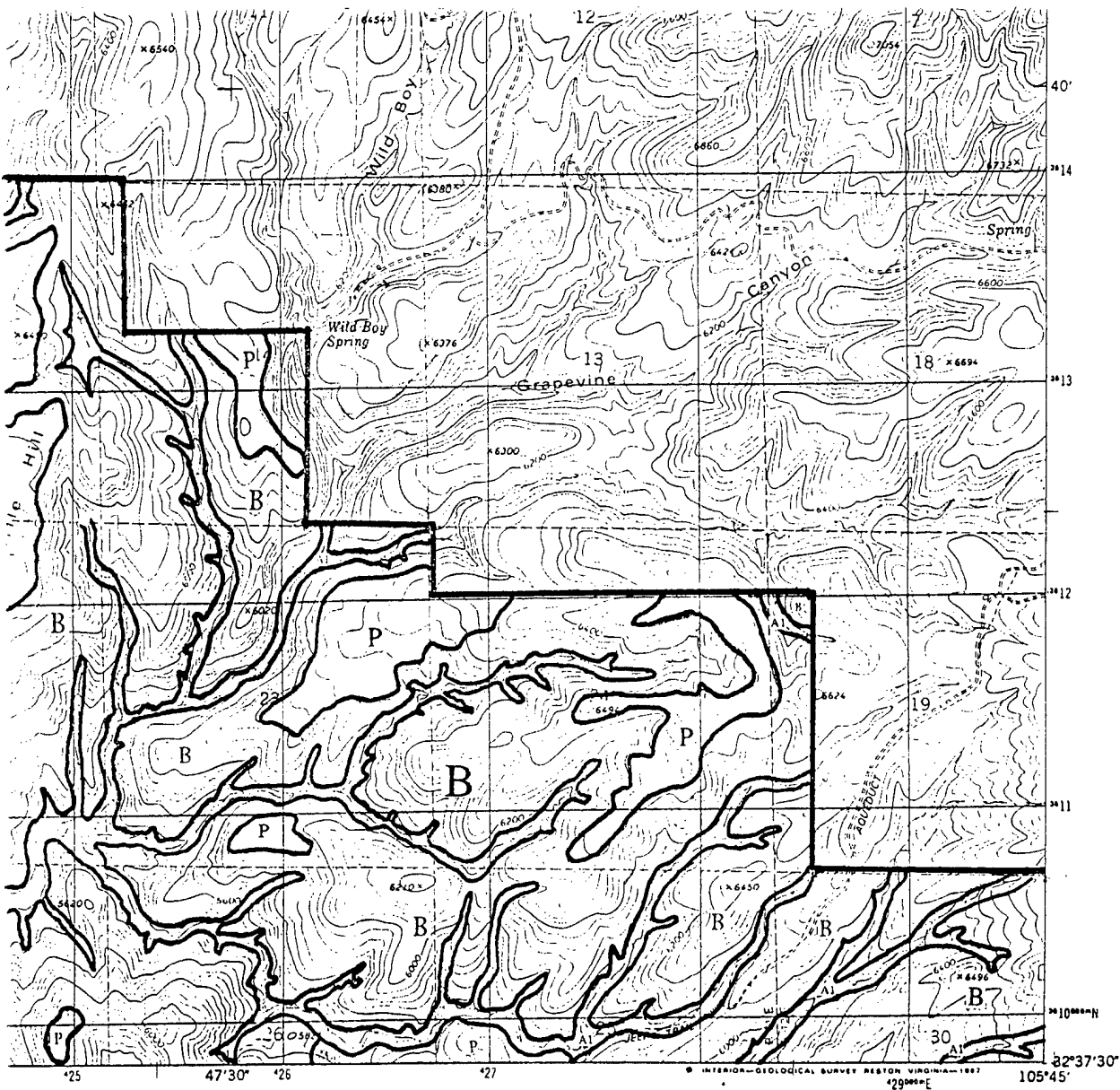


CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



8



ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road

☐ Interstate Route
 ☐ U. S. Route
 ☐ State Route

BUG SCUFFLE CANYON, N. MEX.
 NE/4 ESCONDIDO CANYON 15' QUADRANGLE
 N3237.5-W10545/7.5

1981

DMA 4849 III NE-SERIES V881

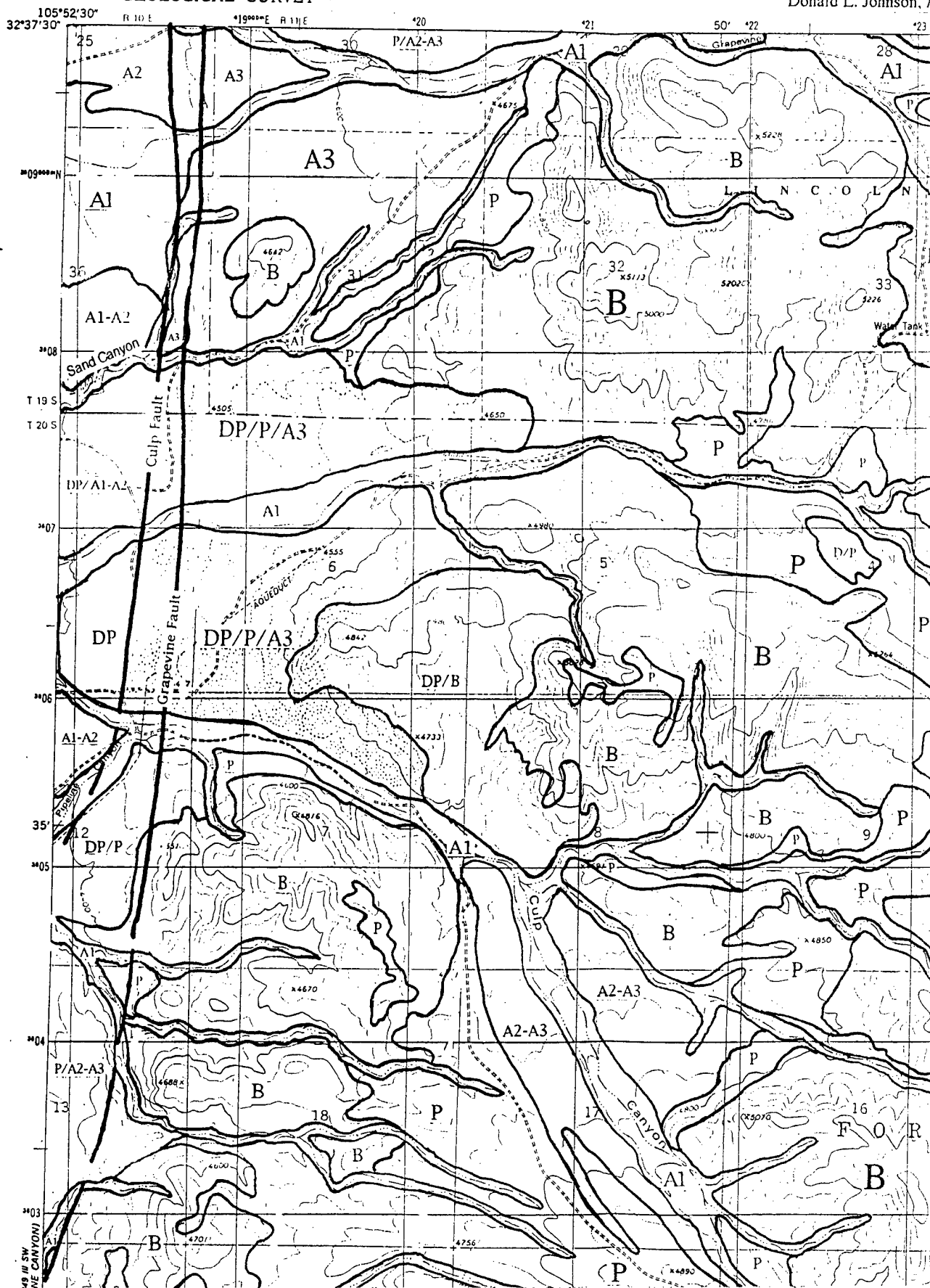
JS
 ESTON, VIRGINIA 22092
 ON REQUEST

UTM GRID AND 1981 MAGNETIC NORTH
 DECLINATION AT CENTER OF SHEET

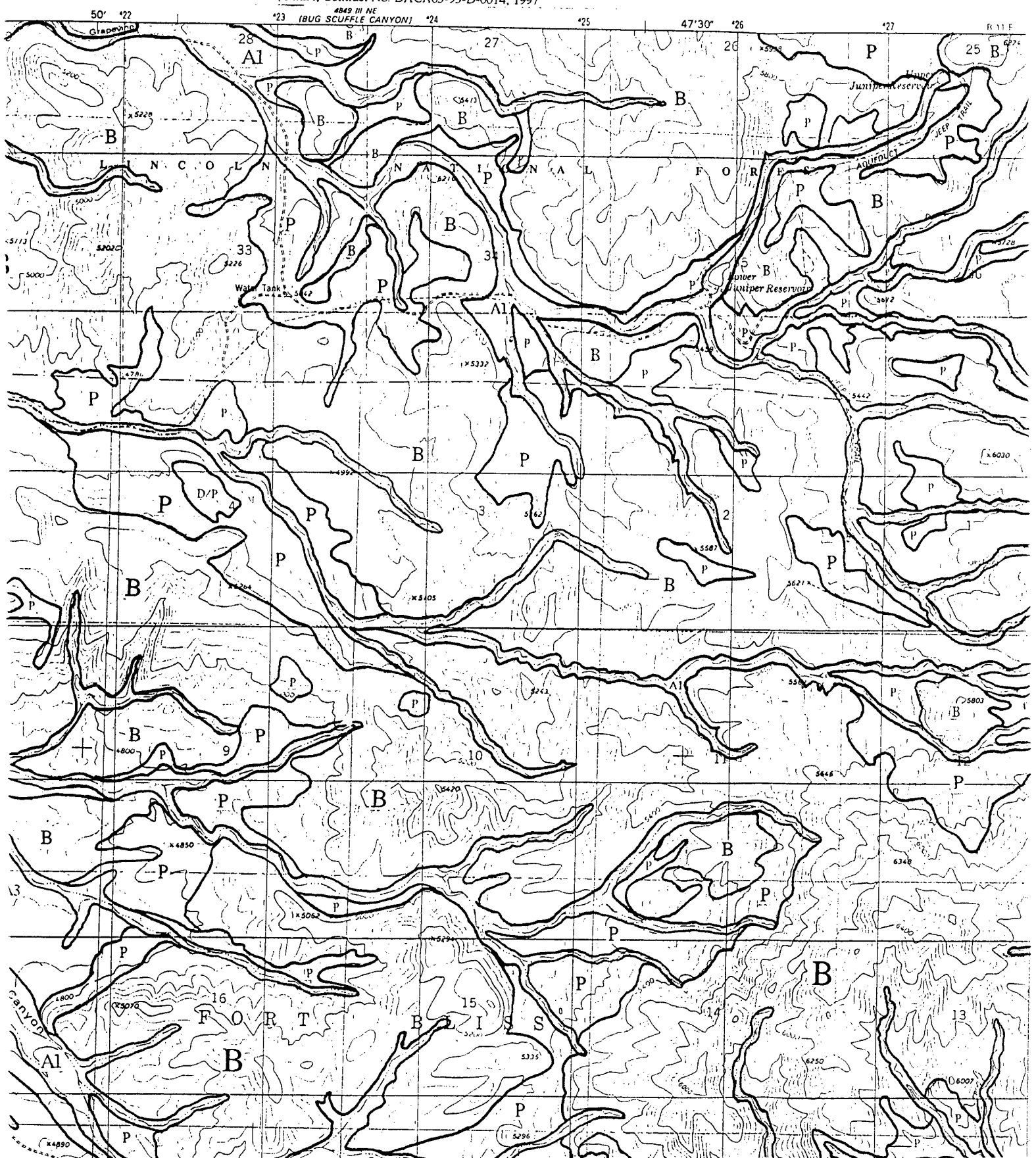
SEADMAN CANYON

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geoecologic
Study of McGregor Gaid
Donald L. Johnson, /

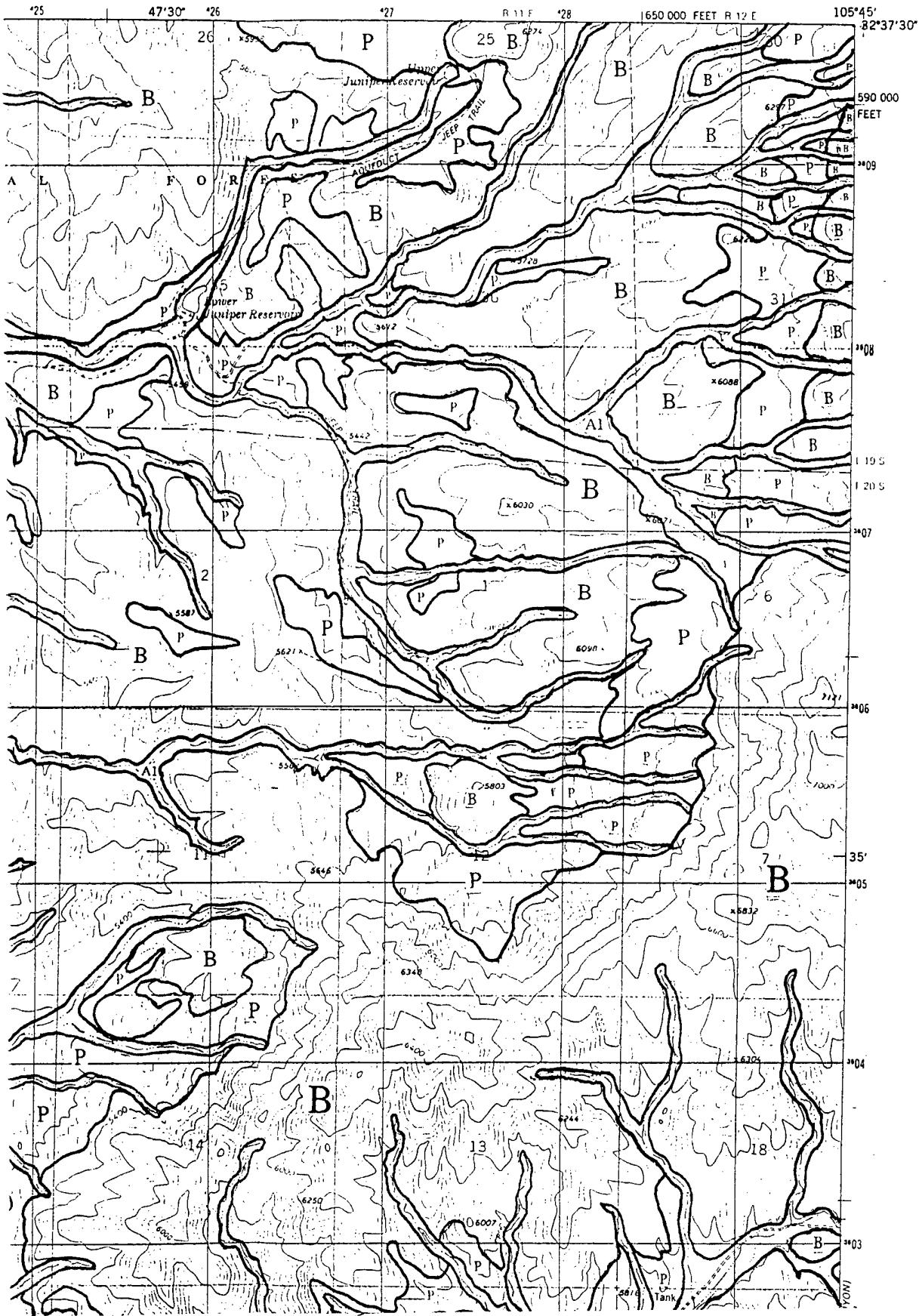


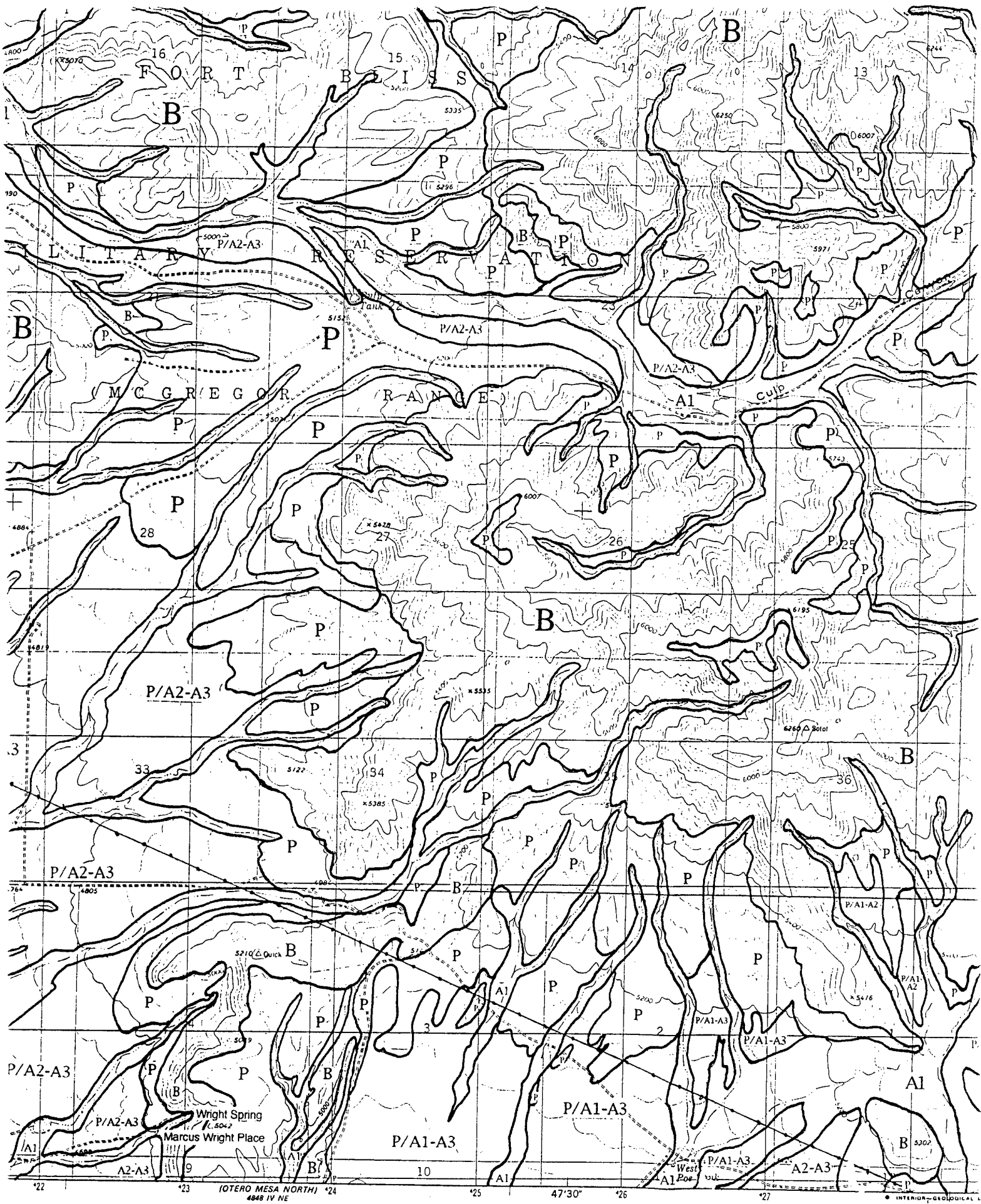
Geomorphological, Geoecological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
 Donald L. Johnson, *Ph.D.*, Contract No. DACA63-93-D-0014, 1997



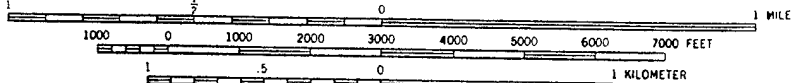
CULP CANYON QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 ESCONDIDO CANYON 15' QUADRANGLE

4848 II NW
(ROGERS RUNS)





SCALE 1:24 000

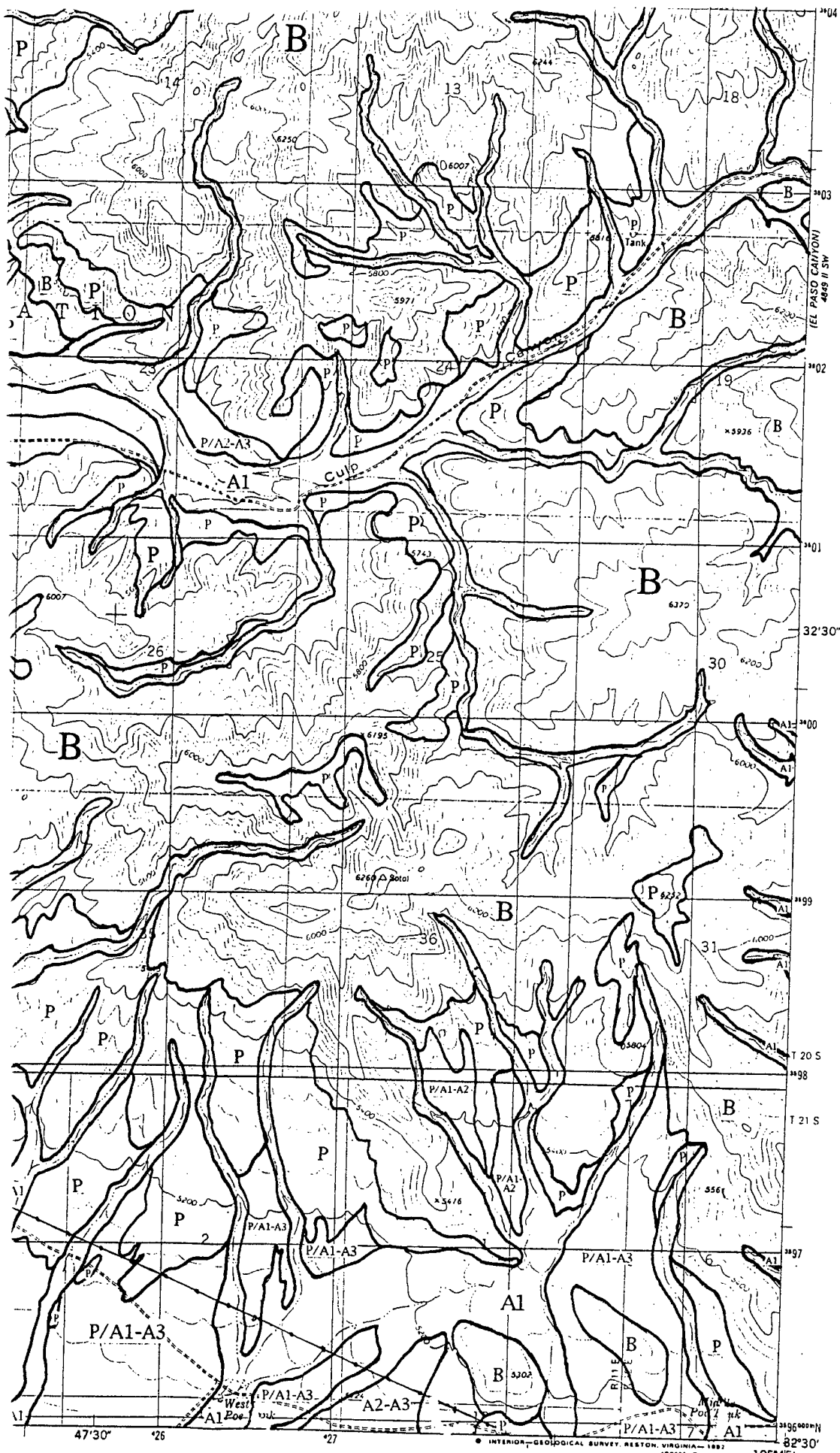


CONTOUR INTERVAL 40 FEET

ROAD CLASS

Primary highway,
hard surface
Secondary highway,
hard surface

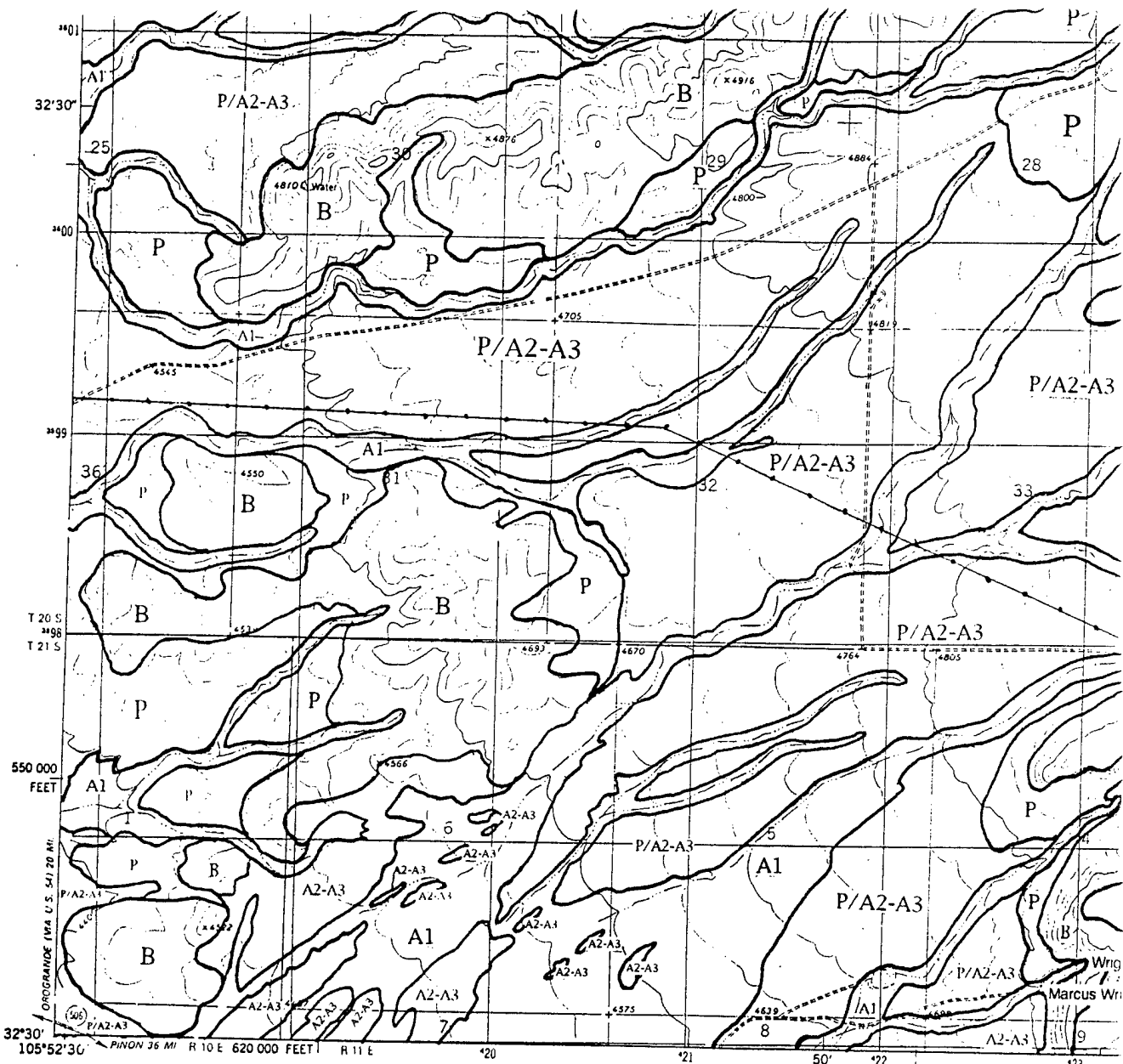
5



ROAD CLASSIFICATION

- | | |
|------------------------------------|--|
| Primary highway,
hard surface | Light-duty road, hard or
improved surface |
| Secondary highway,
hard surface | Unimproved road |

EL PASO DRAW



WILDE TANK
2448 IV NW

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1972. Field checked 1975. Map edited 1981

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks

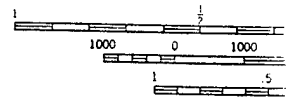
Fine red dashed lines indicate selected fence lines

There may be private inholdings within the boundaries of the
National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

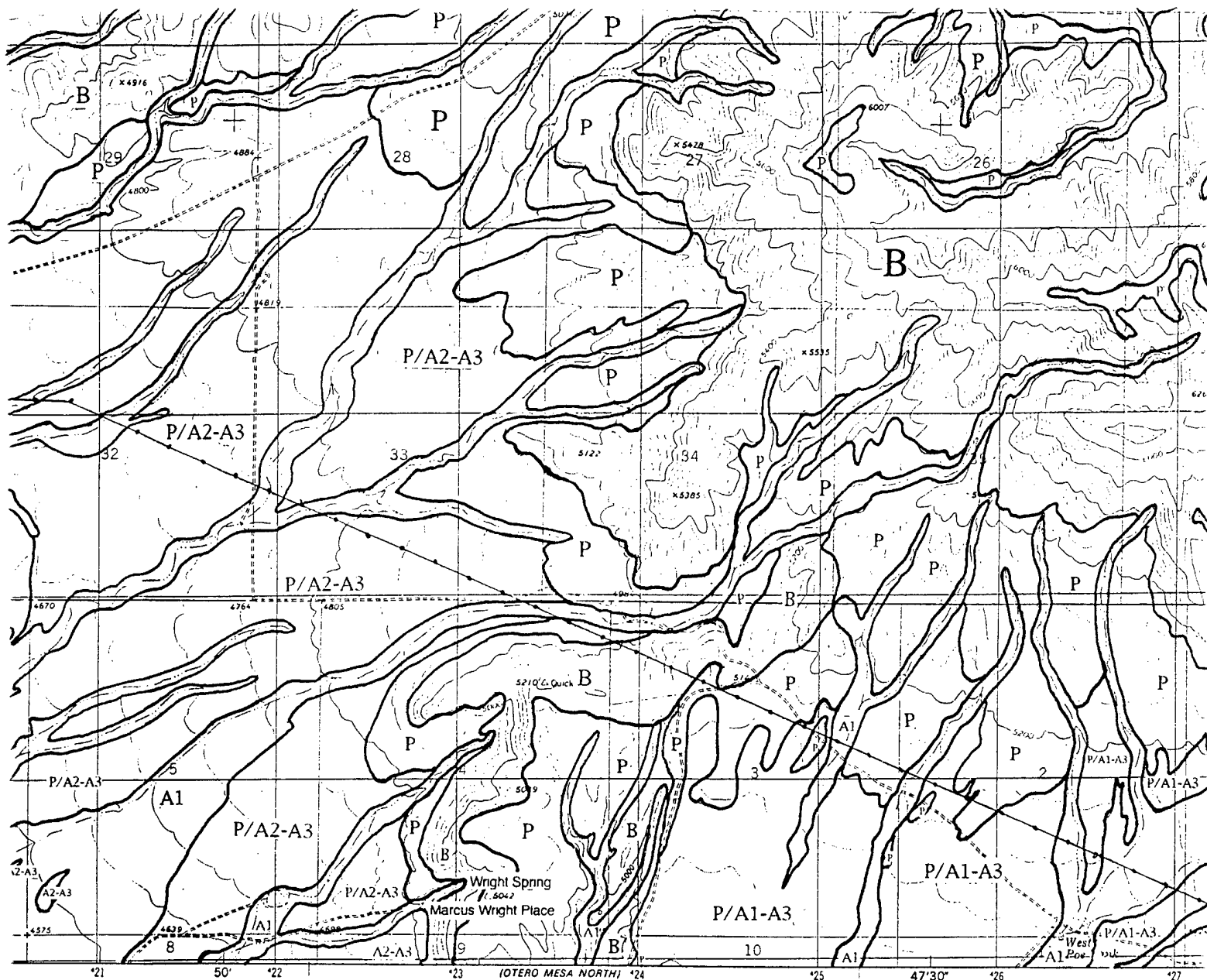
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR •••
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Sheet	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	

¹See text for explanation



CO
NATIONAL

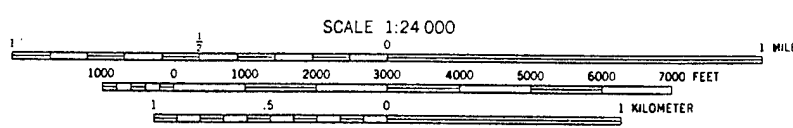
THIS MAP COMPLIES
FOR SALE BY U.S. GEOLOGICAL SURVEY
A FOLDER DESCRIBING TOPOGRAPHY



For Range Geomorphic
ig Units and Symbols

Recent)	A1
Relict)	A2
Der relict)	A3
	B
Complex	CR
(to Grande) Sediments	DL
	DP
	DS
Coppiced	DSC
Gypsiferous	DSG
	P
	P1
	PIL

Explanation



CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

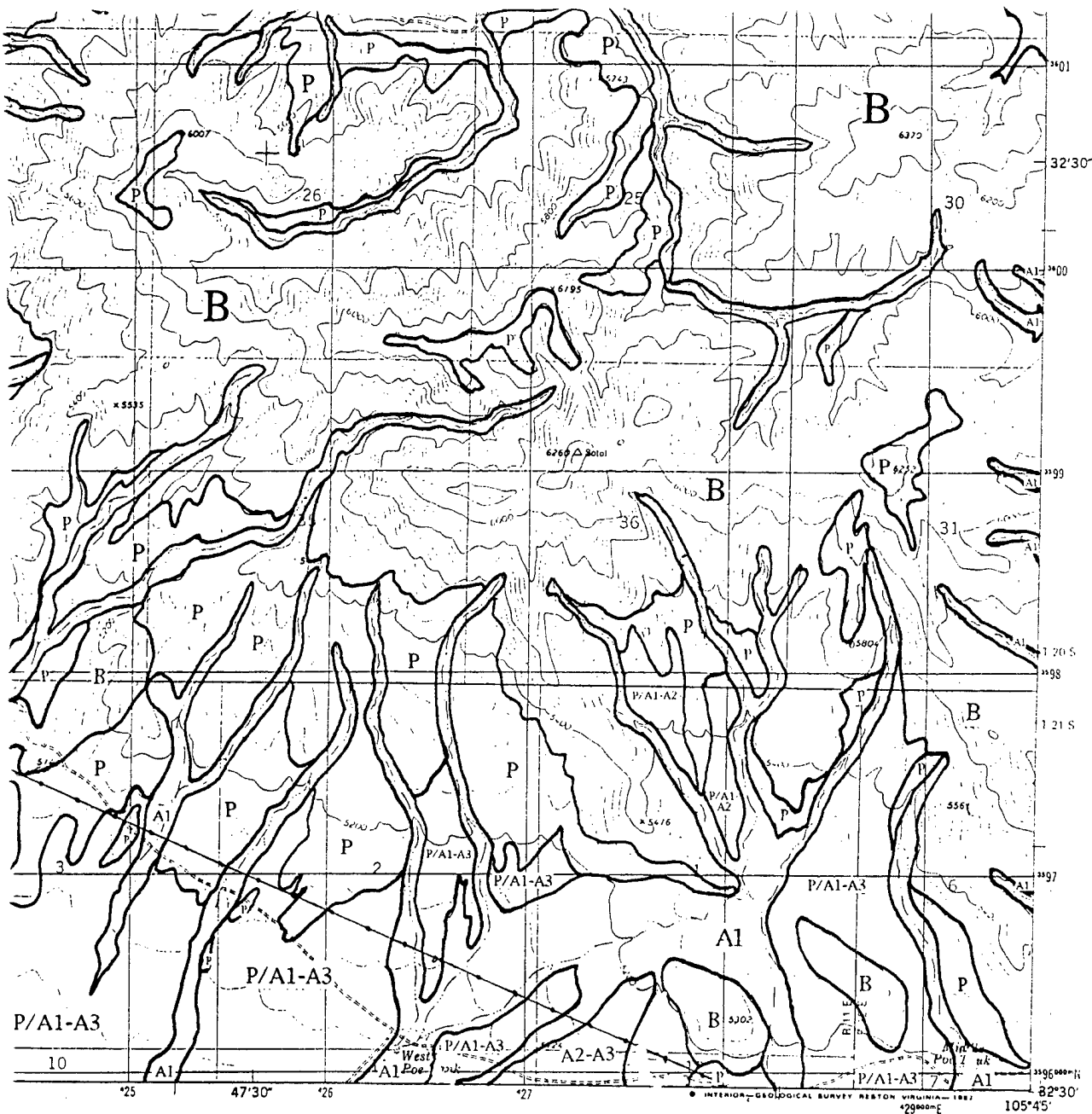
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



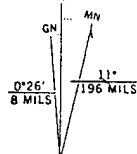
QUADRANGLE LOCATION

UTM GRID AND 1983 DECLINATION AT

8



1 MILE
6000 7000 FEET
1 KILOMETER



UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U. S. Route
State Route

CULP CANYON, N. MEX.

SE/4 ESCONDIDO CANYON 15' QUADRANGLE
N3230-W10545/7.5

1981

DMA 4849 III SE-SERIES V881

STADARS
OR RESTON, VIRGINIA 22092
ABLE ON REQUEST

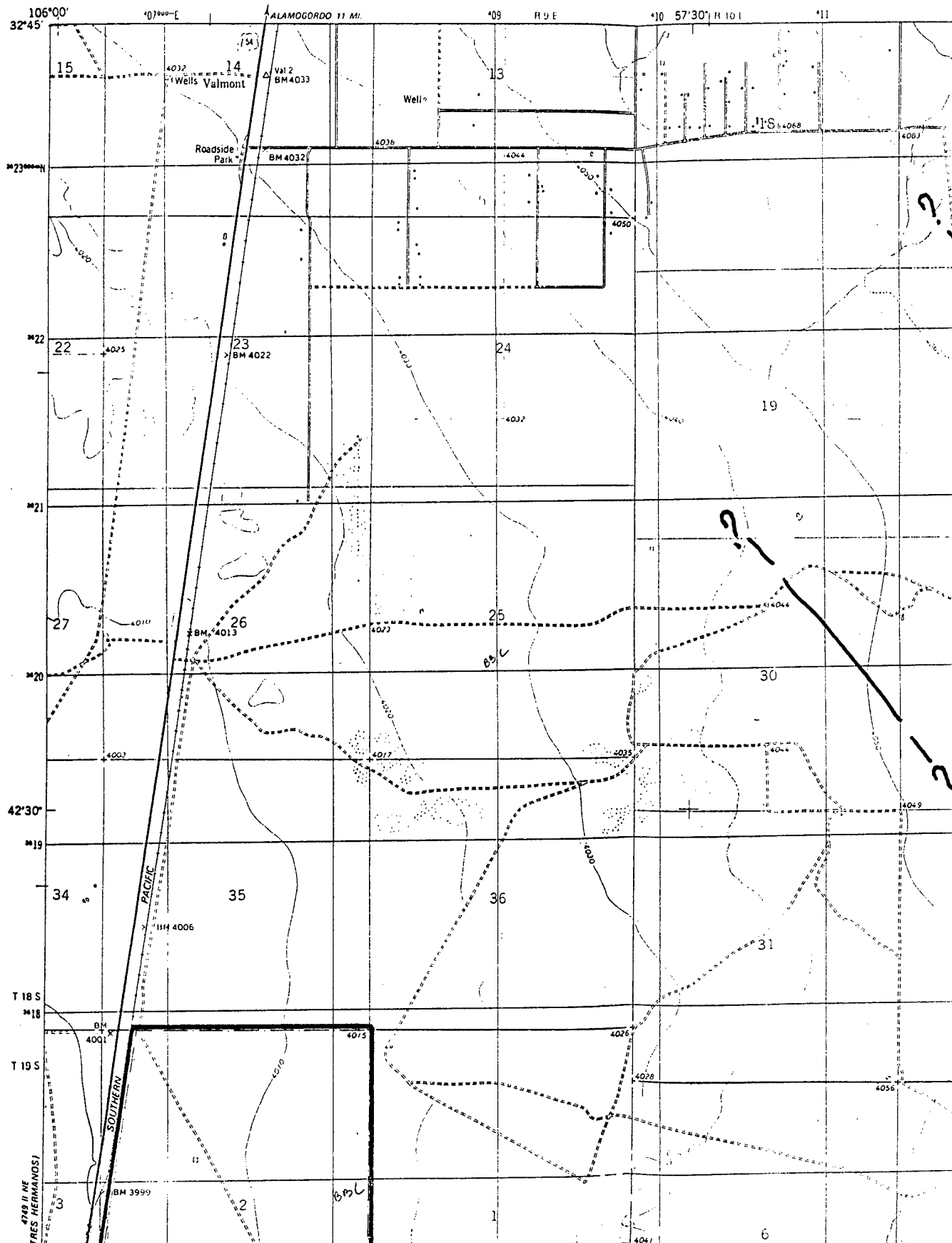
(SEE P. 50 DRAWING)

9

429 J. SE
(HOLMAN)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

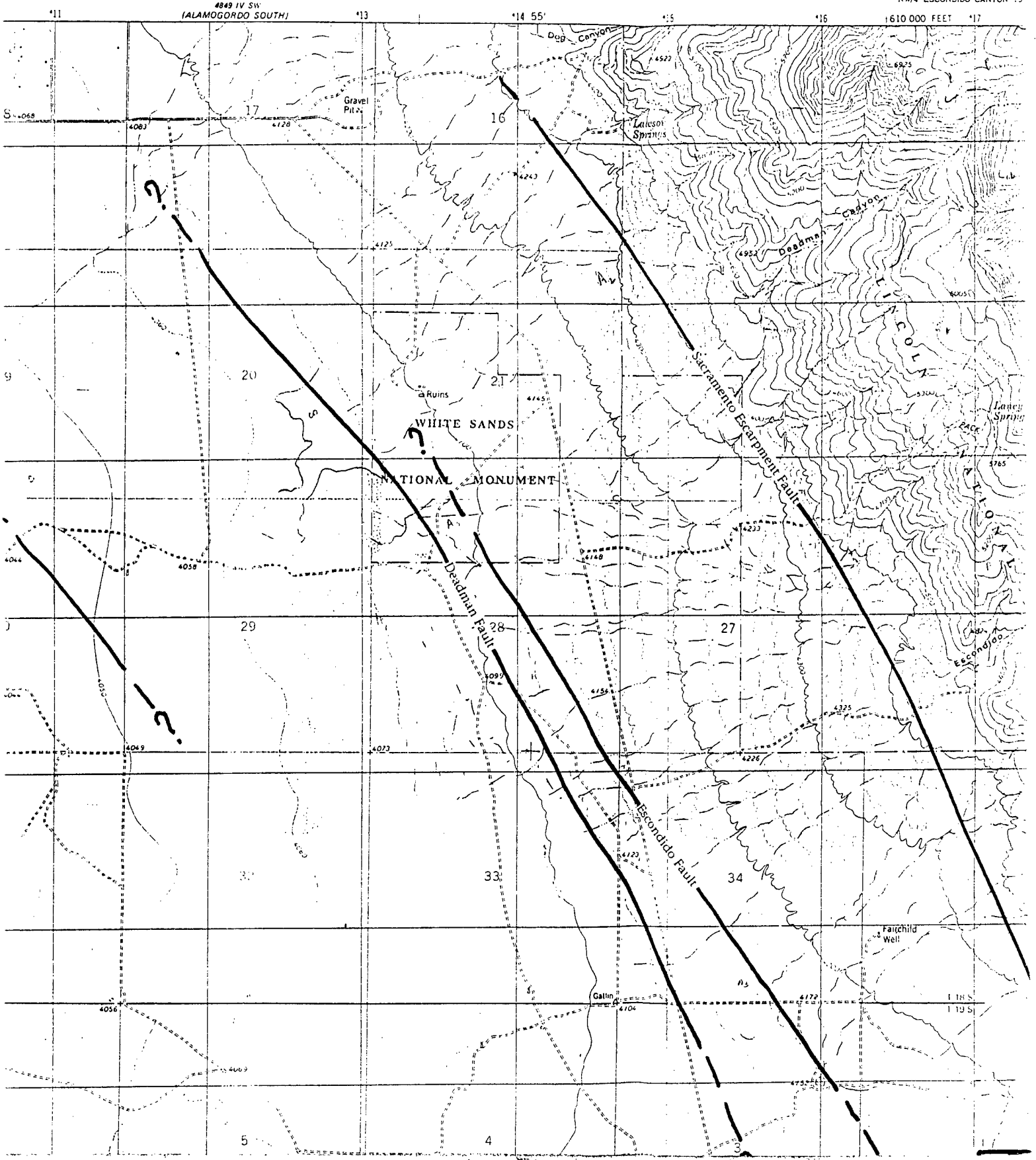
Geomorphological, Geocologic:
Study of McGregor Guide:
Donald L. Johnson, PI



rphological, Geocological, Geoarchaeological and Surficial Mapping
udy of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

2

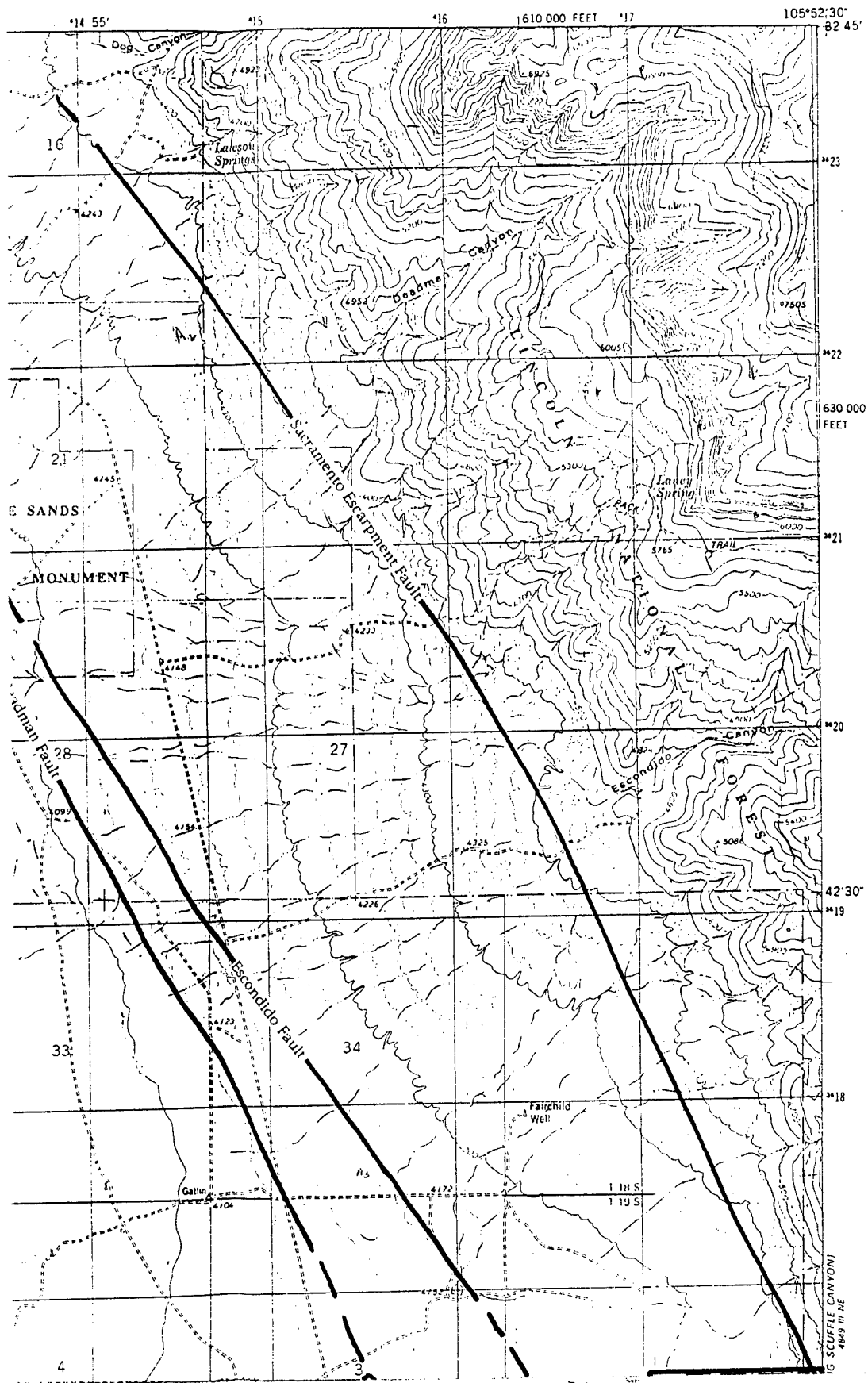
DEADMAN CANYON C
NEW MEXICO-OTF
7.5 MINUTE SERIES (T
NW/4 ESCONDIDO CANYON 15'



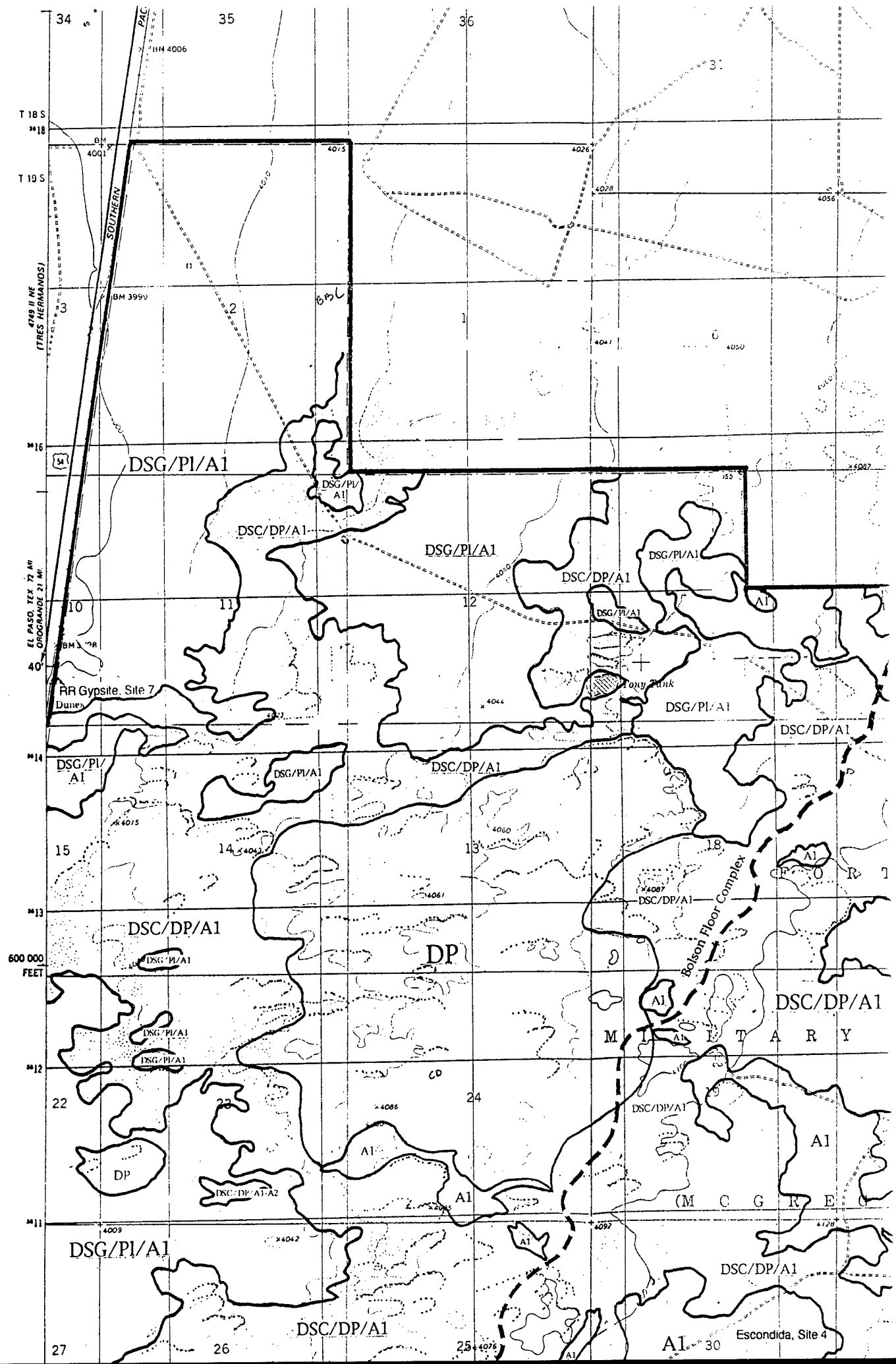
Mapping
xico

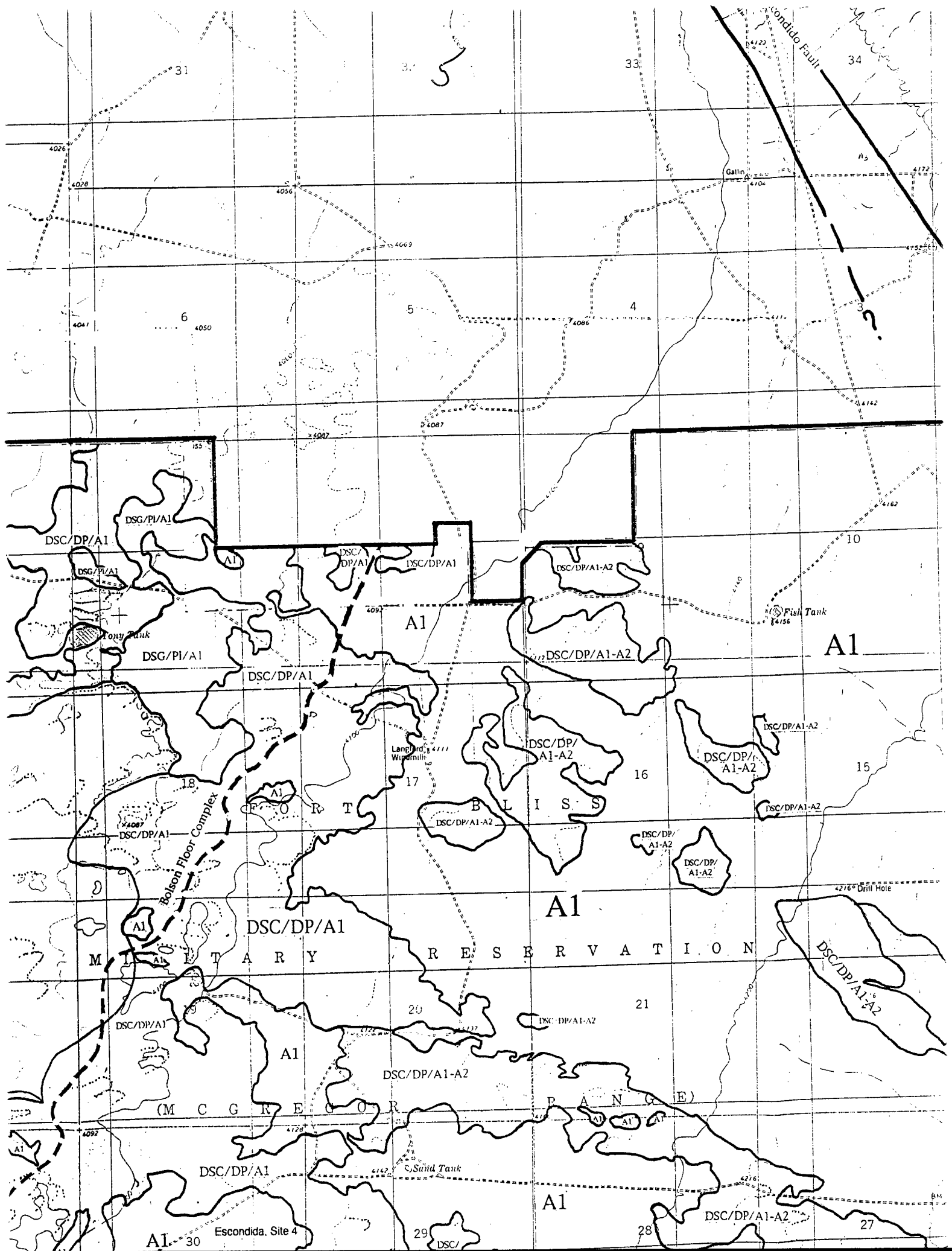
DEADMAN CANYON QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 ESCONDIDO CANYON 15' QUADRANGLE

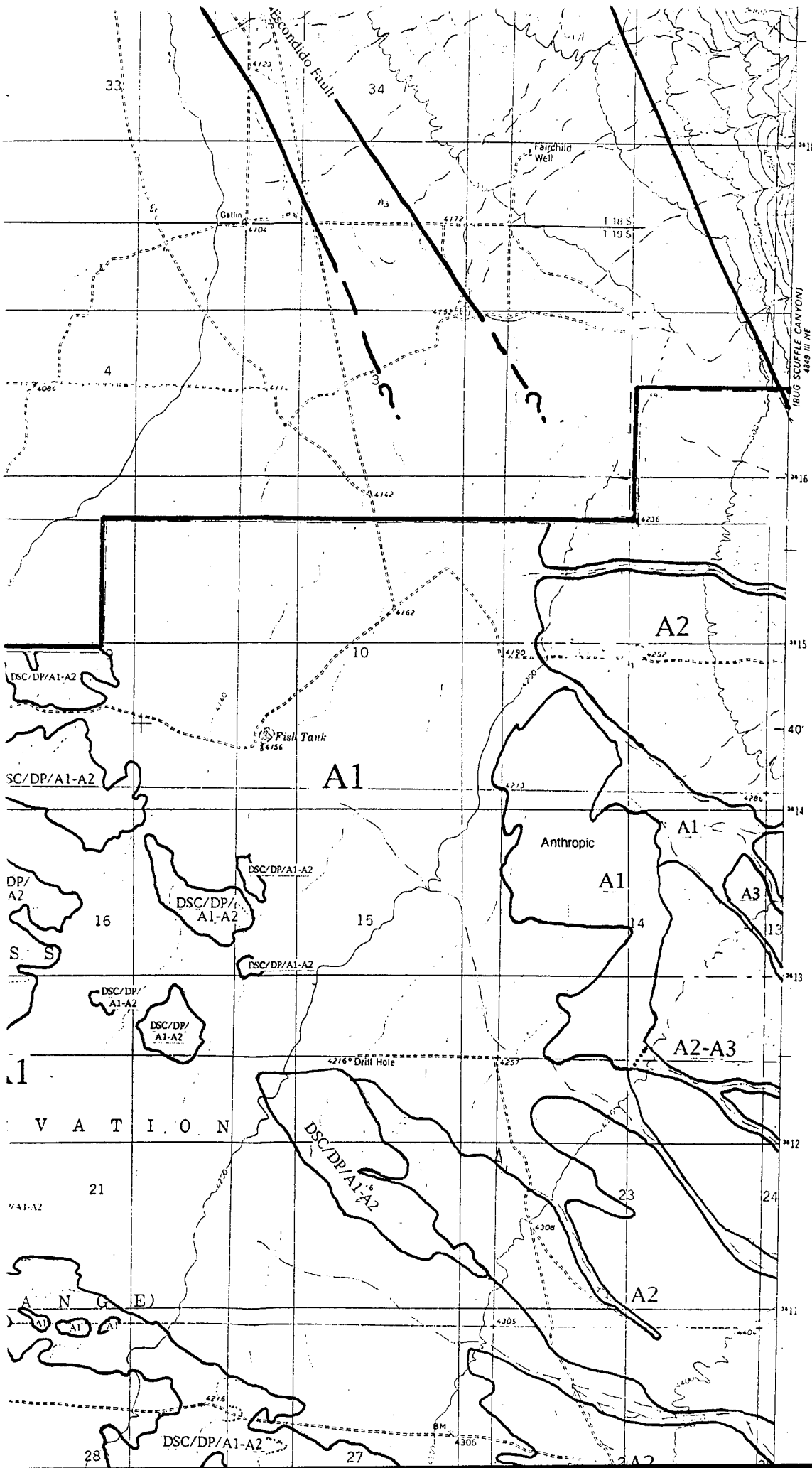
4849 IV SE
(SACRAMENTO PEAK)

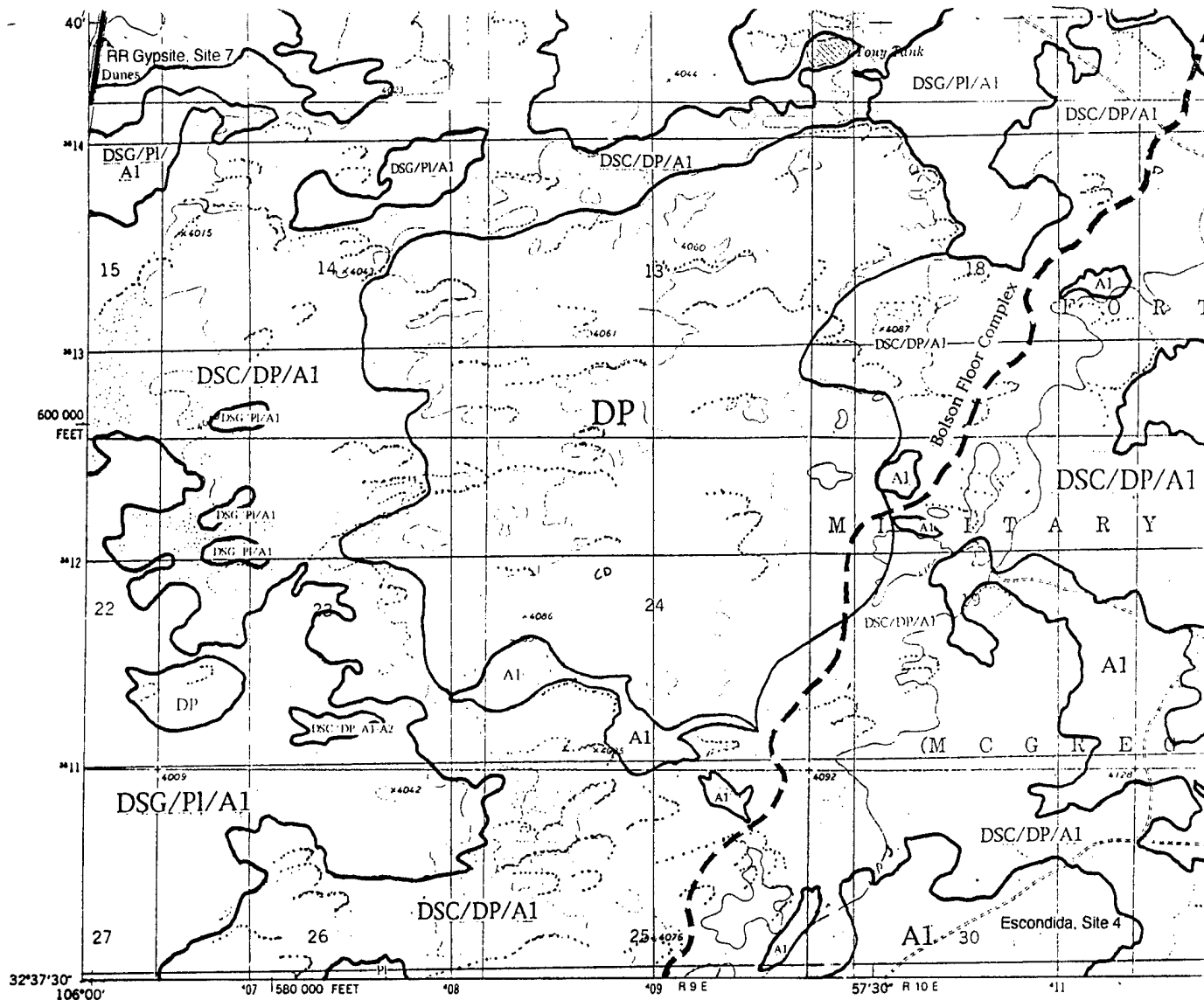


3









ITRES HERMANOS SEI
4745 S.E.

Mapped, edited, and published by the Geological Survey
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Topography by photogrammetric methods from aerial photographs
taken 1972. Field checked 1975. Map edited 1981

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983
move the projection lines 6 meters south and
50 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

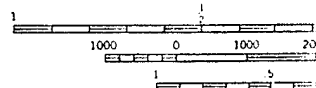
Where omitted, land lines have not been established

There may be private inholdings within the boundaries of the
National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR...
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	F
Pediment	P
Playa	PI
Playa Lunette	PIL

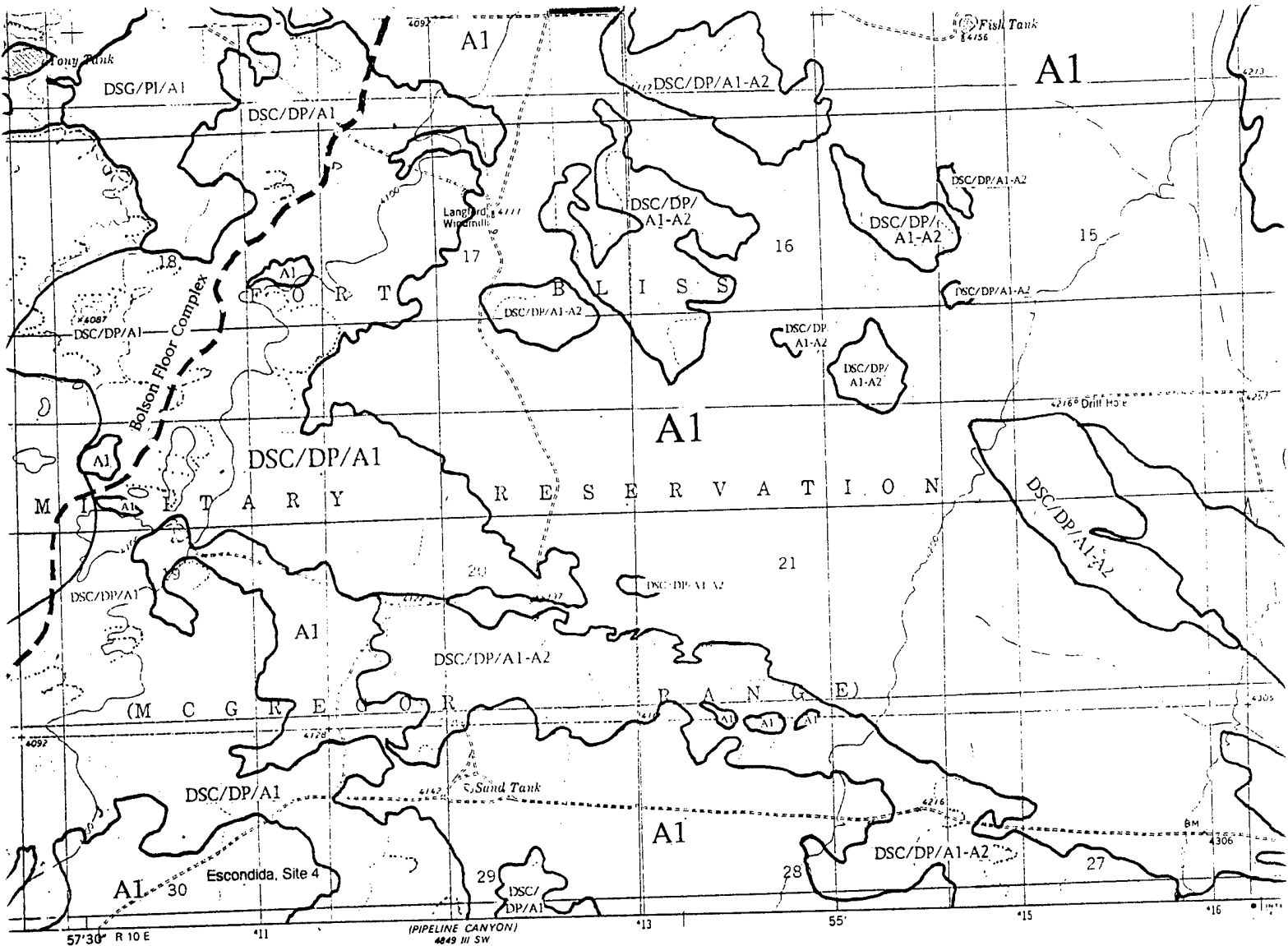
¹See text for explanation



CONTO
DOTTED LINES
NATIONAL GEO.

THIS MAP COMPLIES WITH
FOR SALE BY U.S. GEOLOGICAL SURVEY
A FOLDER DESCRIBING TOPOGRAPHY

7



Topographic Symbols

- A1
- A2
- A3
- B
- CR •••
- DL
- DP
- DS
- DSC
- DSG
- P
- P1
- P1L

SCALE 1:24 000

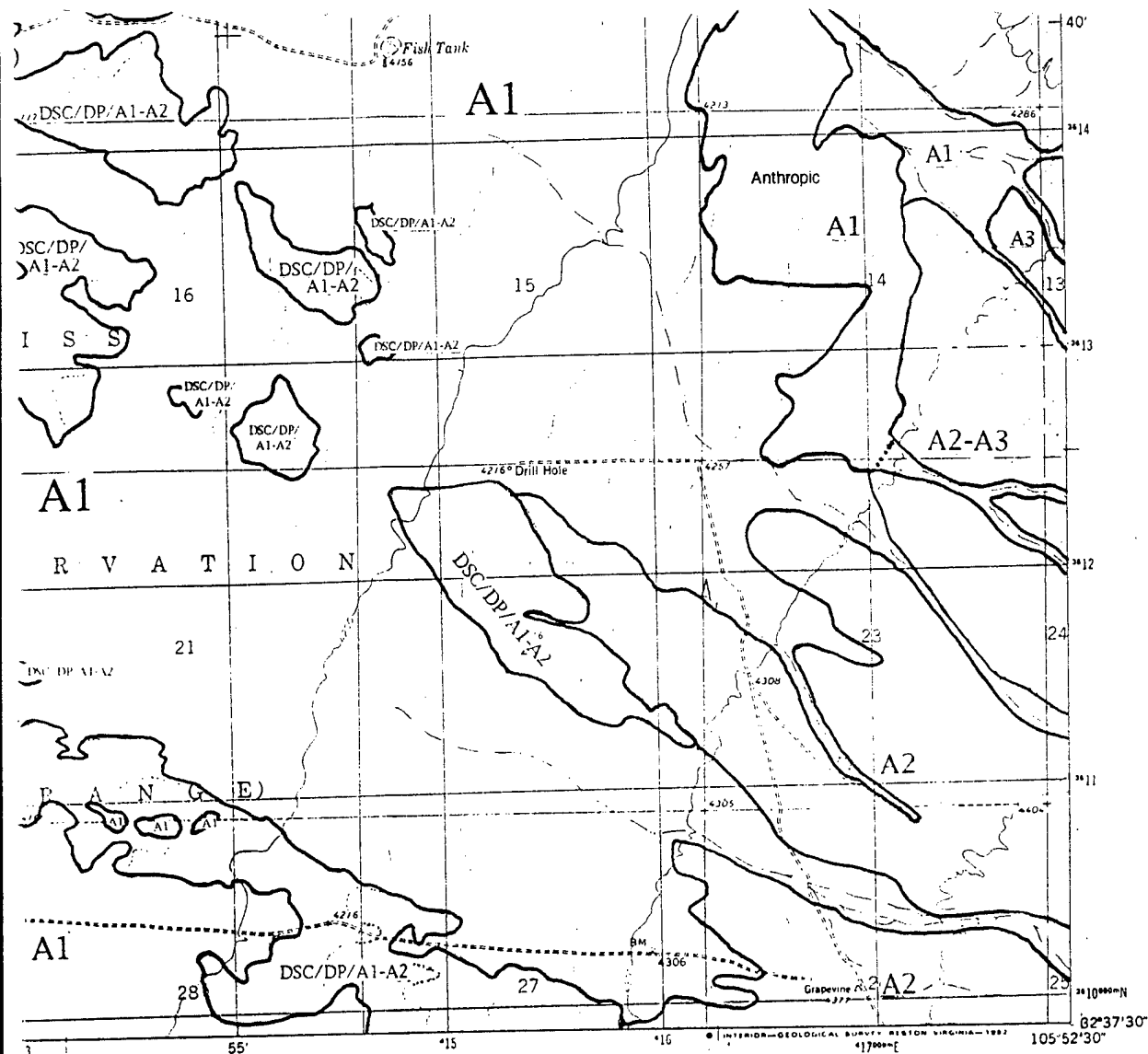
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

8



ROAD CLASSIFICATION

Primary highway, hard surface
 Secondary highway, hard surface
 Light-duty road, hard or improved surface
 Unimproved road
 Interstate Route
 U S Route
 State Route

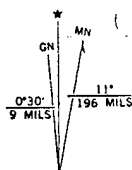
DEADMAN CANYON, N. MEX.

NW/4 ESCONDIDO CANYON 15' QUADRANGLE
 N3237.5-W10552.5/7.5

1981

DMA 4849 III NW-SERIES V881

1 MILE
 7000 FEET
 1 KILOMETER



STON, VIRGINIA 22092
 ON REQUEST

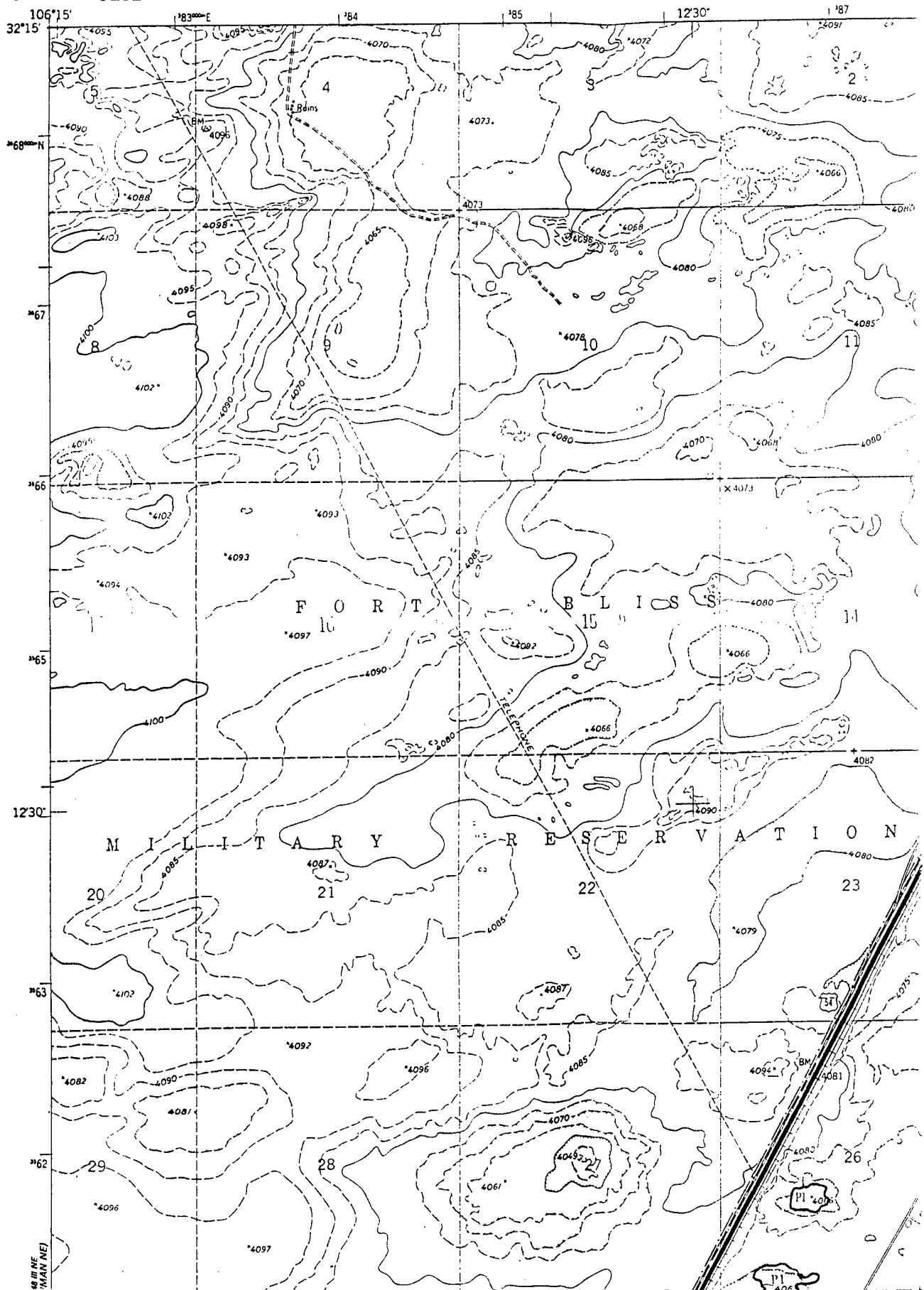
9

4

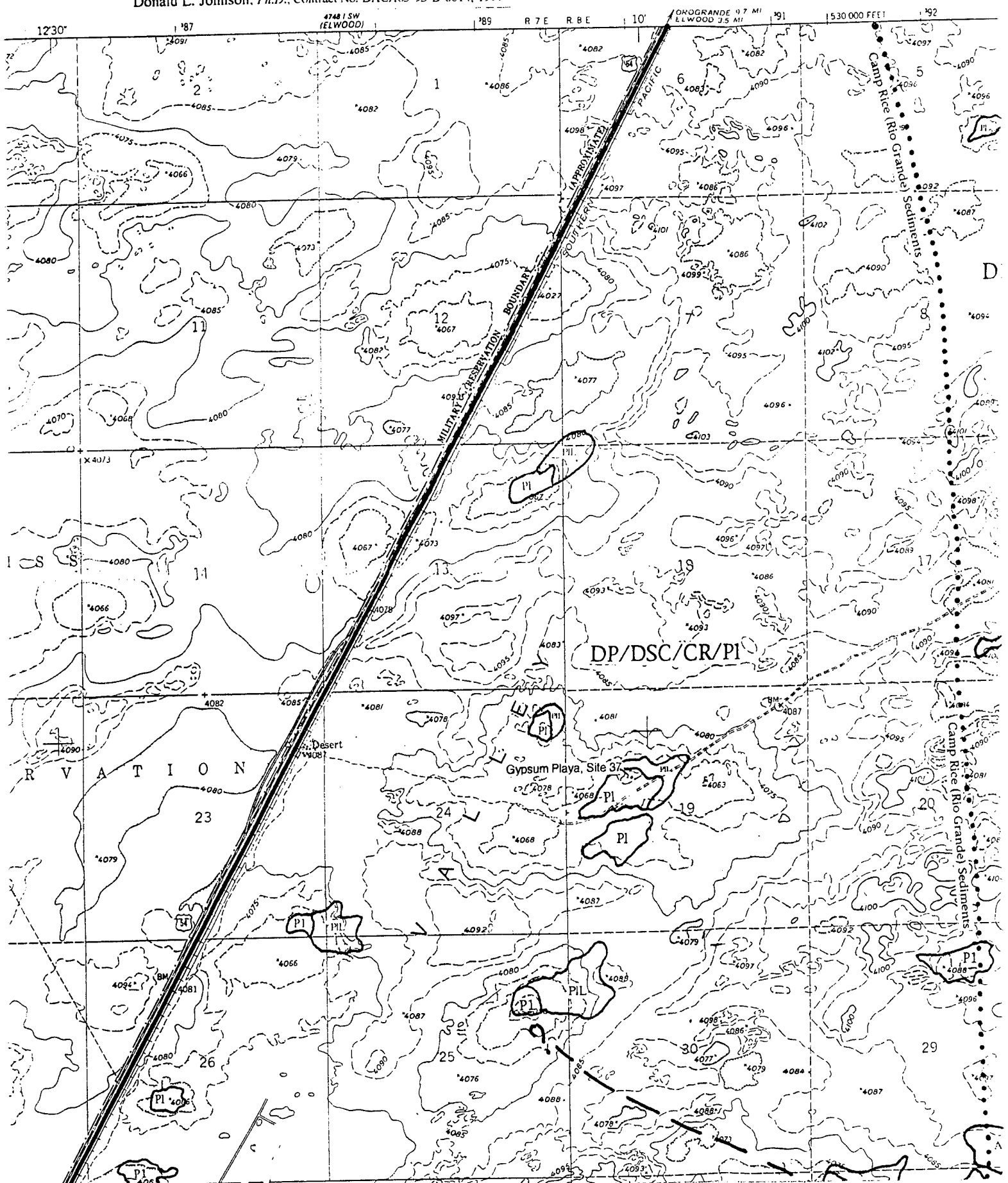
WHITE SANDS SD

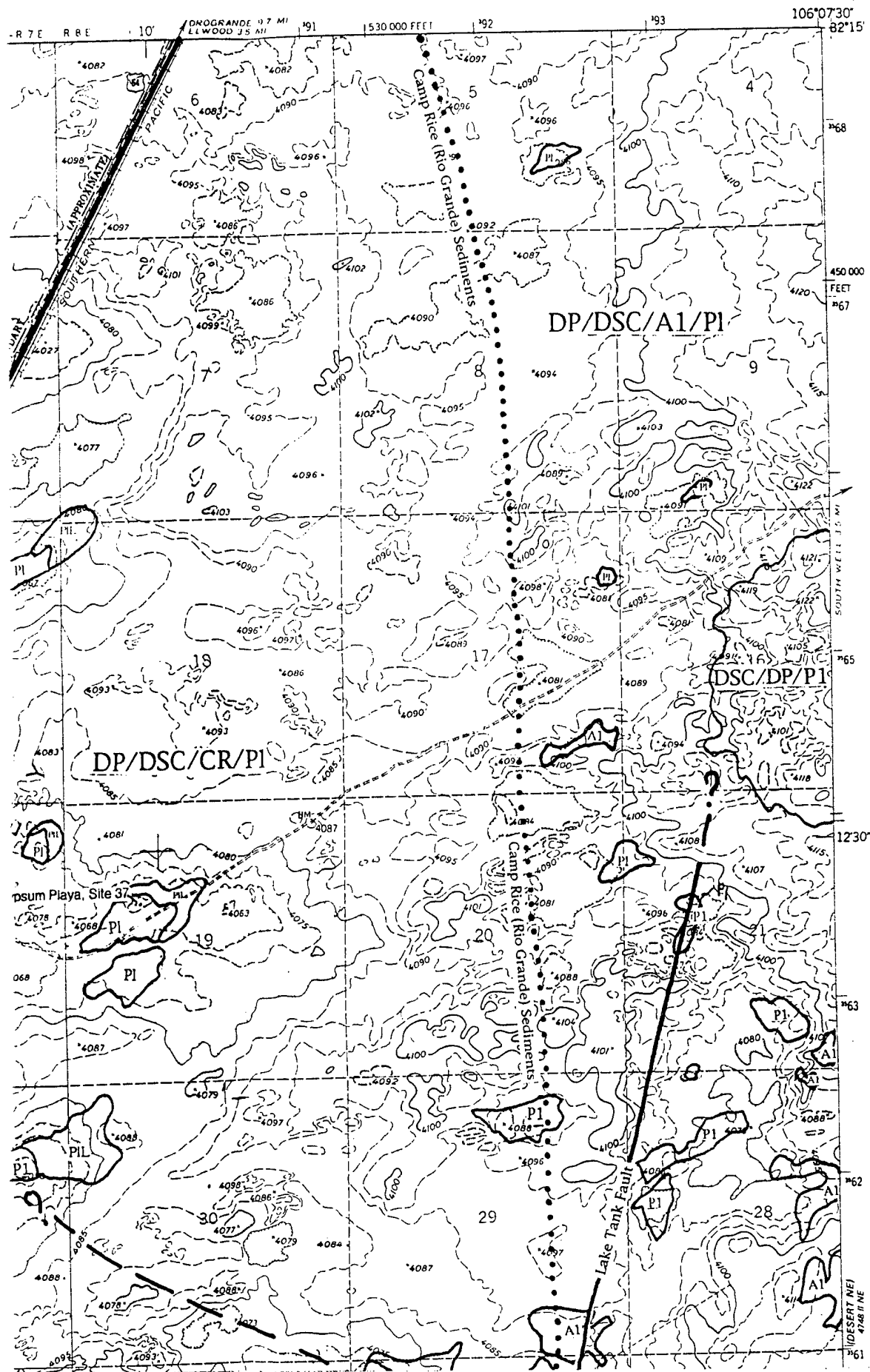
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

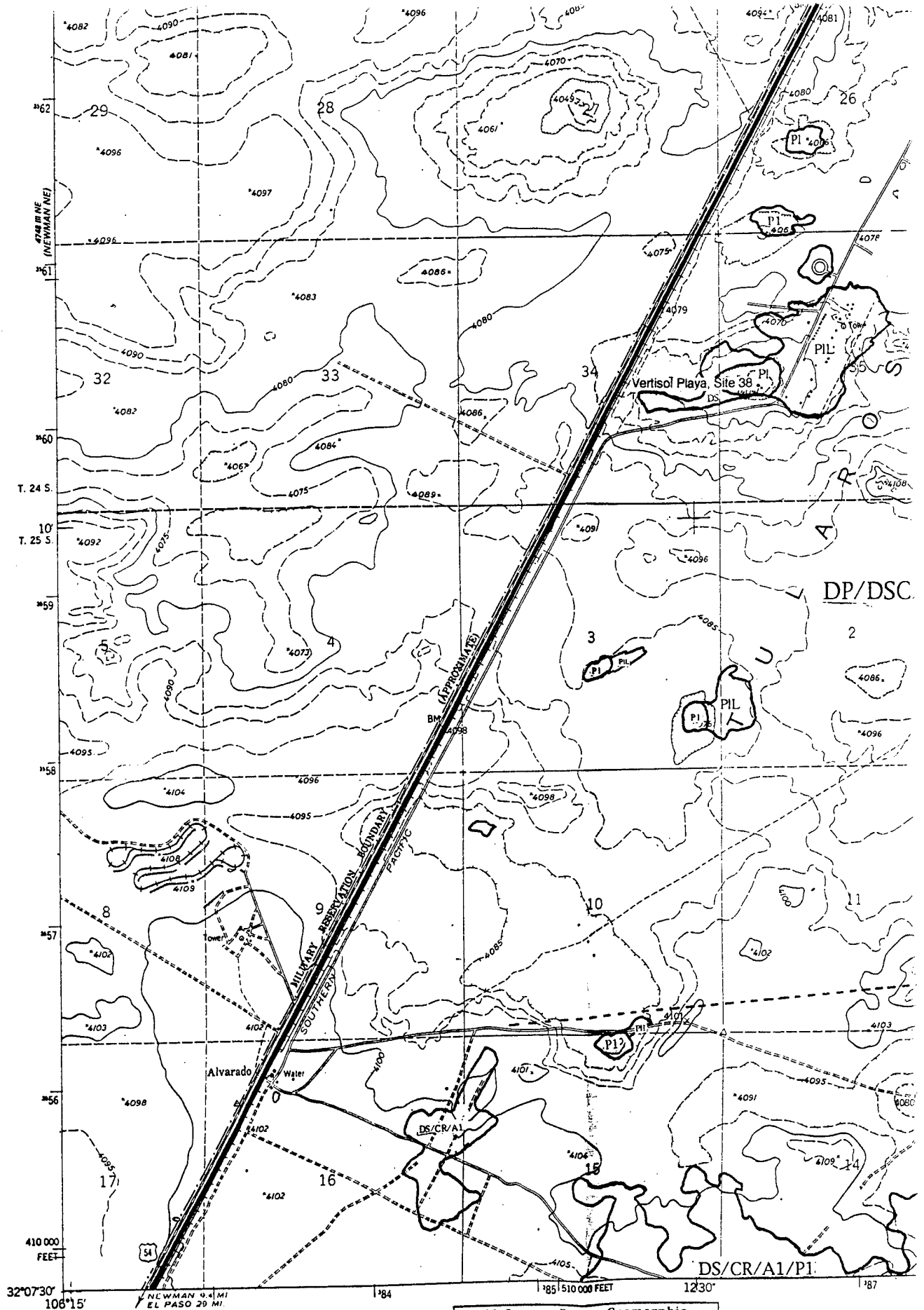
Geomorphological, Geocological
Study of McGregor Gulch
Donald L. Johnson.



Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997



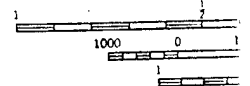


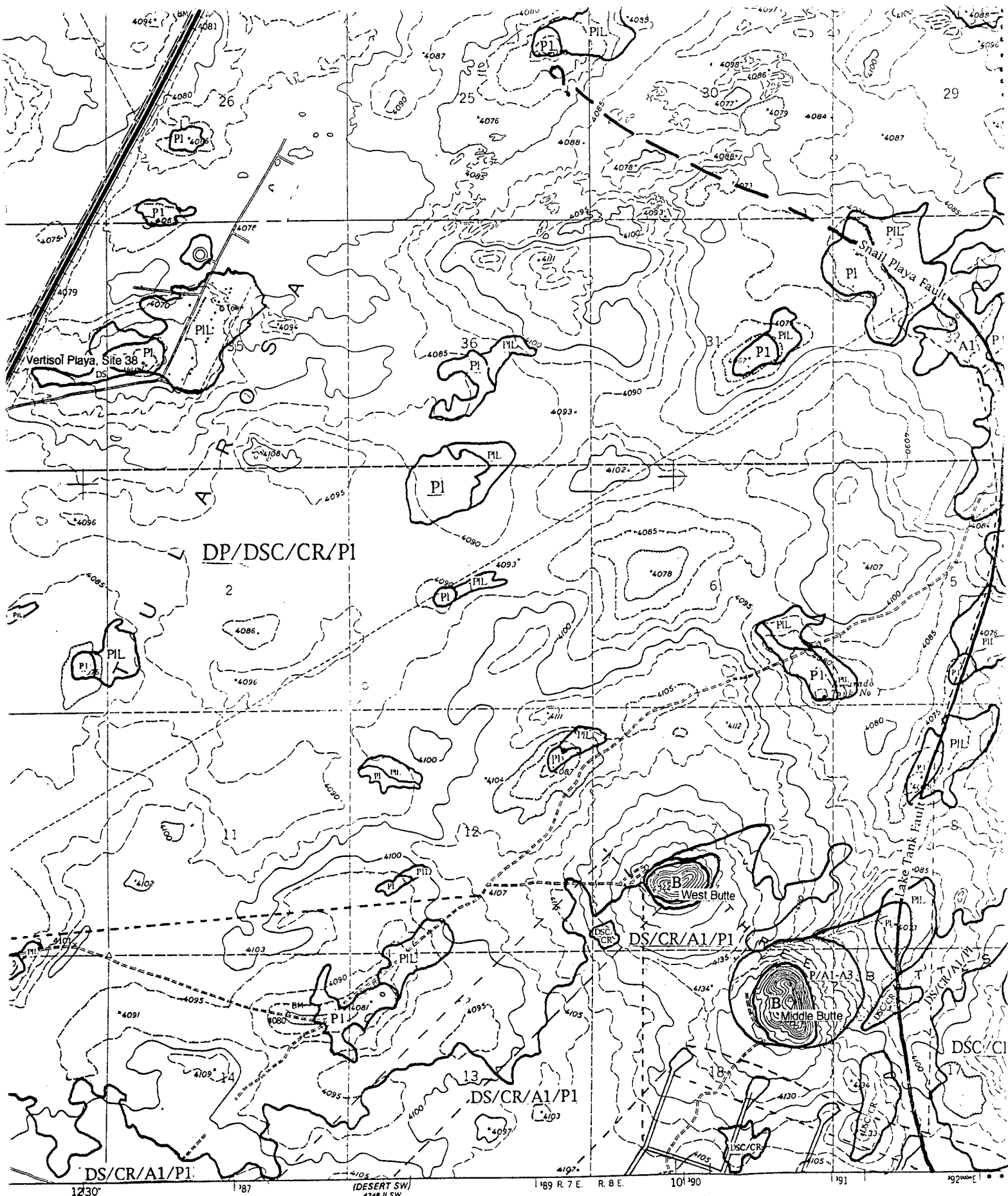


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 Published for civil use by the Geological Survey
 Control by USGS, USC&GS, and USCE
 Topography from aerial photographs by photogrammetric methods
 Aerial photographs taken 1954. Photography field annotated 1955
 Polyconic projection. 1927 North American Datum
 10,000-foot grid based on New Mexico coordinate system,
 central zone

McGregor Range Geomorphic
 Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR • • •
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	PI





omorphs
Symbols

A1
A2
A3
B
CR
DL
DP

iments

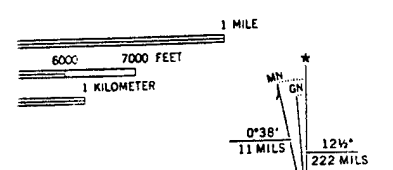
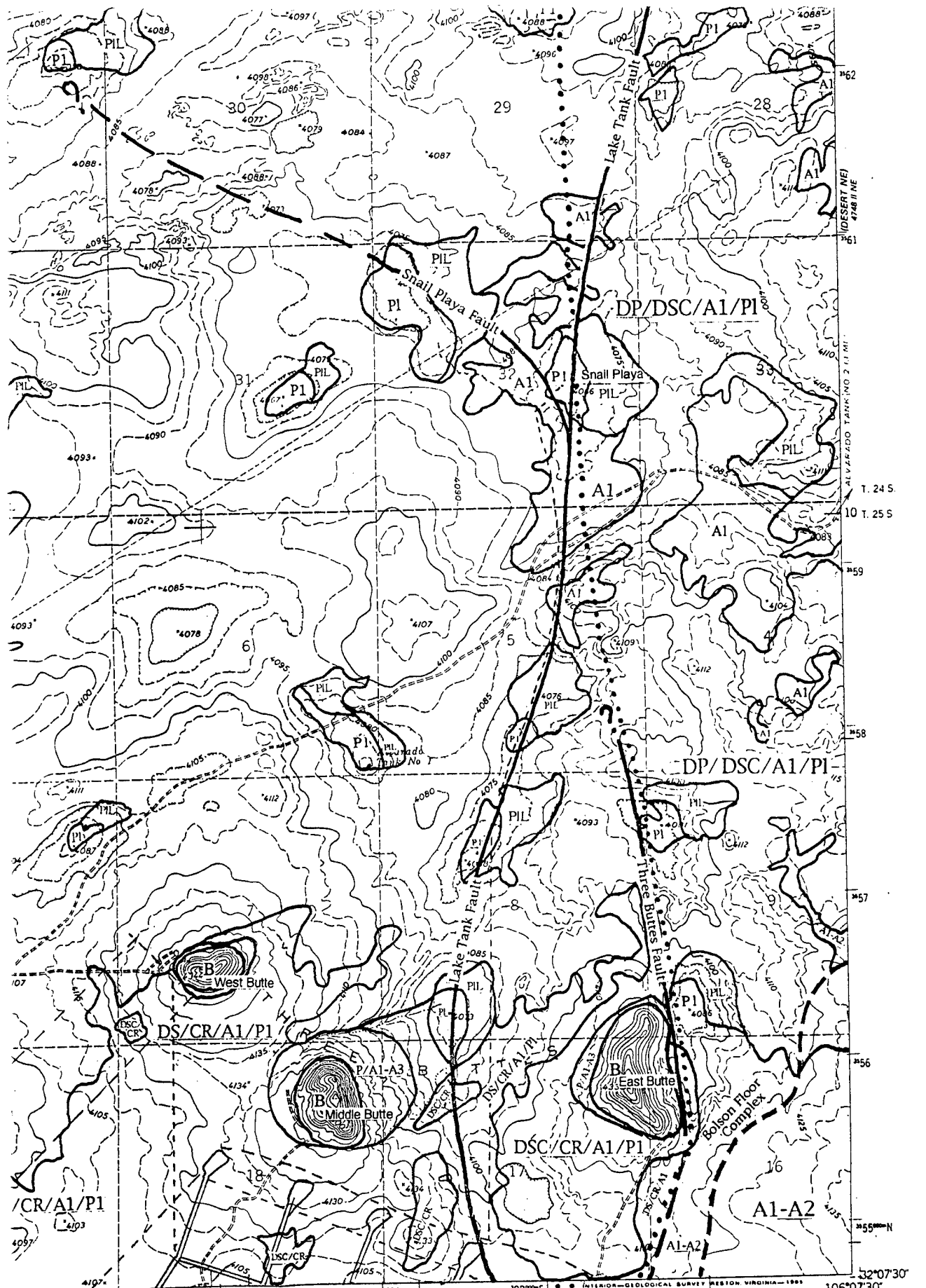
SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

0°38' 11 MILS
12°15' 222 MILS

NEW MEXICO

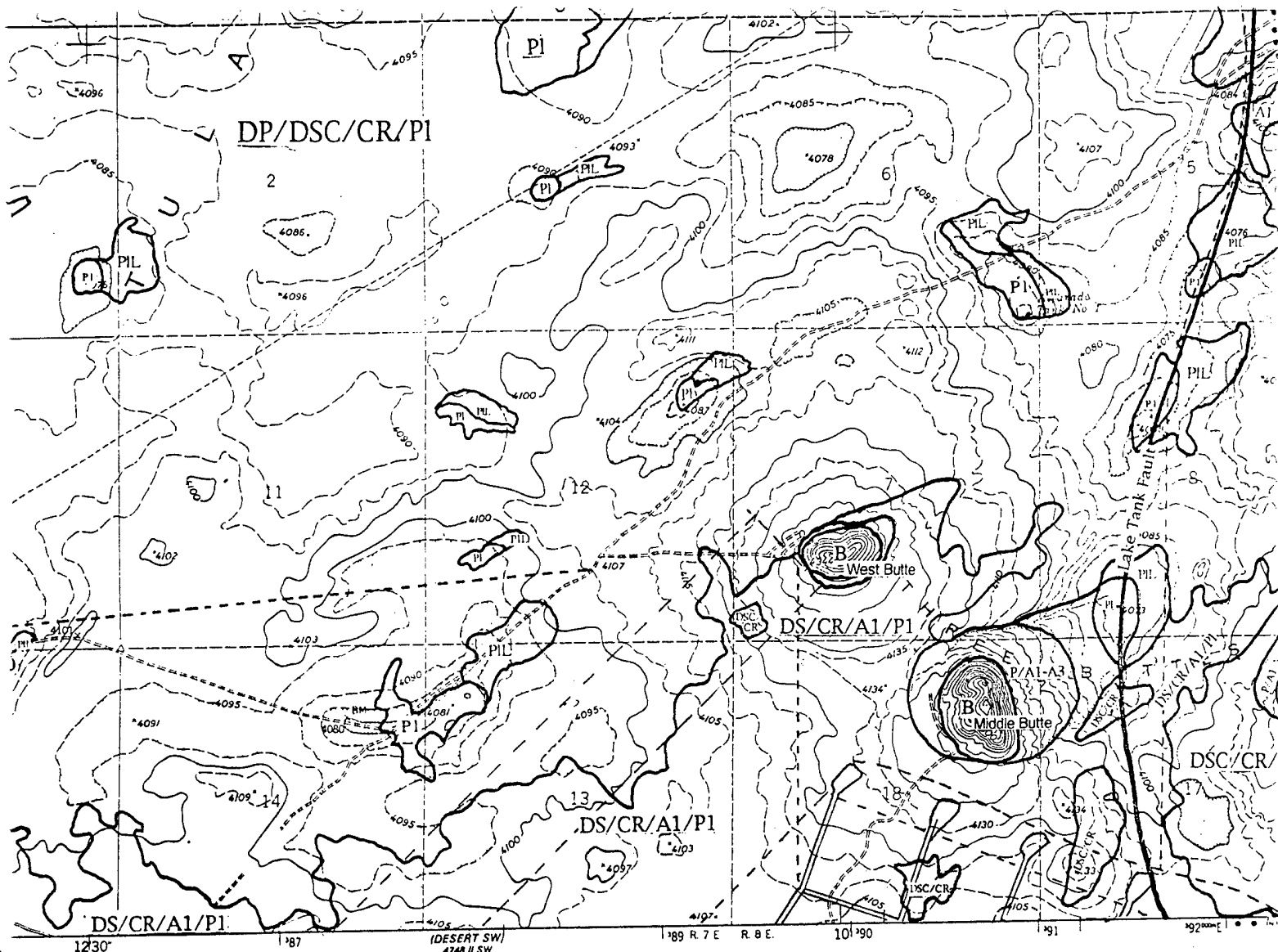
Medium

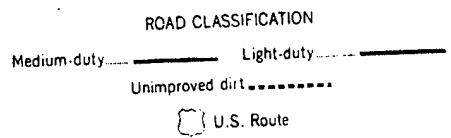
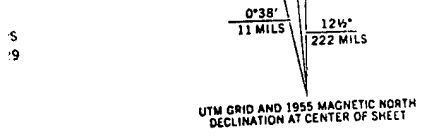
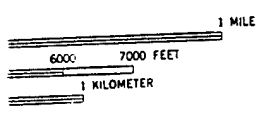
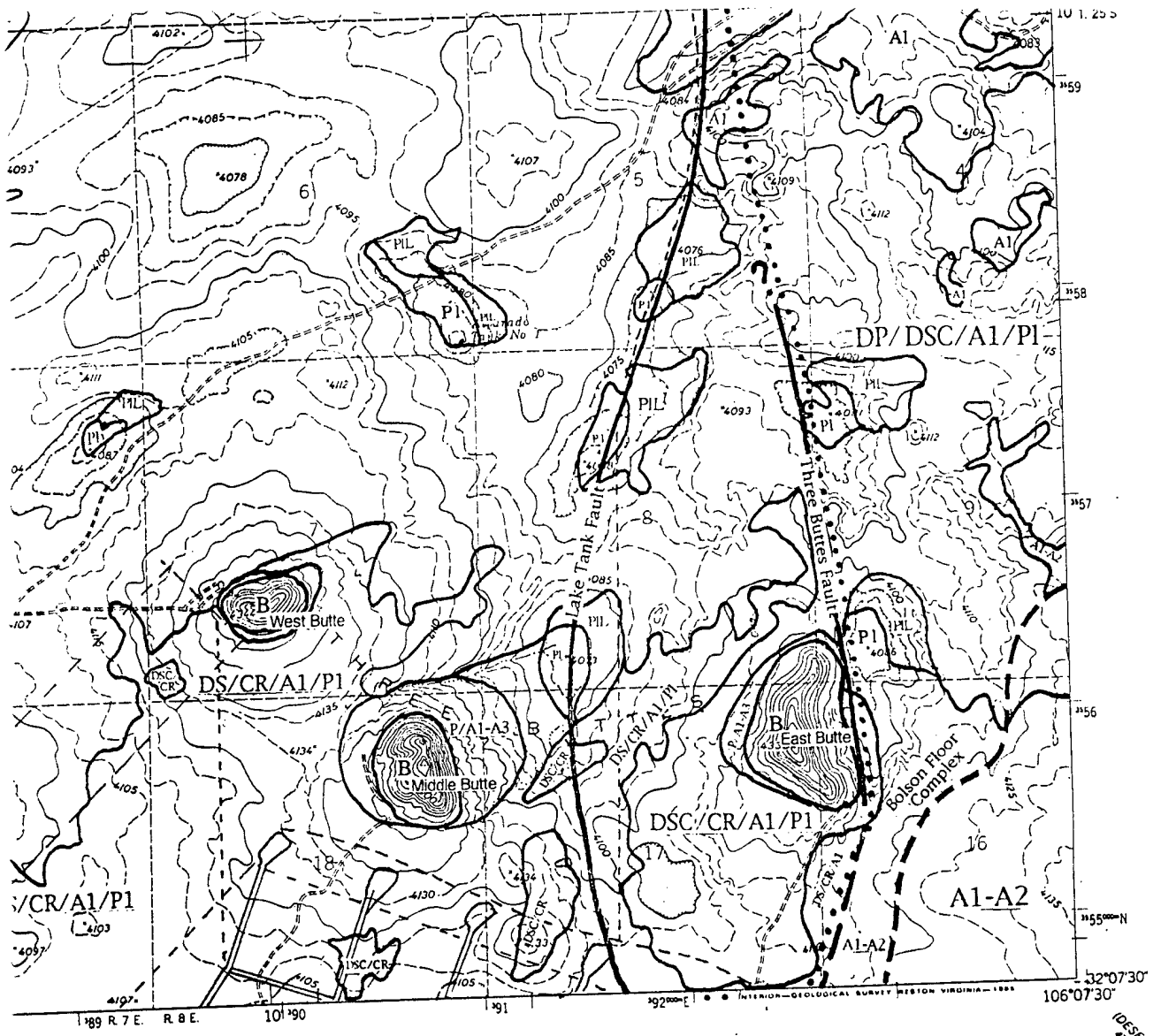


ROAD CLASSIFICATION
Medium-duty _____ Light-duty _____
Unimproved dirt _____
U.S. Route

DESERT, N. MEX.

6





DESERT, N. MEX.

32106-B2-TF-024

1955

DMA 4748 II NW-SERIES V881

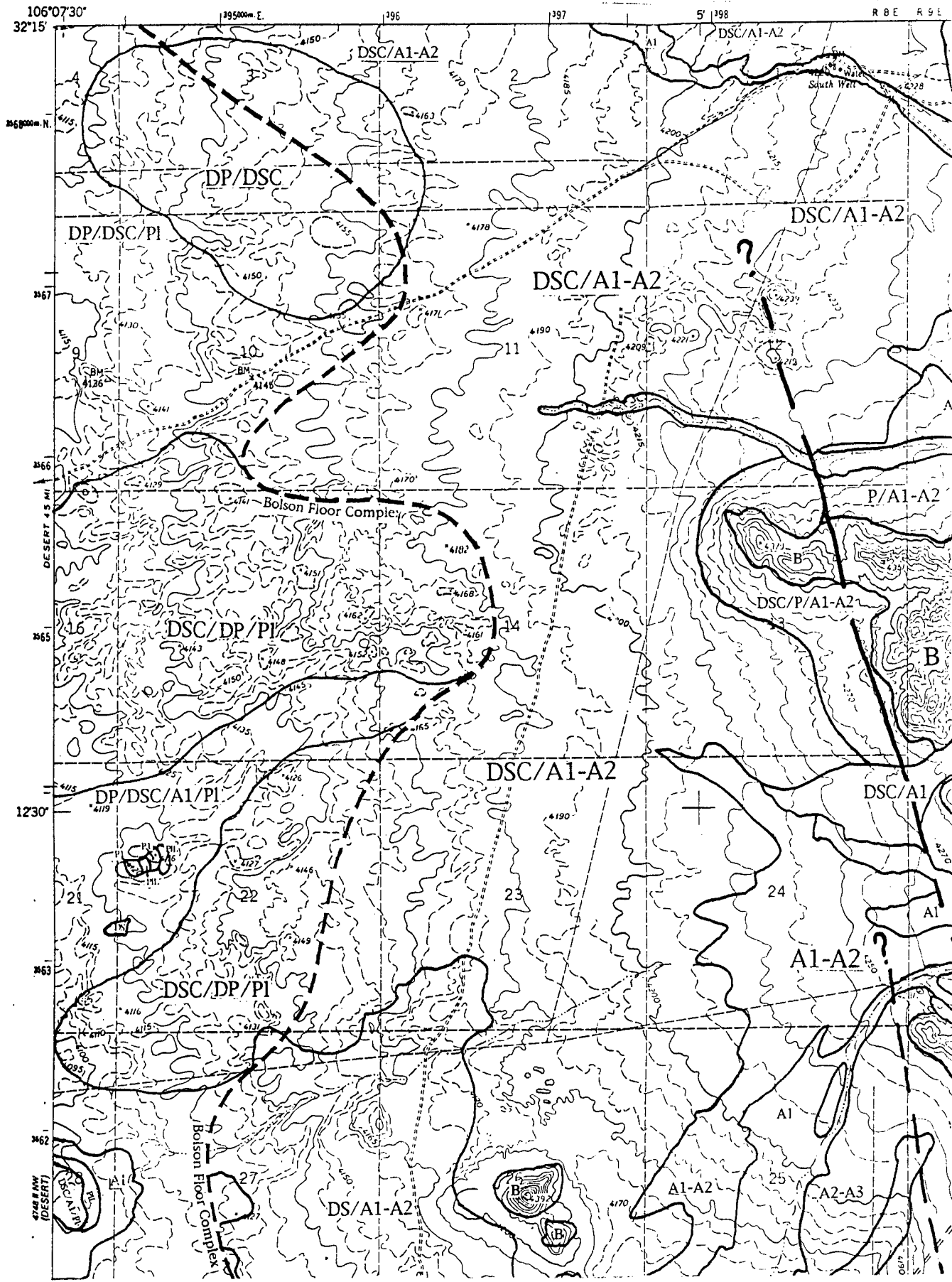
STANDARDS
S. OR RESTON, VIRGINIA 22092
AVAILABLE ON REQUEST

9

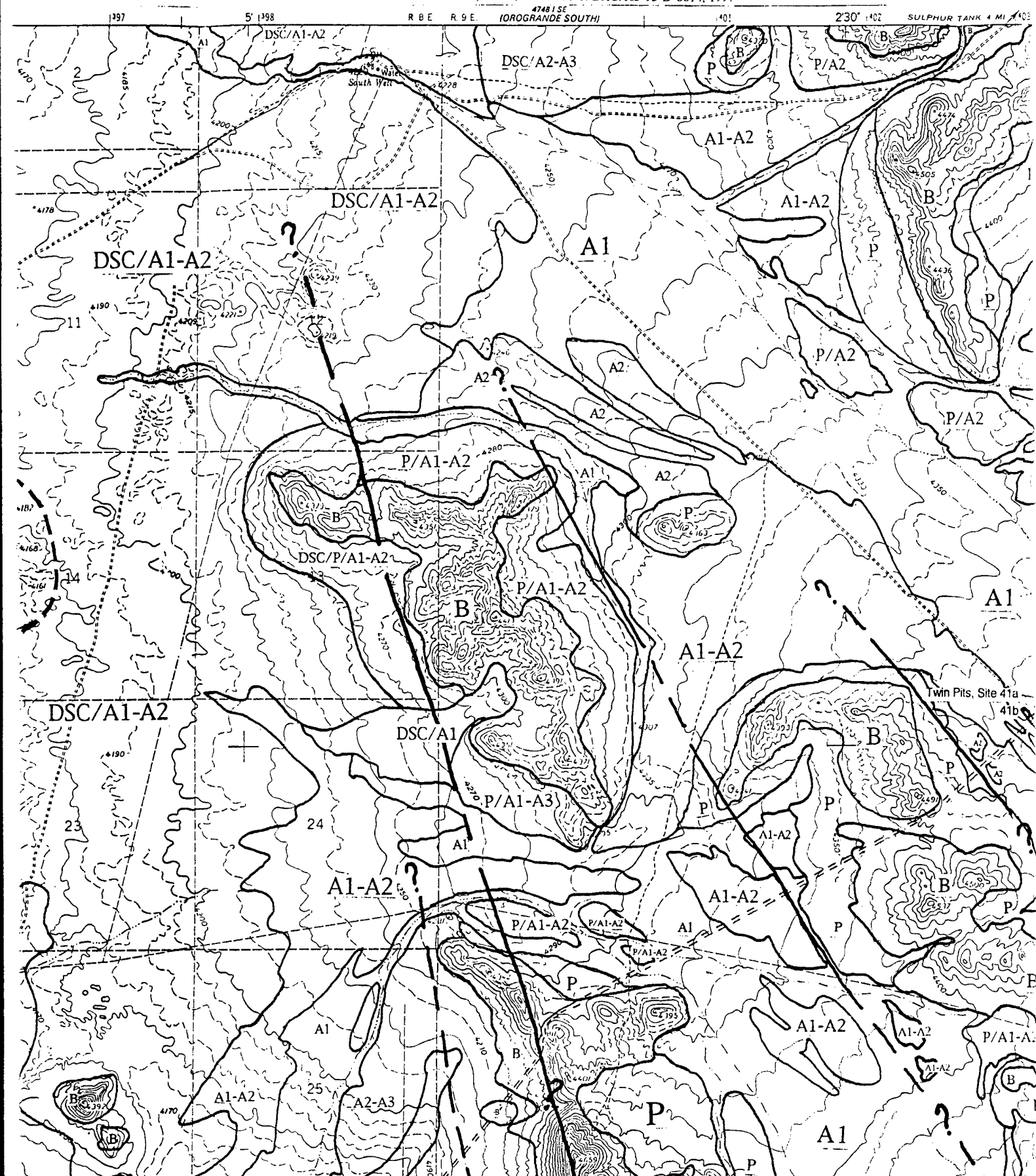
241.15W
(241.15W)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geocological
Study of McGregor Gully
Donald L. Johnson.

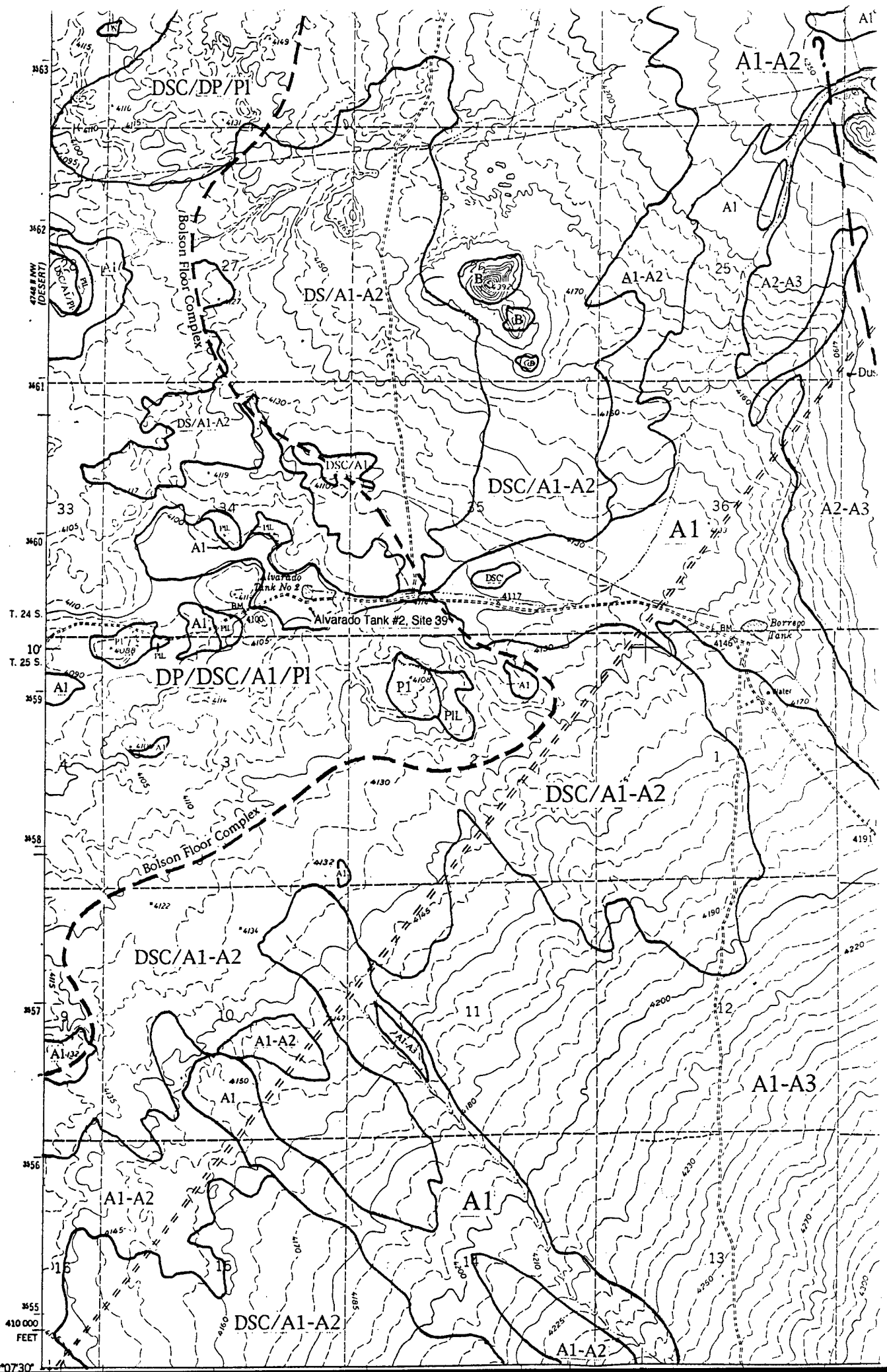


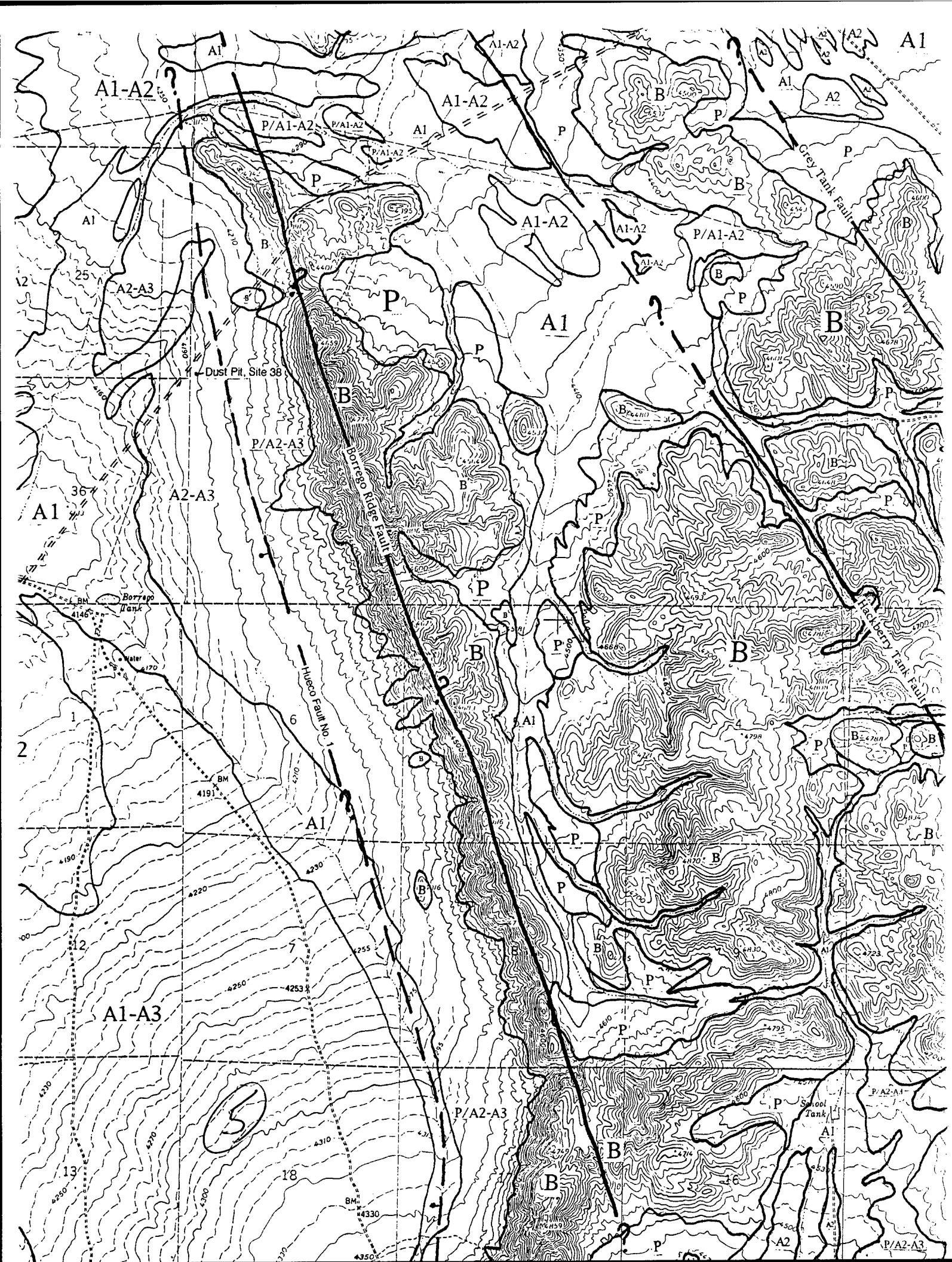
Geomorphological, Geoecological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

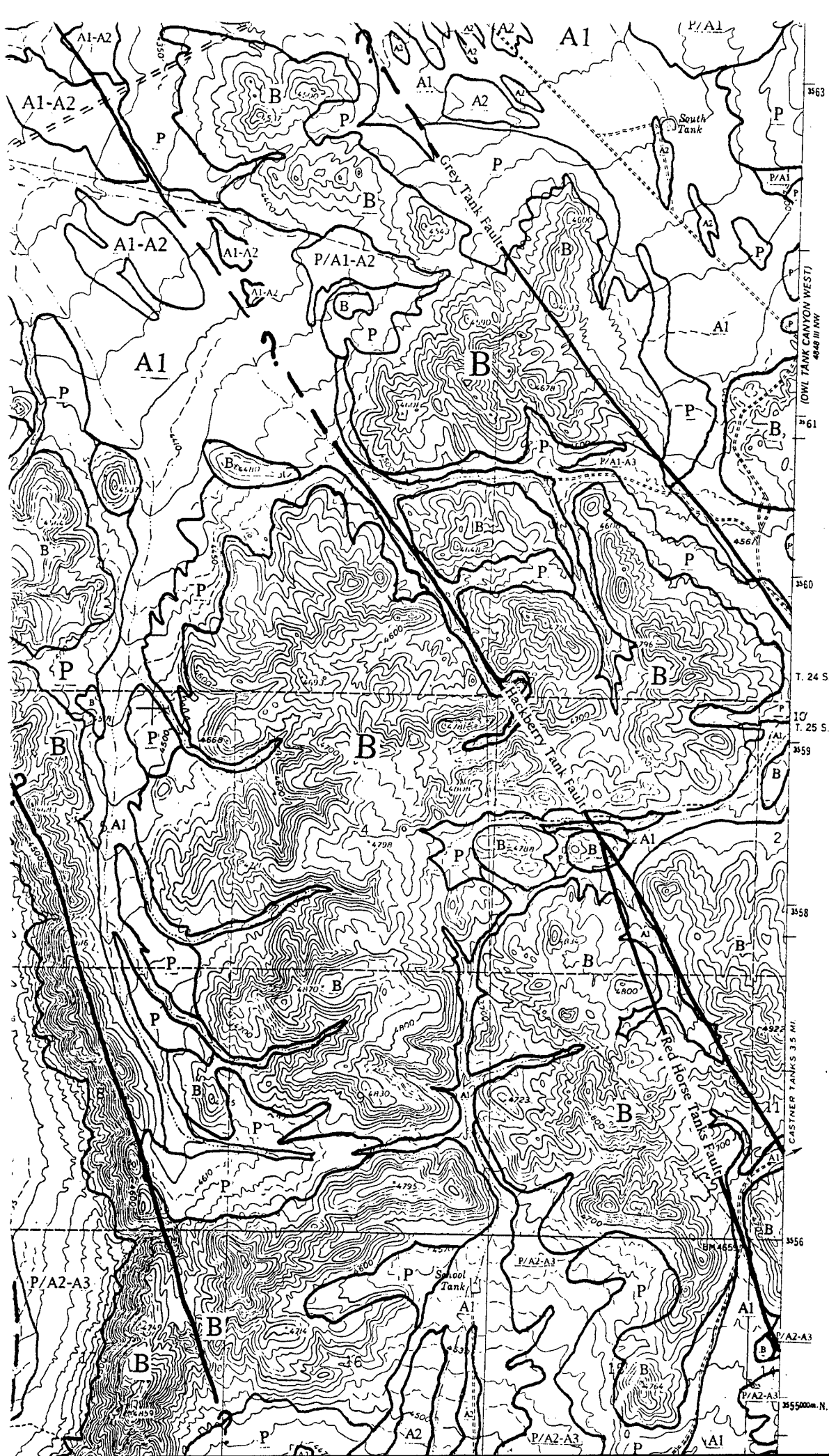


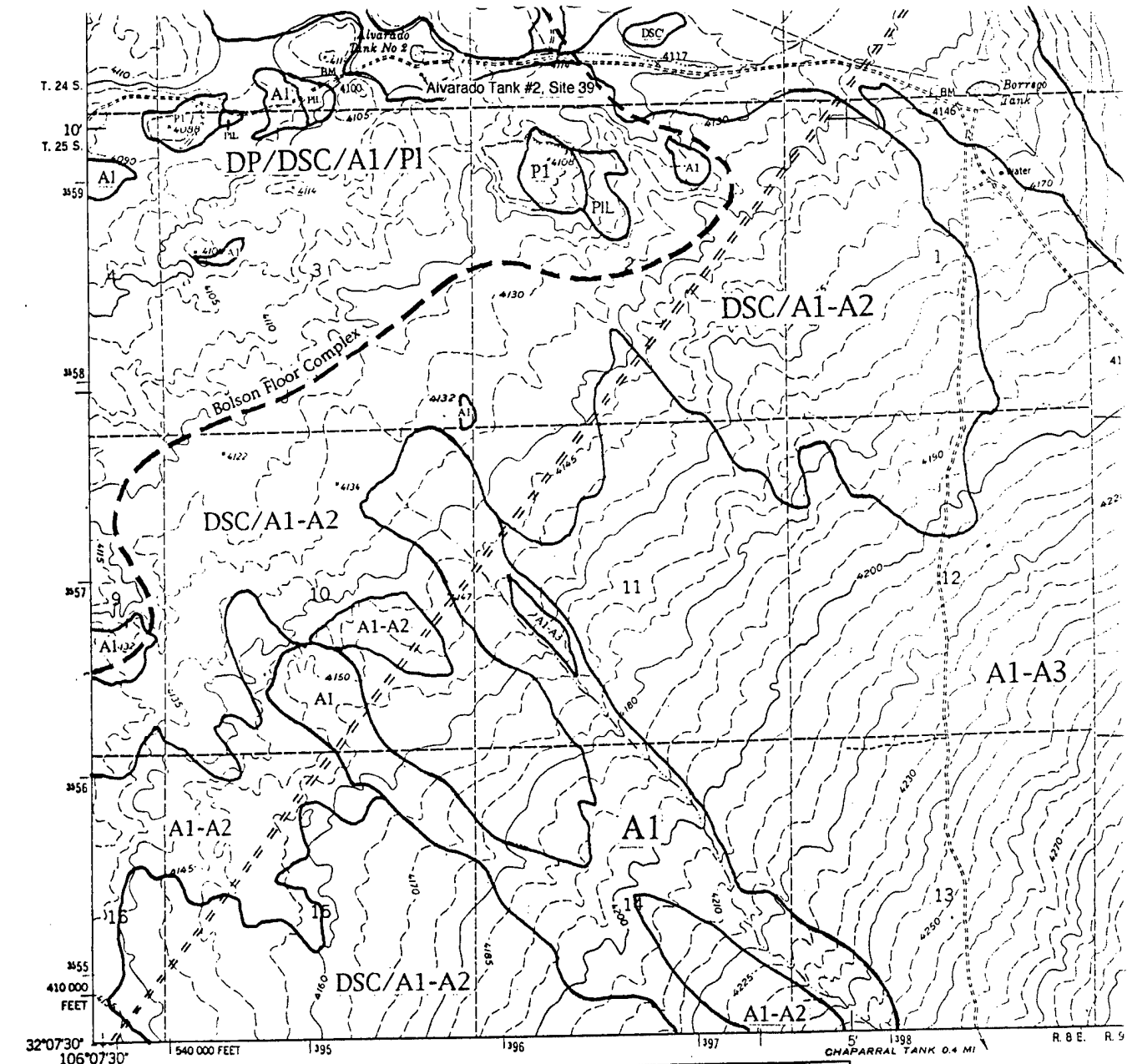
4848 P. SW.
(BLACK TANKS)









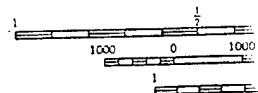


DESERT SWI
414 1 54

Mapped by the Army Map Service
Published for civil use by the Geological Survey
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Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955
Polyconic projection. 1927 North American Datum
10,000-foot grid based on New Mexico coordinate system,
central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue
Dashed land lines indicate approximate locations
Land lines omitted in T. 24 S.-R. 9 E. because of insufficient data
Fine red dashed lines indicate selected fence lines

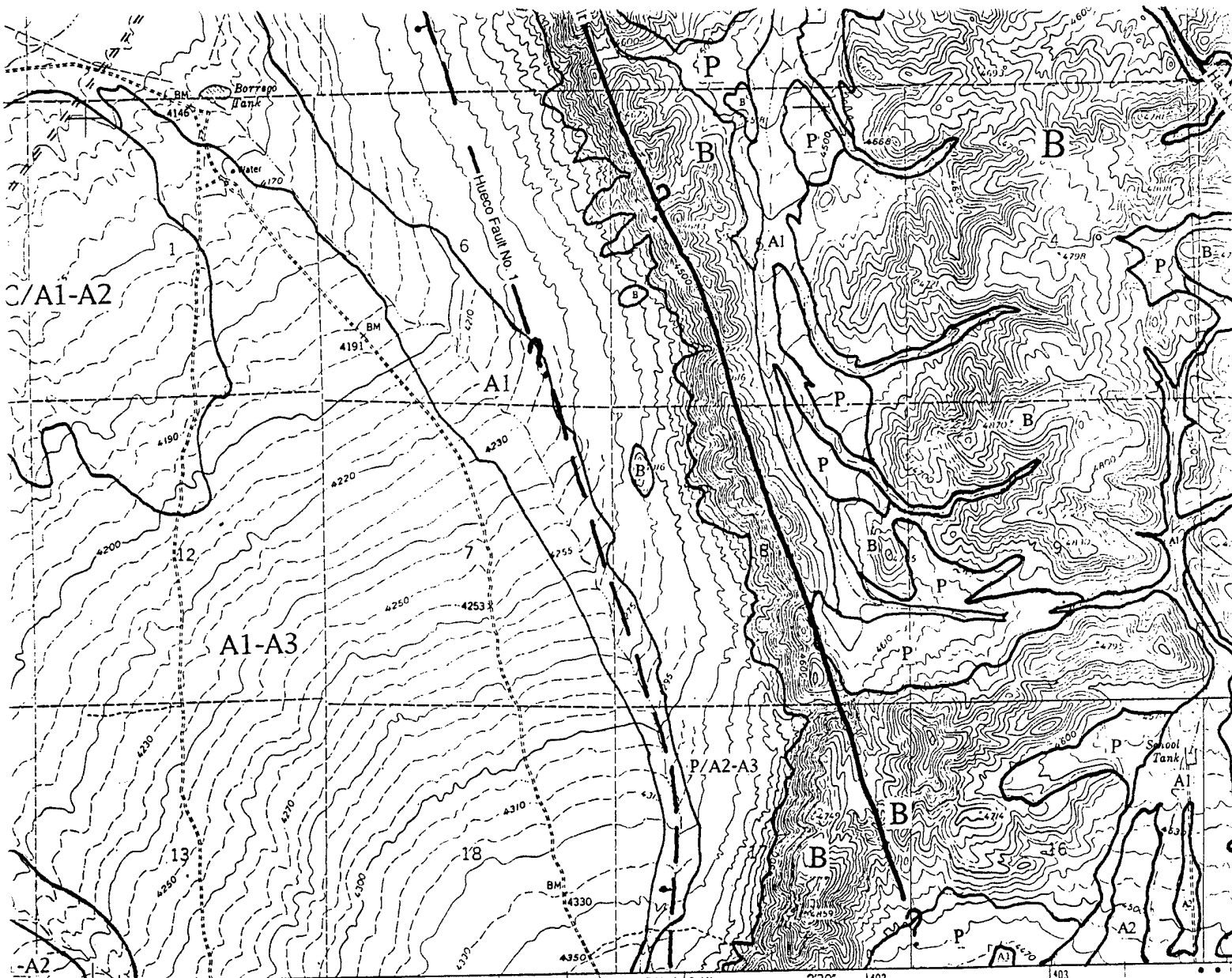
McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR • • •
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet (Sand Sheet)	DSC
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSC
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	PIL

¹See text for explanation

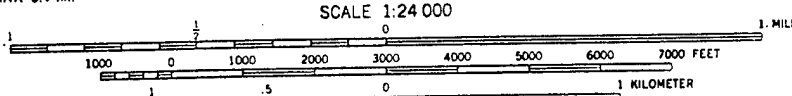


DASHED
NATI

THIS MAP CO:
FOR SALE BY U. S. GEOLOGICAL
A FOLDER DESCRIBING TC

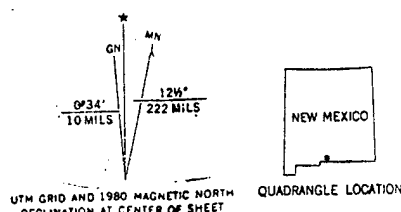


- Topographic Symbols
- A1
 - A2
 - A3
 - B
 - CR ●●●
 - DL
 - DP
 - DS
 - DSC
 - DSC
 - P
 - P1
 - PIL

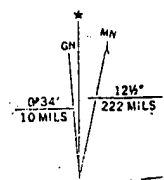
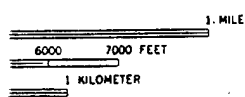
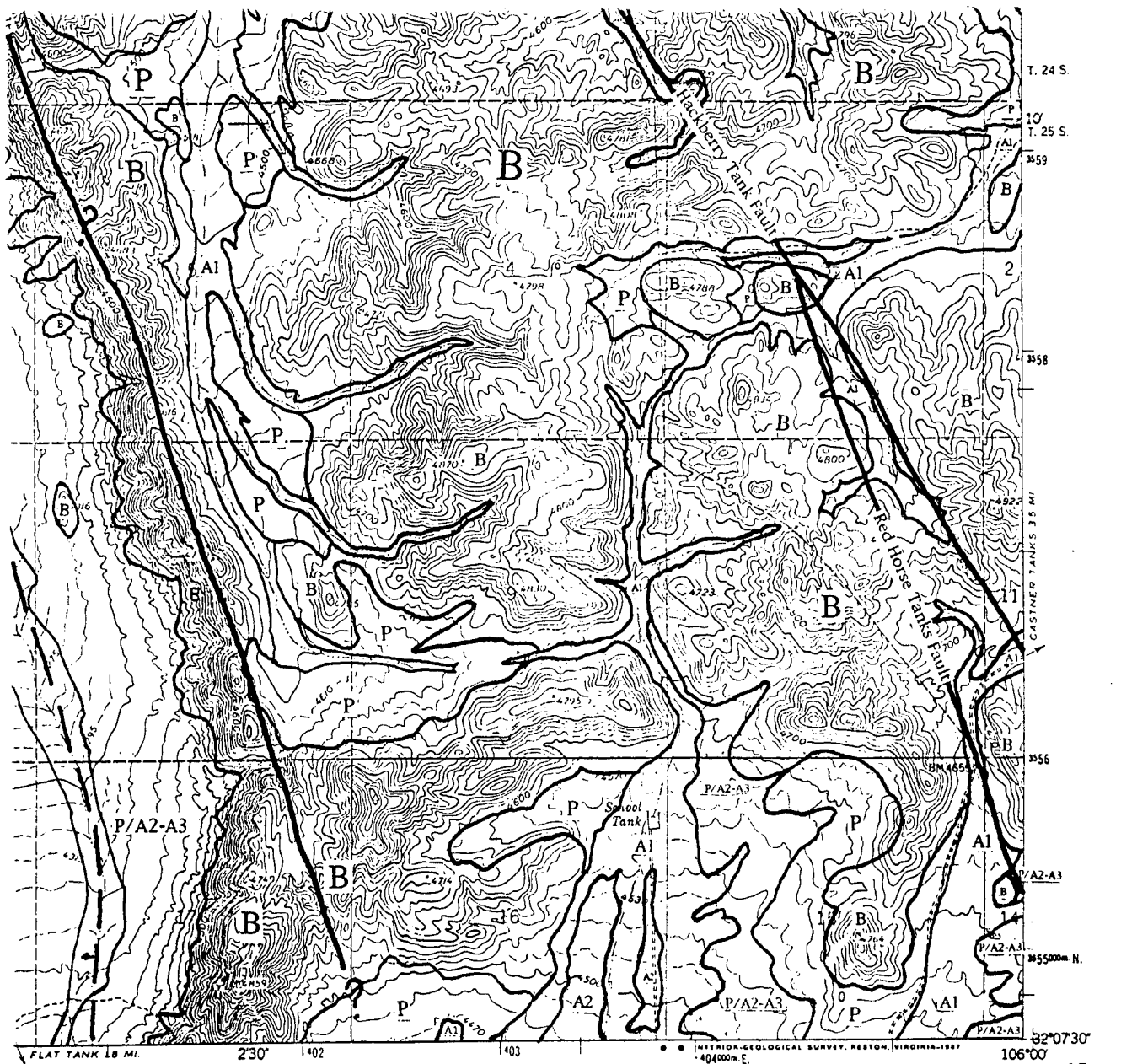


CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



8



STANDARDS
OR RESTON, VIRGINIA 22092
AVAILABLE ON REQUEST

UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Unimproved dirt -----

DESERT NE, N. MEX.
32106-B1-TF-024

1955

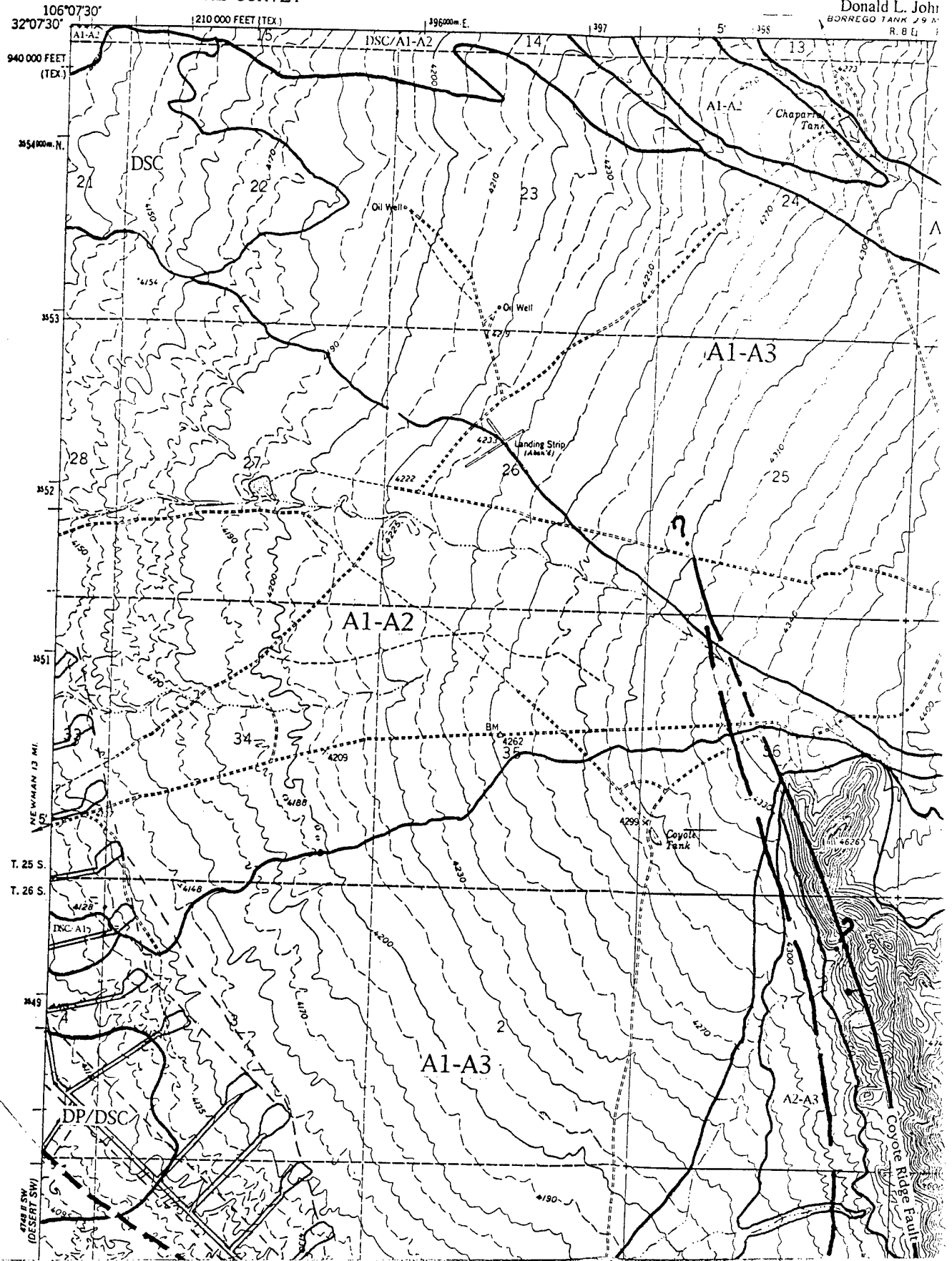
DMA 4748 II NE-SERIES V881

9

SW 1/4 SW 1/4
(DESERT)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

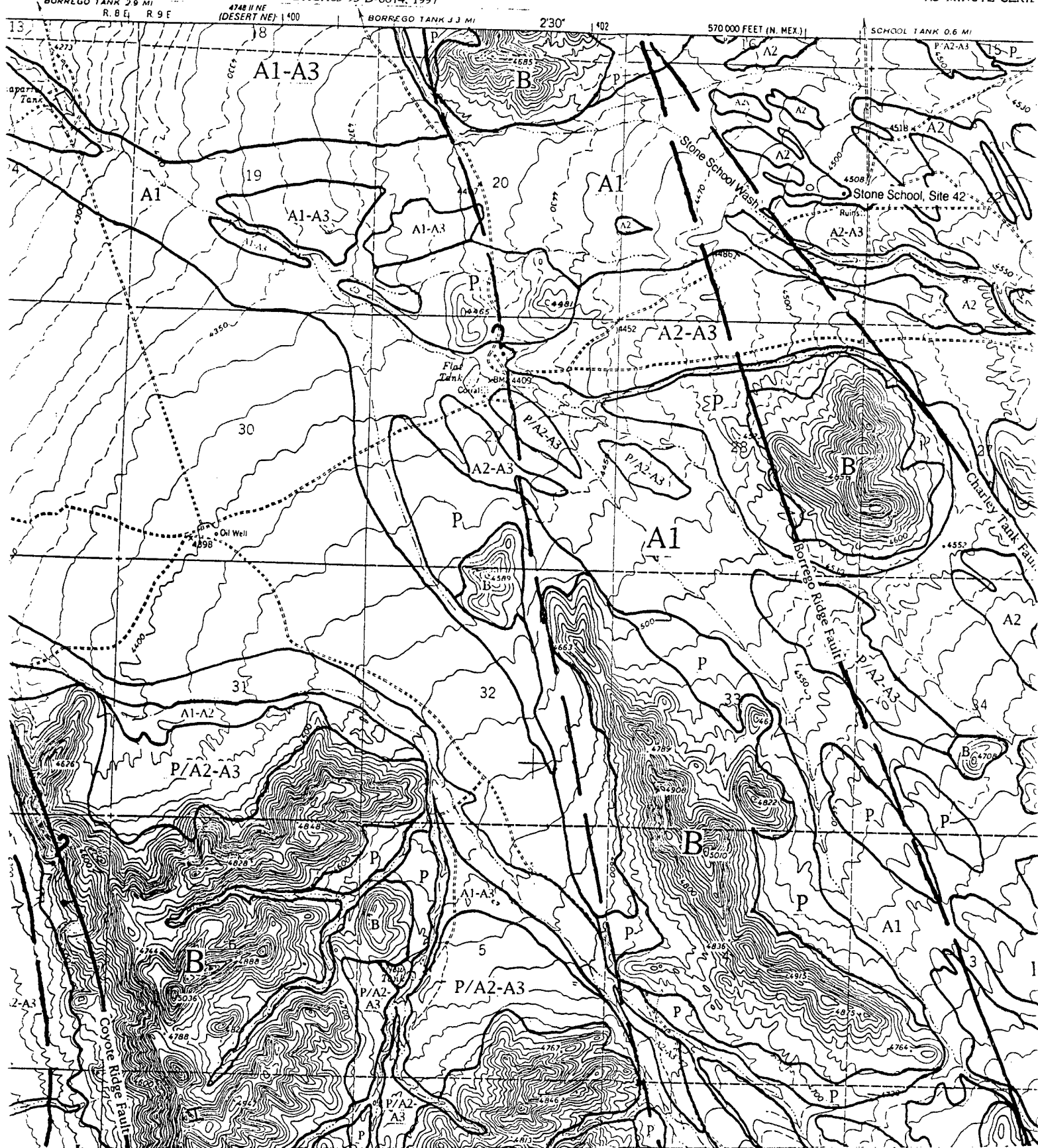
Geomorphological, Geoc
Study of McGregor
Donald L. John
BORREGO TANK 1/4 N.
R. 8 E.



①

**Morphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico**
Donald L. Johnson, Ph.D., Contract No. D-3142-61-2

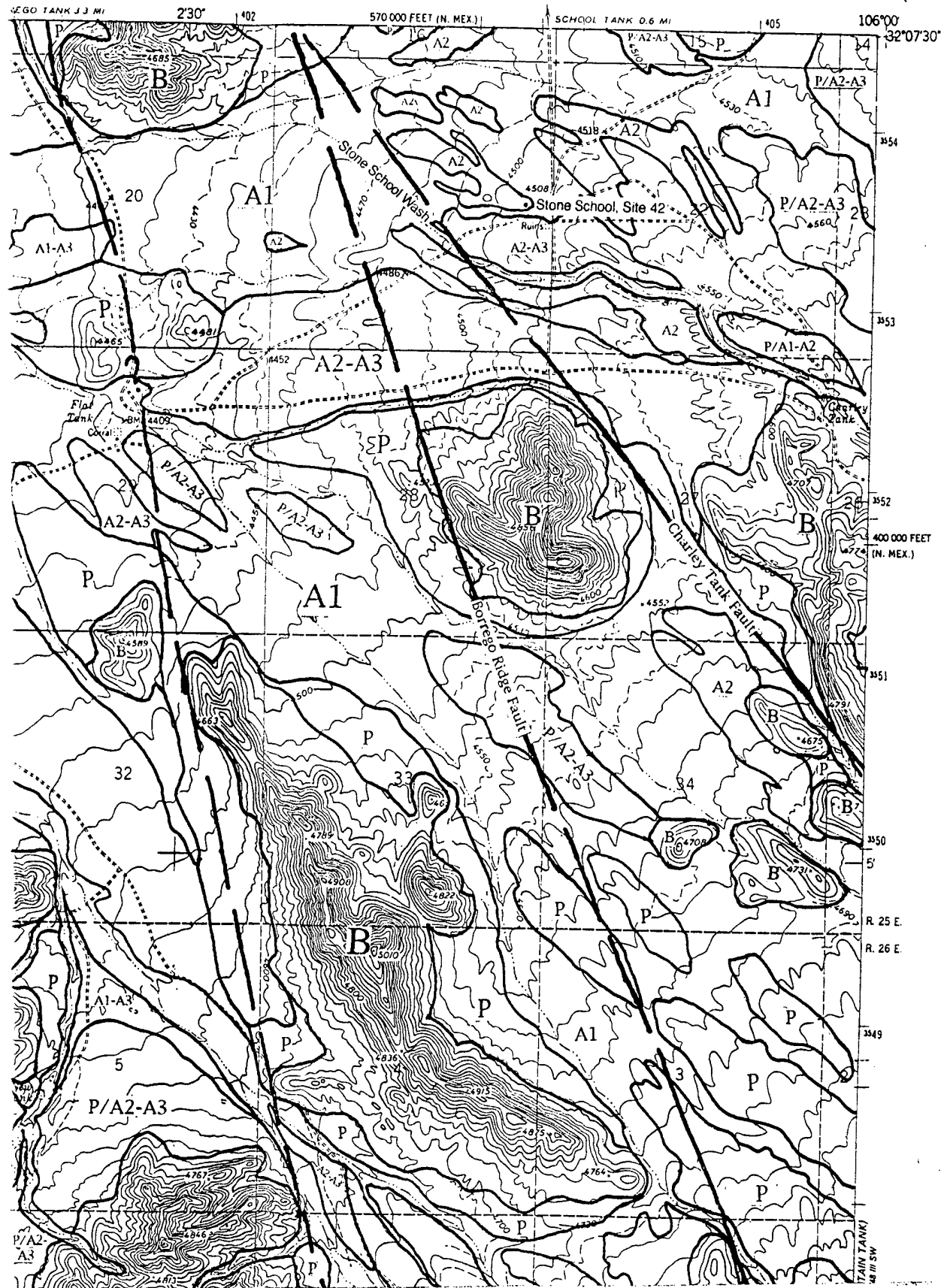
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997



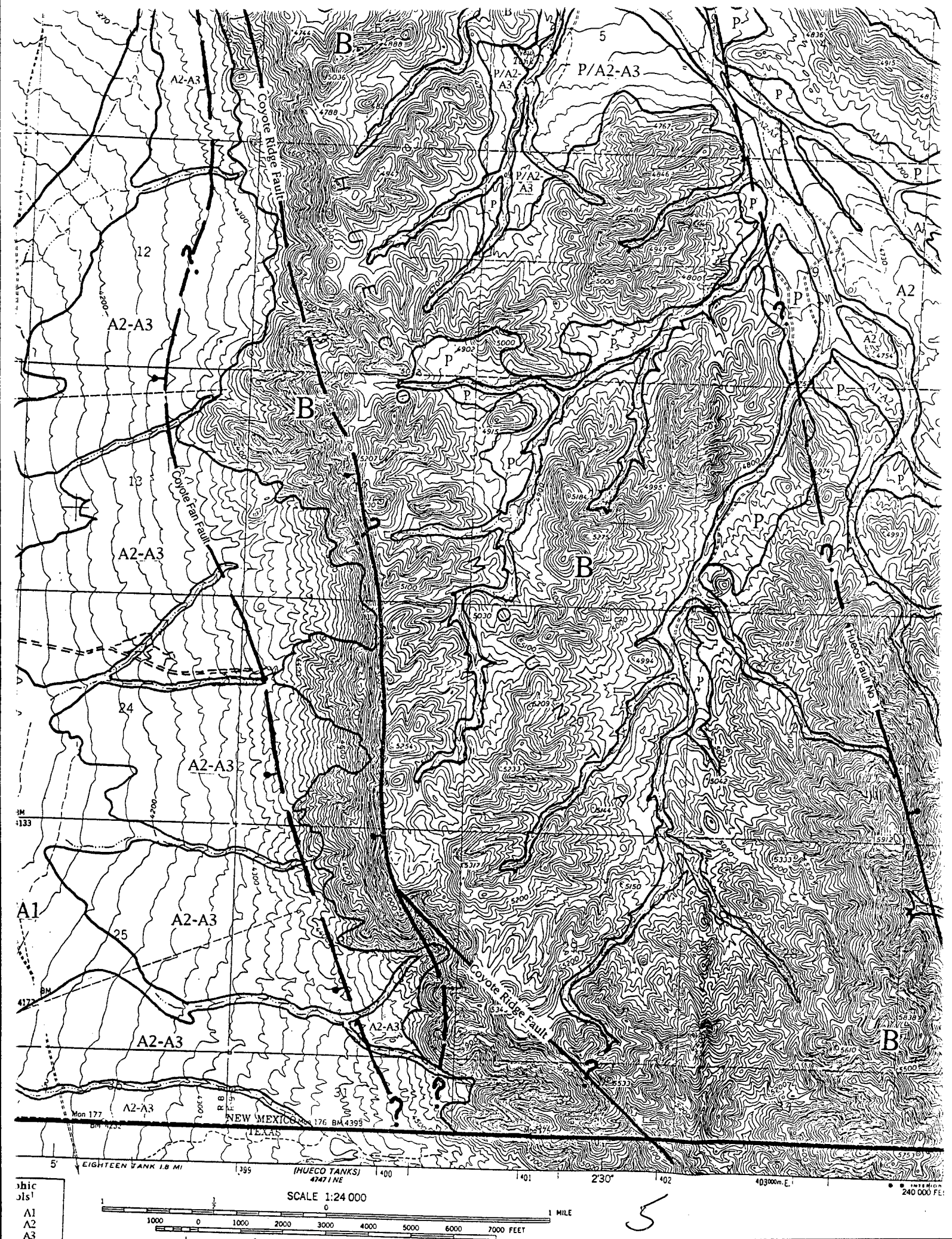
114, 1997

7.5 MINUTE SERIES (TOPOGRAPHIC)

4848 III NW
(OWL TANK CANYON
WEST)



3



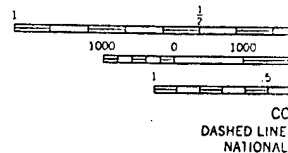


INATIONS EAST WELL
2471 NW

Mapped by the Army Map Service
Published for civil use by the Geological Survey
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Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955
Polyconic projection. 1927 North American Datum
10,000-foot grid based on New Mexico coordinate system,
central zone and Texas coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue
Dashed land lines indicate approximate locations
Fine red dashed lines indicate selected fence lines

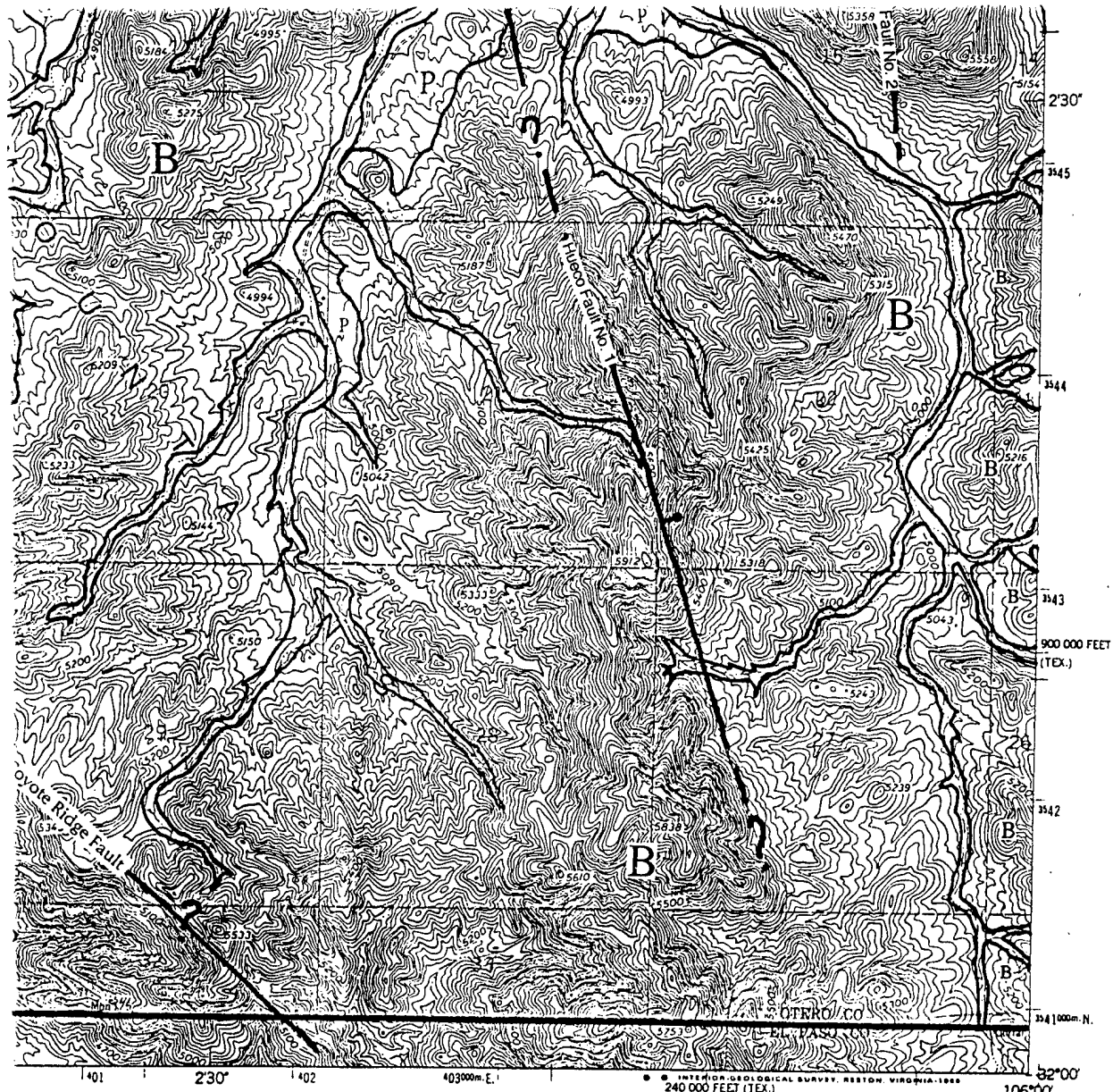
McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR •••
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	
Pediment	P
Playa	P1
Playa Lunette	PIL

¹See text for explanation



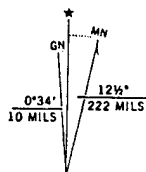
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FOR SALE BY U. S. GEOLOGICAL SURV
A FOLDER DESCRIBING TOPOGR

7



1 MILE
7000 FEET
KILOMETER

ROAD CLASSIFICATION
Unimproved dirt -----



DESERT SE, N. MEX.-TEX.

32106-A1-TF-024

1955

DMA 4748 II SE-SERIES V881

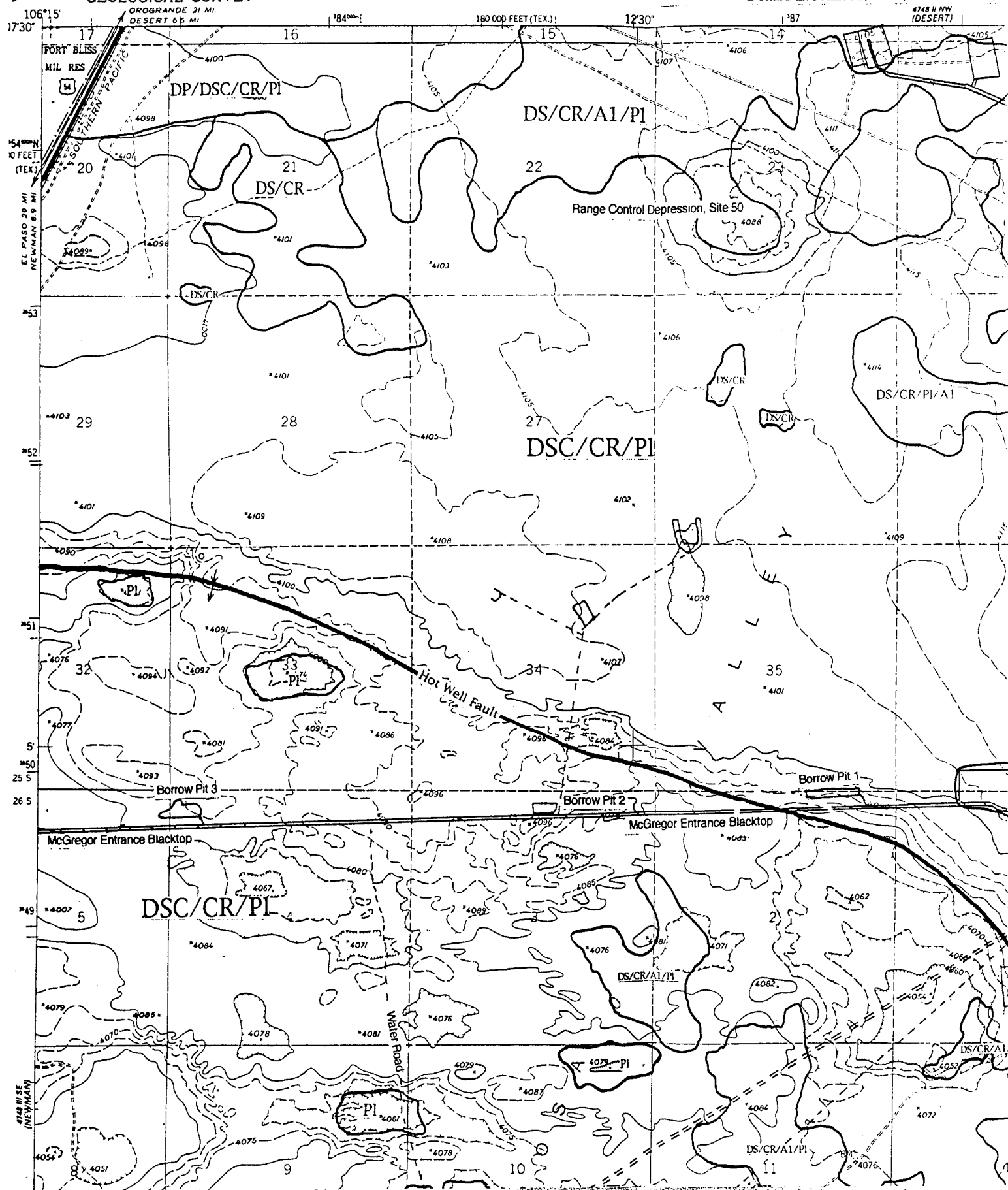
ON, VIRGINIA 22092
REQUEST

UTM GRID AND 1955 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

9

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

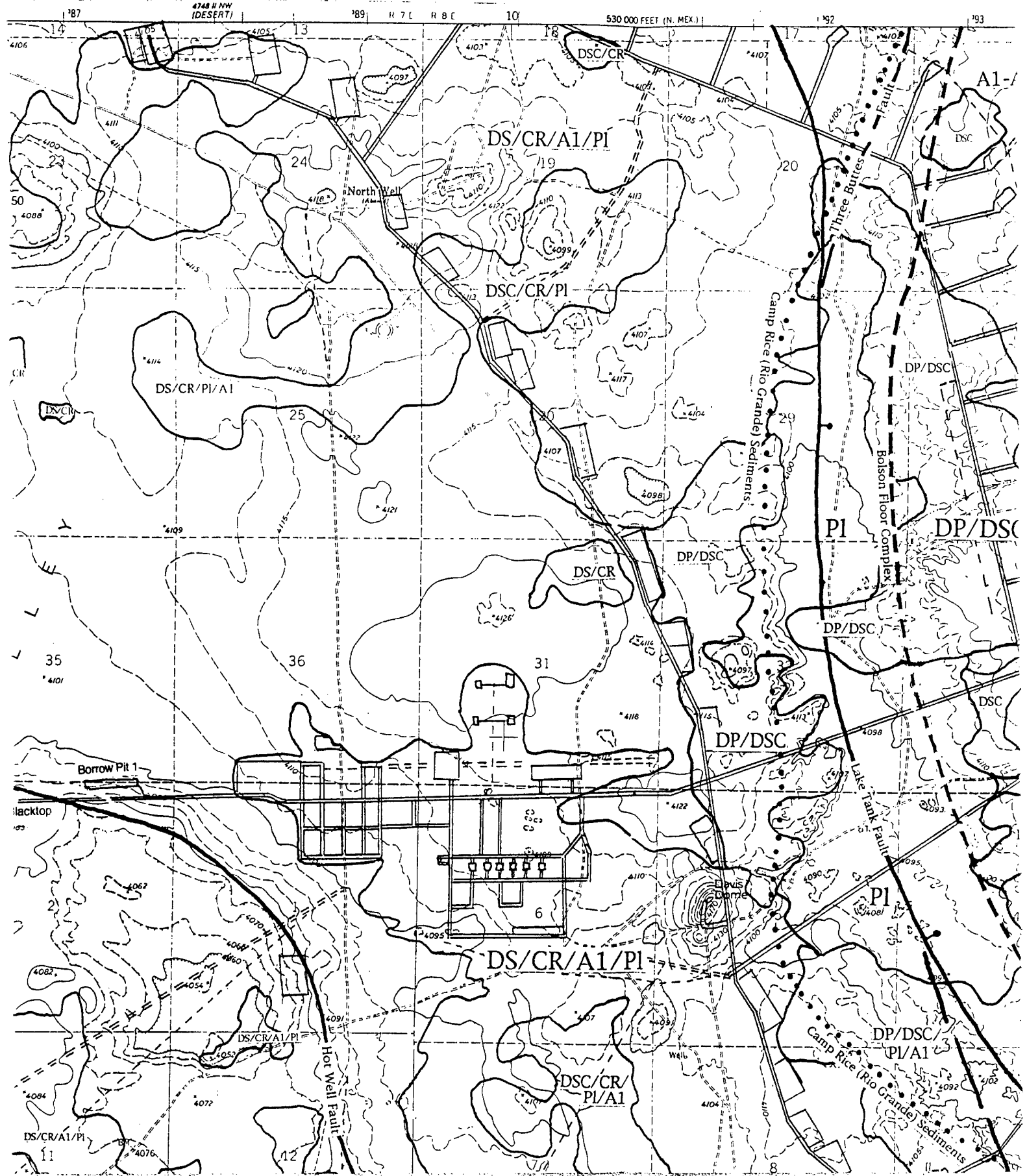
Geomorphological, Geocological, Geomorphological
Study of McGregor Guided Missile Range,
Donald L. Johnson, Ph.D., Contract No. DAC

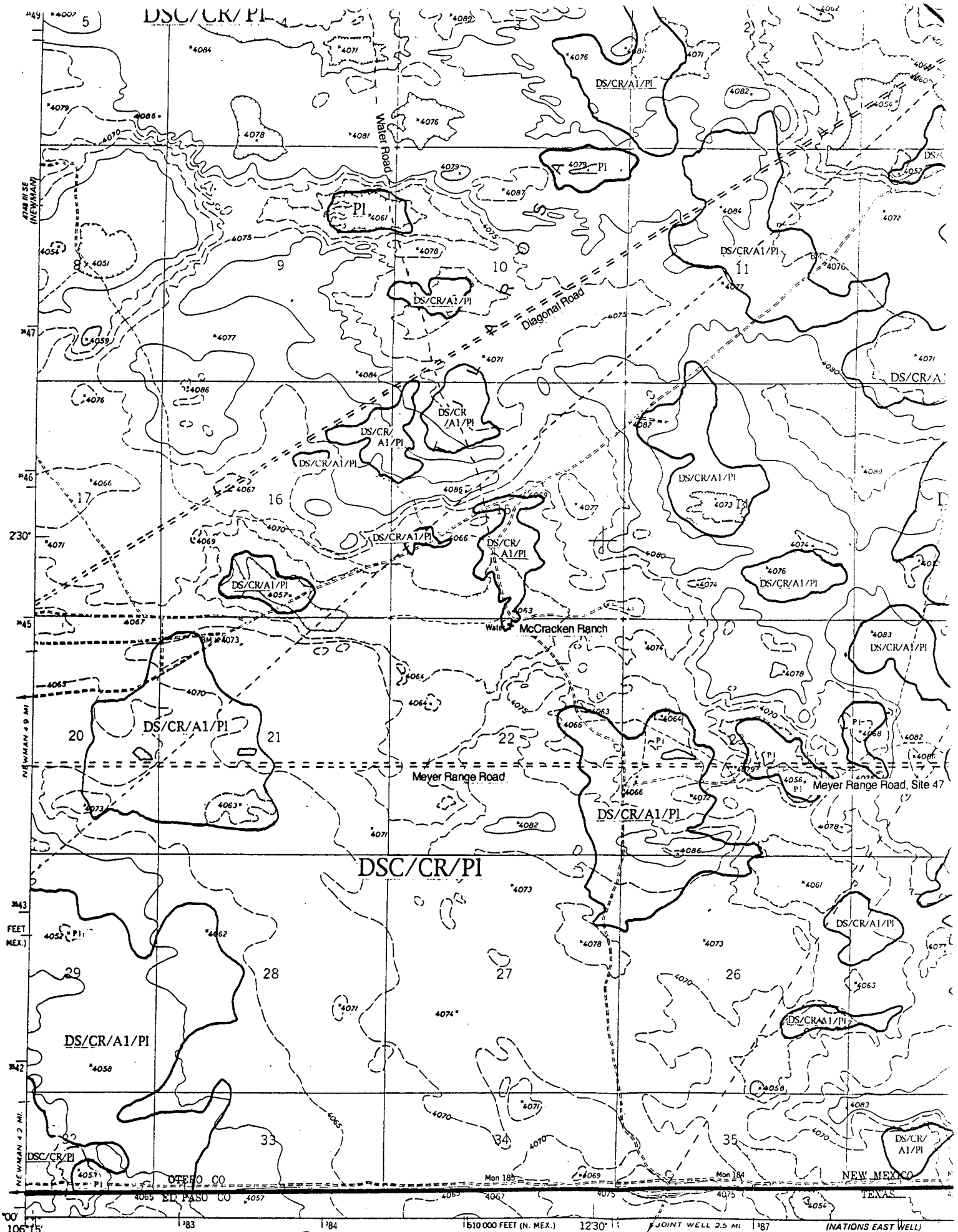


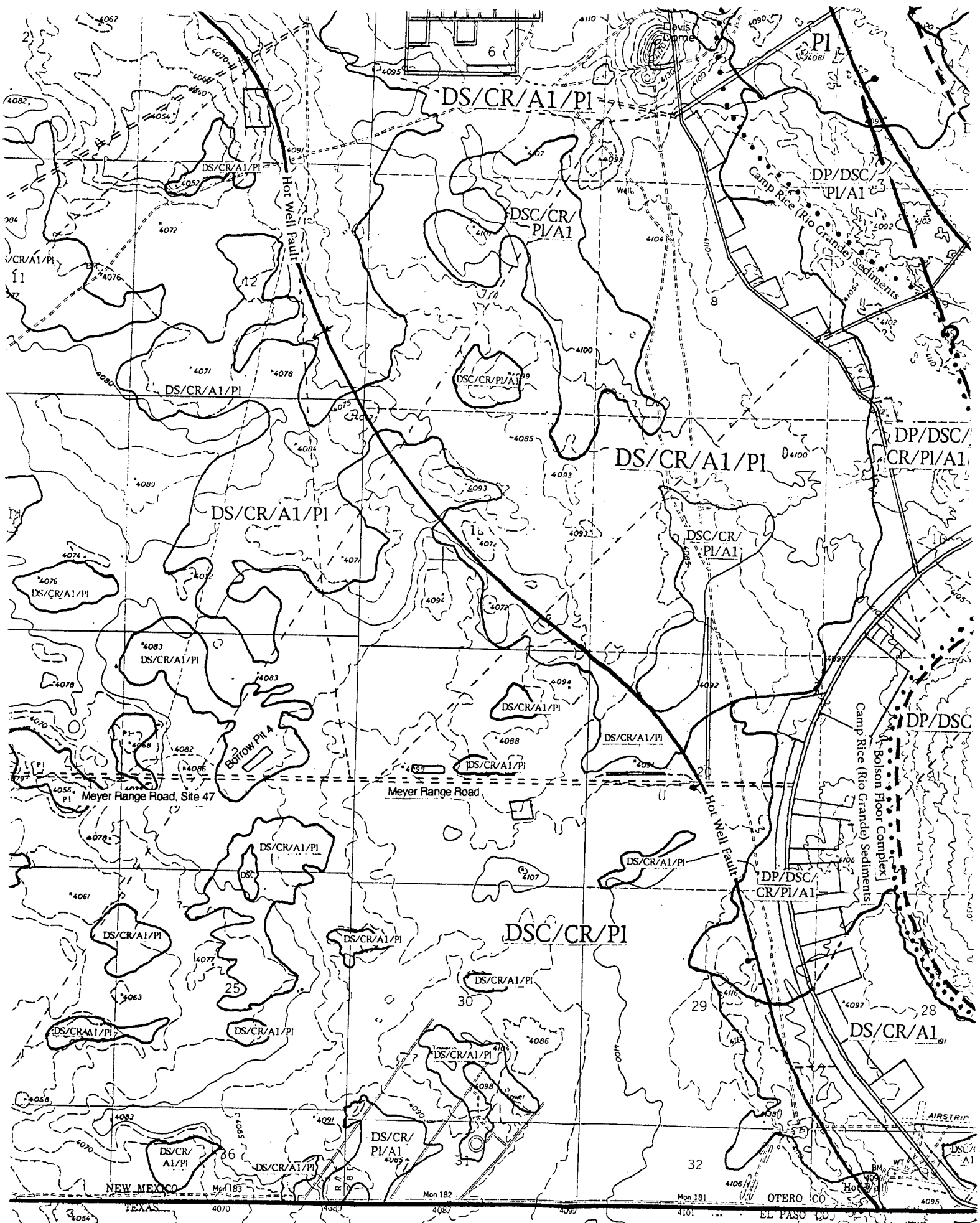
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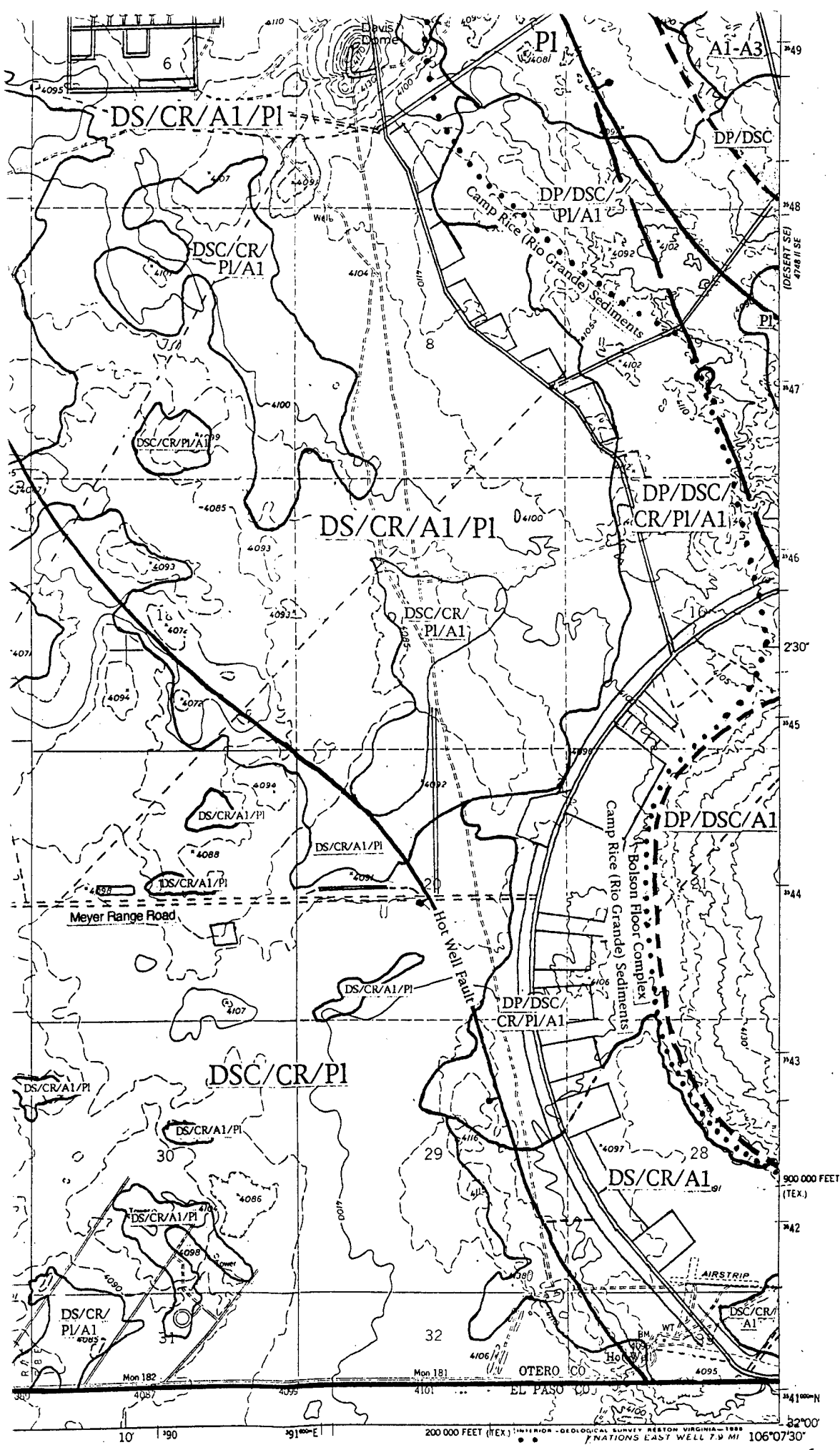
7.5 MINUTE SERIES (T.

Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

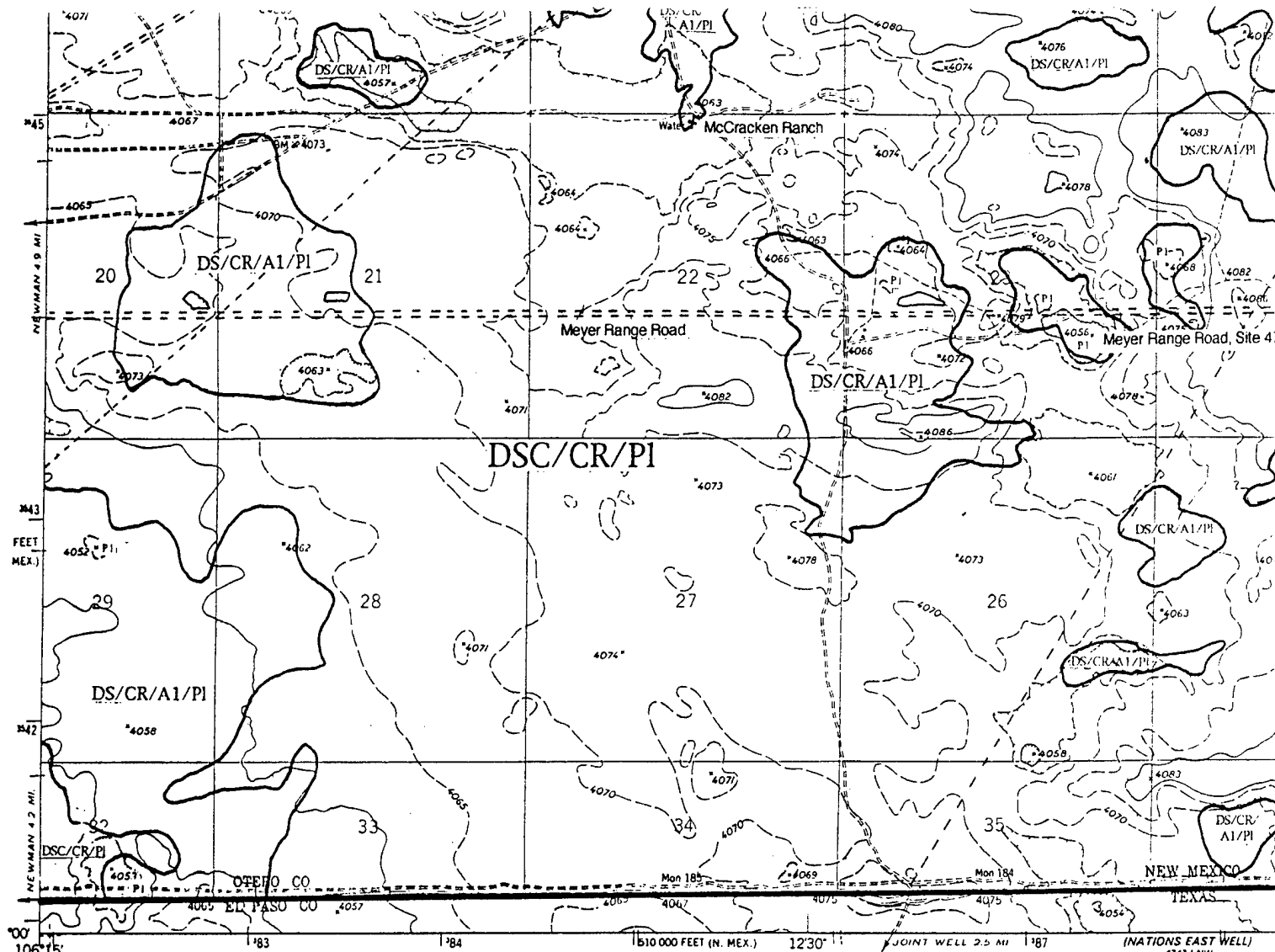








6



Mapped by the Army Map Service
Published for civil use by the Geological Survey

Control by USGS, USC&GS, and USCE

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955

Polyconic projection. 1927 North American Datum
10,000-foot grid based on New Mexico coordinate system, central zone and Texas coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue

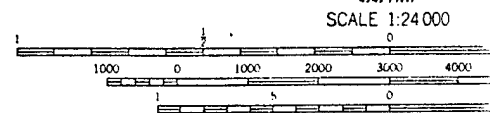
Dashed land lines indicate approximate locations

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR •••
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet (Sand Sheet)	DSC
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	
Fault	
Pediment	P
Playa	PI
Playa Lunette	PIL

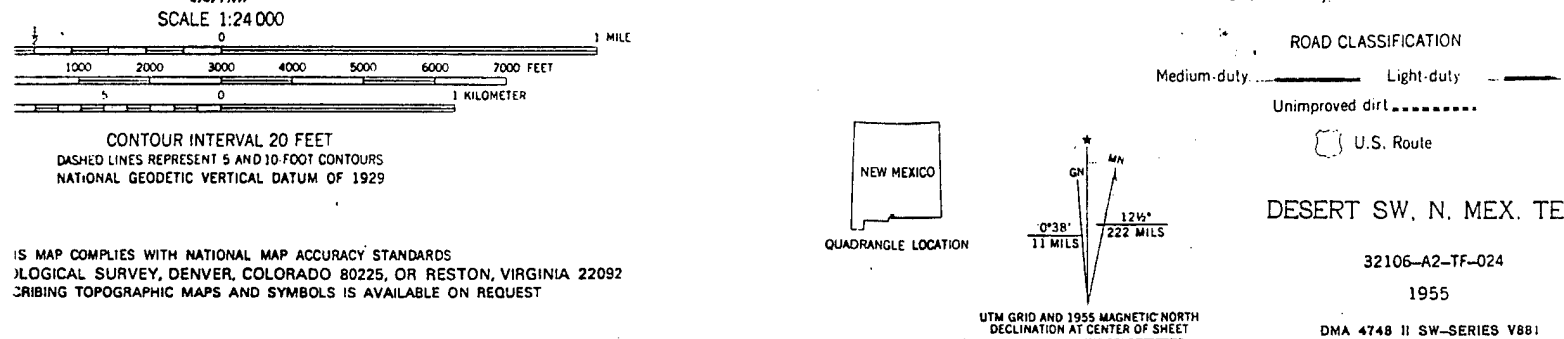
¹See text for explanation

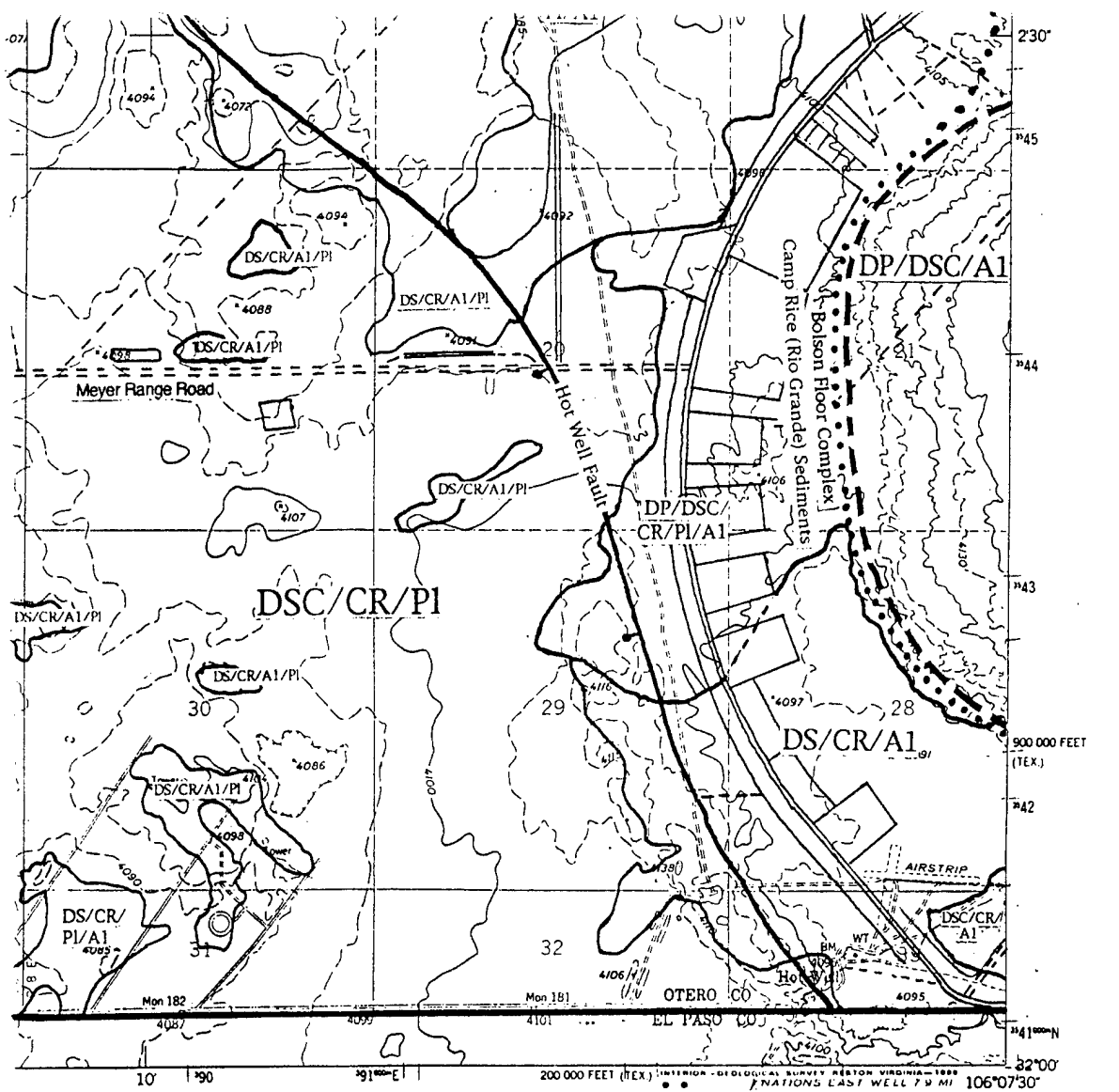


CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10 FOOT
NATIONAL GEODETIC VERTICAL DATUM

THIS MAP COMPLIES WITH NATIONAL MAP ACCU
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS

7





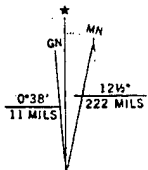
1 MILE
ET

ROAD CLASSIFICATION
 Medium-duty ——— Light-duty ———
 Unimproved dirt

U.S. Route



QUADRANGLE LOCATION



UTM GRID AND 1955 MAGNETIC NORTH
 DECLINATION AT CENTER OF SHEET

DESERT SW. N. MEX. TEX.

32106-A2-TF-024

1955

DMA 4748 II SW-SERIES V881

NIA 22092

(S)

9



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



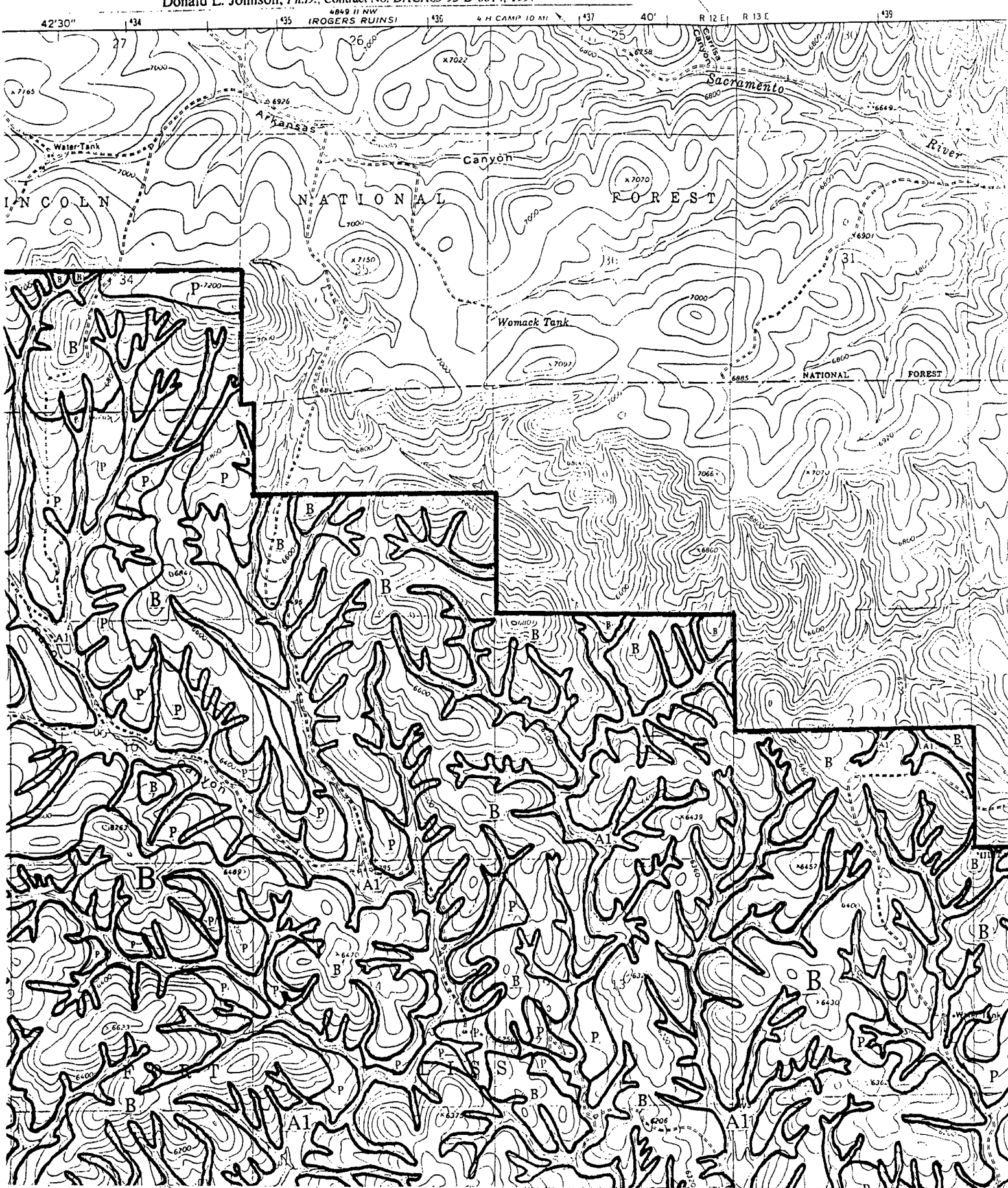
Geomorphological, Geoccol
Study of McGregor G
Donald L. Johnse



Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

EL P.

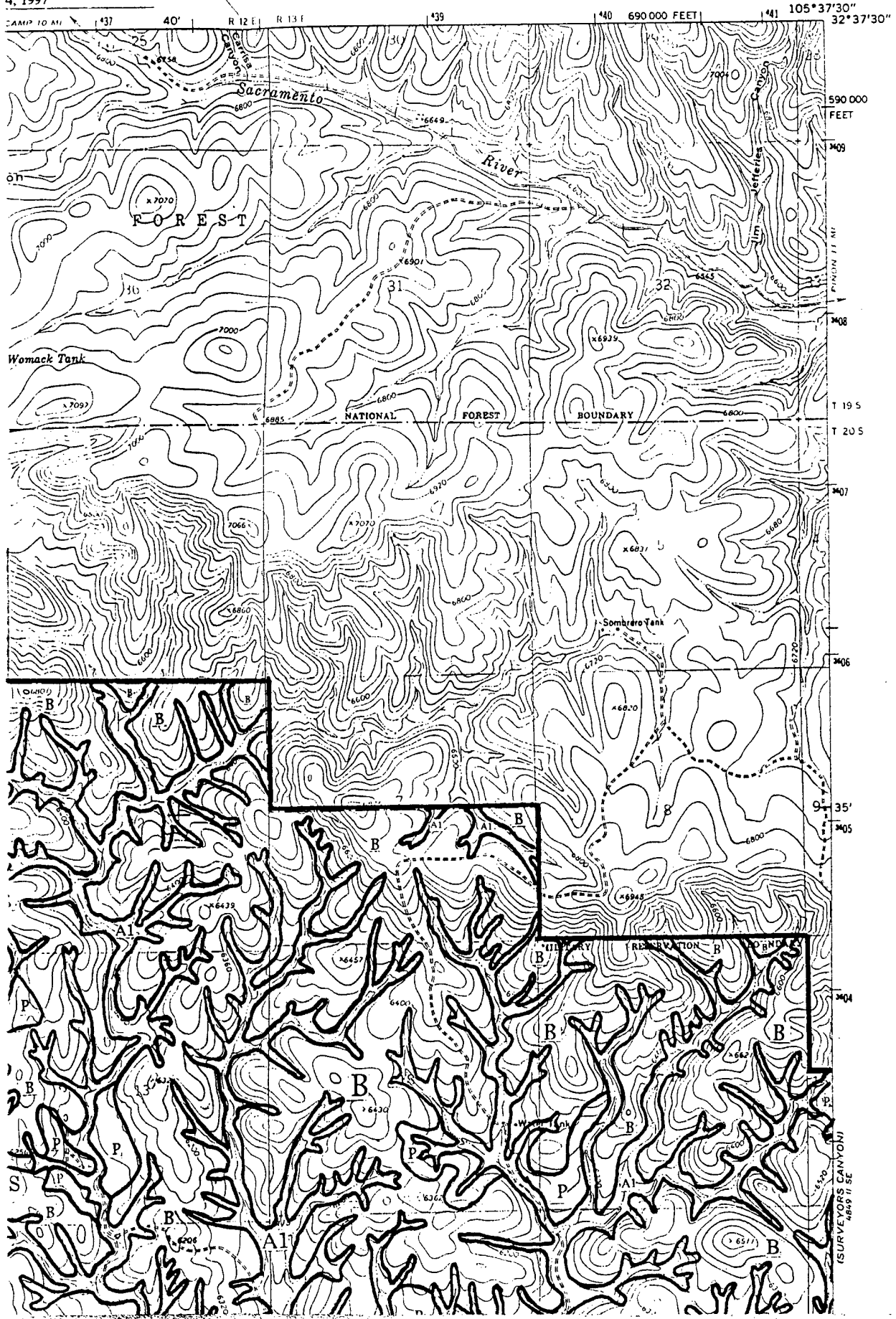
7.5 M.



Surficial Mapping
New Mexico
4, 1997

EL PASO CANYON QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

4889
10 BEAR ST.



3



4848 IV
(PENNSYLVANIA)
1:62,500

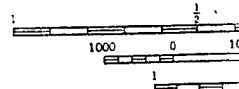
Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

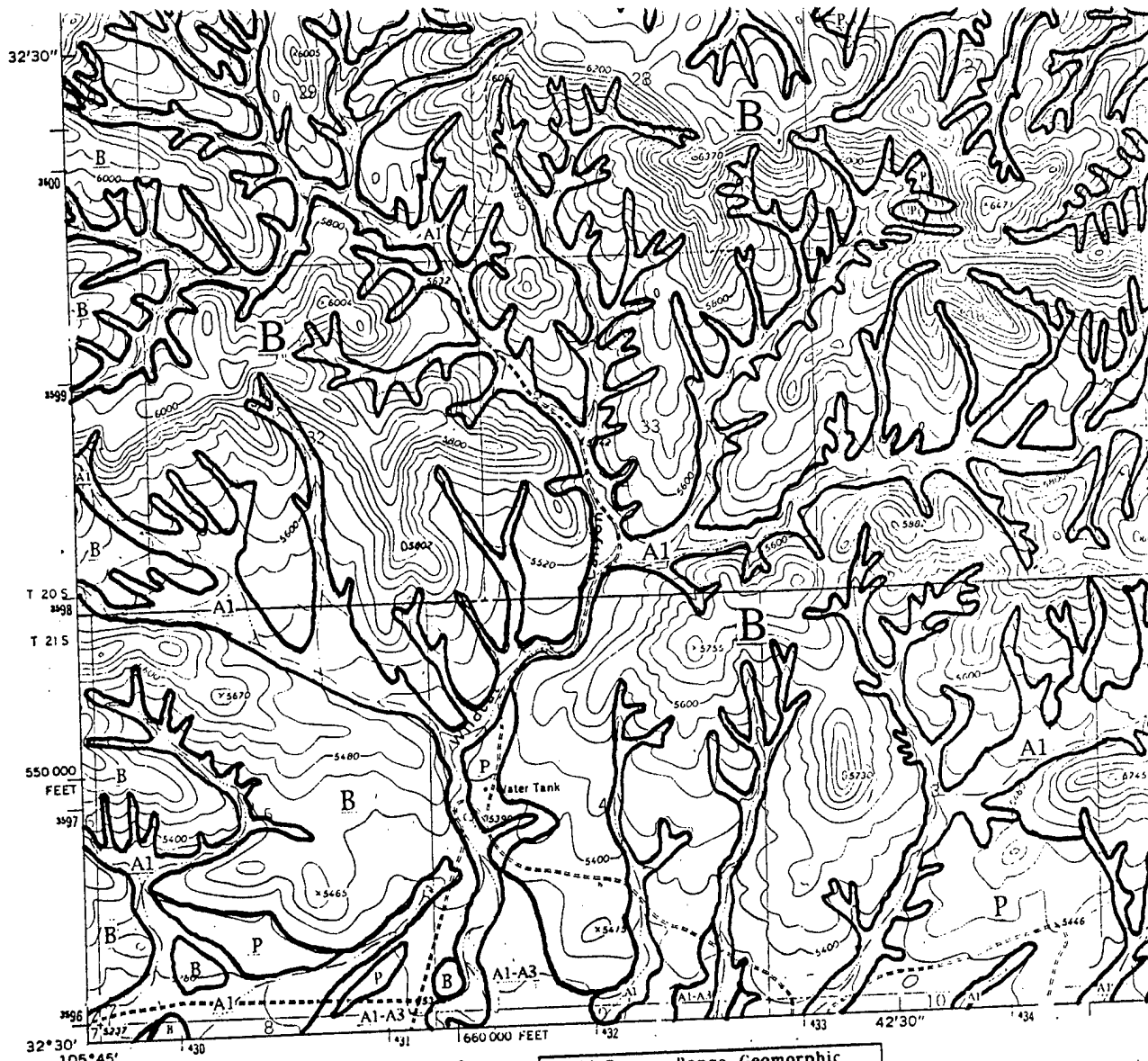
Topography by photogrammetric methods from aerial
photographs taken 1964. Field checked 1965

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system.

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	P





4448 N
(PEROGUO WASH)
1:50,000

Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

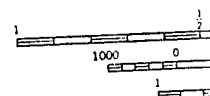
Topography by photogrammetric methods from aerial
photographs taken 1964. Field checked 1965
Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue

There may be private inholdings within the boundaries of
the National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

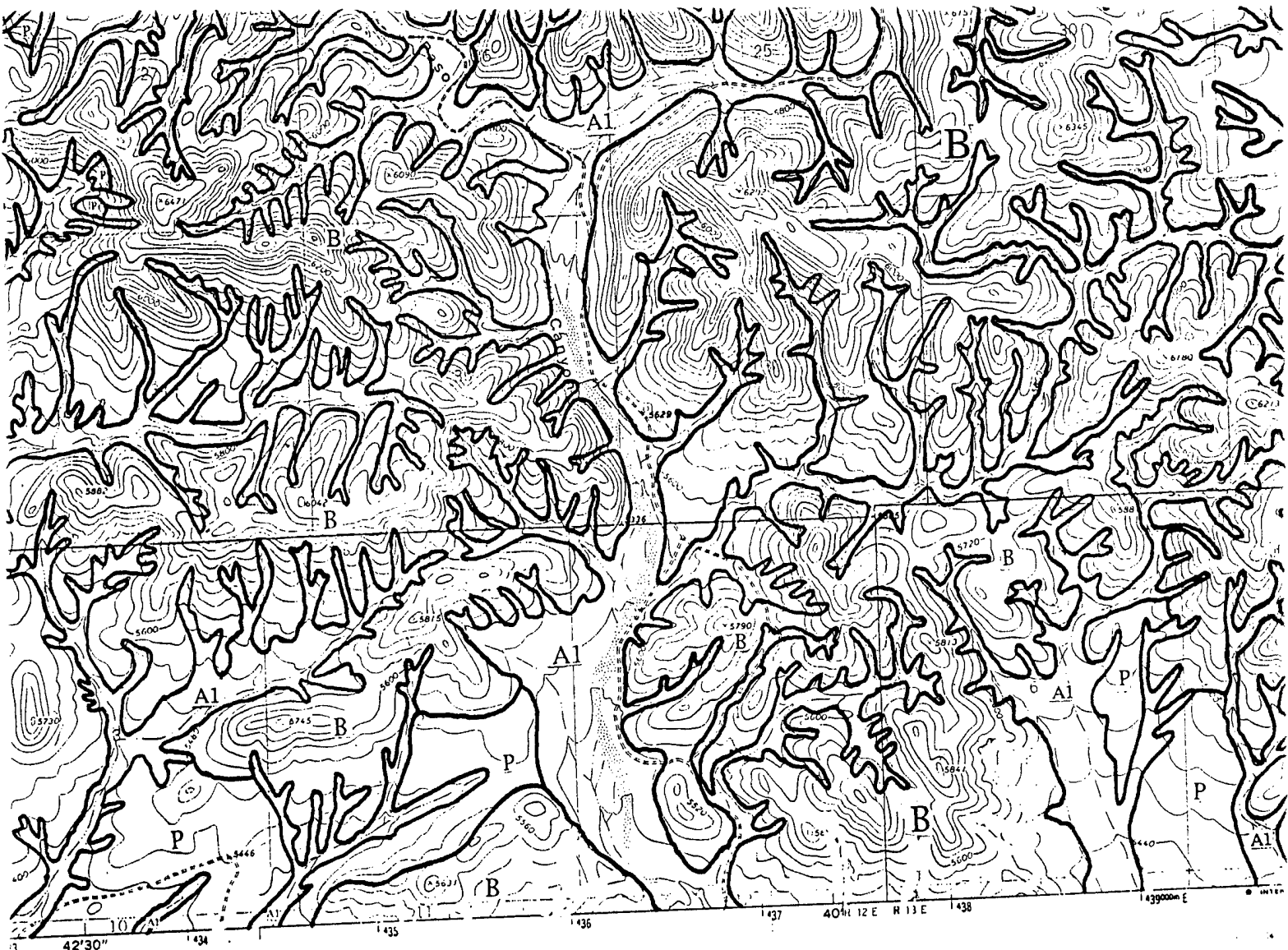
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR••••
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet	DSC
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	
Fault	P
Pediment	P1
Playa	P1L
Playa Lunette	

¹See text for explanation

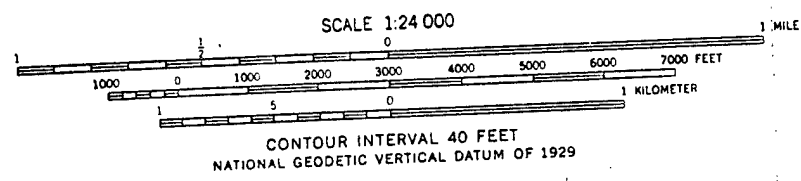


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FOR SALE BY U.S. GEOLOGICAL SURVEY
A FOLDER DESCRIBES

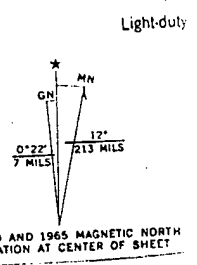
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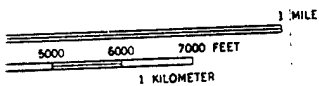
- A1
 A2
 A3
 B
 CR
 DL
 DP
 DS
 DSC
 DSG
 P
 P1
 P1L



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



8

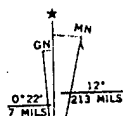


EET
JUN OF 1929

ACCURACY STANDARDS
JO 80225, OR RESTON, VIRGINIA 22092
XLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION



UTM GRID AND 1965 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Light-duty ————— Unimproved dirt - - - - -

EL PASO CANYON, N. MEX.
N3230—W10537.5/7.5

1965

DMA 4849 II SW—SERIES A/881

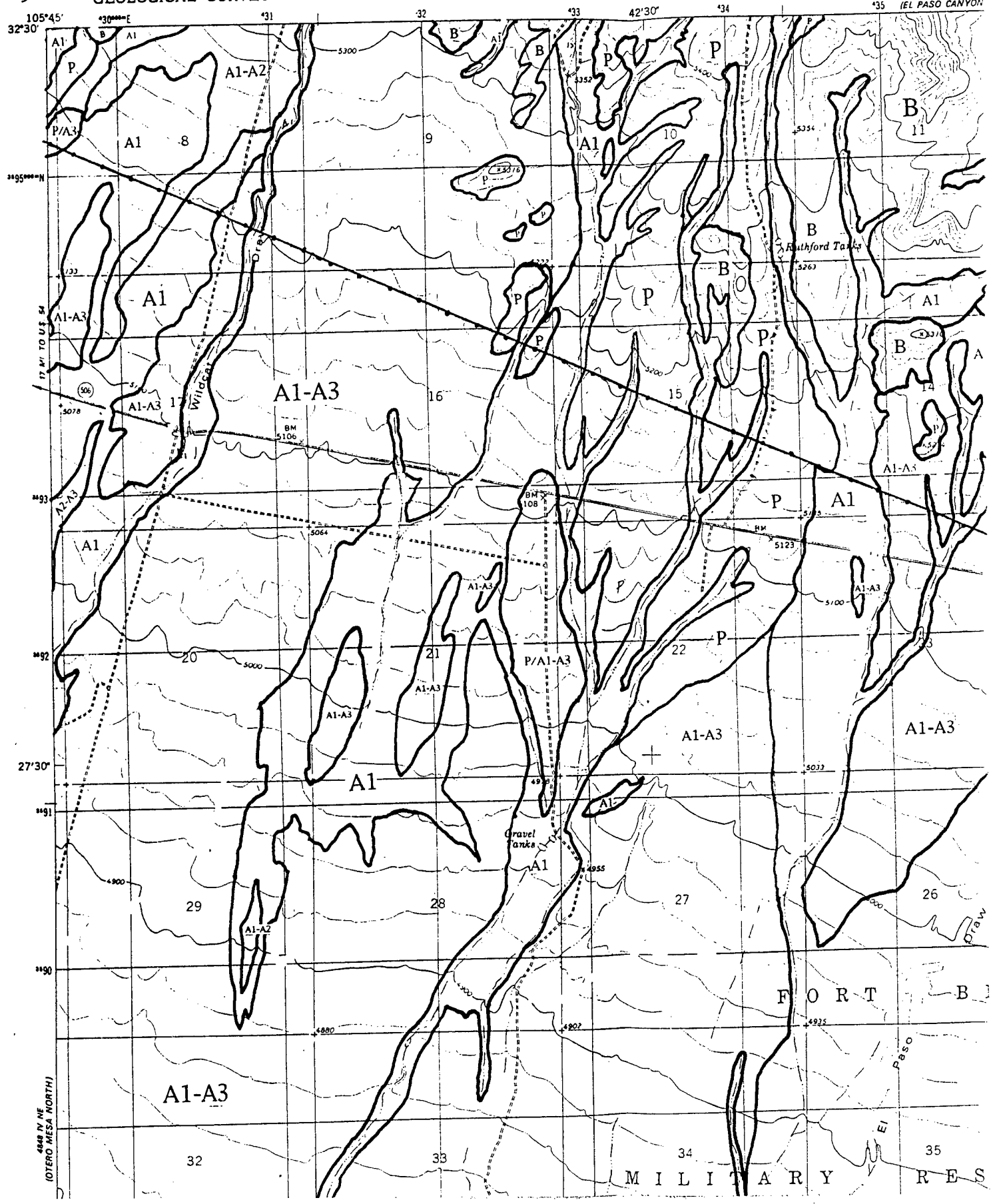
6

9

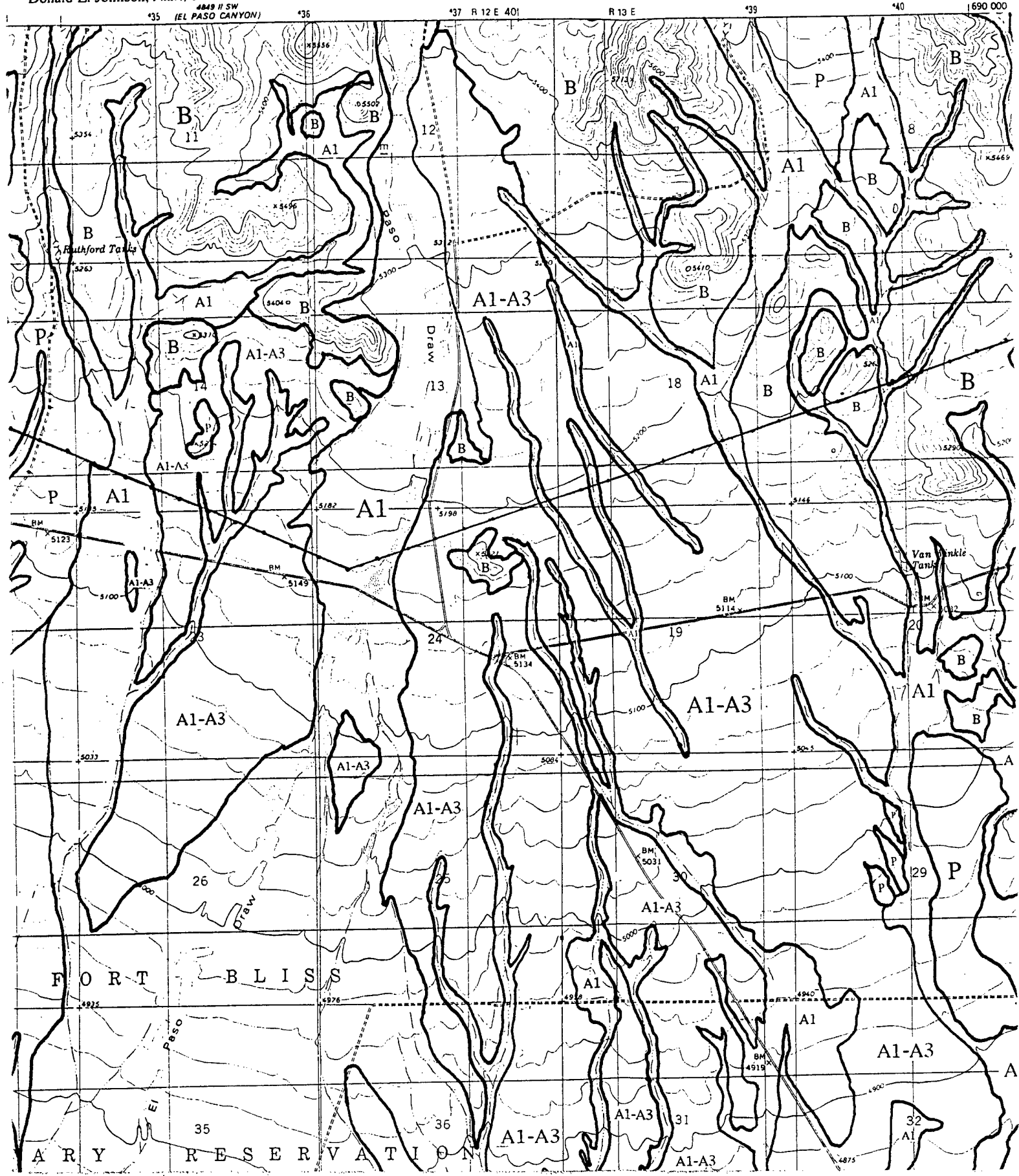
4448 IV NE
1:25,000

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geocological, Geoarchaeological
Study of McGregor Guided Missile Range
Donald L. Johnson, Ph.D., Contract No. 4849 II SW
(EL PASO CANYON)



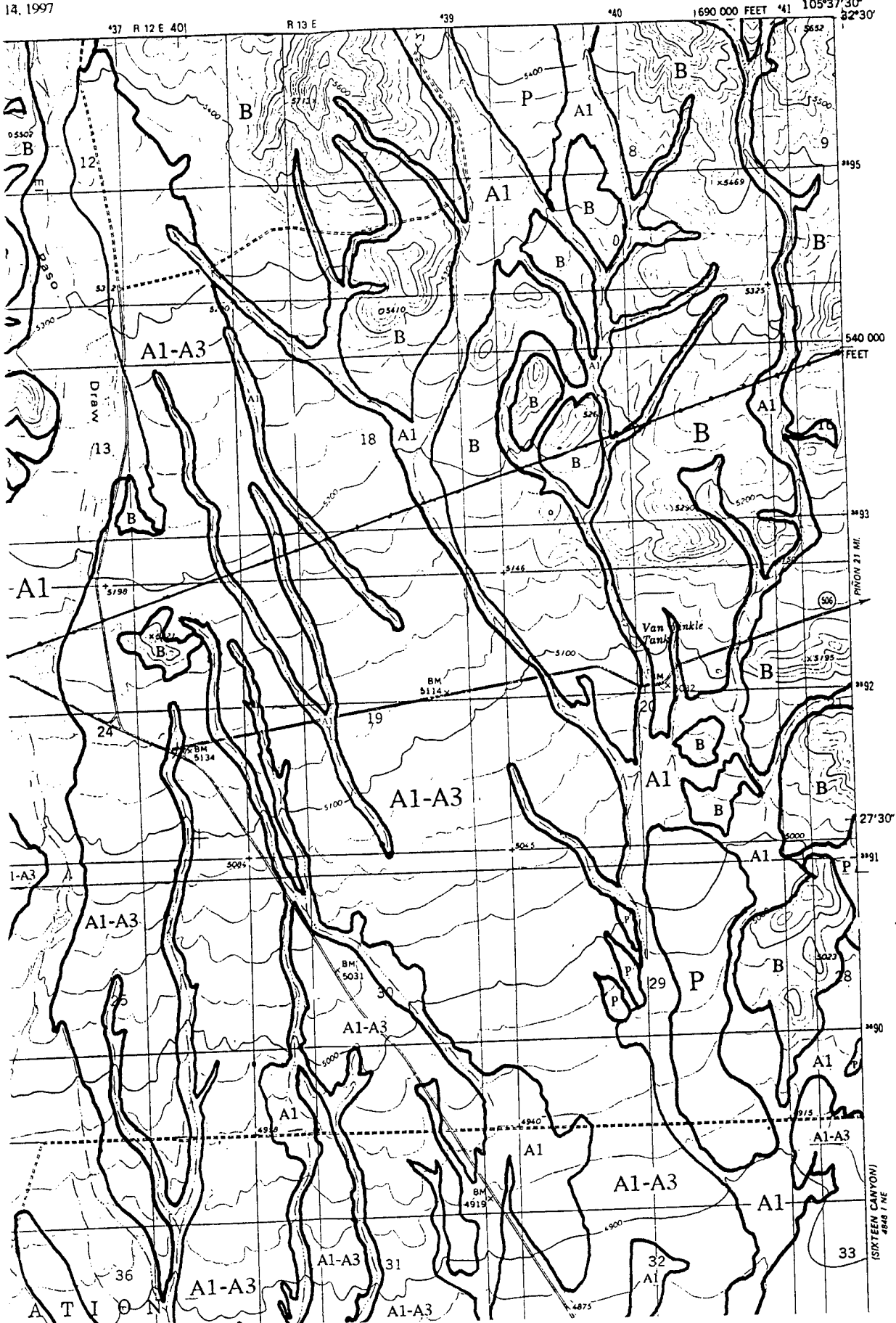
MILITARY RES



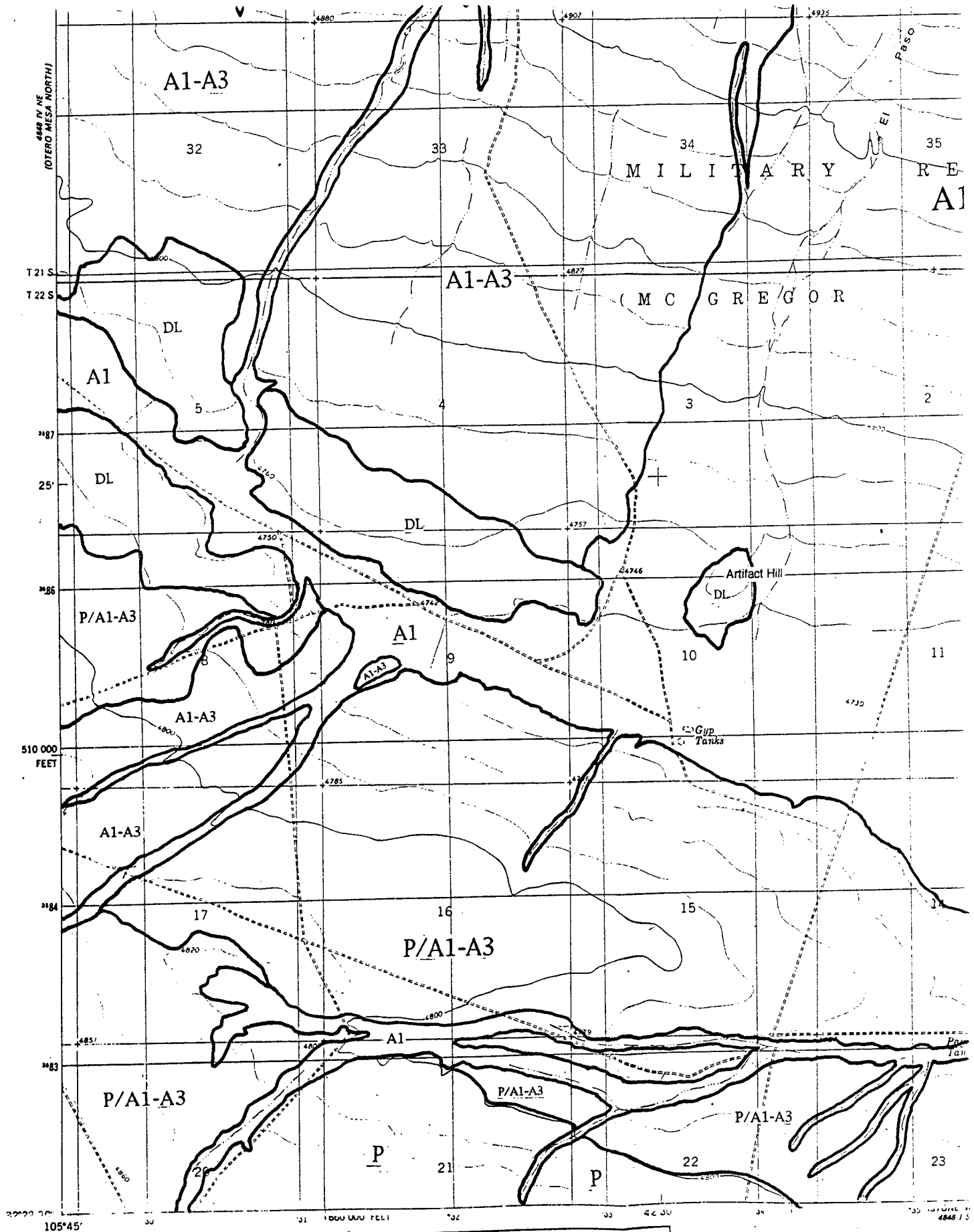
Surficial Mapping
s, New Mexico
14, 1997

EL PASO DRAW QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

848 M DE
(SURVEYORS
CANYON)



3



Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1971. Field checked 1975. Map edited 1980

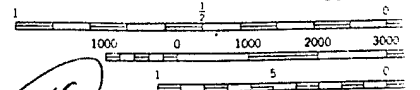
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and

McGregor Range Geomorphologic Mapping Units and Symbols¹

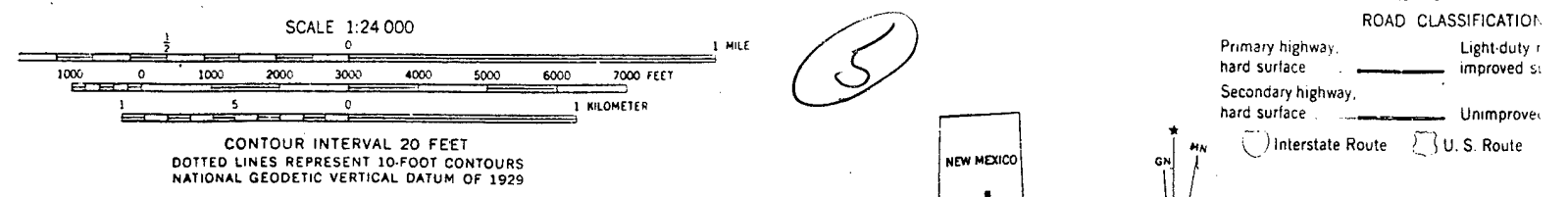
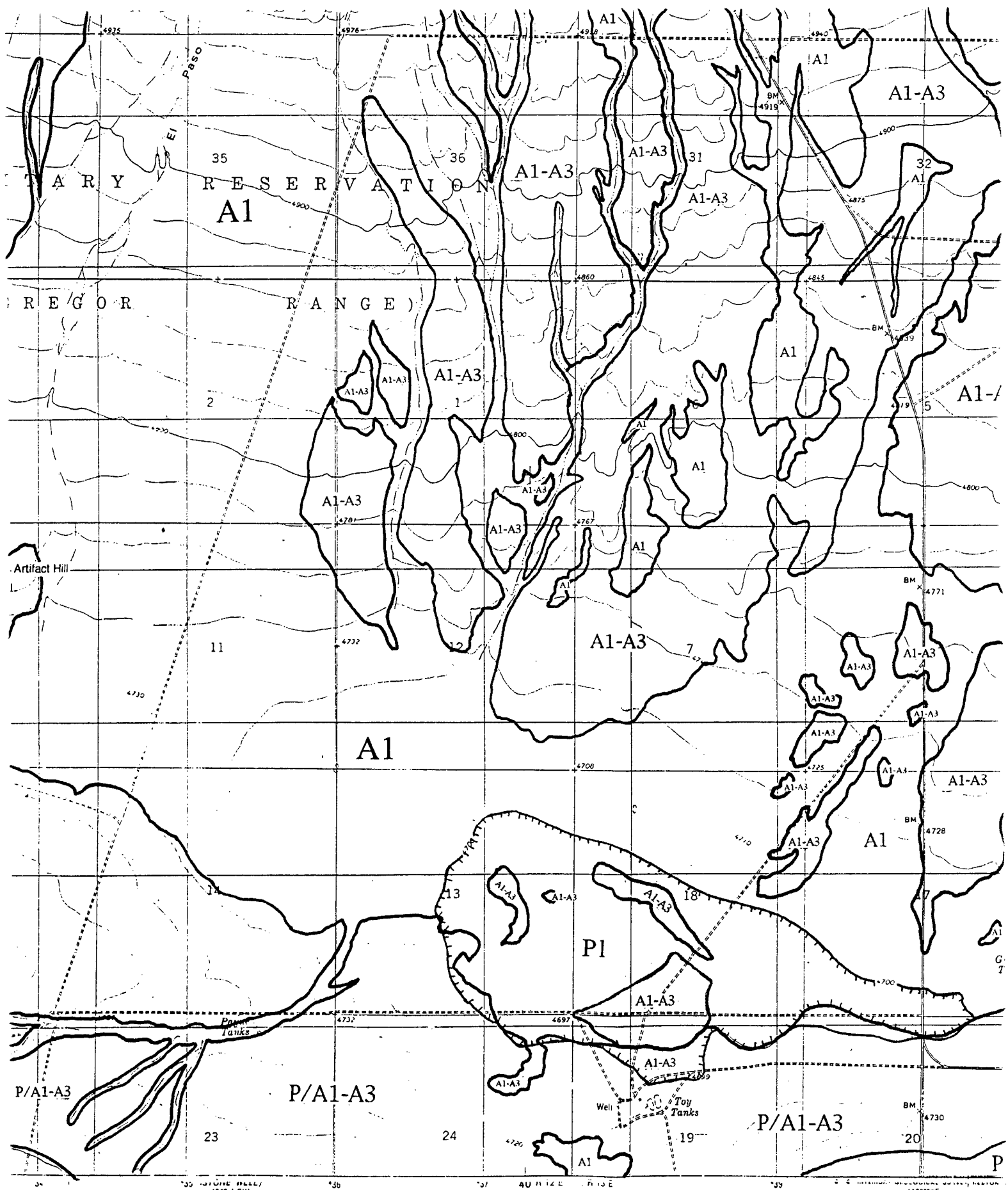
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bedrock Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS

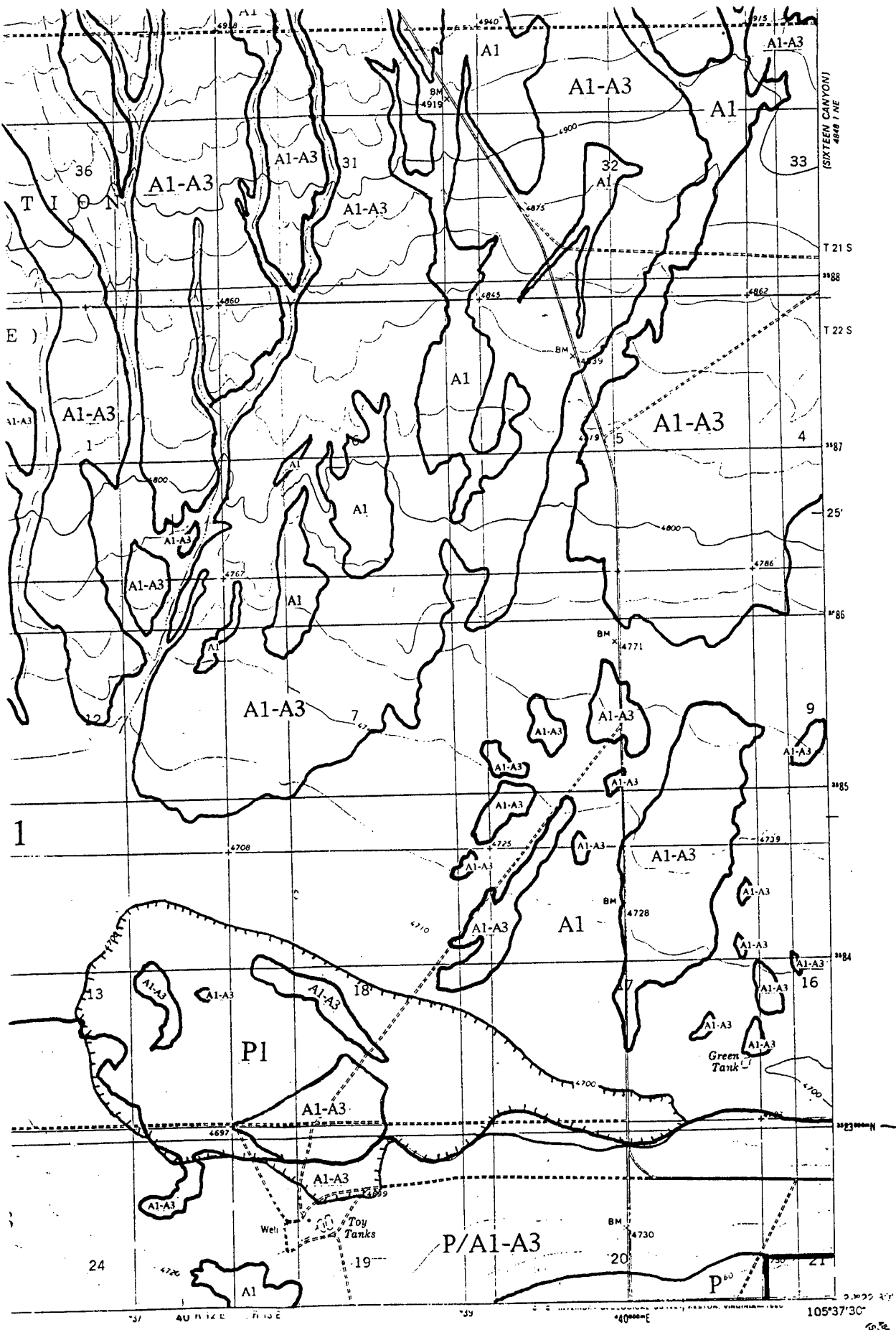
SCALE 1:2



CONTOUR INTERVAL
DOTTED LINES REPRESENT
NATIONAL GEODETIC VERT

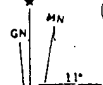
4448 IV NE
OTERO MESA
SOUTH





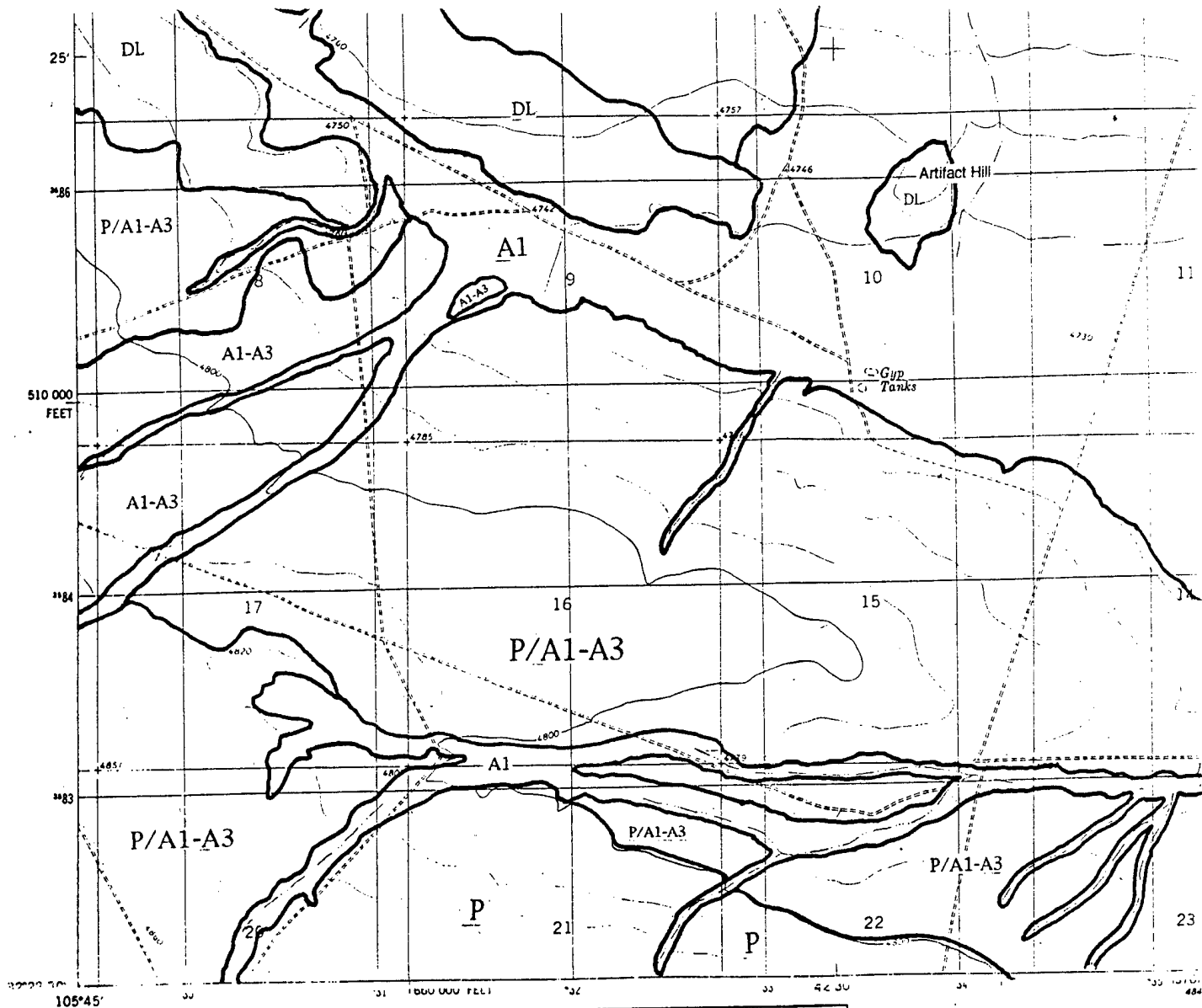
ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U. S. Route
- State Route



EL PASO DRAW N. MEX.

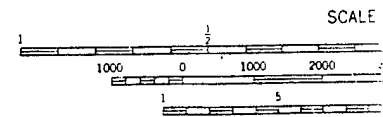
6



4888 N 13
(10170 M 13)
SOUTHERN

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs
taken 1971. Field checked 1975. Map edited 1980
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
49 meters east as shown by dashed corner ticks
Fine red dashed lines indicate selected fence lines
There may be private inholdings within the boundaries of the
National or State reservations shown on this map

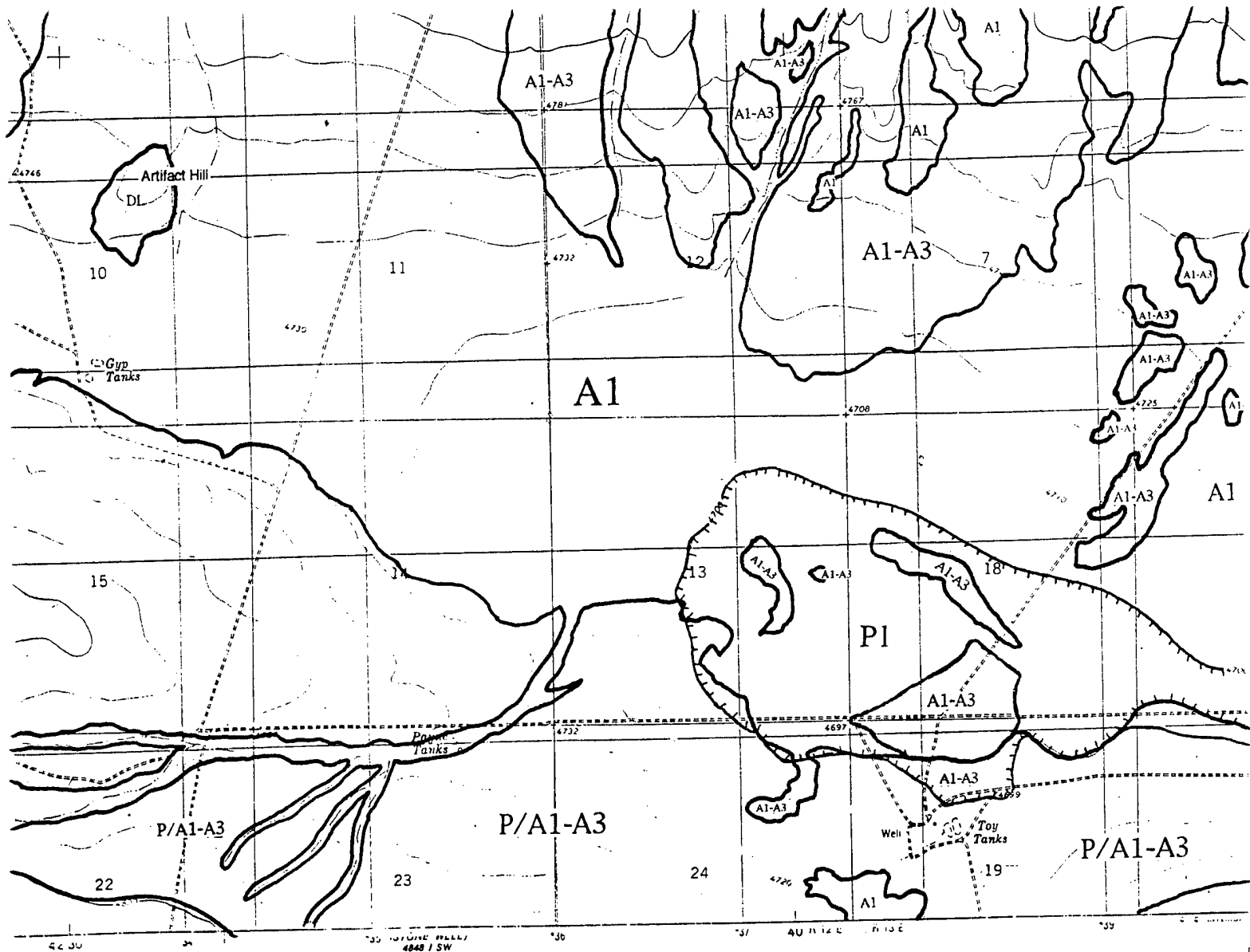
McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR •••
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	—
Pediment	P
Playa	P1
Playa Lunette	PIL
¹ See text for explanation	



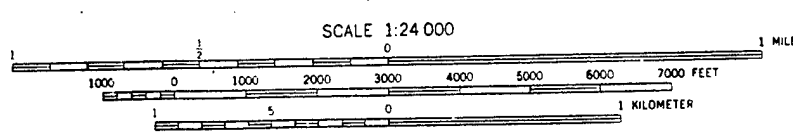
CONTOUR INT
DOTTED LINES REPRESENT
NATIONAL GEODETIC V

THIS MAP COMPLIES WITH NAT
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENV
A FOLDER DESCRIBING TOPOGRAPHIC MAP

7

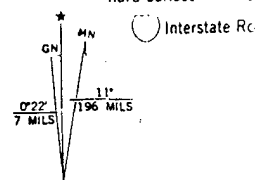


- phic
ols!
- A1
 - A2
 - A3
 - B
 - CR
 - DL
 - DP
 - DS
 - DSC
 - DSC
 - P
 - P1
 - PIL

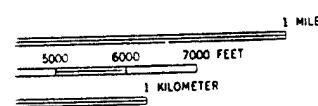
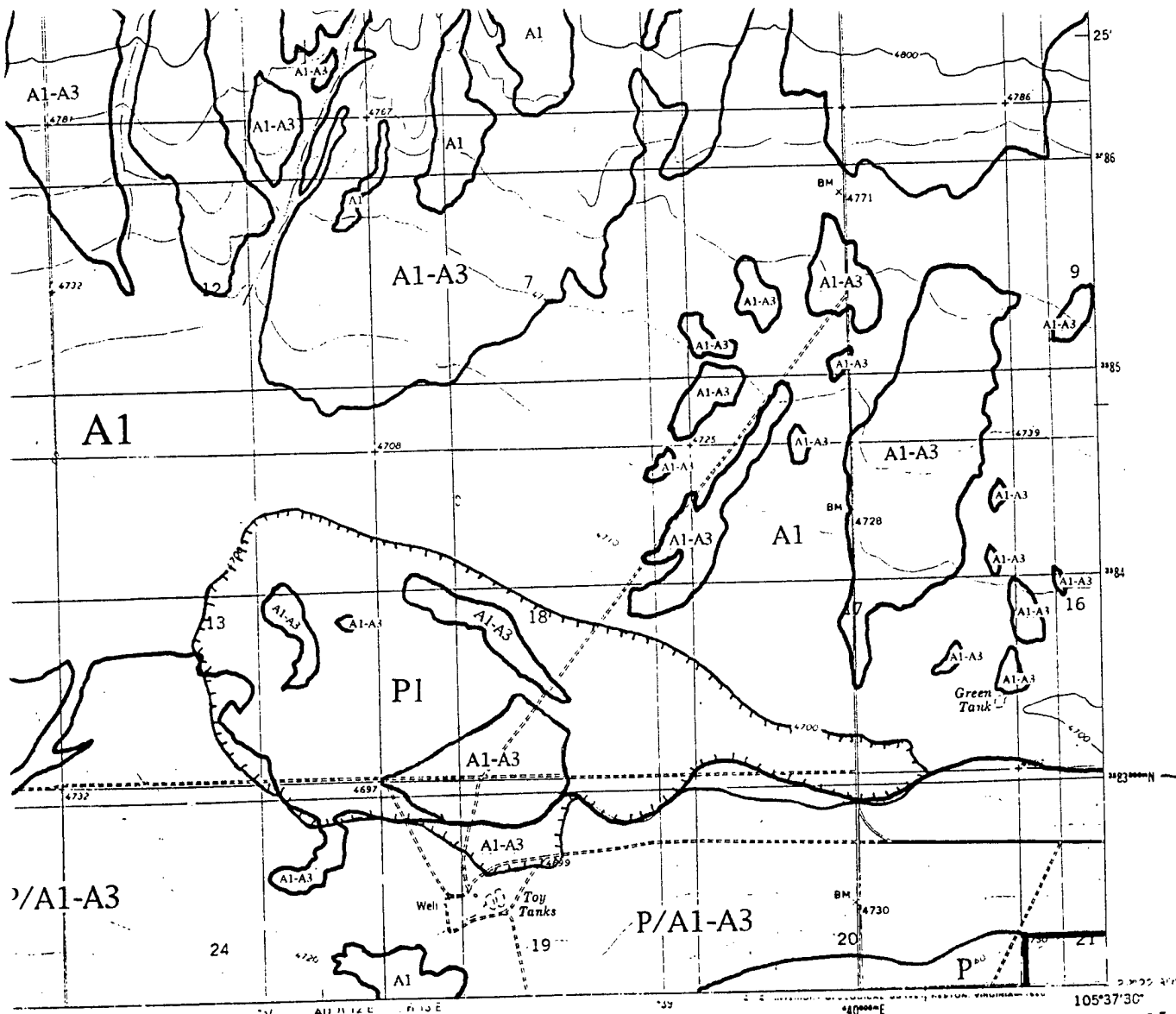


CONTOUR INTERVAL 20 FEET
 DOTTED LINES REPRESENT 10-FOOT CONTOURS
 NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



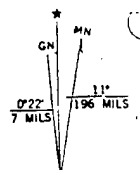
8



ET
CONTOURS
M OF 1929



QUADRANGLE LOCATION



UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U. S. Route
- State Route

EL PASO DRAW, N. MEX.
N3225.5-W10537.5/7.5

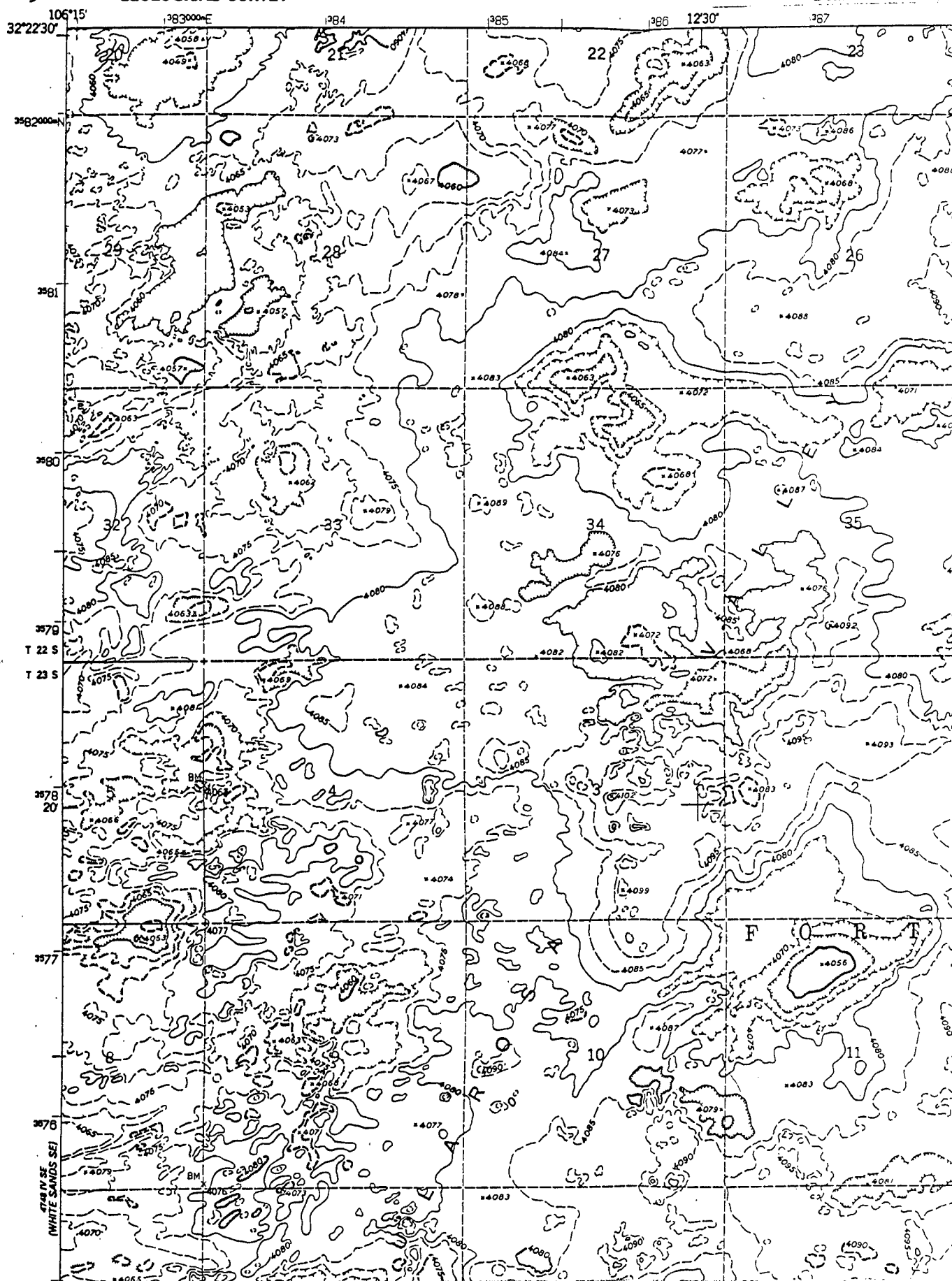
1980

DMA 4848 I NW—SERIES V881

9

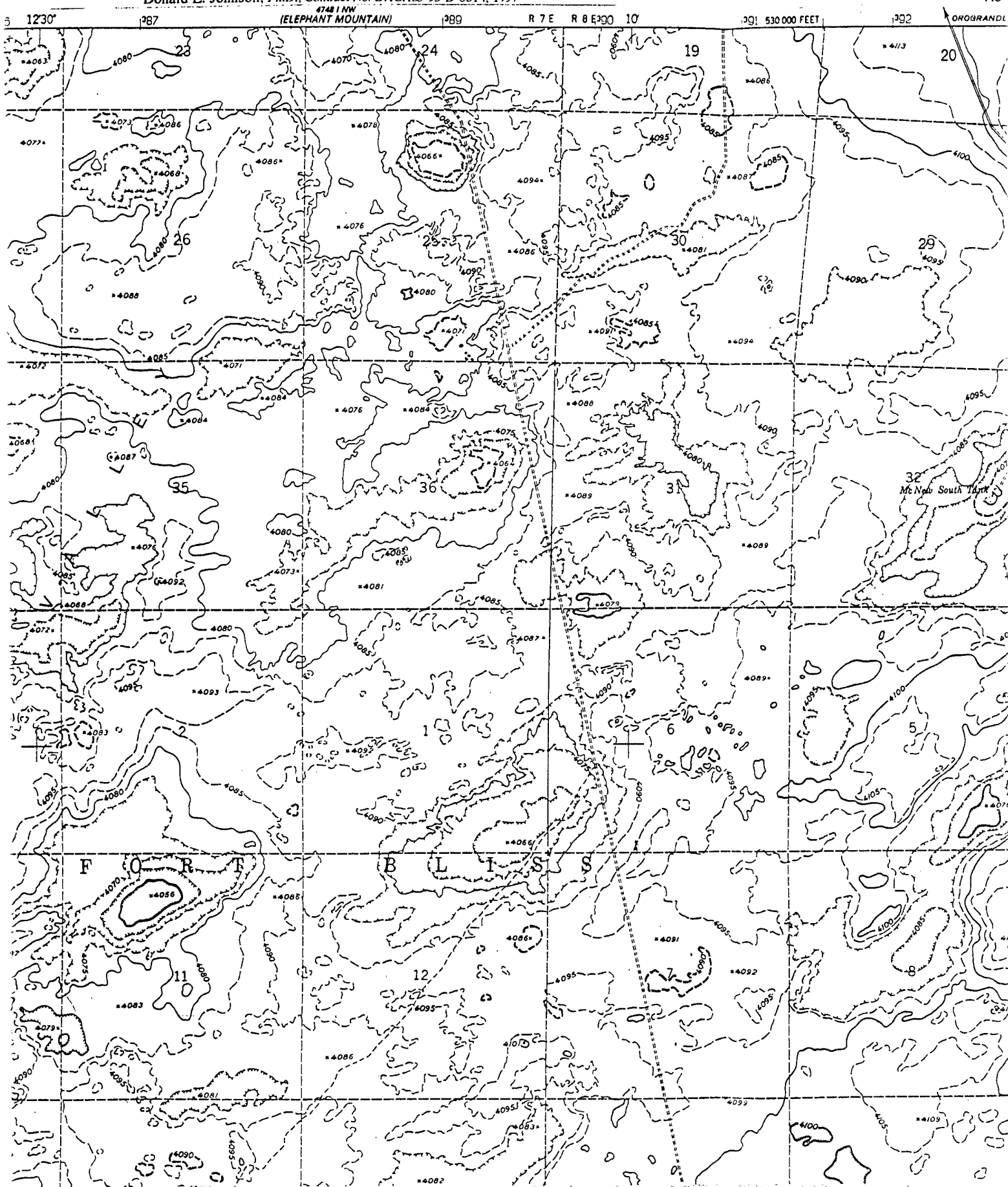
**Geomorphological, Geocologic
Study of McGregor Guide**
Donald L. Johnson, *P.*

**Geomorphological, Geocologic
Study of McGregor Guide**
Donald L. Johnson, *P.*

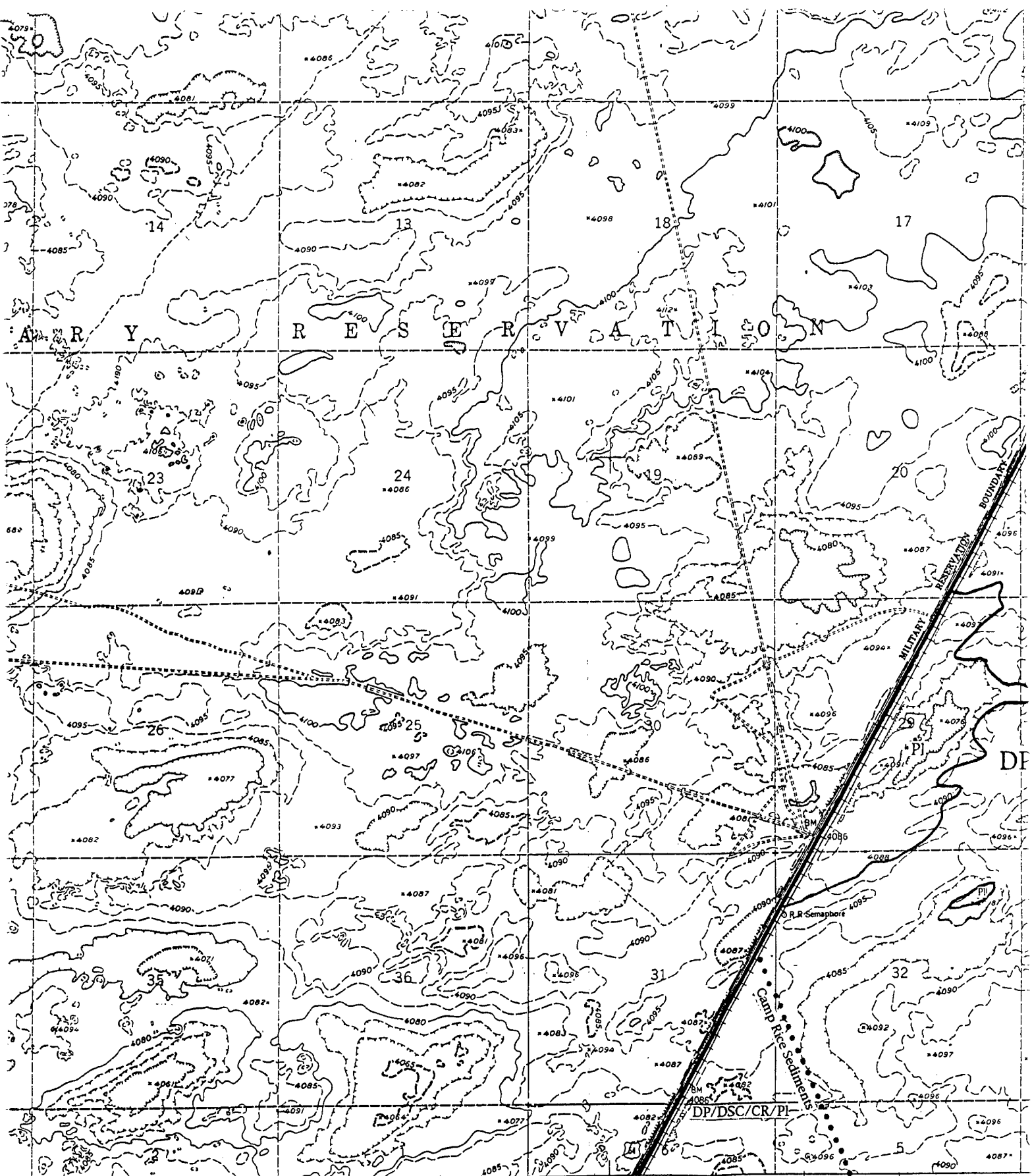


Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

7.5



2



SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0.5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

SUPPLEMENTARY CONTOUR INTERVAL 5 AND 10 FOOT

NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U.S. GEOLOGICAL SURVEY

NEW MEXICO

QUADRANGLE LOCATION

0°38' 11 MILS

10°14' 187 MILS

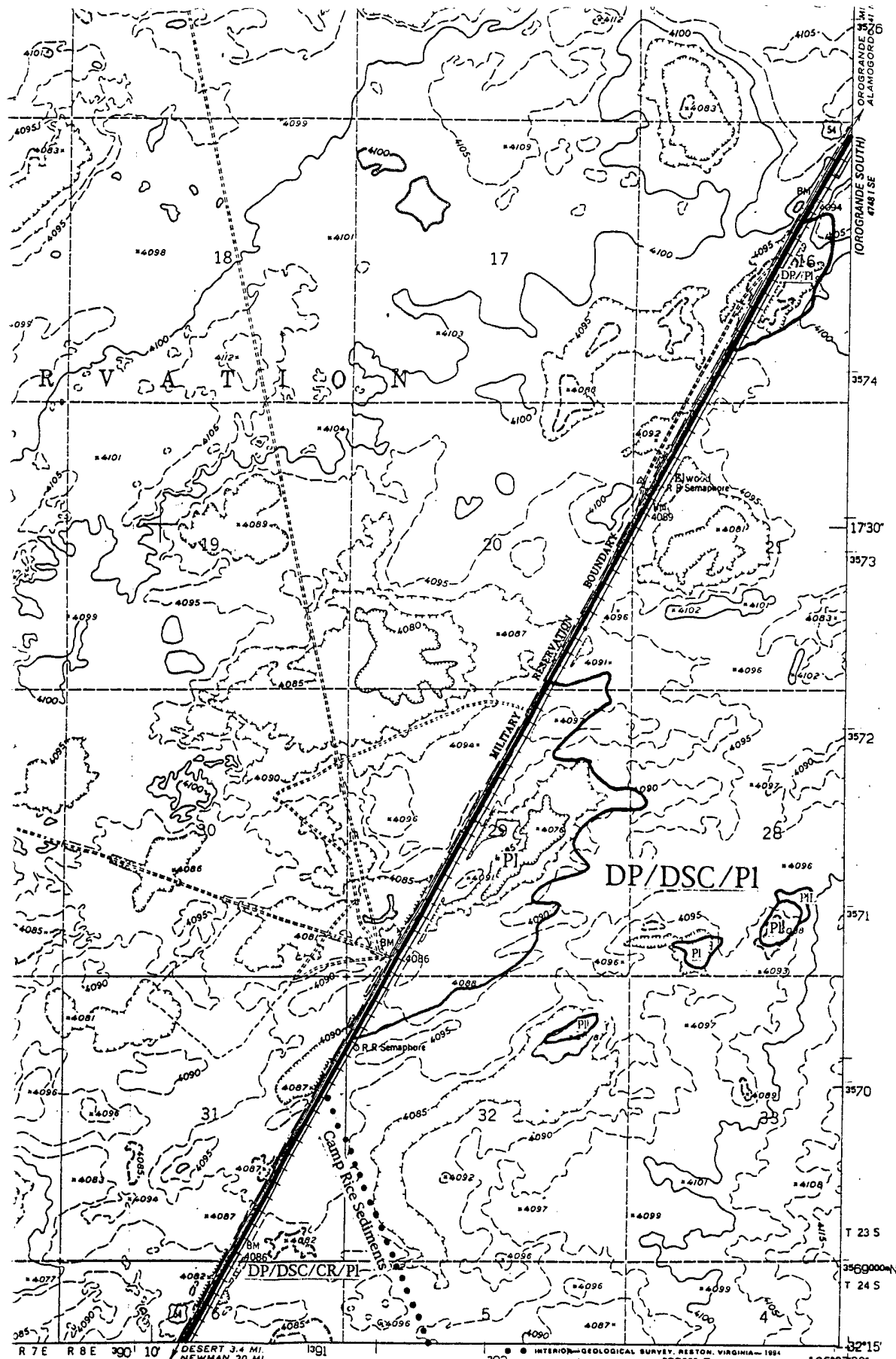
ROAD C

Primary highway, hard surface

Secondary highway, hard surface

Interstate Route

5



1 MILE
7000 FEET
OMETER

NEW MEXICO

QUADRANGLE LOCATION

0°38' 11" N
106°07'30" W

187 MILES

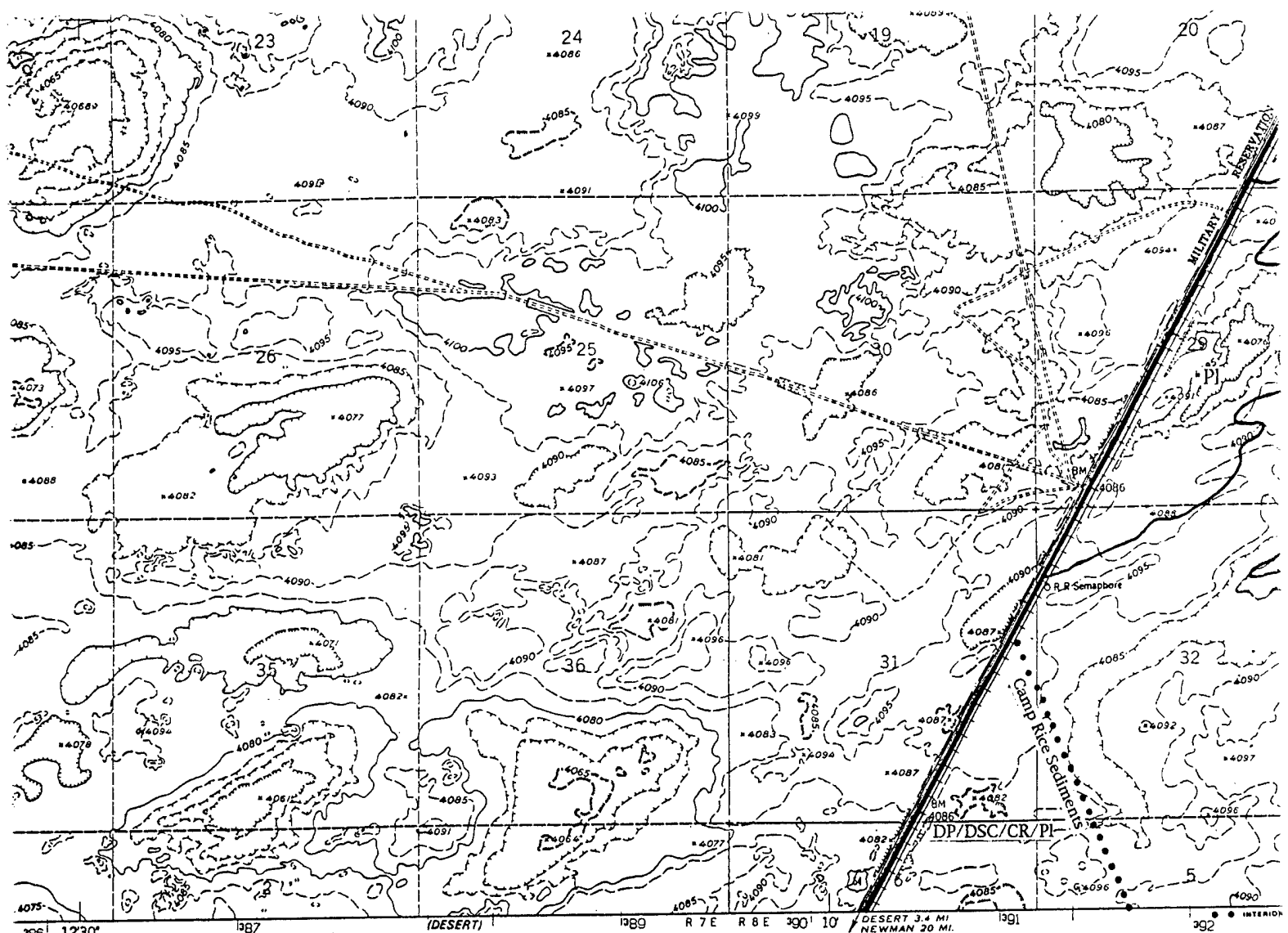
ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road

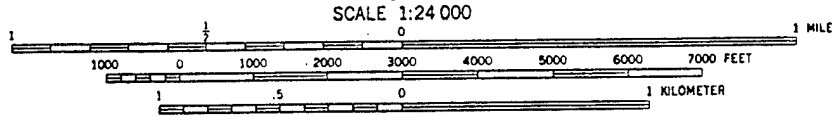
Interstate Route U. S. Route State Route

DESERT NEI 4748 1 SE

ELWOOD, NM

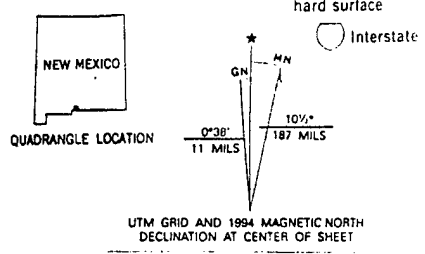


- hic
- ls¹
- A1
- A2
- A3
- B
- CR •••
- DL
- DP
- DS
- DSC
- DSG
- P
- PI
- PIL



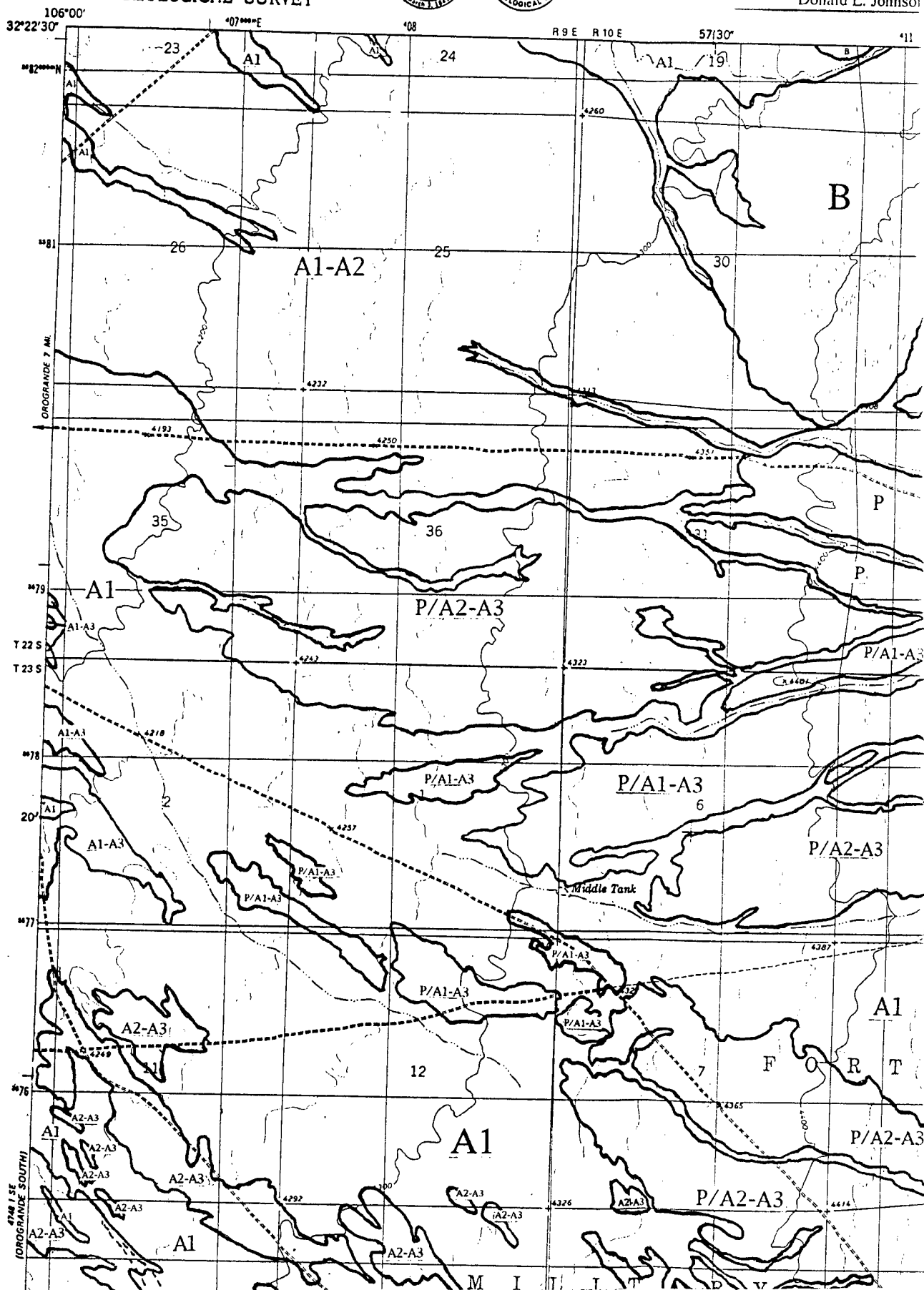
CONTOUR INTERVAL 20 FEET
 SUPPLEMENTARY CONTOUR INTERVAL 5 AND 10 FOOT
 NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY
 DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

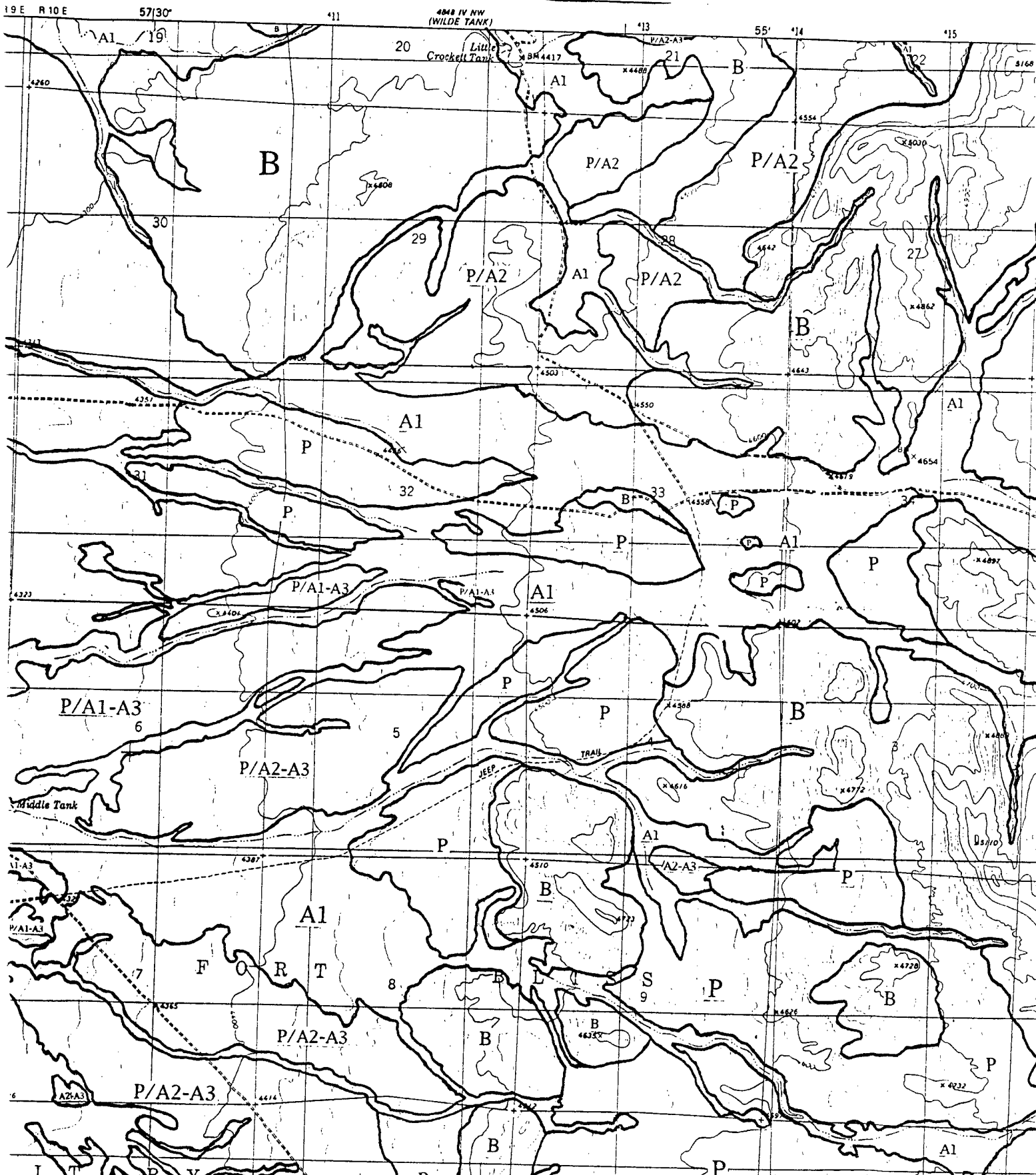


8

9



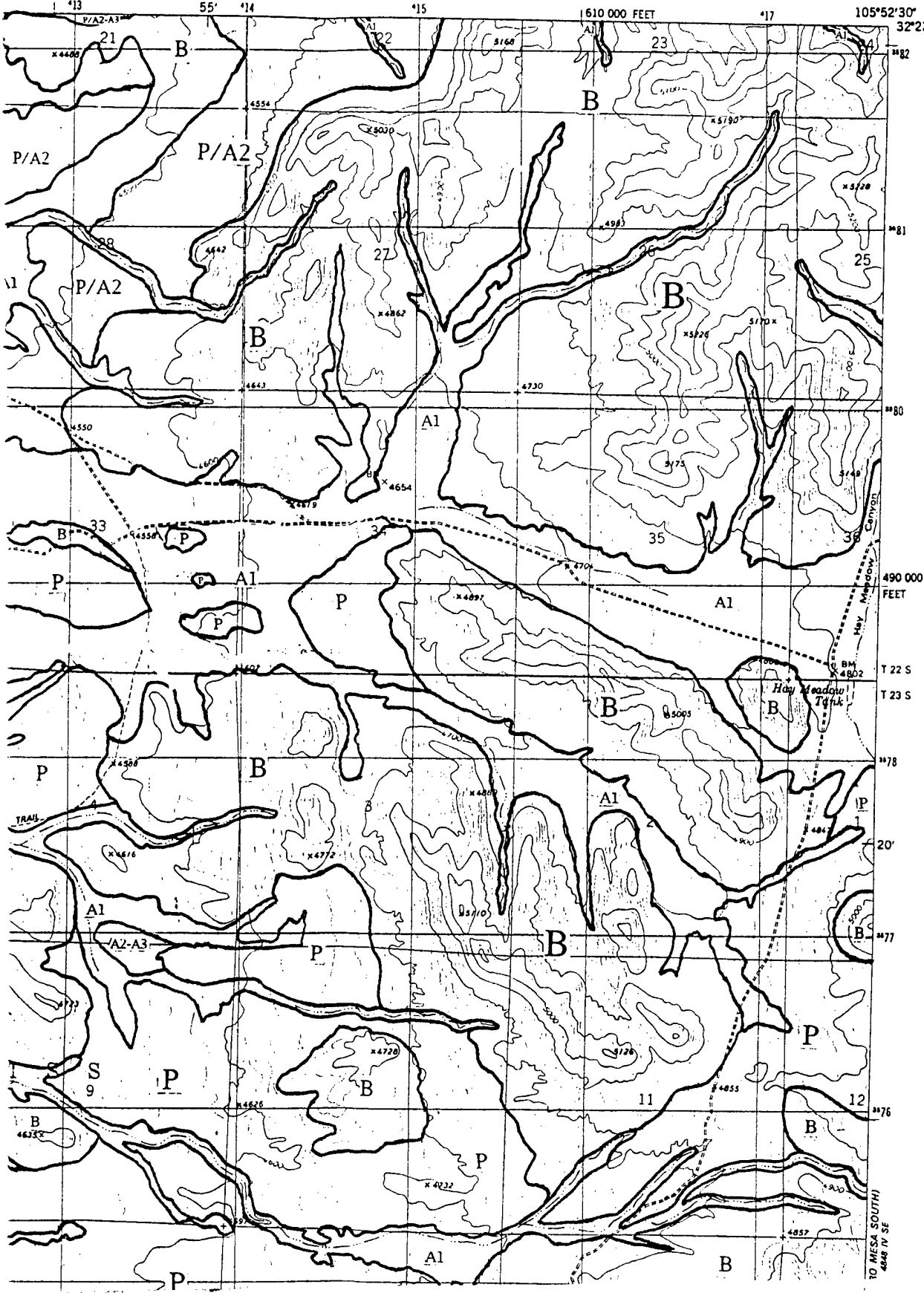
Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
 Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997



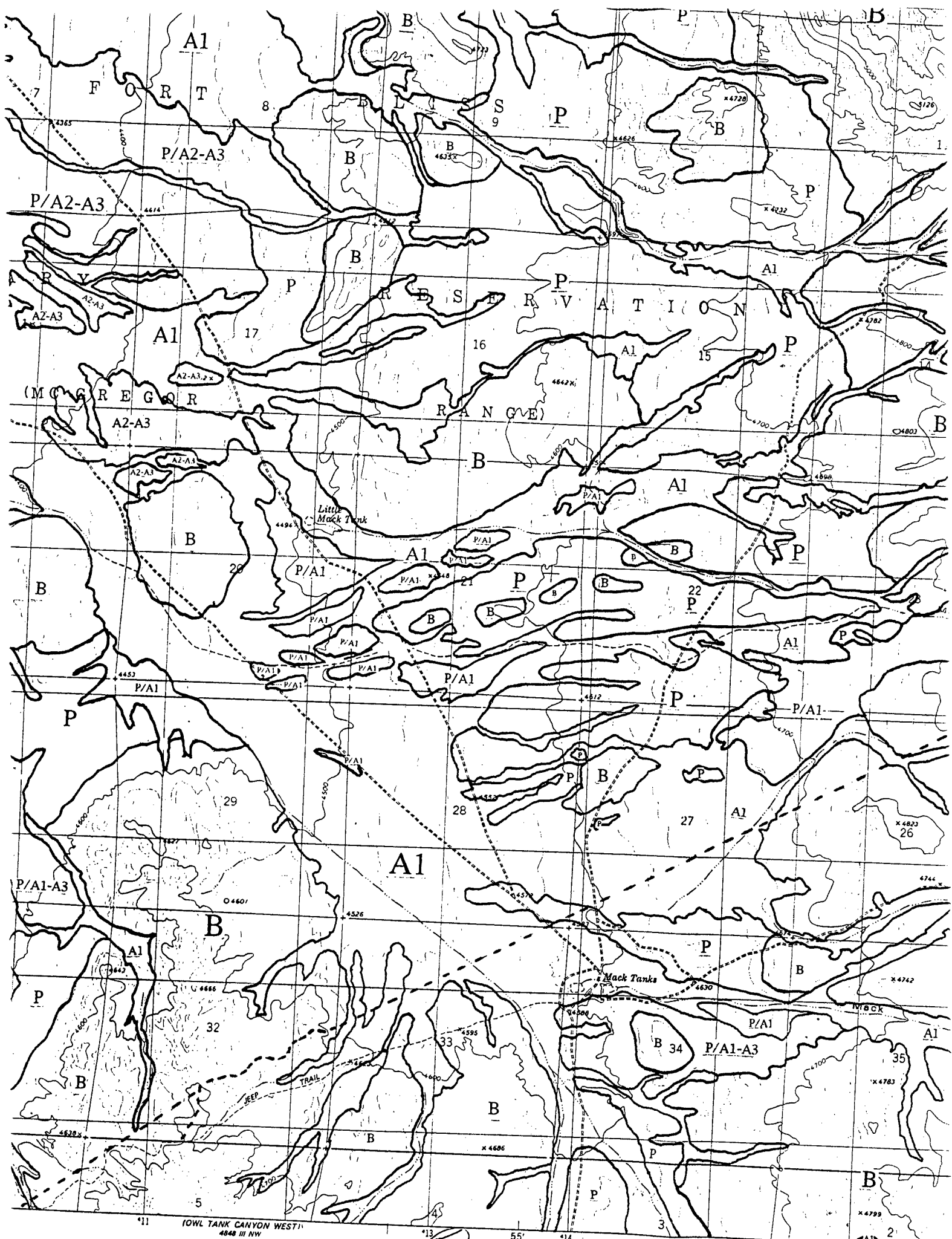
Surficial Mapping
New Mexico
1, 1997

MACK TANKS QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
8W/4 PENDEJO WASH 15' QUADRANGLE

4848 N NE
(OTERO MESA NORTH)



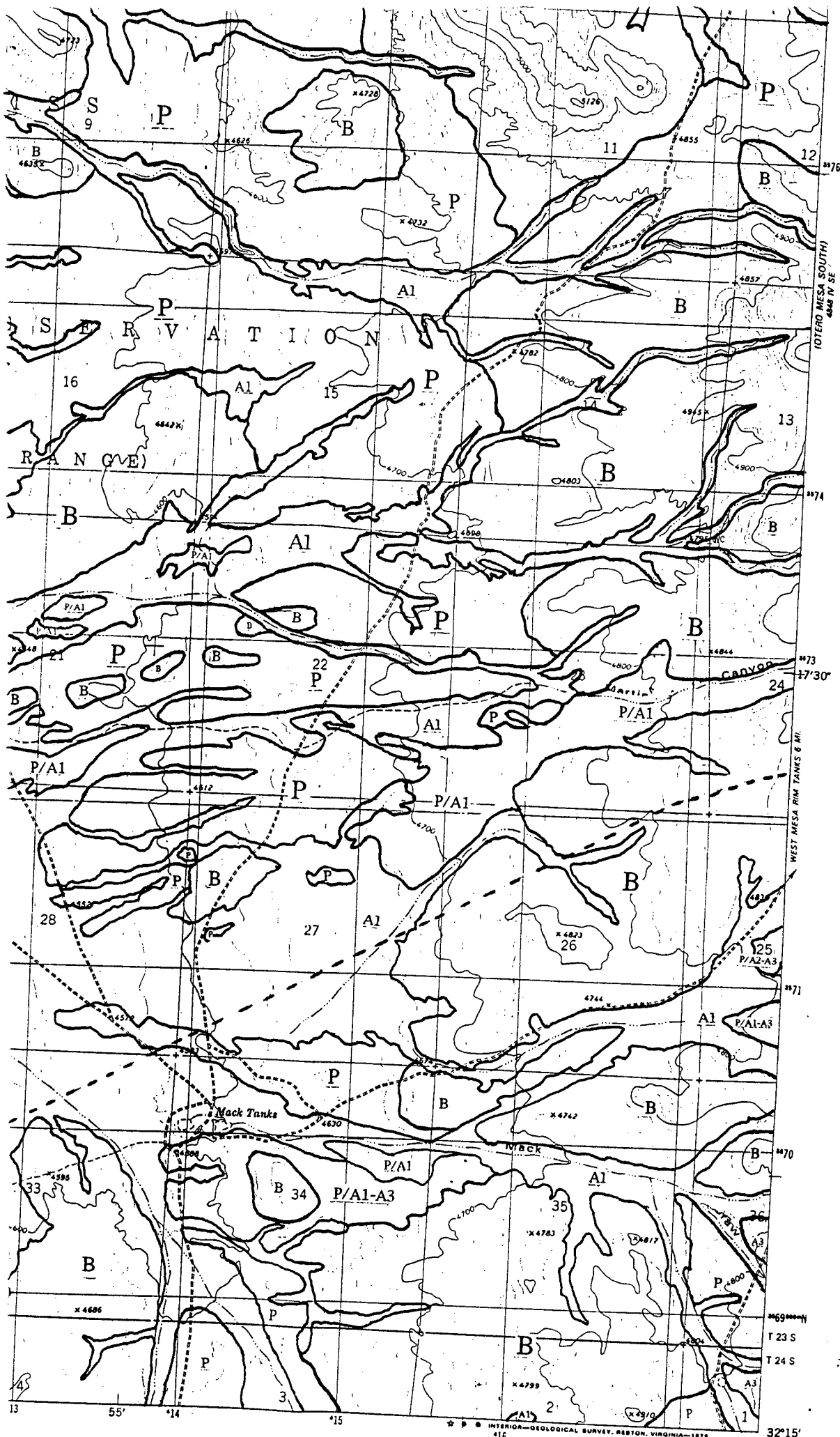
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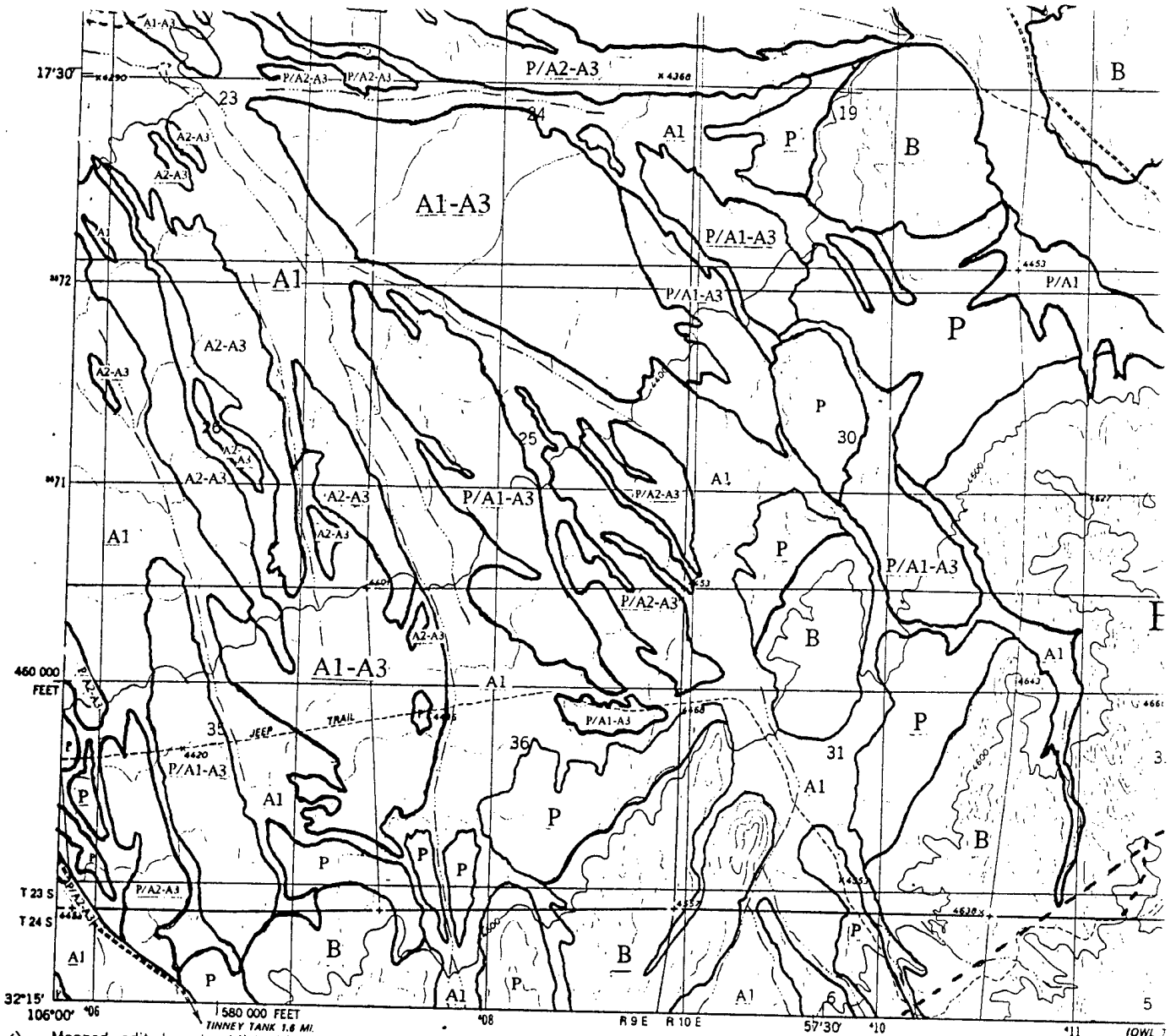
TOWL TANK CANYON WEST
4848 III NW

SCALE 1:24,000

INTERIOR-GEOLOGICAL SURVEY



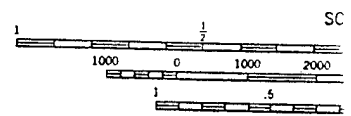
6



(DESEPT NE)
4748 8 NE

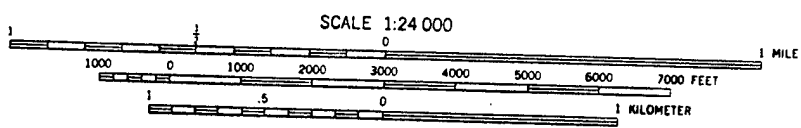
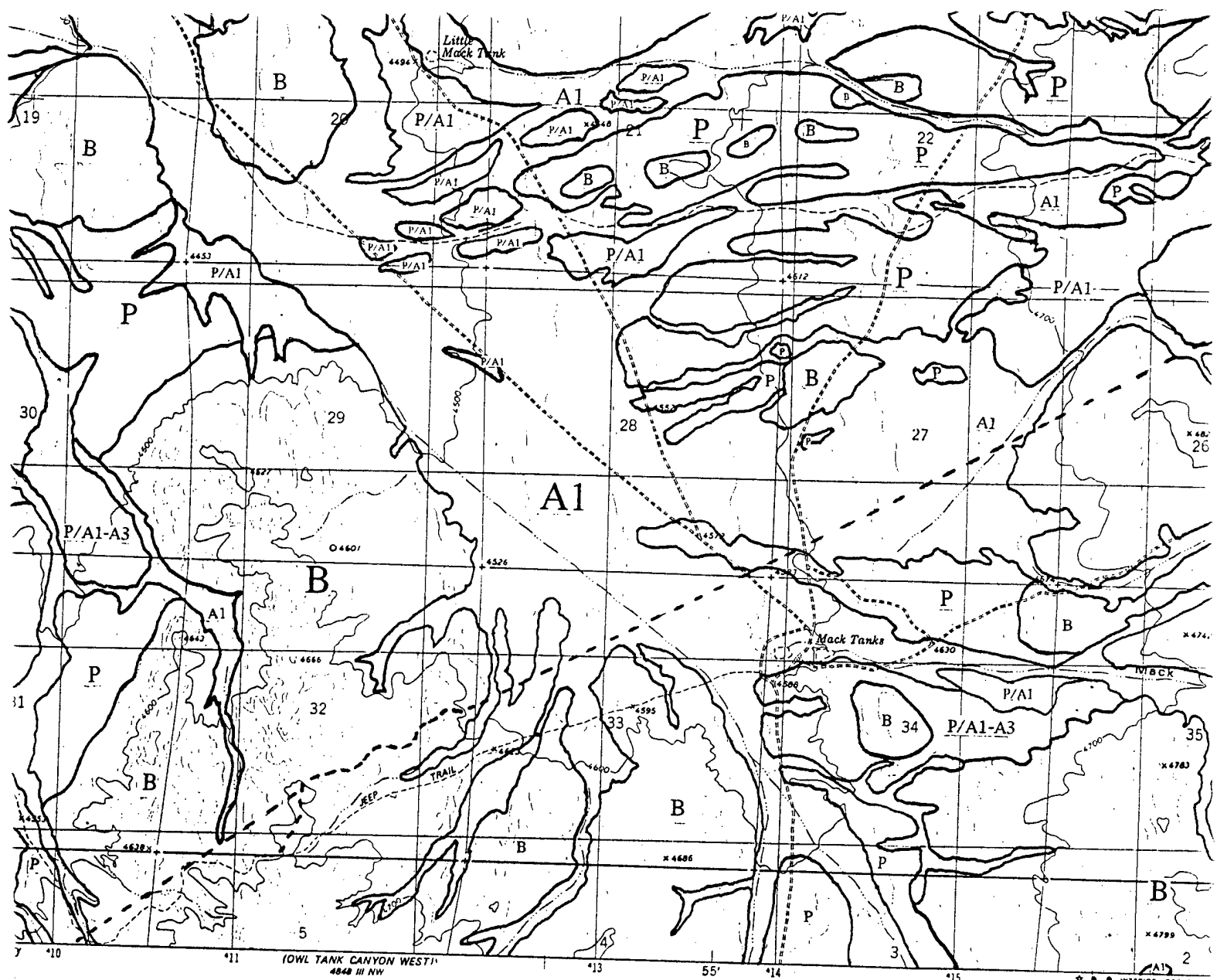
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1979
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
Certain land lines are omitted because of insufficient data
There may be private inholdings within the boundaries of the
National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	— — —
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	— — —
Pediment	P
Playa	P1
Playa Lunette	PIL
¹ See text for explanation	



THIS MAP COMPLIES WITH
FOR SALE BY U.S. GEOLOGICAL SURVEY, DE
A FOLDER DESCRIBING TOPOGRAPHIC

7

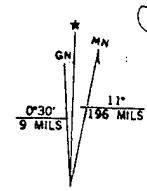


CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



- ROAD CL
- Primary highway, hard surface
 - Secondary highway, hard surface
 - Interstate Route

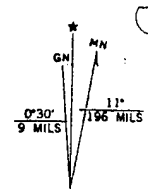
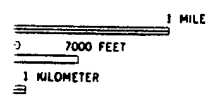
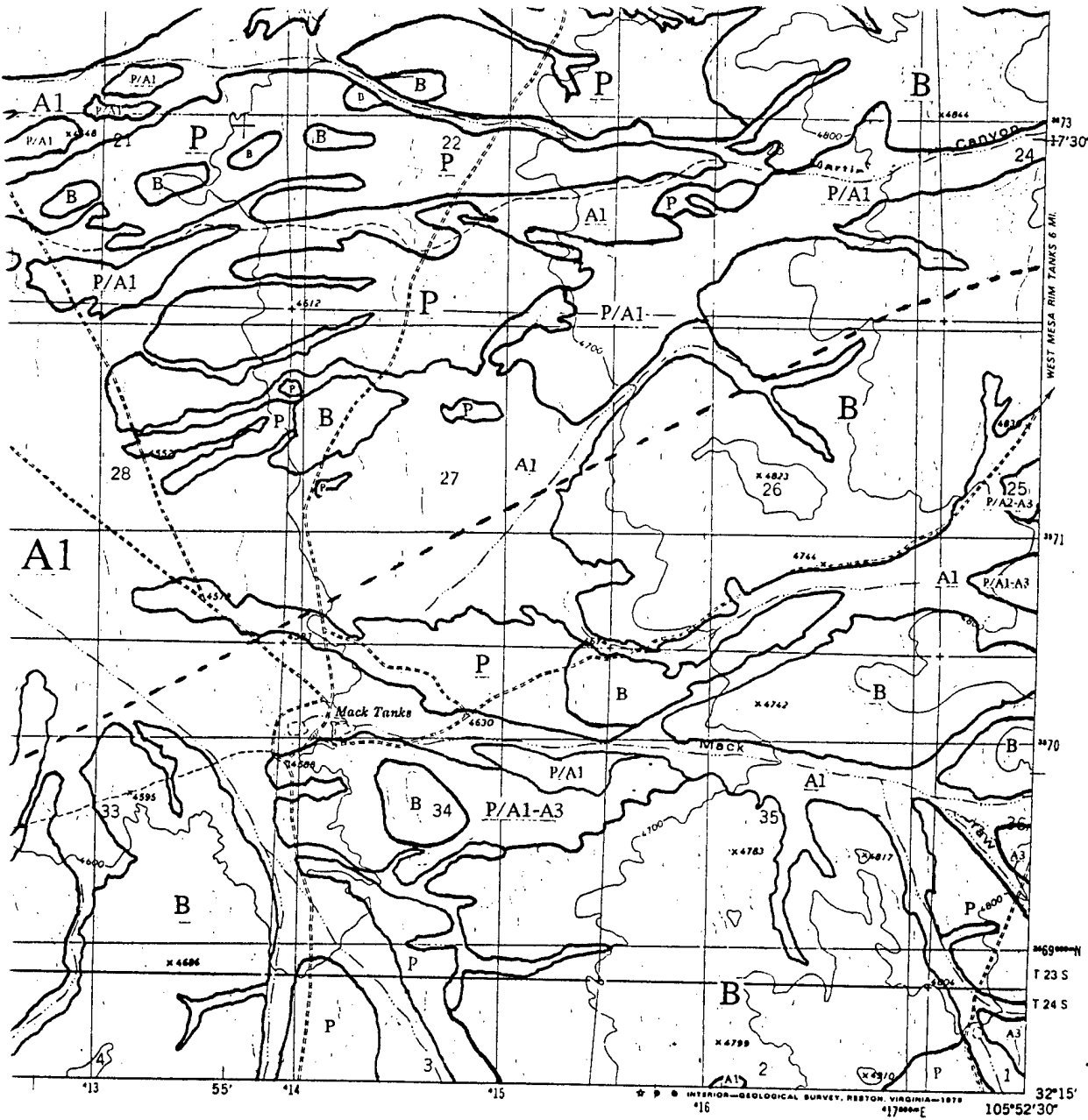


UTM GRID AND 1979 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

MAC
SW/4

DA

8



ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road
○ Interstate Route	□ U. S. Route
	○ State Route

STON, VIRGINIA 22092
ON REQUEST

MACK TANKS, N. MEX.
SW/4 PENDEJO WASH 15' QUADRANGLE
N3215-W10552.5/7.5

1979

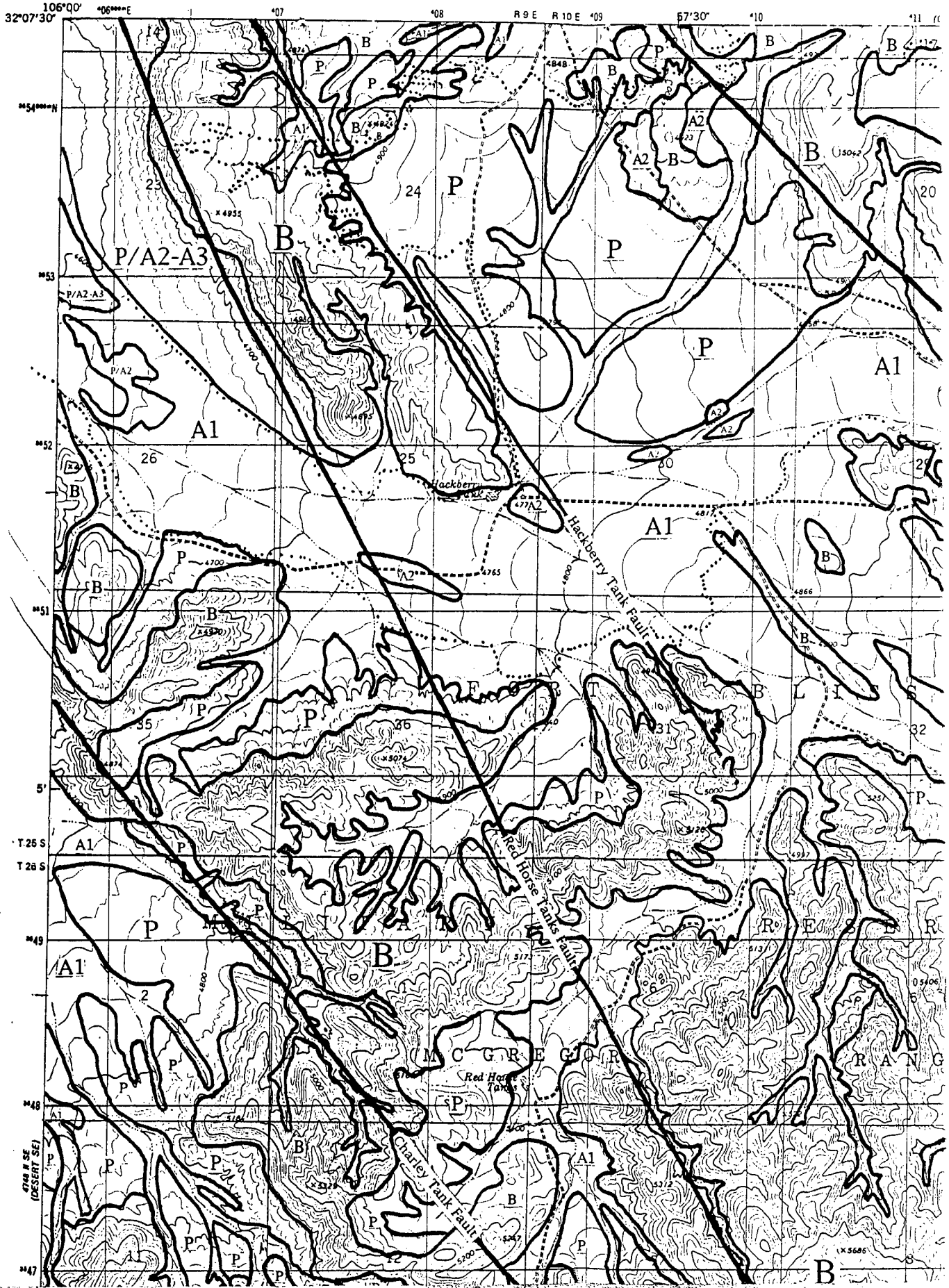
DMA 4848 IV SW—SERIES V881

9

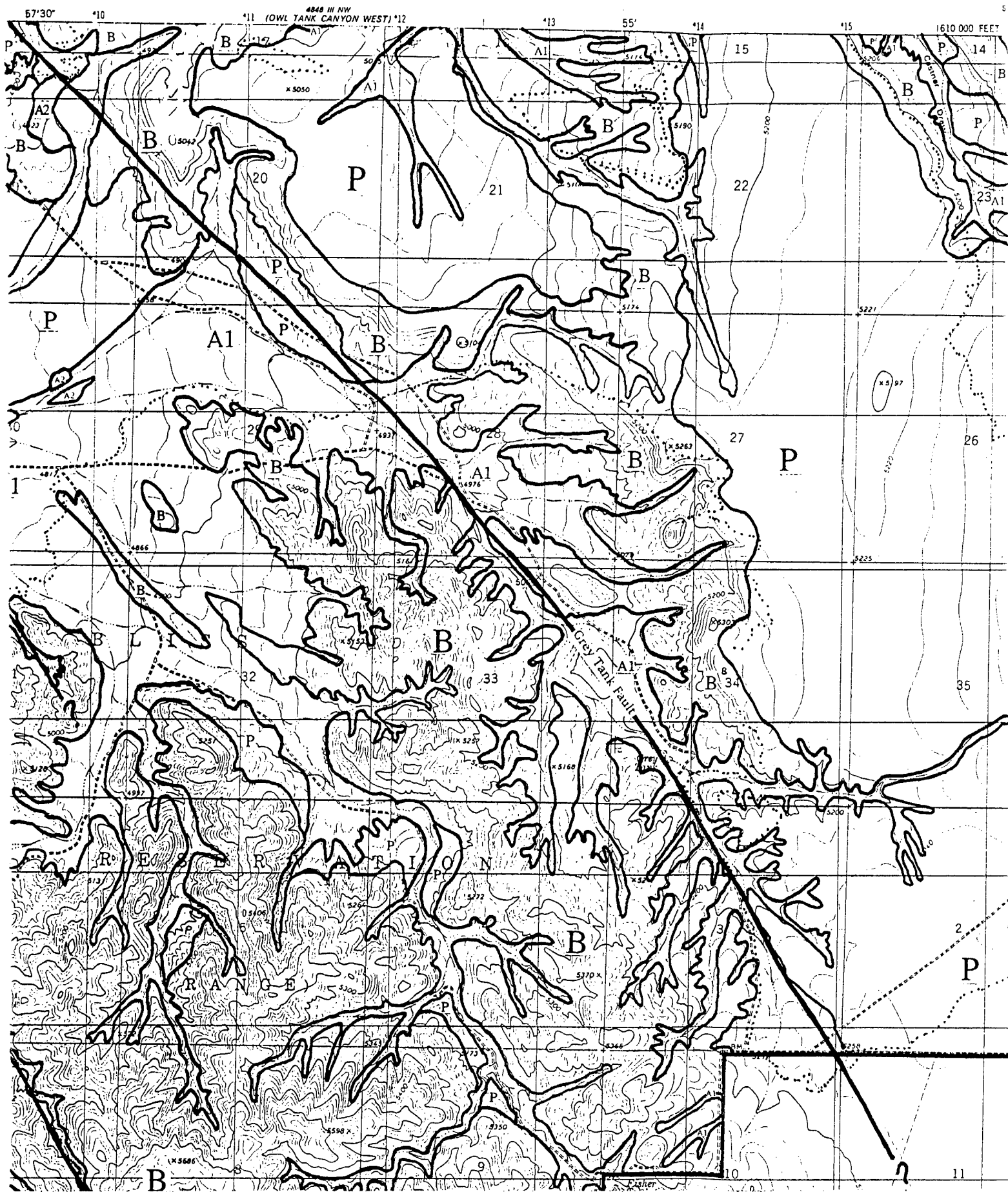
11 NE
JERT NEI

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Study of McGregor Guide
Donald L. Johnson, PI

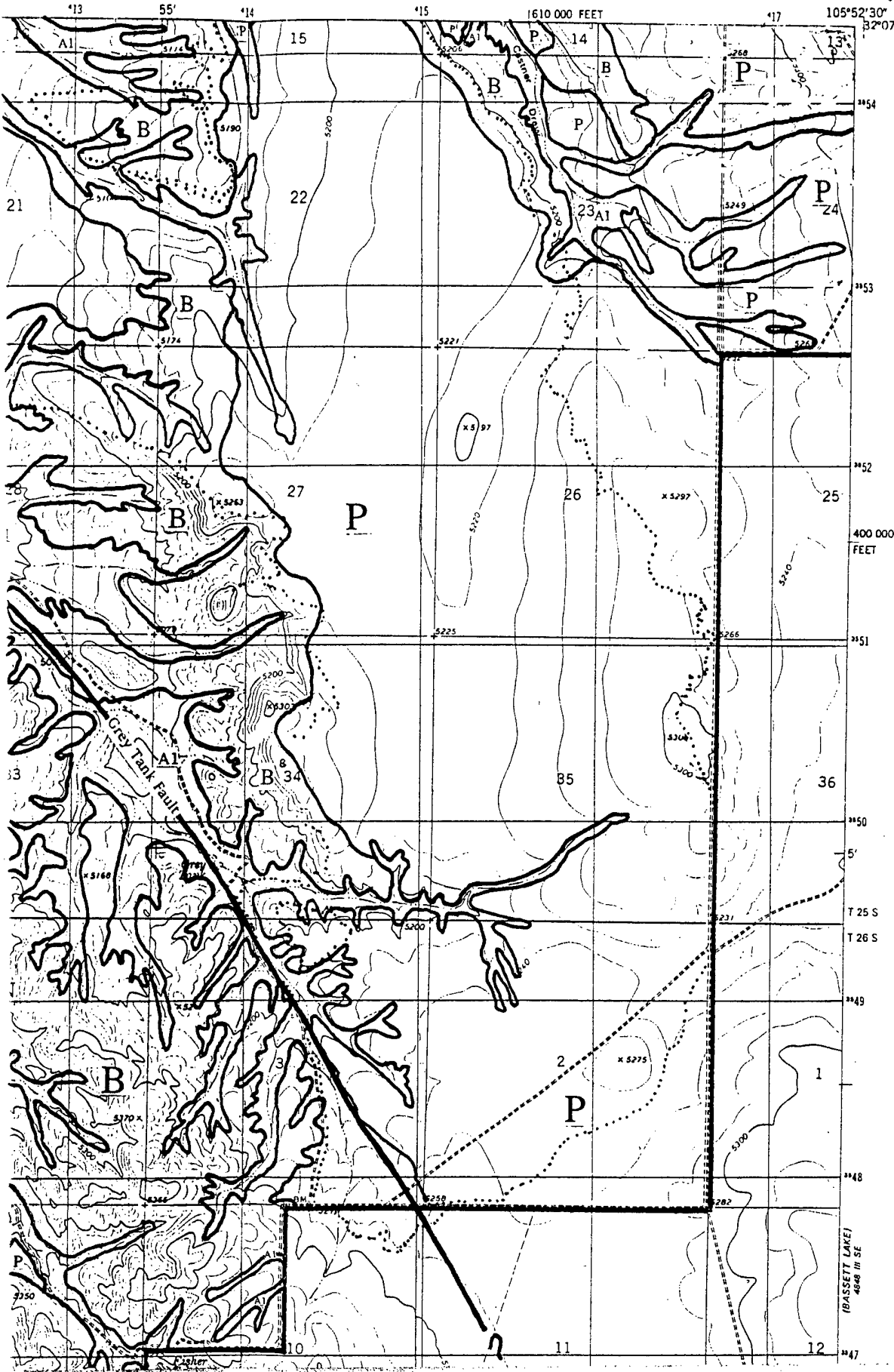


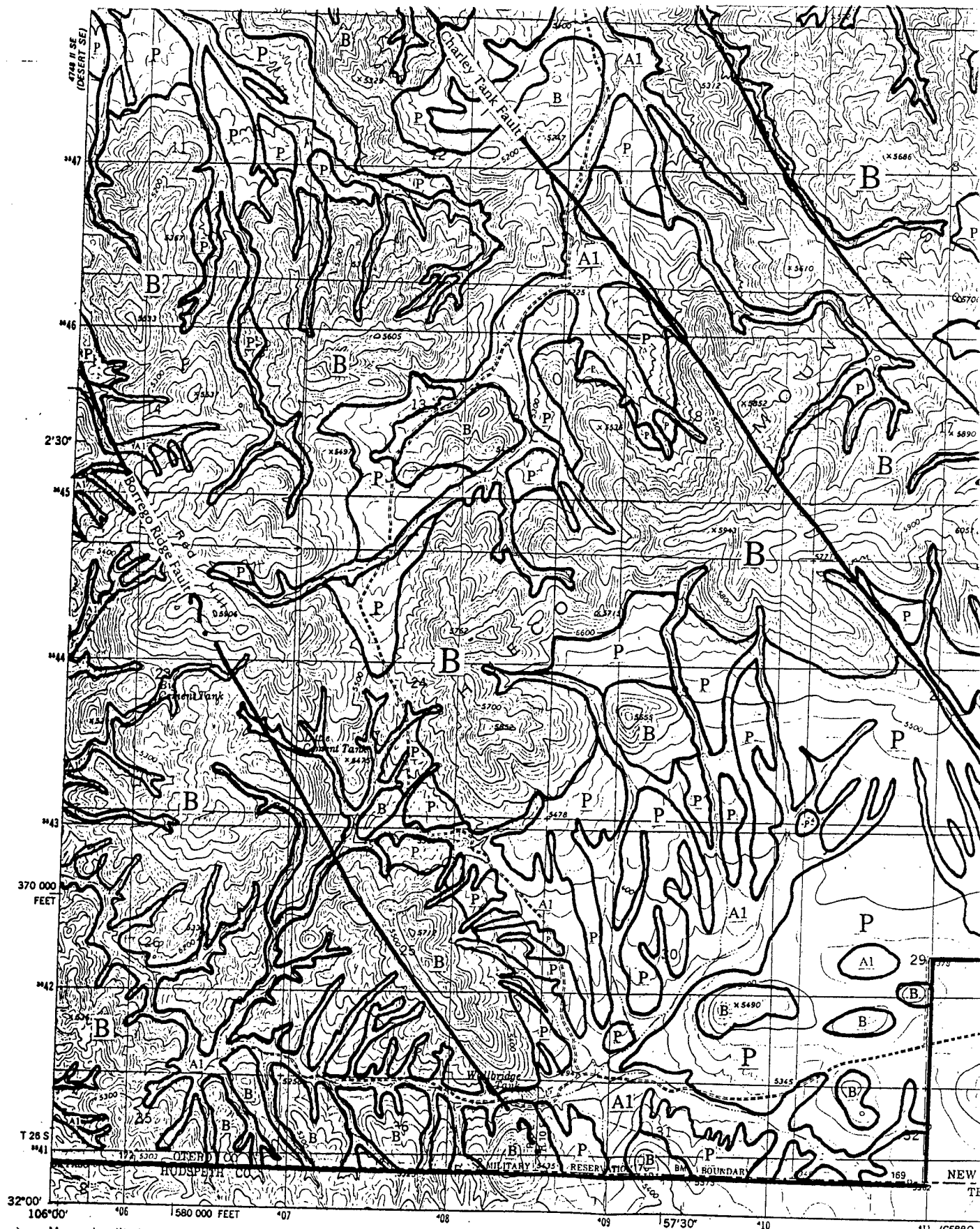
①



MOUNTAIN TANK QUADRANGLE
NEW MEXICO—TEXAS
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 BASSETT LAKE 15' QUADRANGLE

ADD IN NE
TOWEL TANK
CANYON EAST





Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

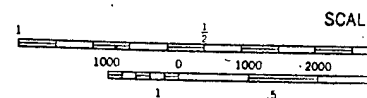
To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

There may be private inholdings within the boundaries of the
National or State

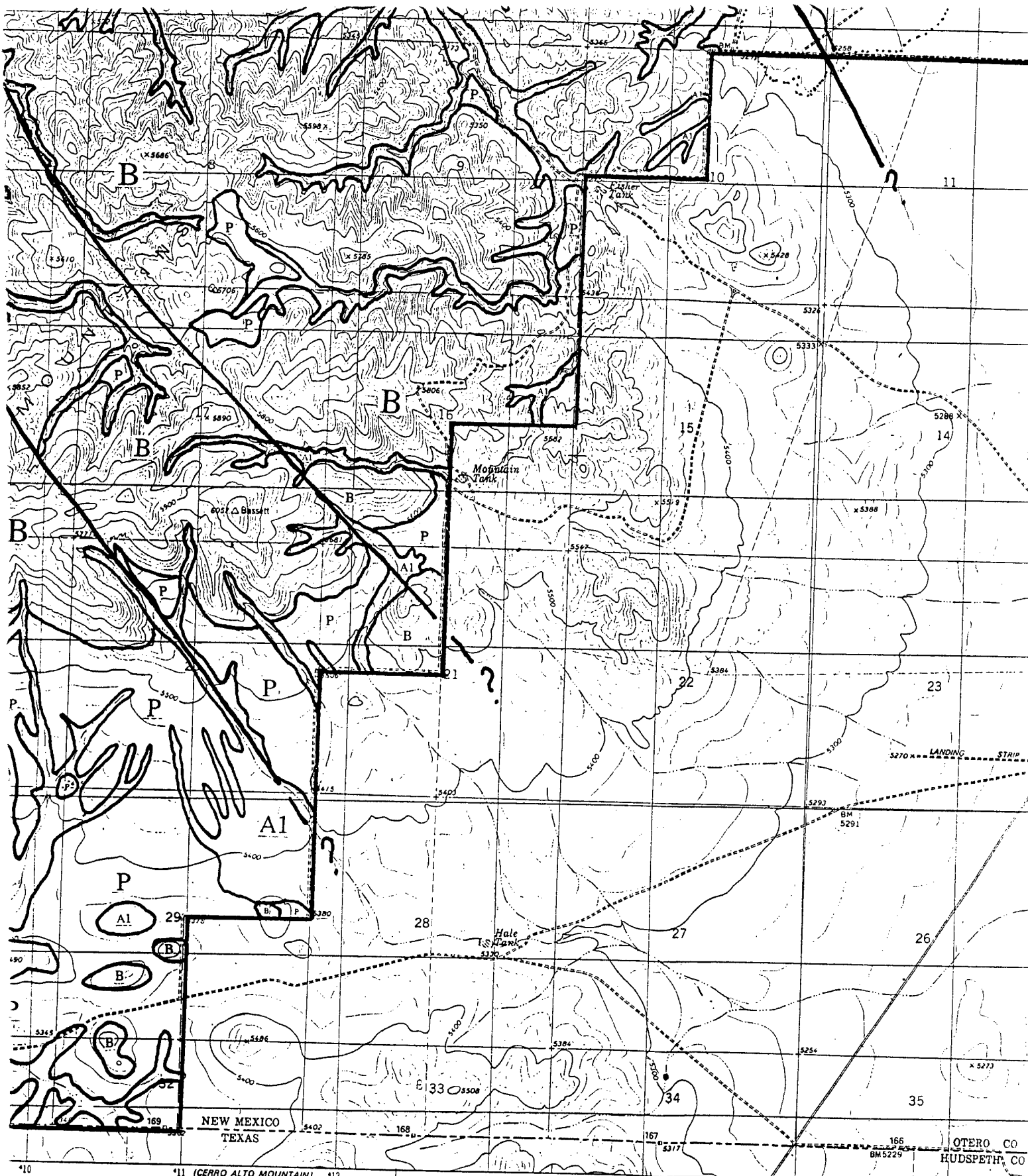
McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolton Floor Complex	CR...
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet (Sand Sheet)	DSC
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSC
Fault	F
Pediment	P

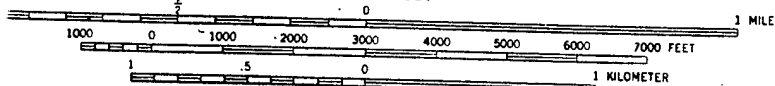


CONTOUR IN
NATIONAL GEODETIC

THIS MAP COMPLIES WITH NAT
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENV

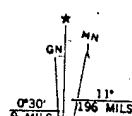


SCALE 1:24 000



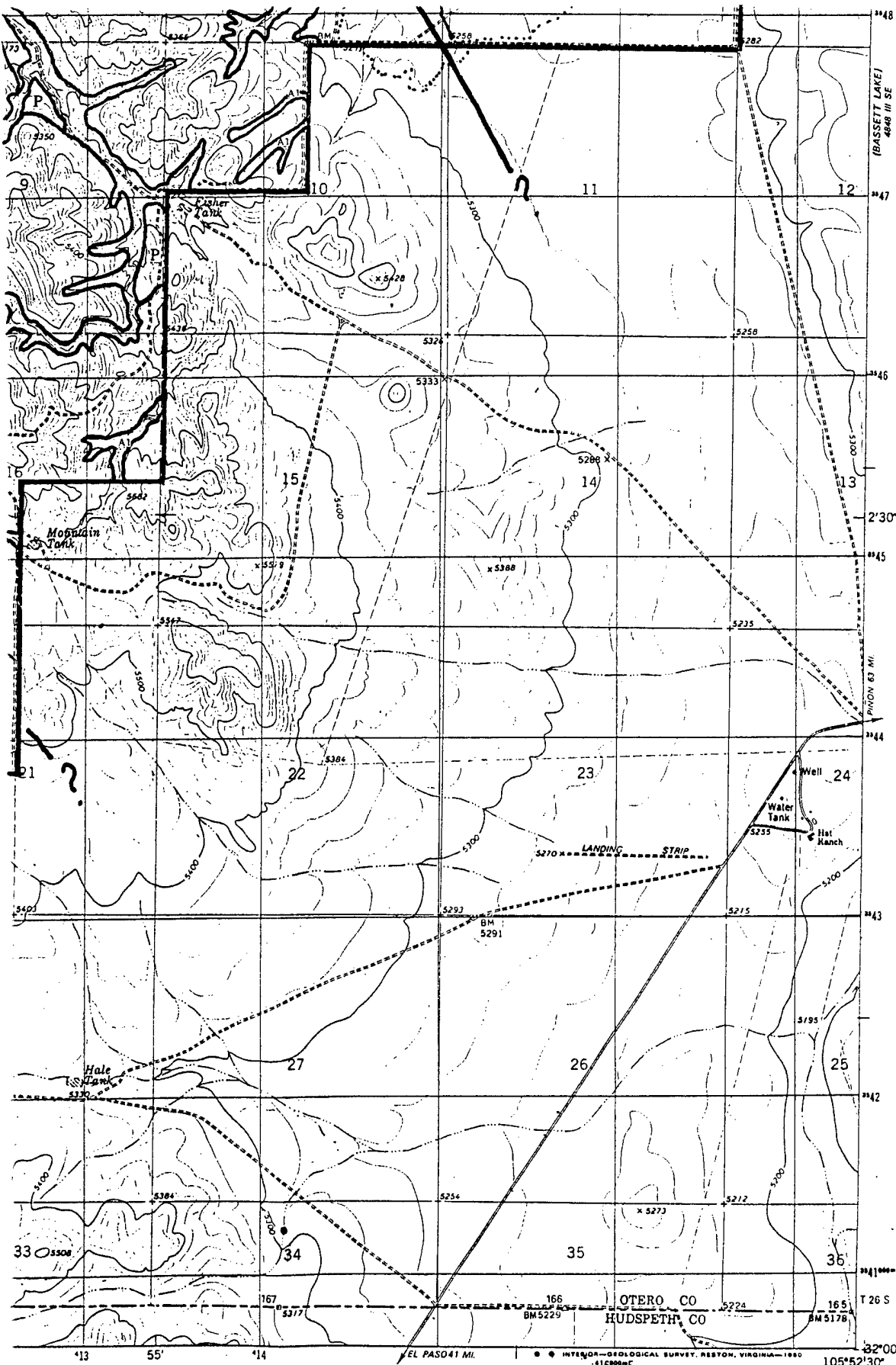
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
 Primary highway, hard surface ——— Light-duty improve
 Secondary highway, hard surface ——— Unimproved
 ○ Interstate Route □ U. S. Route



MOUNTAIN TANK, N

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR RESTON, VIRGINIA 20192



1 MILE
7000 FEET
METER



GN
11°
196 MILS
0°30'
9 MILS

ROAD CLASSIFICATION

Primary highway, hard surface _____ Light-duty road, hard or improved surface _____

Secondary highway, hard surface _____ Unimproved road _____

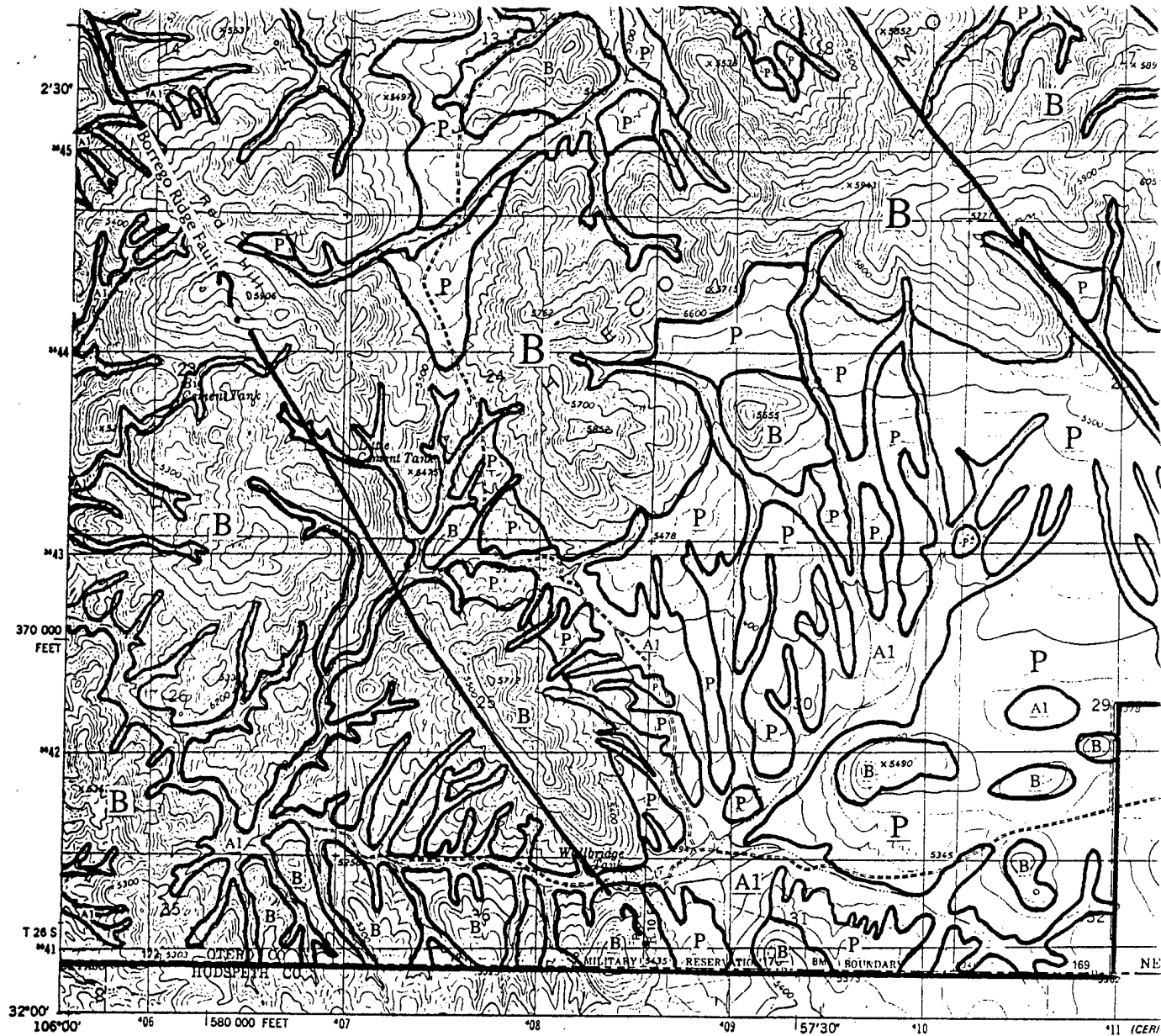
○ Interstate Route □ U. S. Route ○ State Route

MOUNTAIN TANK, N. MEX.-TEX.

SW/4 BASSETT LAKE 15' QUADRANGLE
N3200-W10552.5/7.5

6

13

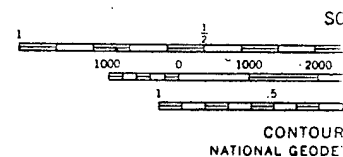


(HUECO TANKS)
DAY LINE

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks
Fine red dashed lines indicate selected fence lines
There may be private inholdings within the boundaries of the
National or State reservations shown on this map

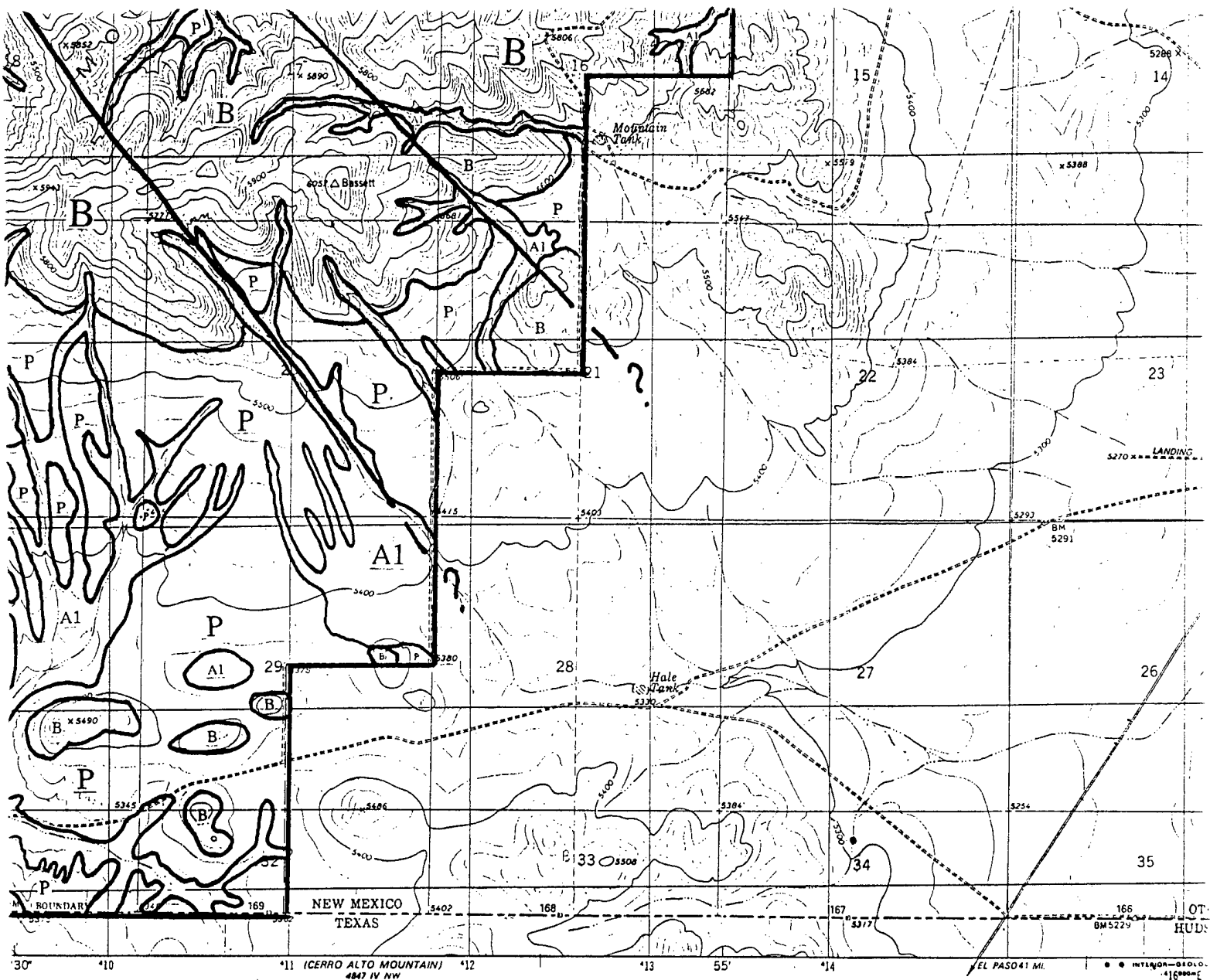
McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR...
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet (Sand Sheet)	DSC
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	
Wind Erosion (fire induced)	

¹See text for explanation

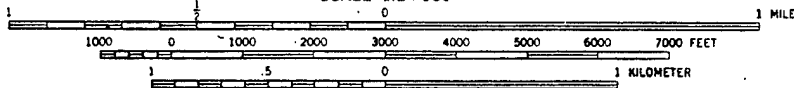


THIS MAP COMPLIES WITH
FOR SALE BY U.S. GEOLOGICAL SURVEY, D
A FOLDER DESCRIBING TOPOGRAPHIC

7



SCALE 1:24 000



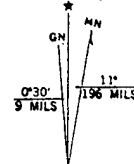
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION

3205-222



UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

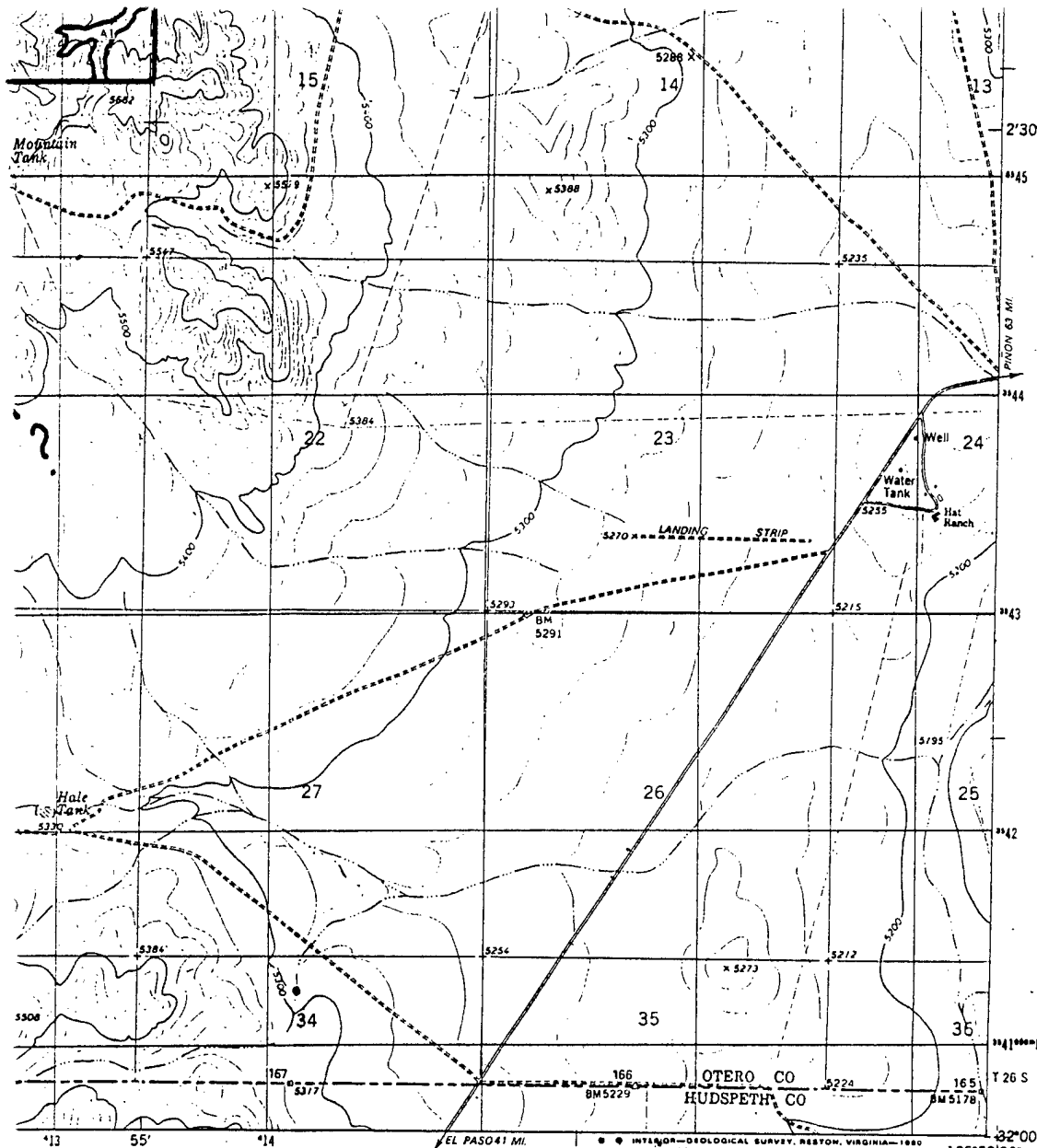
Primary highway,
hard surface
Secondary highway,
hard surface
Interstate Route

MOUNTAIN

SW/4 BA:
N:

DMA 4

8



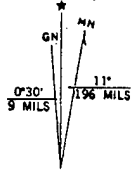
ROAD CLASSIFICATION

- | | |
|--|---|
| Primary highway, hard surface | Light-duty road, hard or improved surface |
| Secondary highway, hard surface | Unimproved road |
| ○ Interstate Route □ U. S. Route ○ State Route | |



QUADRANGLE LOCATION

3205-222



UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

MOUNTAIN TANK, N. MEX.-TEX.

SW/4 BASSETT LAKE 15' QUADRANGLE
N3200-W10552.57.5

1980

DMA 4848 III SW-SERIES V881

NIA 22092

(13)

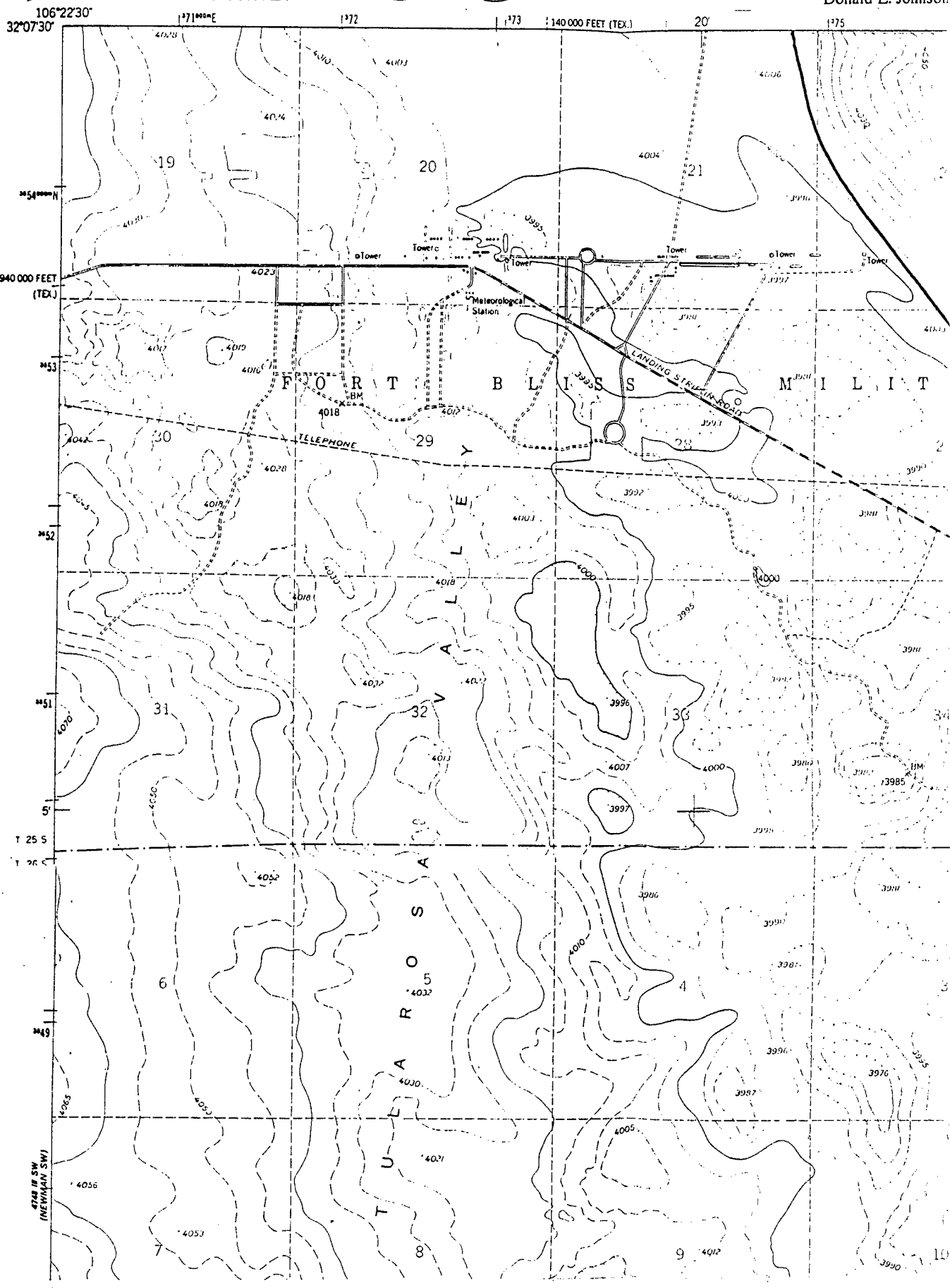
9

5148 11 NW
(NEWMAN NW)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

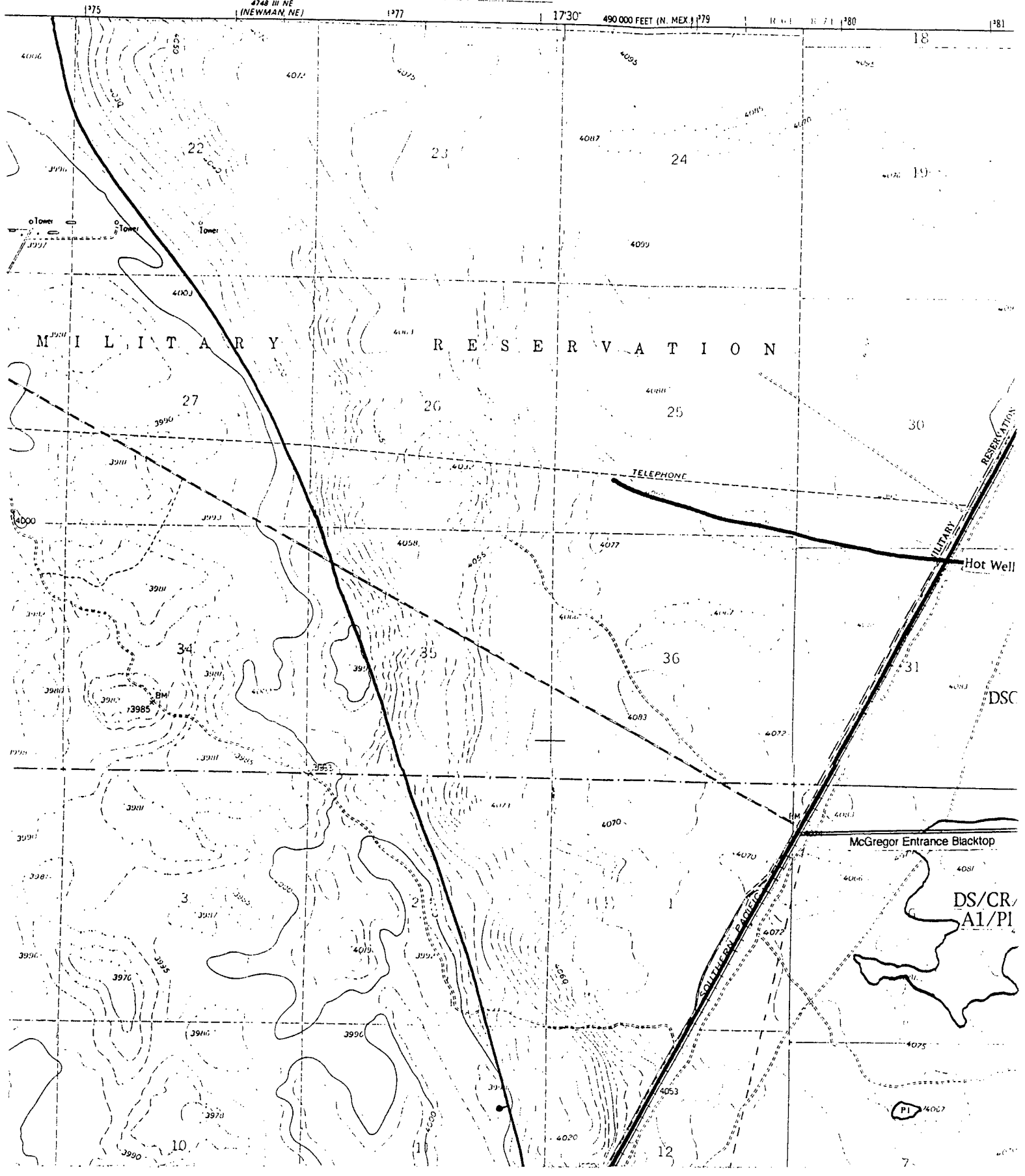


Geomorphological, Geocological
Study of McGregor Gu.
Donald L. Johnson



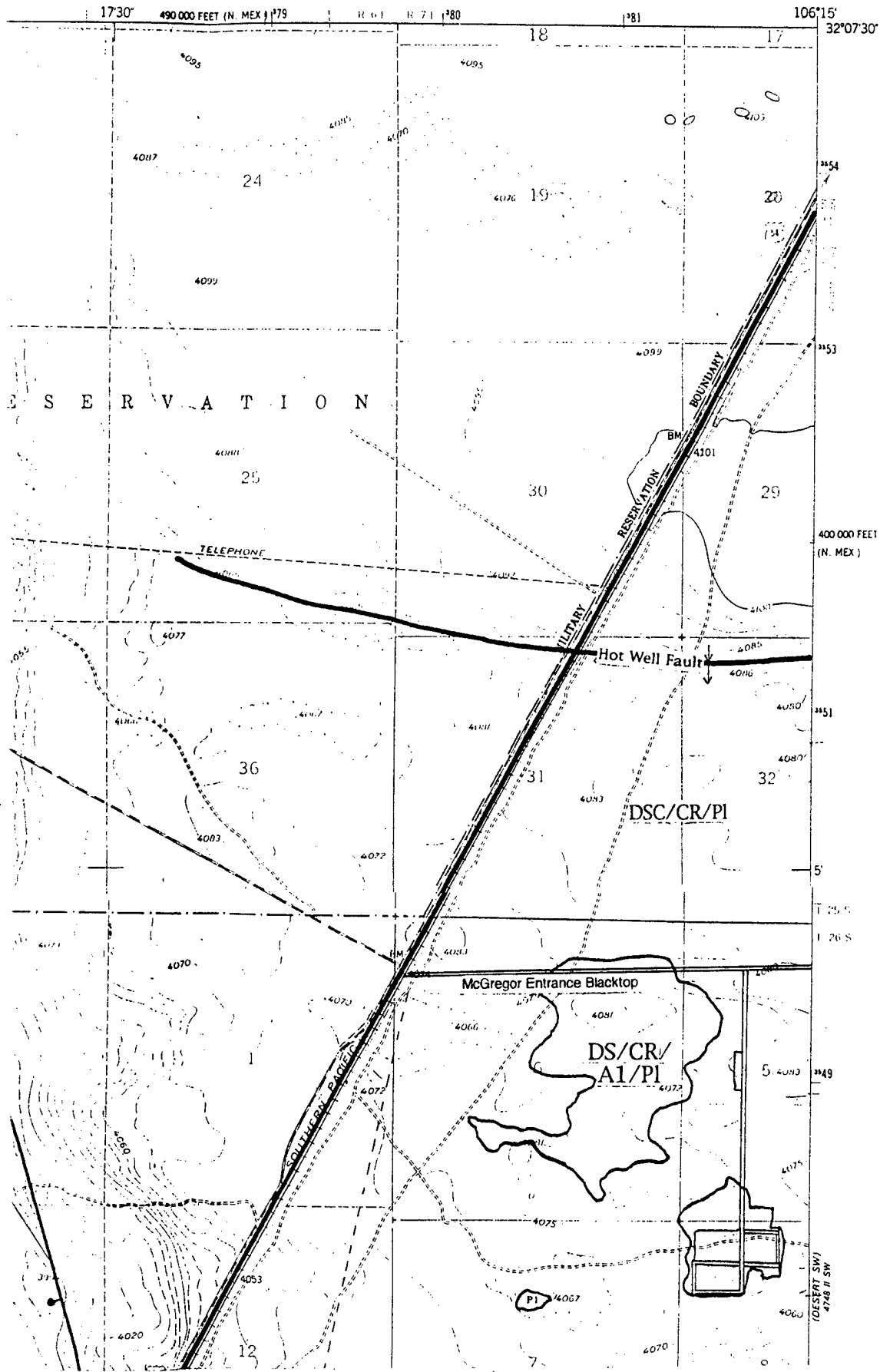
Geomorphological, Geoecological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

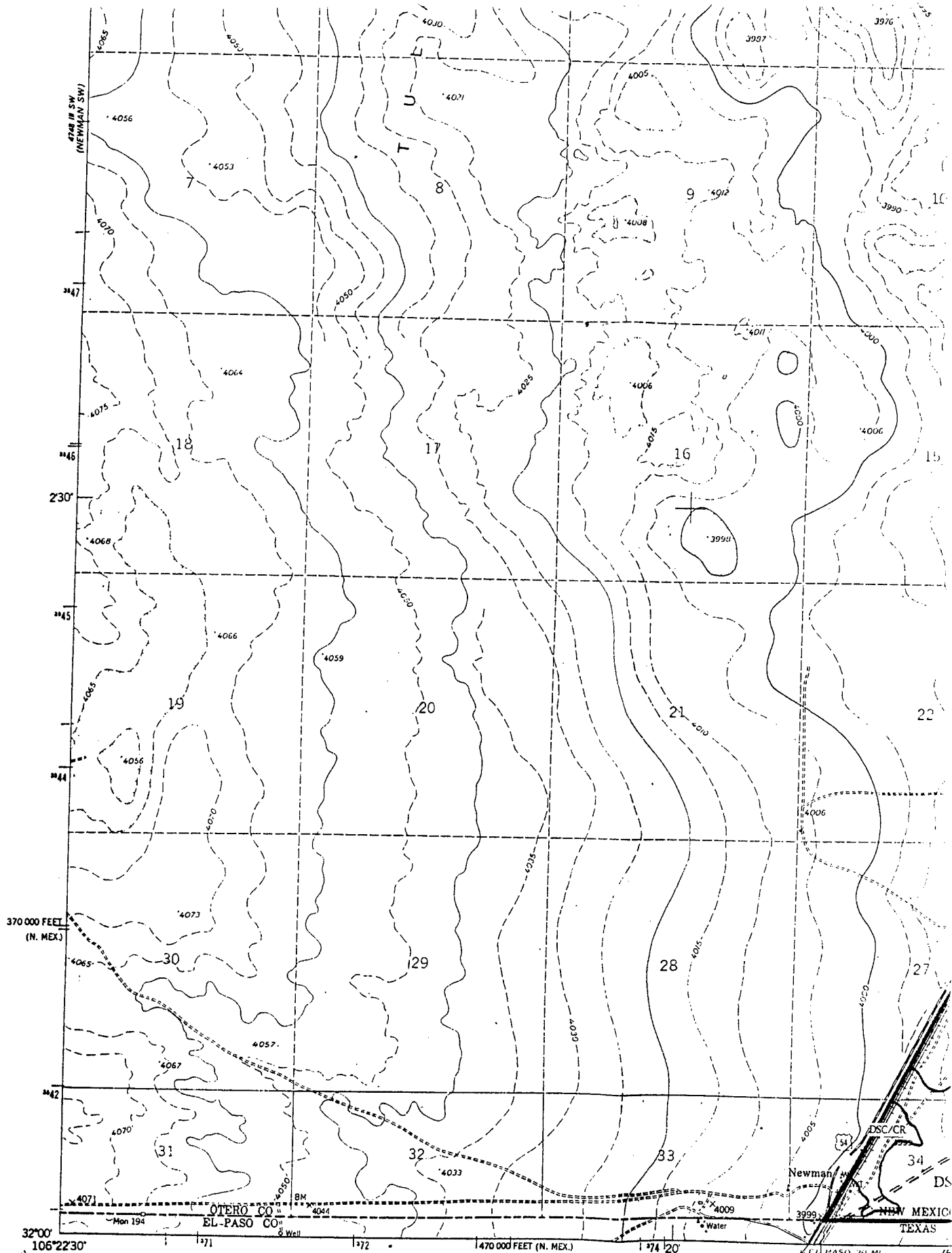
NEWMAN
NEW
7.5 MINUTE SECTION



NEWMAN QUADRANGLE
NEW MEXICO-Texas
7.5 MINUTE SERIES (TOPOGRAPHIC)

4748 II NW
(DSERT 71)



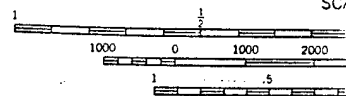


4
NORTH FRANKLIN
MOUNTAIN
4747 IV NW

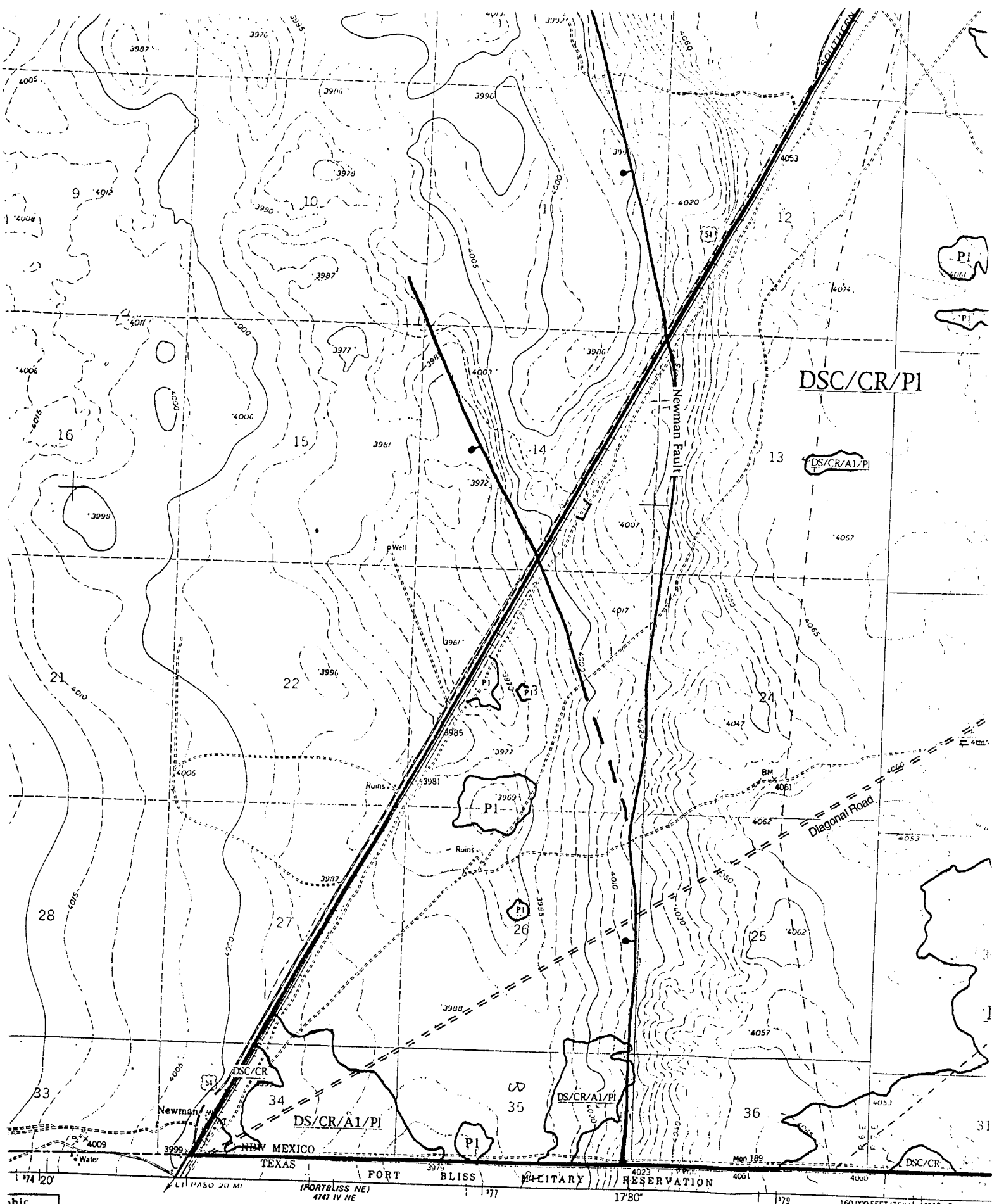
Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955
Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone and Texas coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks

McGregor Range Geomorphic Mapping Units and Symbols¹

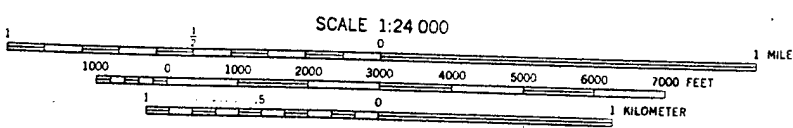
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP



CONTOUR
DASHED LINES REPR
NATIONAL GEODET



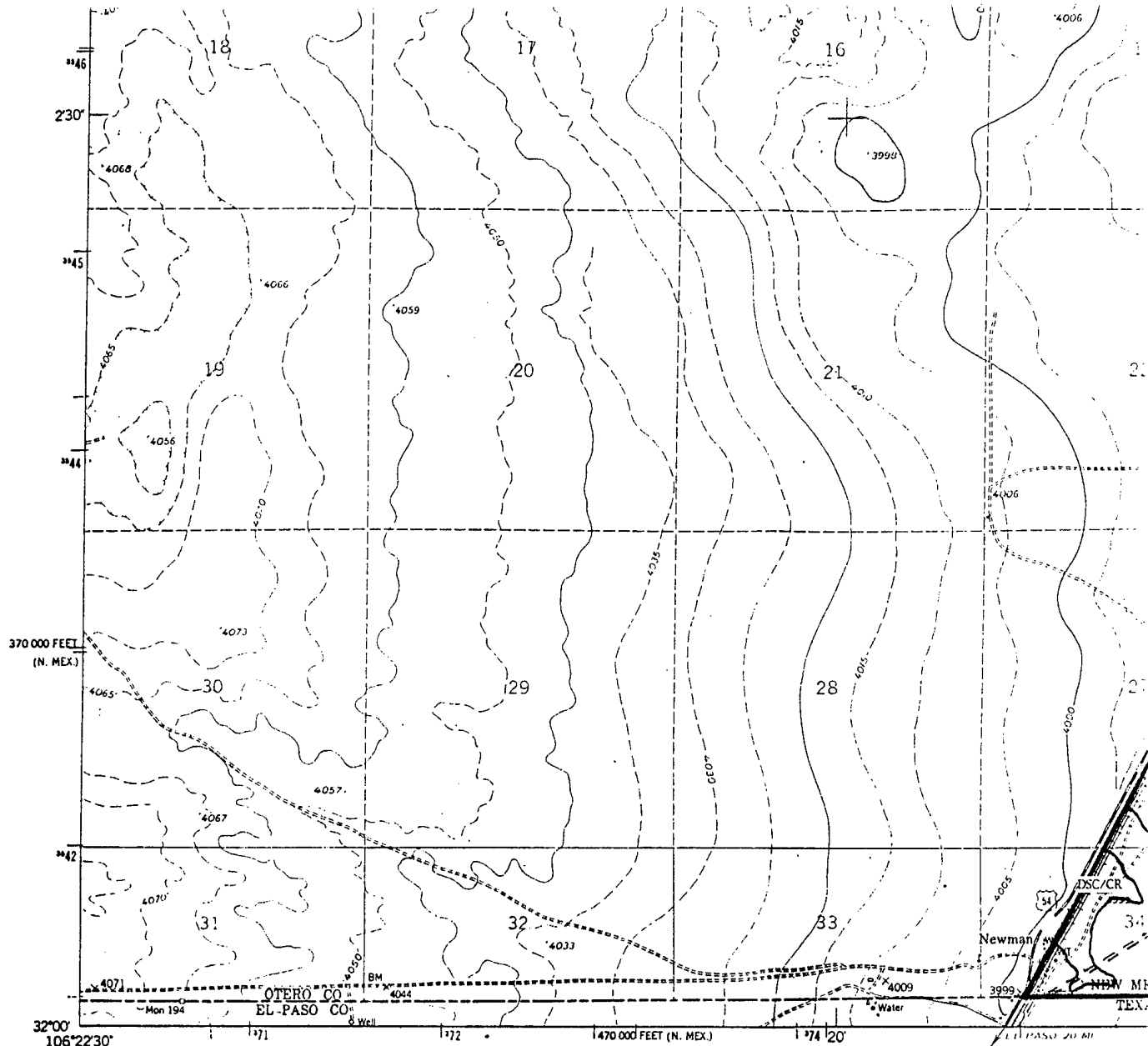
A1
 A2
 A3
 B
 CR
 DL
 DP



5

Medium-duty

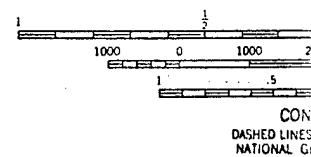
GN
 MN



(NORTH FRANKLIN
MOUNTAINS)
247' IV NW

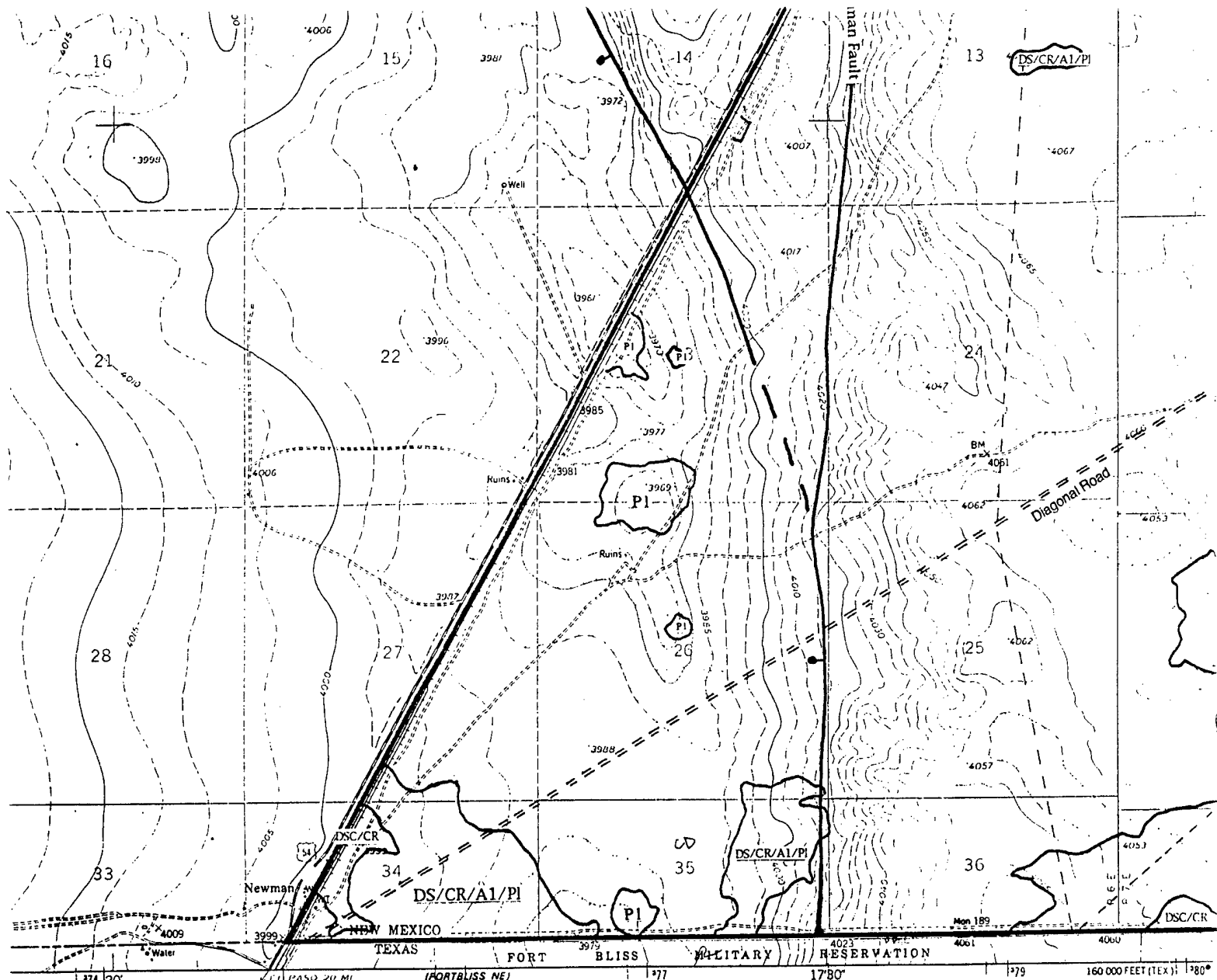
Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955
Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone and Texas coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue
Dashed land lines indicate approximate locations
There may be private inholdings within the boundaries of
the National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	—
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	—
Pediment	P
Playa	P1
Playa Lunette	PIL
¹ See text for explanation	

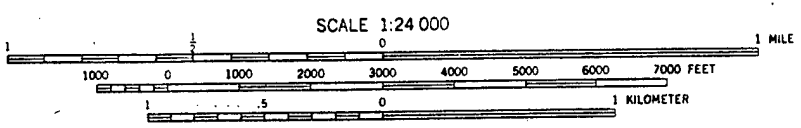


THIS MAP COMPLIES WITH
FOR SALE BY U.S. GEOLOGICAL SURVEY
A FOLDER DESCRIBING TOPOGRAPHY

7



- Geomorphic Symbols**
- A1
 - A2
 - A3
 - B
 - CR
 - DL
 - DP
 - DS
 - DSC
 - DSG
 - P
 - P1
 - PIL

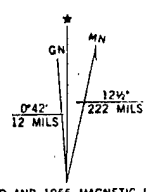


CONTOUR INTERVAL 20 FEET
 DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
 NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

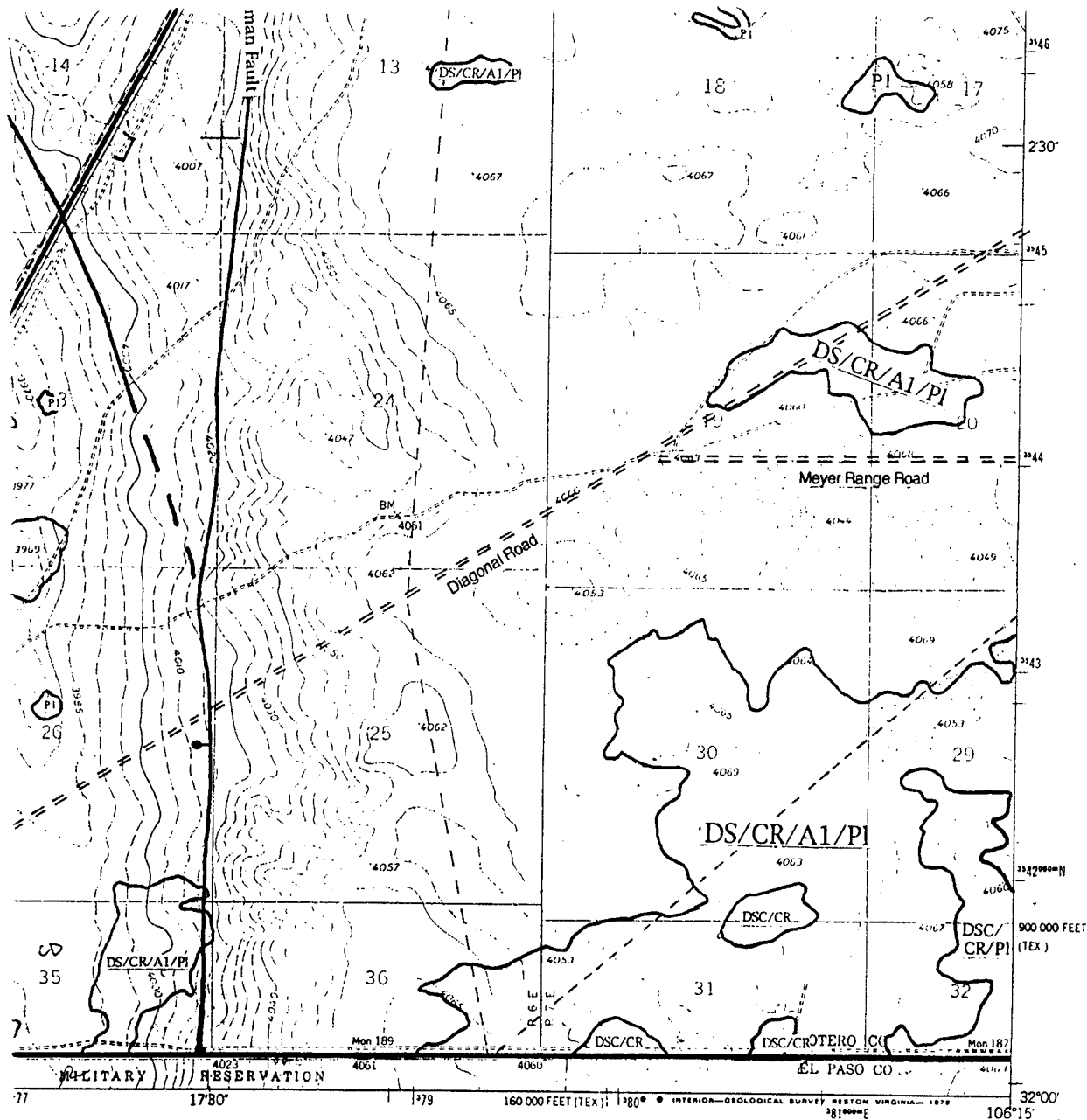


QUADRANGLE LOCATION

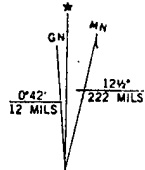


UTM GRID AND 1955 MAGNETIC DECLINATION AT CENTER OF SP

8



1 MILE
7000 FEET
KILOMETER



UTM GRID AND 1955 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Medium-duty ——— Light-duty ———
Unimproved dirt

U.S. Route

NEWMAN, N. MEX.-TEX.

N3200-W10615/7.5

1955

DMA 4748 III SE-SERES V881

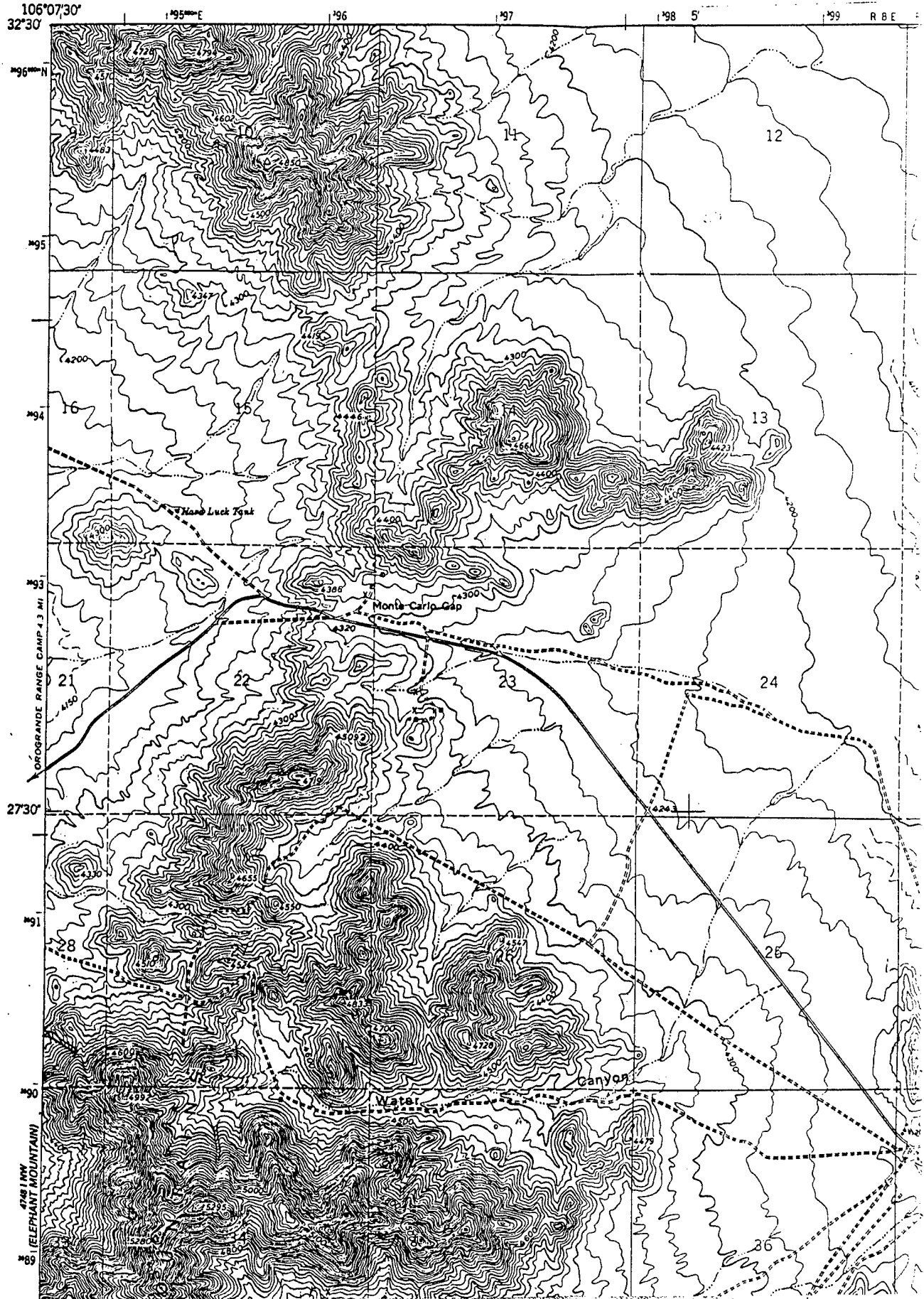
ON, VIRGINIA 22092
REQUEST

9

106°07'30"
32°30'
106°07'30"
32°30'

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

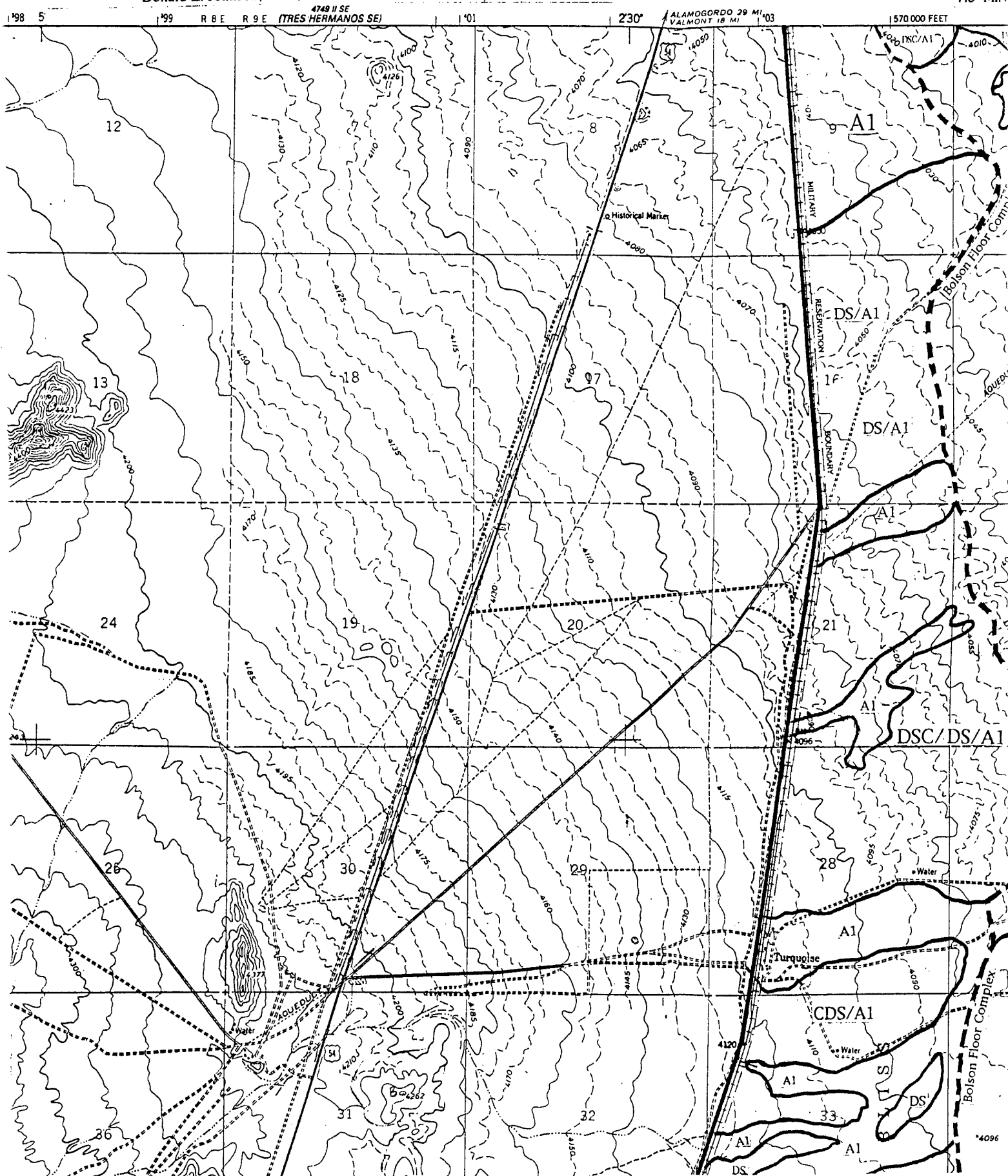
Geomorphological, Geocological
Study of McGregor G
Donald L. Johnson



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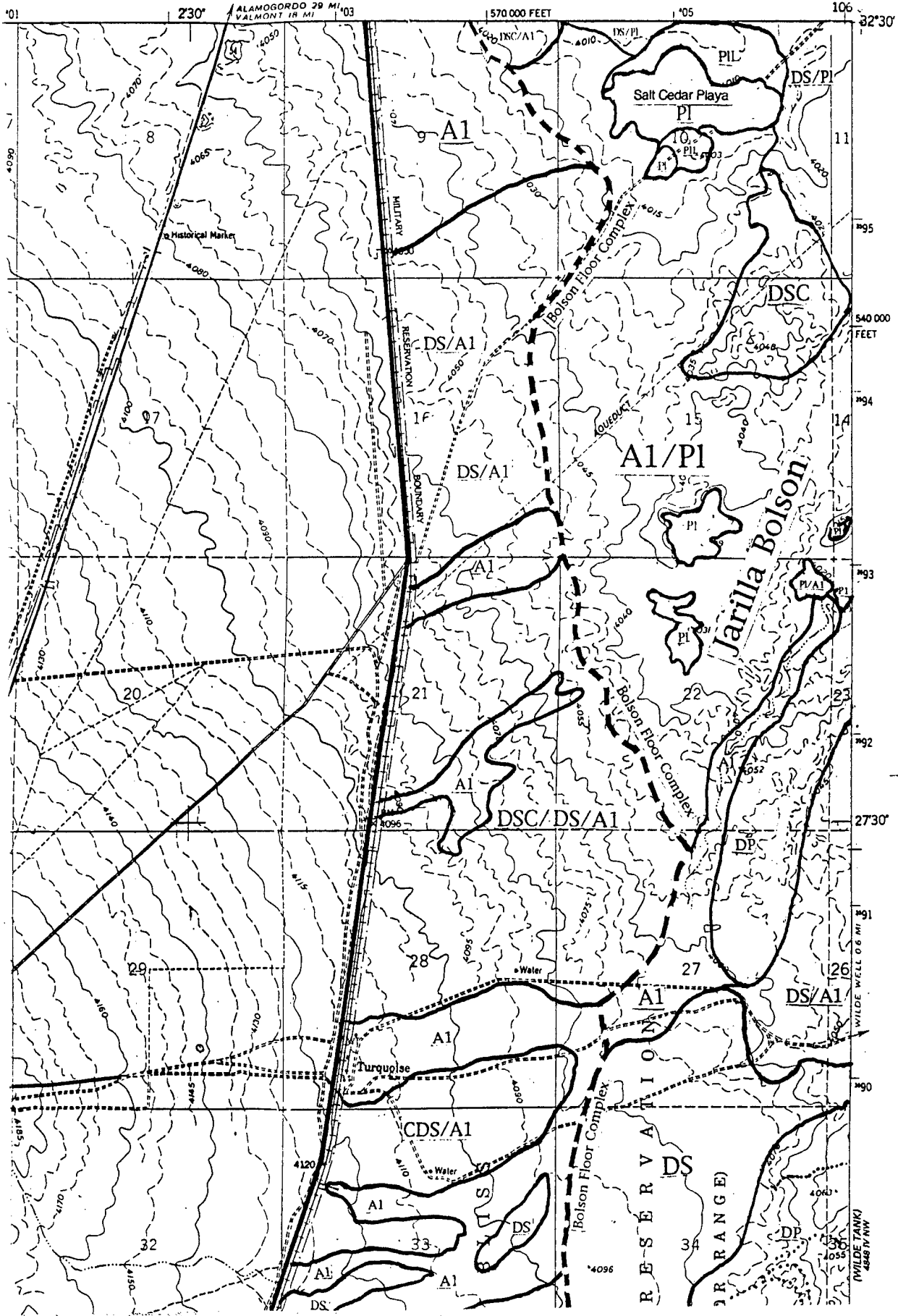
OROGRA
NE
7.5-MIN

Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

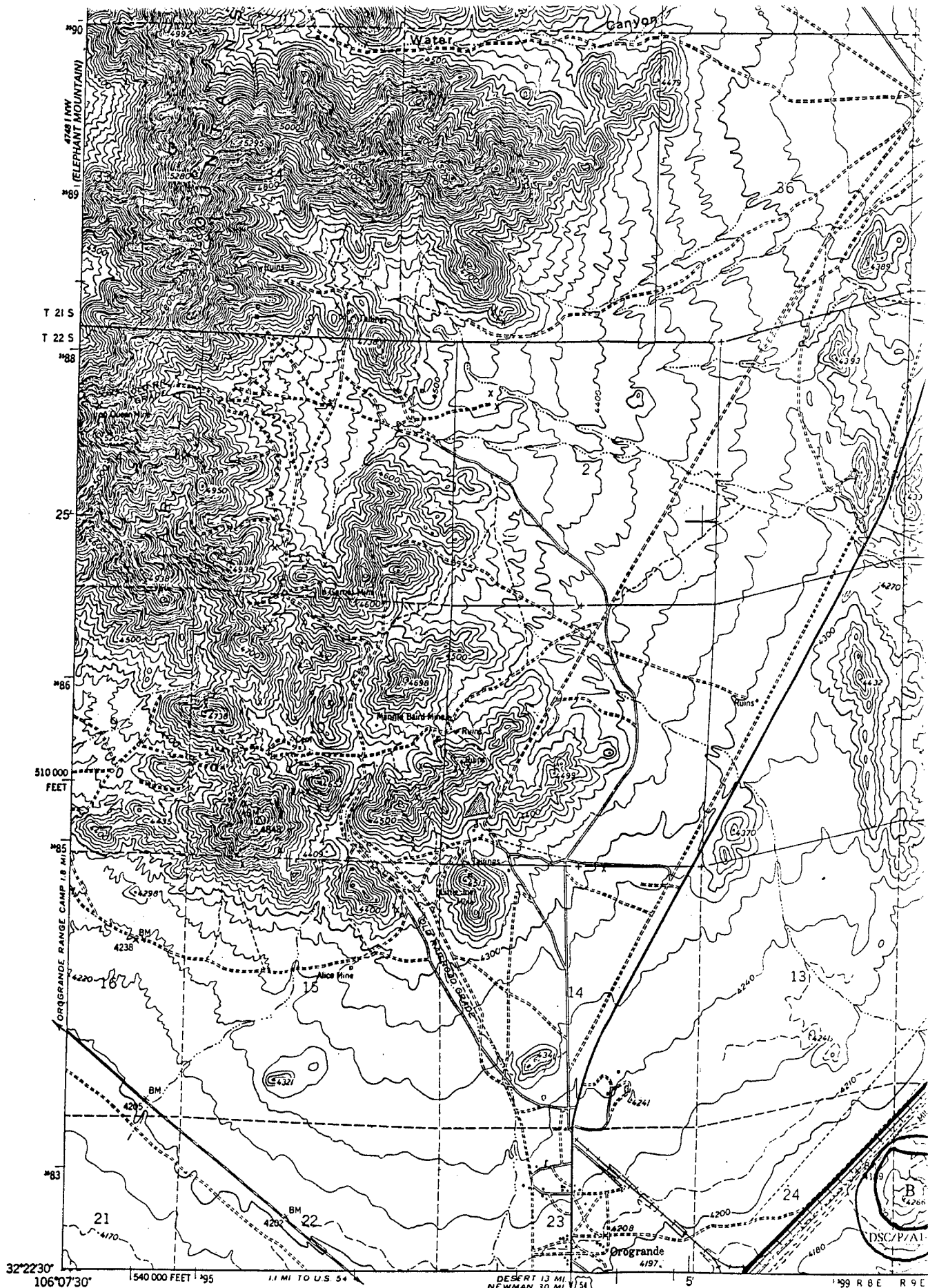


2

400' BY
1/2" = 1 MILE



3



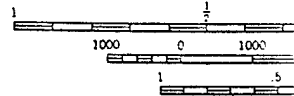
(B1, WOOD)
4146 150

Mapped by the Defense Mapping Agency
Produced by the United States Geological Survey
Control by USGS, NOS/NOAA and USCE

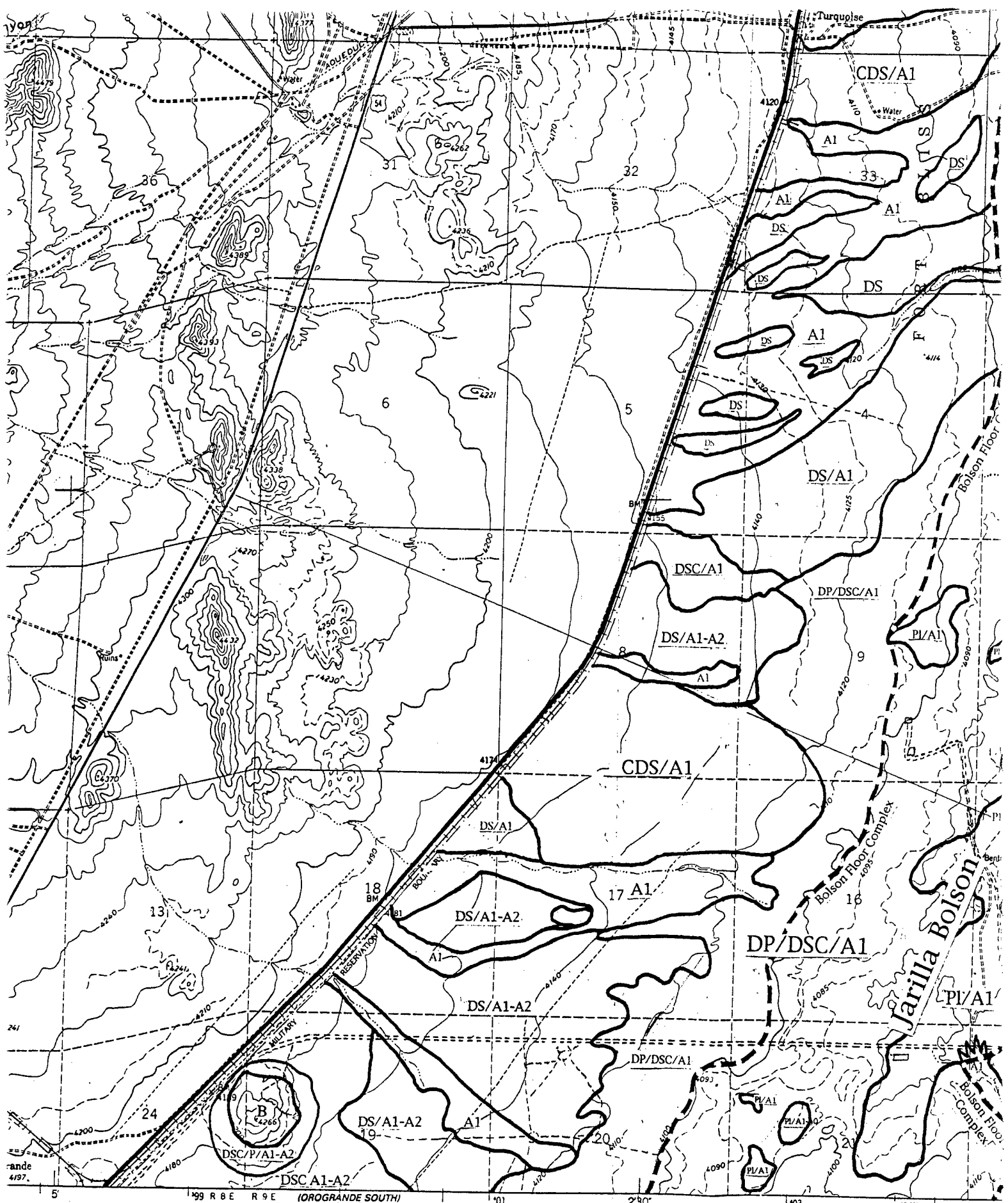
Compiled from aerial photographs taken 1954. Field checked 1955
North American Datum of 1927 (NAD 27). Projection and
10000-foot ticks: New Mexico Coordinate System, central zone
(Transverse Mercator)
Blue 1000-meter Universal Transverse Mercator ticks, zone 13
North American Datum of 1983 (NAD 83) is shown by dashed
corner ticks. The values of the ticks between NAD 27 and NAD 83

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DL
Dune, Pile	DL



CO
SUPPLEMENTA
NATIONAL



hic
ls¹
A1
A2
A3
B
CR
DL
DP

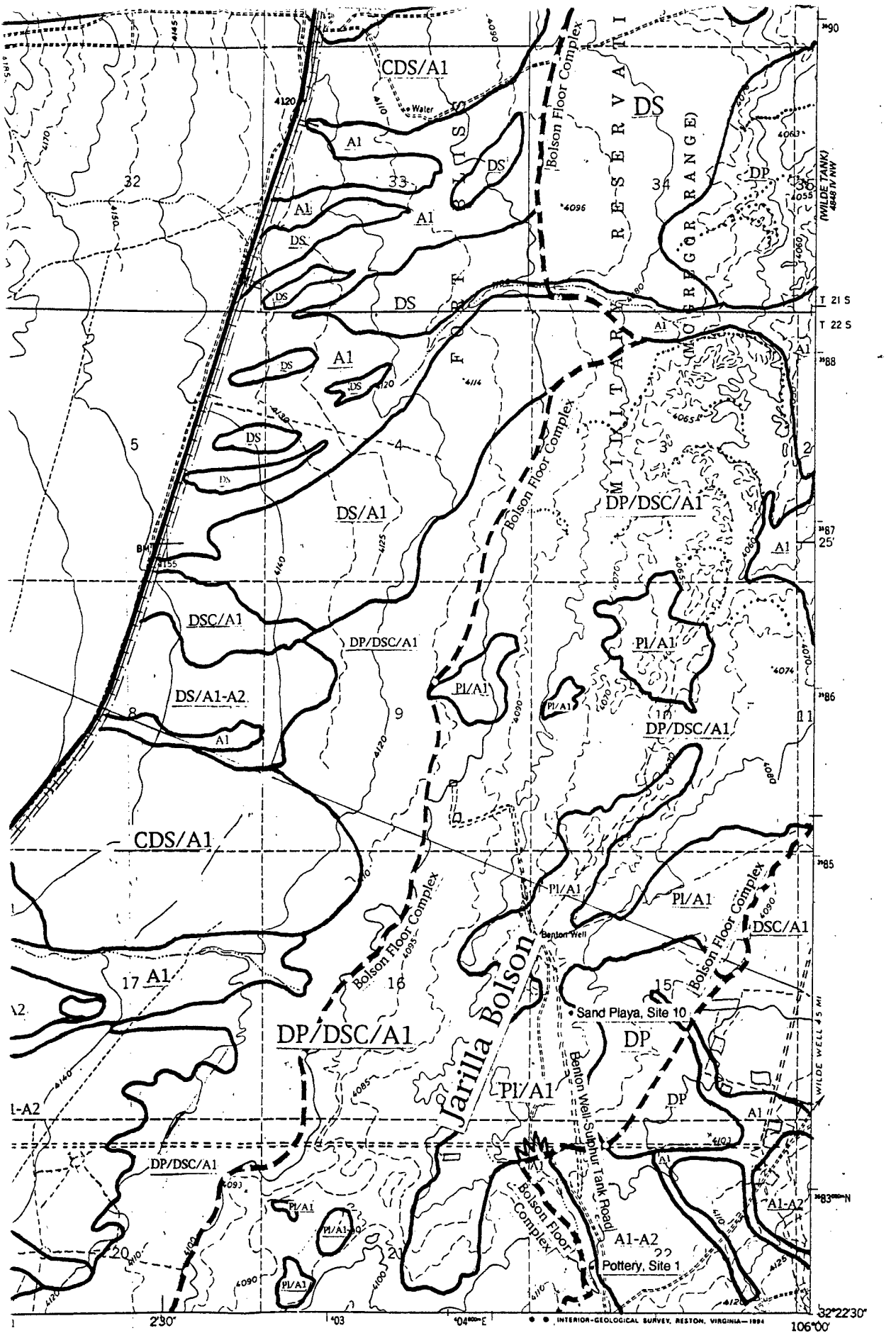
SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 5 AND 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1989

Primary highway,
hard surface
Secondary highway,
hard surface
Interstate R

NEW MEXICO

GN



1 MILE
7000 FEET
1 KILOMETER

NEW MEXICO

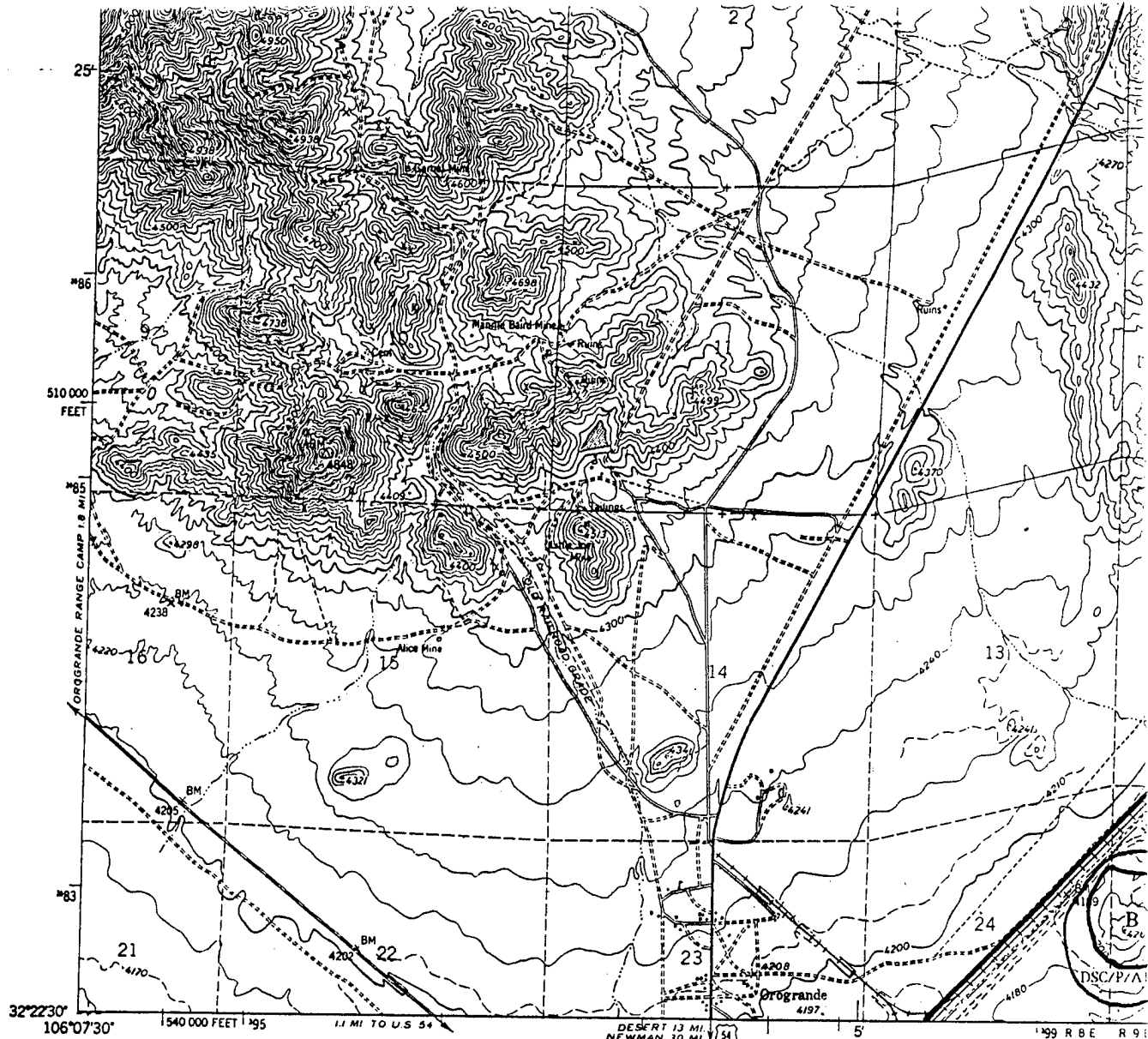


ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road

Interstate Route U. S. Route State Route

(MACK TANKS)
4848 IV NW

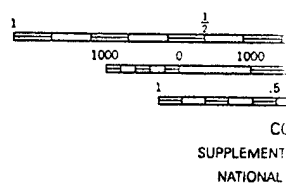


ELWOOD
2141.5W

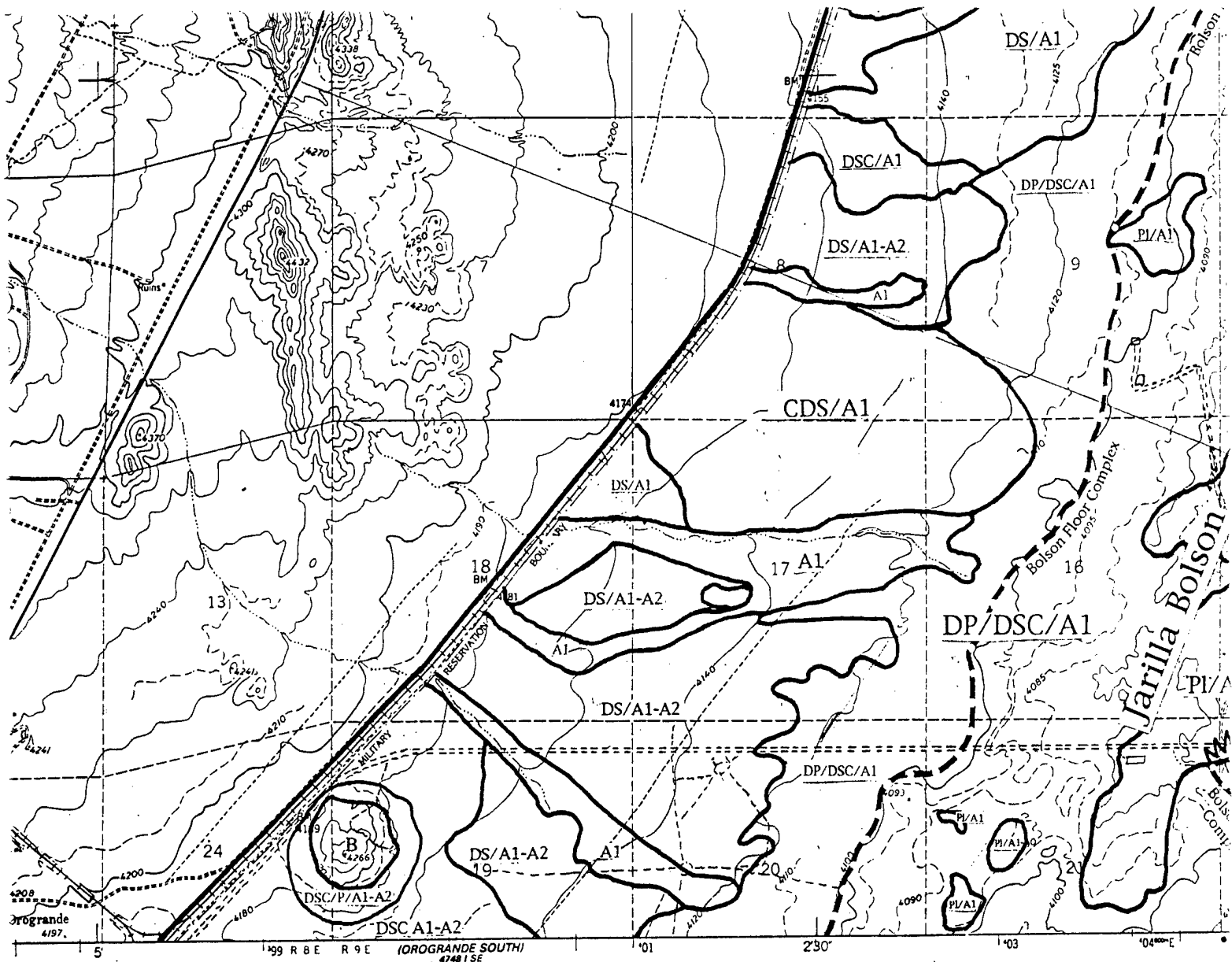
Mapped by the Defense Mapping Agency
Produced by the United States Geological Survey
Control by USGS, NOS/NOAA and USCE
Compiled from aerial photographs taken 1954. Field checked 1955
North American Datum of 1927 (NAD 27). Projection and
10000-foot ticks: New Mexico Coordinate System, central zone
(Transverse Mercator)
Blue 1000-meter Universal Transverse Mercator ticks, zone 13
North American Datum of 1983 (NAD 83) is shown by dashed
corner ticks. The values of the shift between NAD 27 and NAD 83
for 7.5-minute intersections are obtainable from National Geodetic
Survey NADCON software
There may be private inholdings within the boundaries of the
National or State reservations shown on this map
Photinspected from 1990 source; no major culture or
drainage changes observed. Boundaries and names
revised 1994

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSC
Fault	
Pediment	P
Playa	P1
Playa Lunette	P1L

¹See text for explanation



THIS MAP COM
FOR SALE BY U. S. GEOLOGICAL S
A FOLDER DESCRIBING TO:



- Morphic mbols**
- A1
 - A2
 - A3
 - B
- nts**
- CR ●●●
 - DL
 - DP
 - DS
 - DSC
 - DSG
 - P
 - P1
 - PIL

SCALE 1:24 000

1 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
SUPPLEMENTARY CONTOUR INTERVAL 5 AND 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Primary high
hard surface
Secondary high
hard surface
Inters

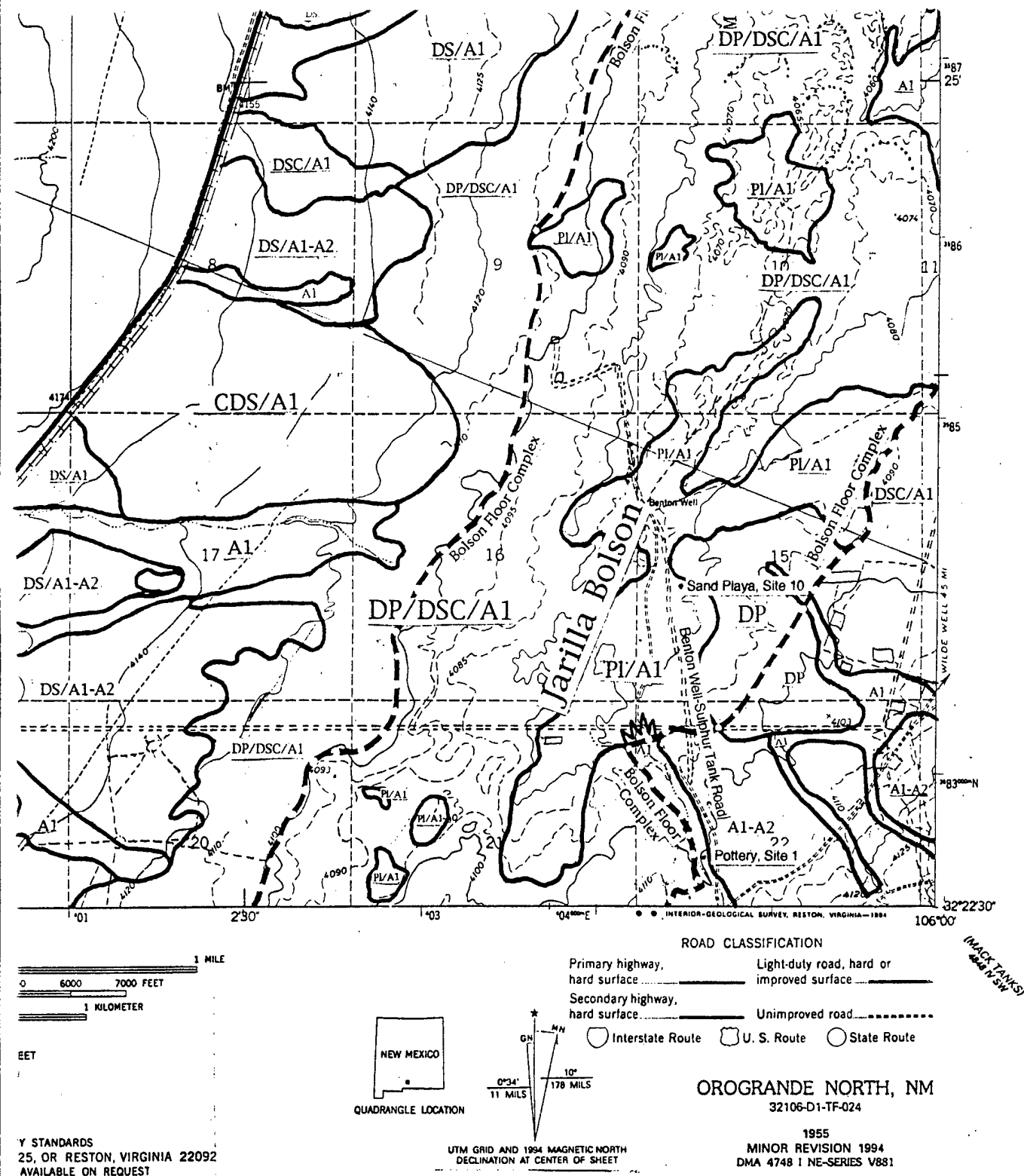
NEW MEXICO

QUADRANGLE LOCATION

UTM GRID AND 1994 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

0°34' 11 MILS
10° 178 MILS

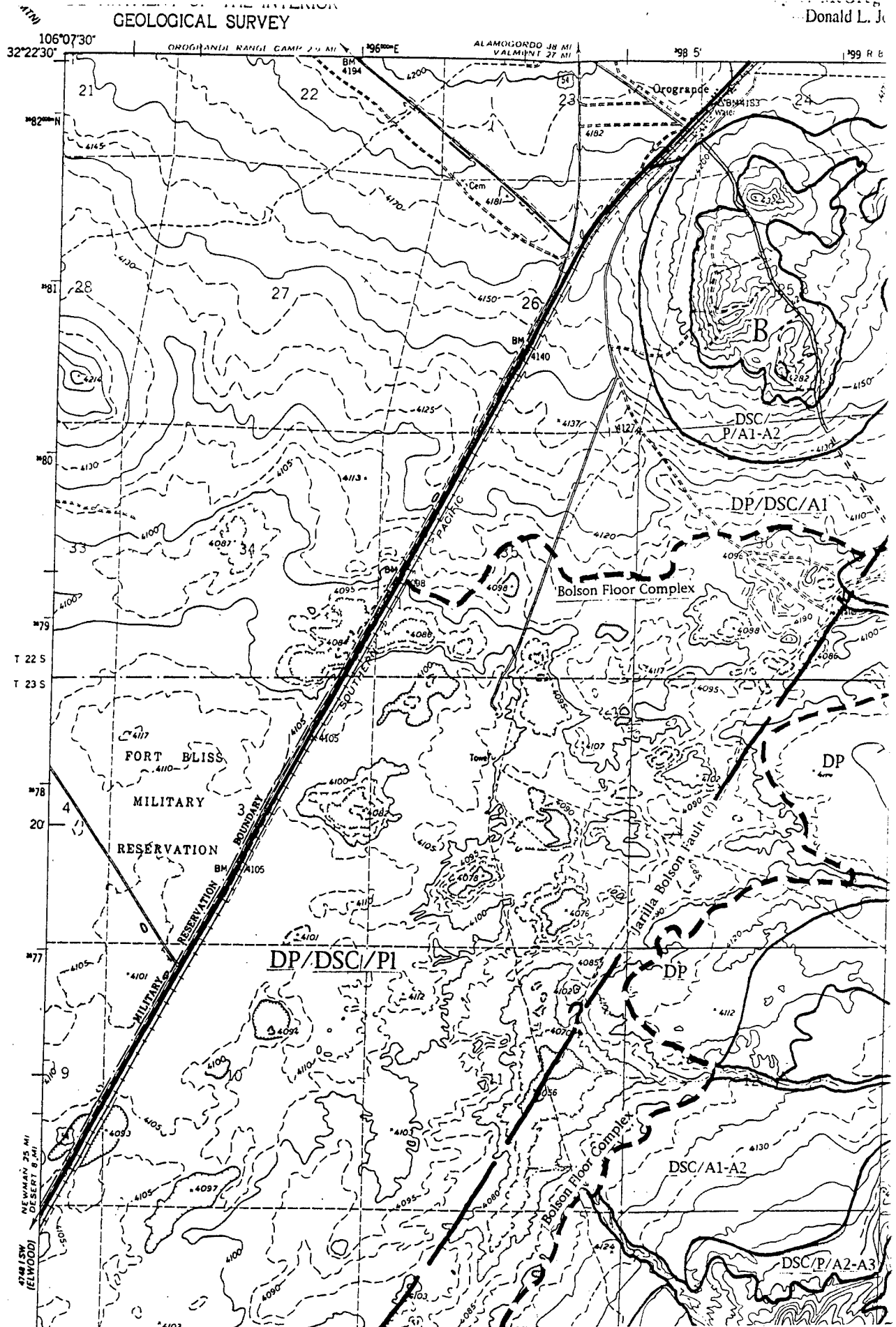
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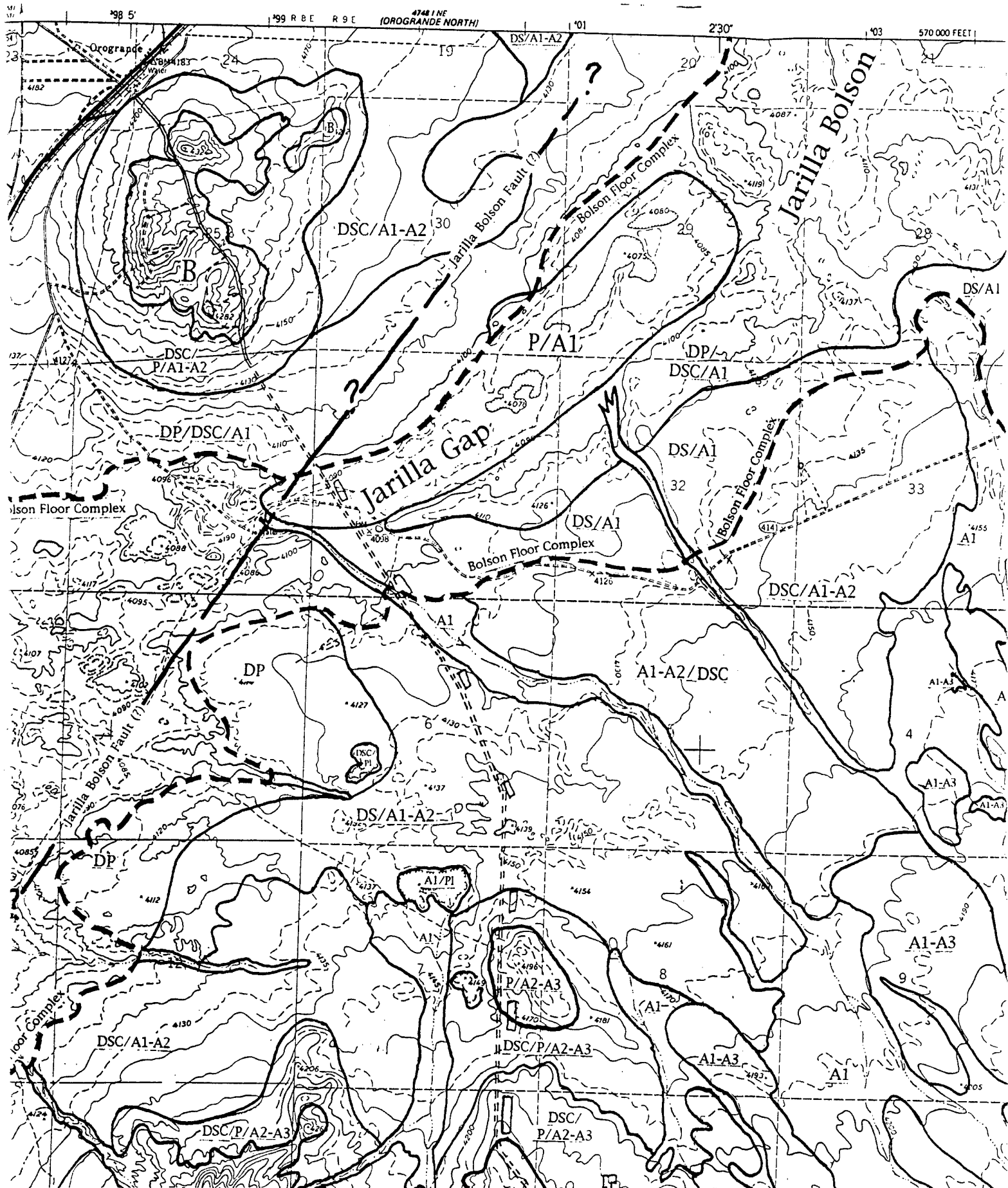


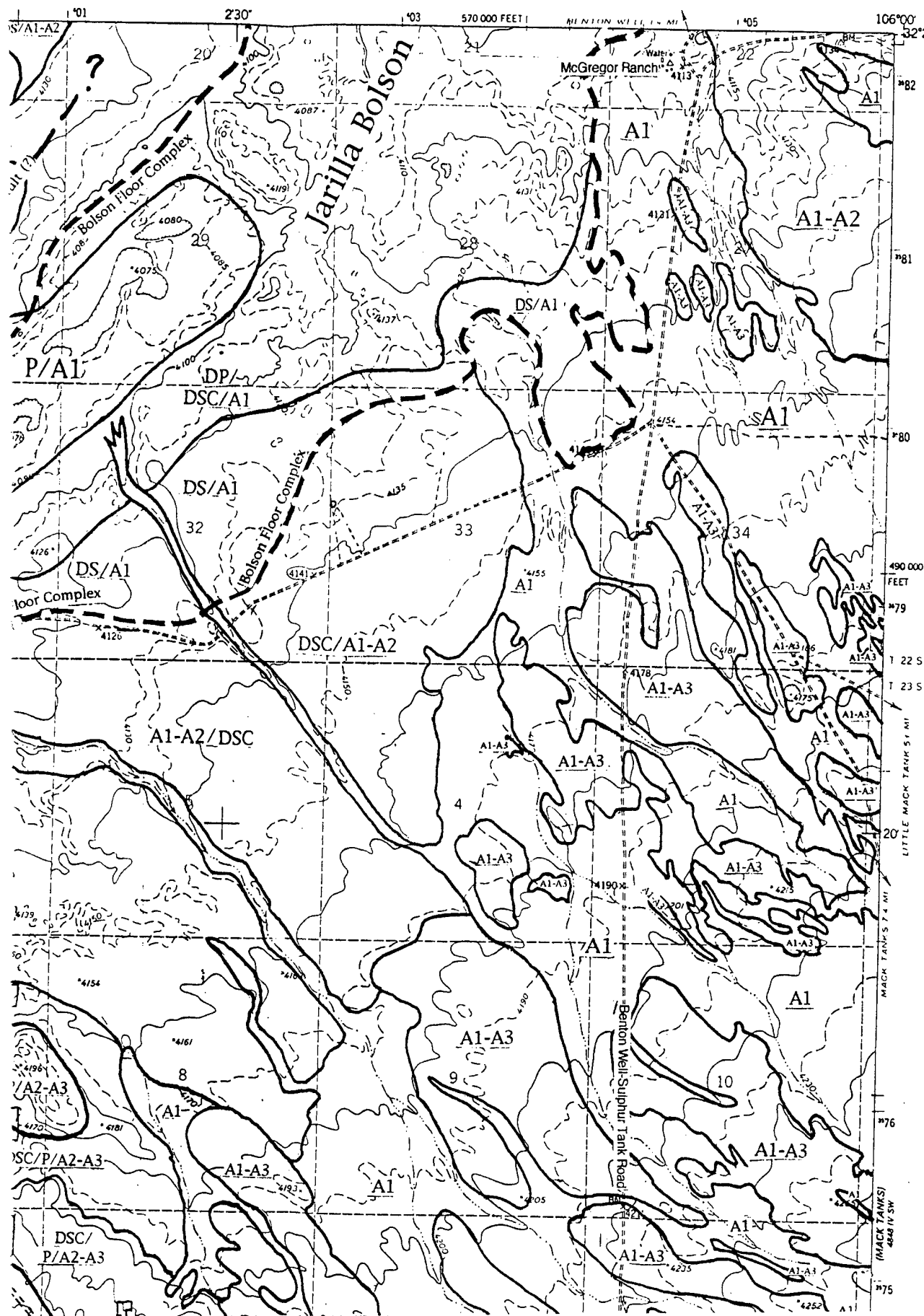
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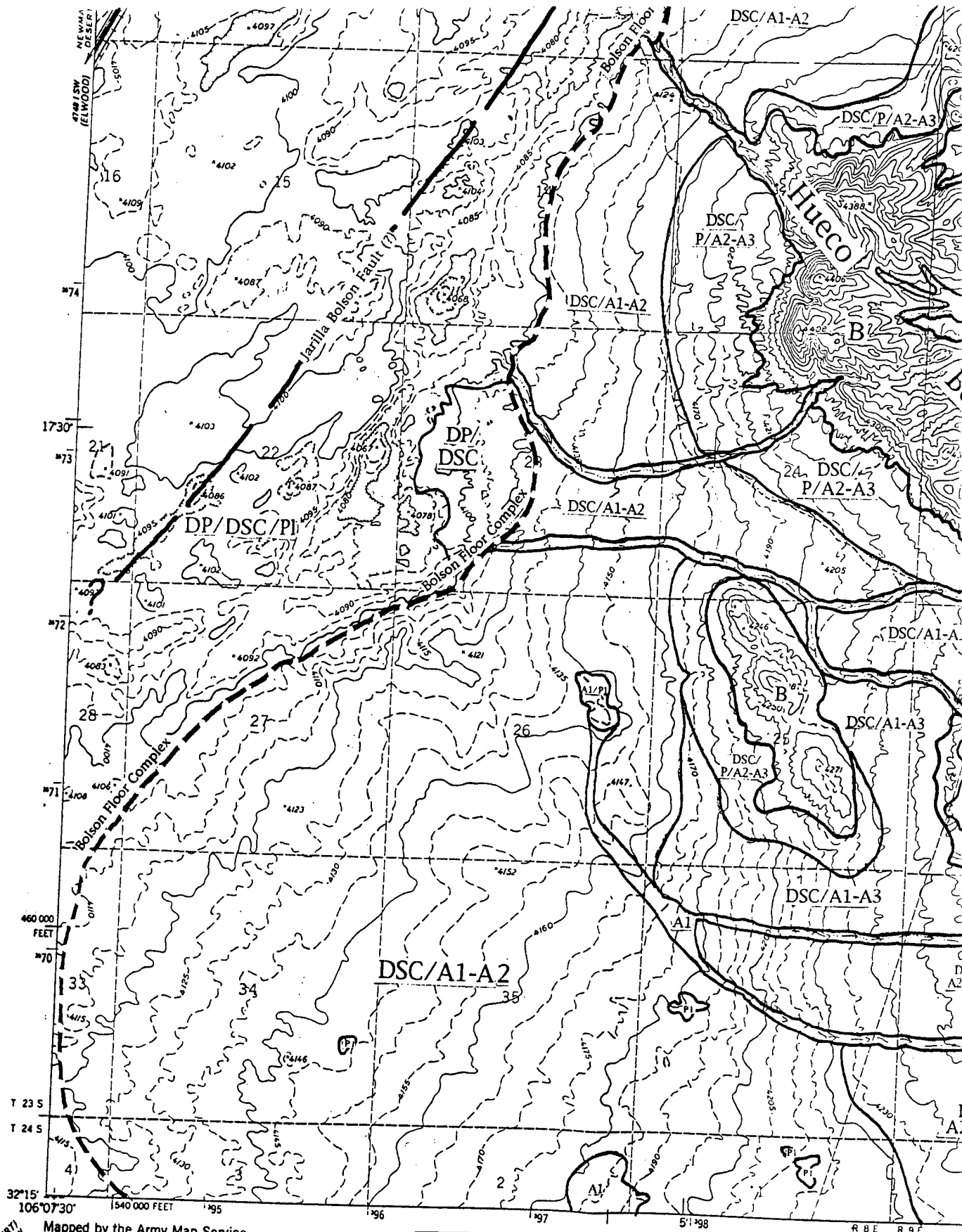
GEOLOGICAL SURVEY

Donald L. J.









DESERT
4146 N 10W

Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USC&GS, and USCE

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955

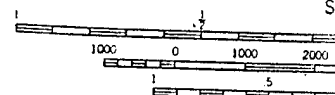
Polyconic projection. 1927 North American Datum
10,000-foot grid based on New Mexico coordinate system
central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue

Dashed land lines indicate approximate locations
Land lines omitted in T.24S.-R.9E. because of insufficient data

Fine red dashed lines indicate selected fence and field lines
where generally visible on aerial photographs
This information is unchecked

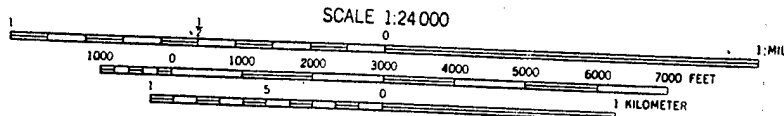
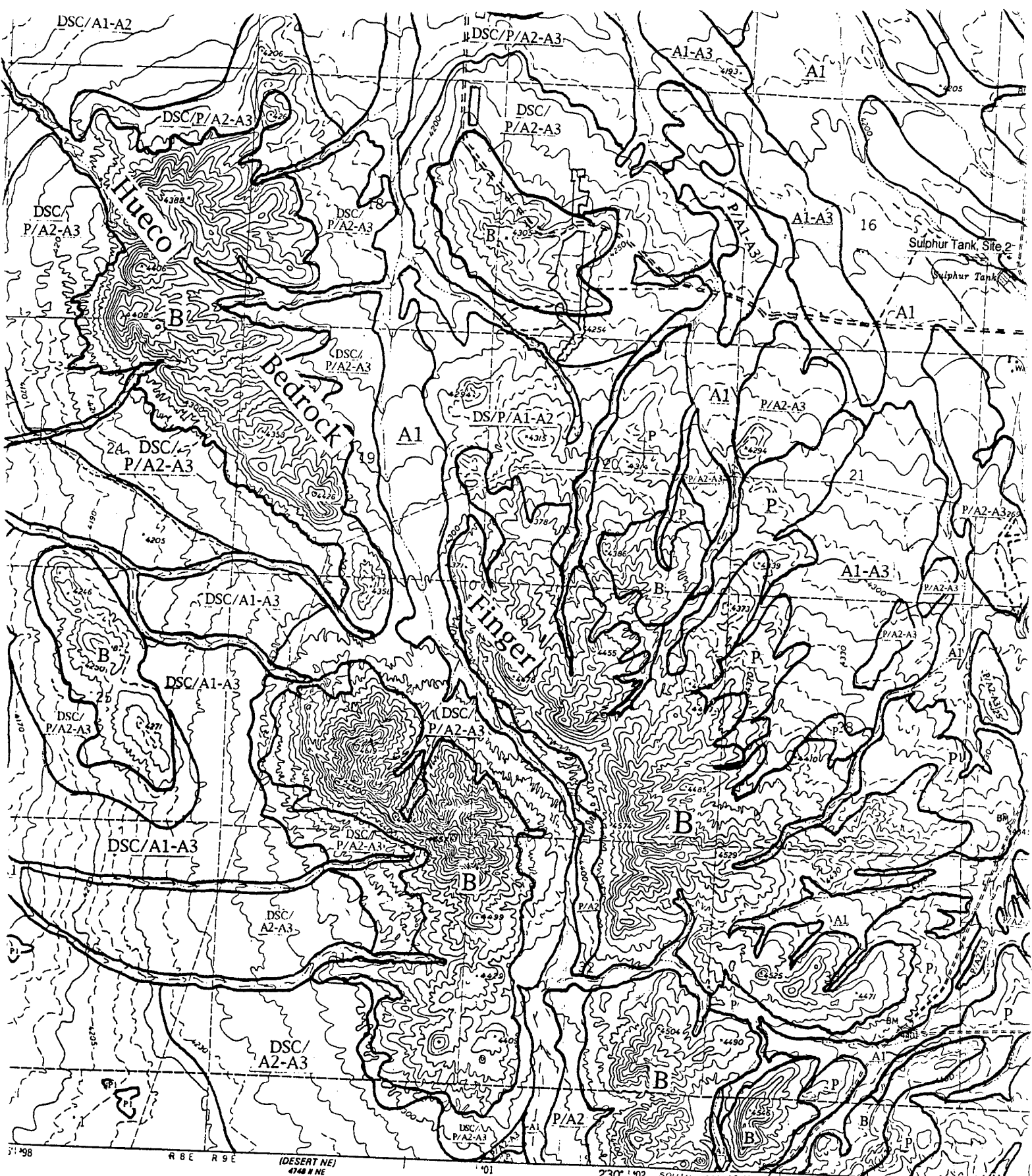
McGregor Range Geomorphic Mapping Units and Symbols

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR
Dune, Local	DL
Dune, Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSC
Fault	DL
Pediment	P
Playa	PI

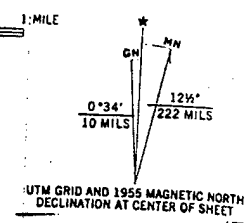


CONTOUR
DASHED LINES REPRESENT
NATIONAL GEOGRAPHIC

THIS MAP COMPLIES WITH
FOR SALE BY U.S. GEOLOGICAL SURVEY, DE
A FOLDER DESCRIBING TOPOGRAPHIC



CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

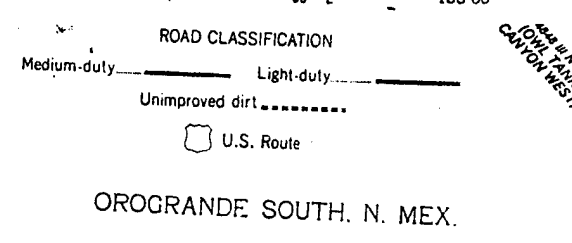
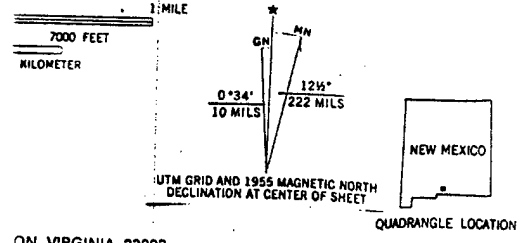
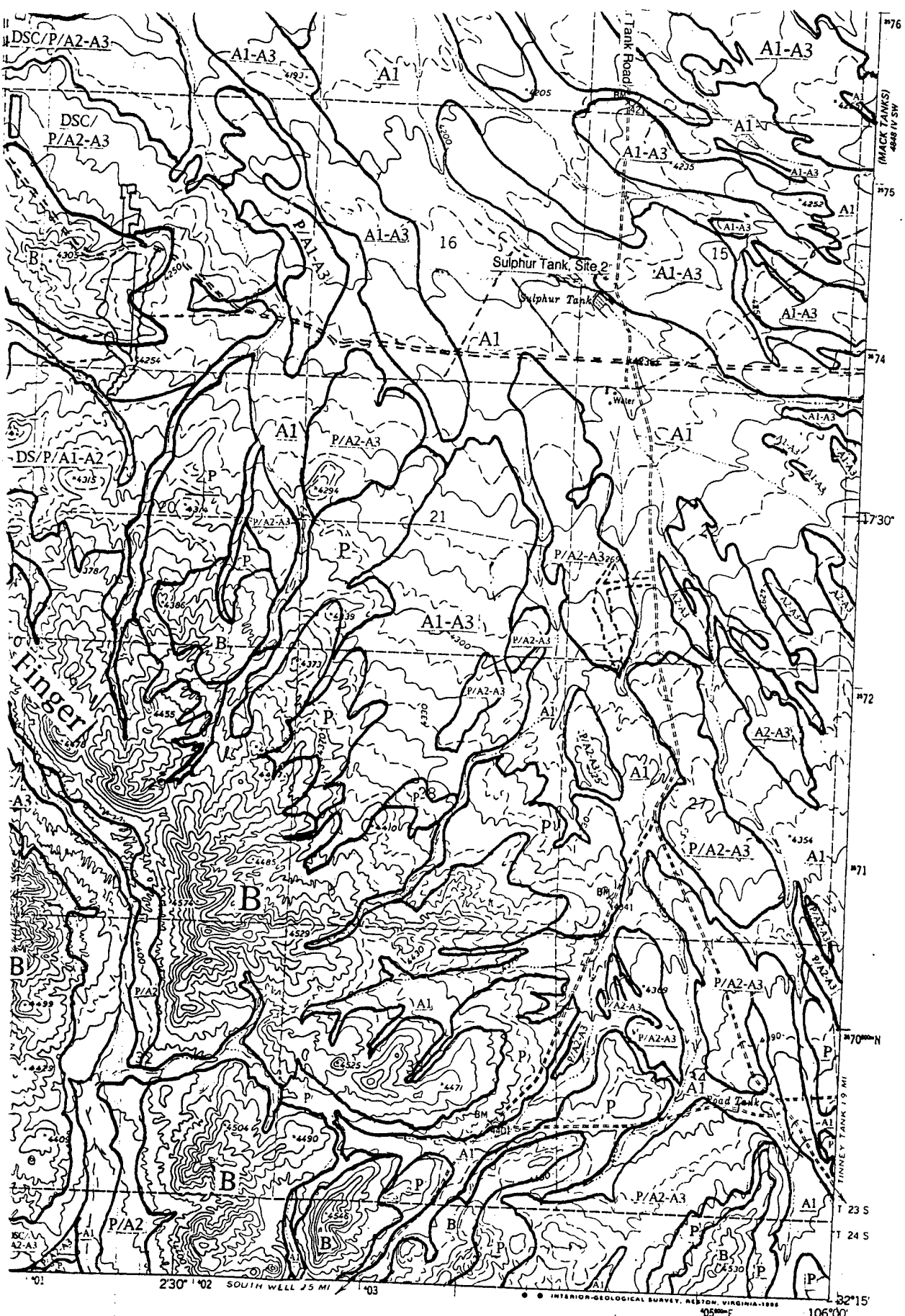


ROAD
Medium-duty
Unimpro

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE

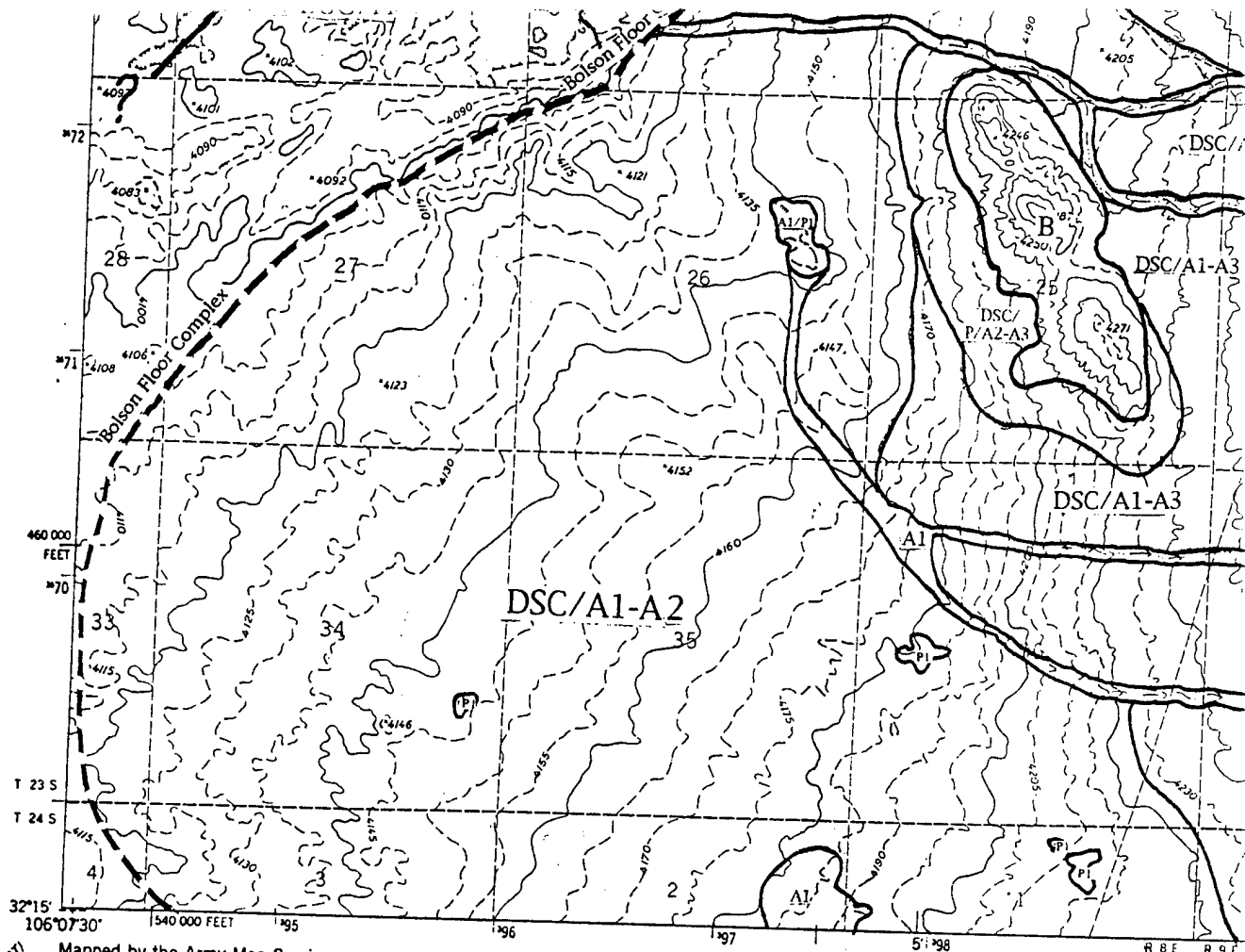
QUADRANGLE LOCATION

OROGRAI



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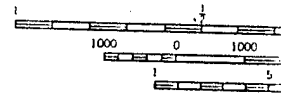
91



DESERT
7148 2 NW

Mapped by the Army Map Service
Published for civil use by the Geological Survey
Control by USGS, USC&GS, and USCE
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1954. Photography field annotated 1955
Polyconic projection. 1927 North American Datum
10,000-foot grid based on New Mexico coordinate system
central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue
Dashed land lines indicate approximate locations
Land lines omitted in T.24S.-R.9E. because of insufficient data
Fine red dashed lines indicate selected fence and field lines
where generally visible on aerial photographs
This information is unchecked

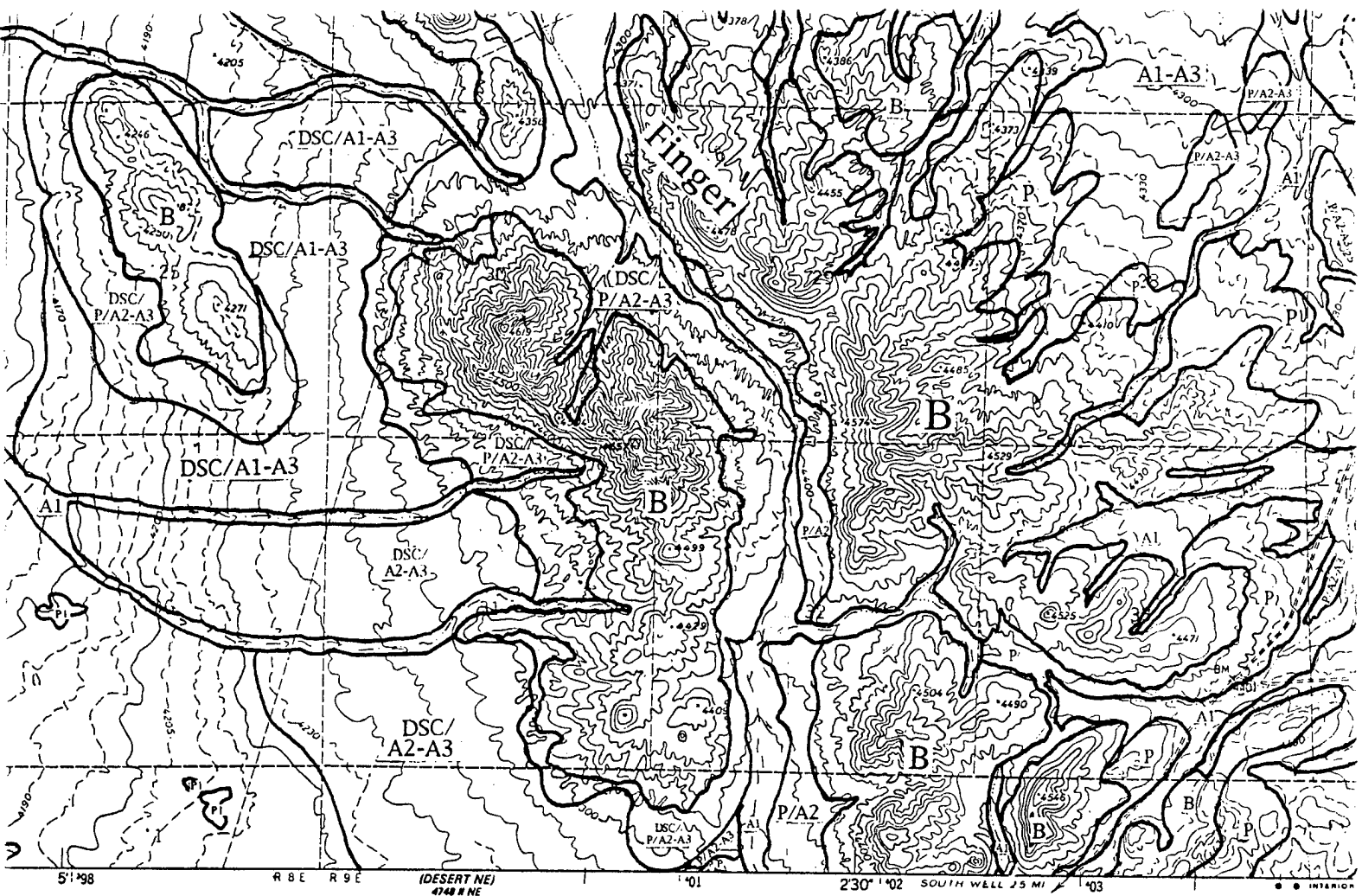
McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	—
Pediment	P
Playa	PI
Playa Lunette	PIL
¹ See text for explanation	



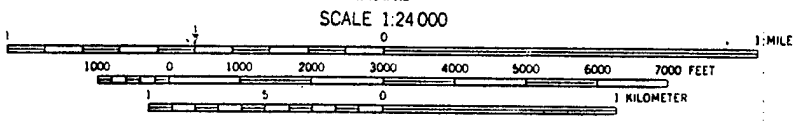
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THIS MAP COMPLETES
FOR SALE BY U. S. GEOLOGICAL SURV
A FOLDER DESCRIBING TOPOGR.

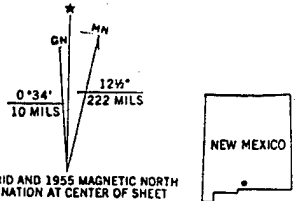
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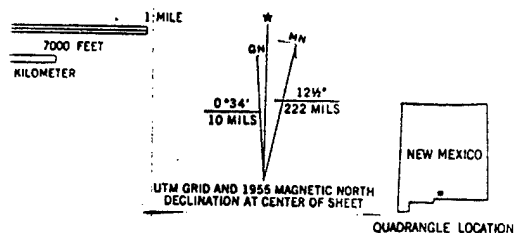
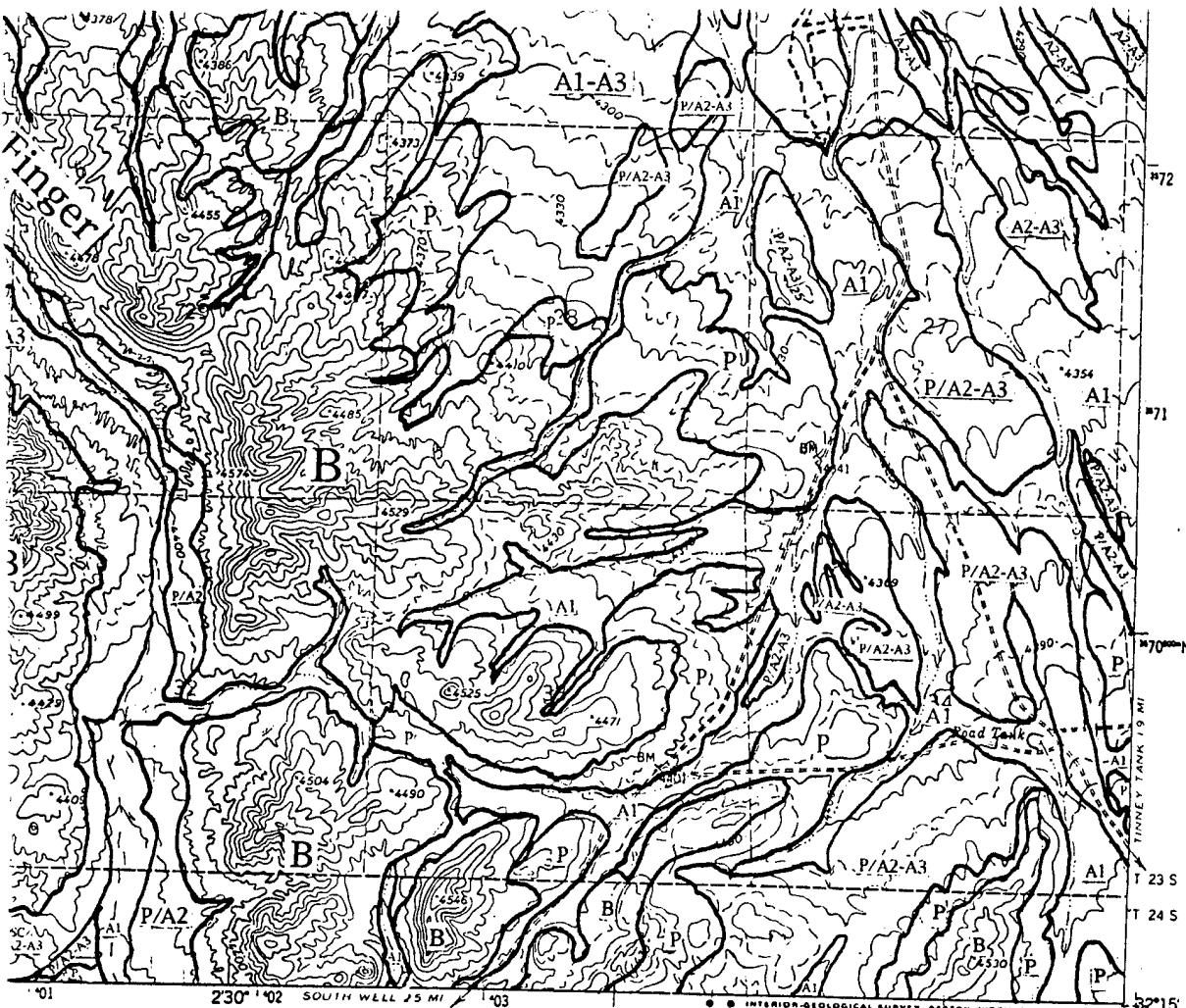


CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 5 AND 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

8



ROAD CLASSIFICATION

Medium-duty _____ Light-duty _____

Unimproved dirt

U.S. Route

OROGRANDE SOUTH, N. MEX.

32106-C1-TF-024

1955

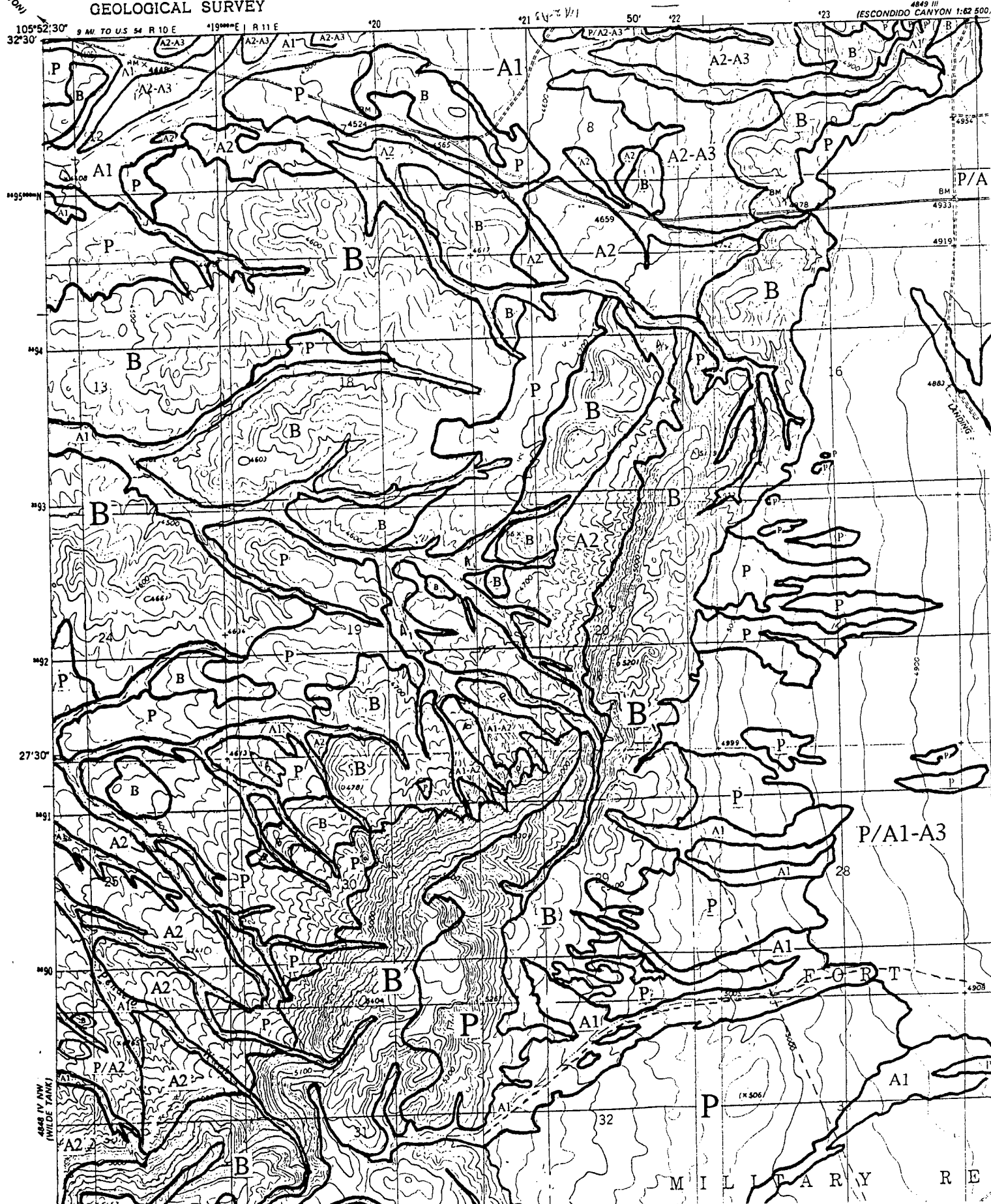
DMA 4748 I SE-SERIES V881

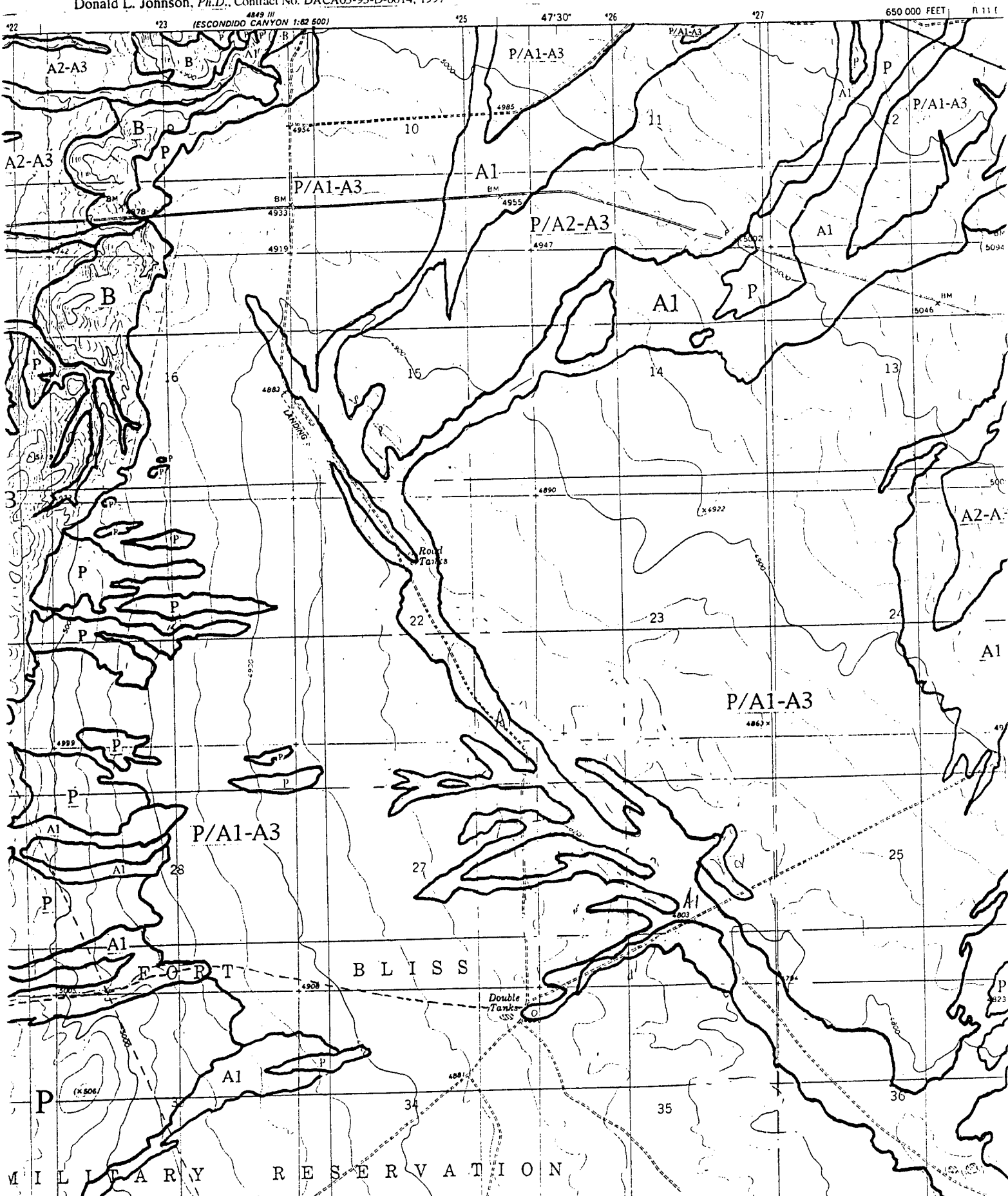
ON, VIRGINIA 22092
REQUEST

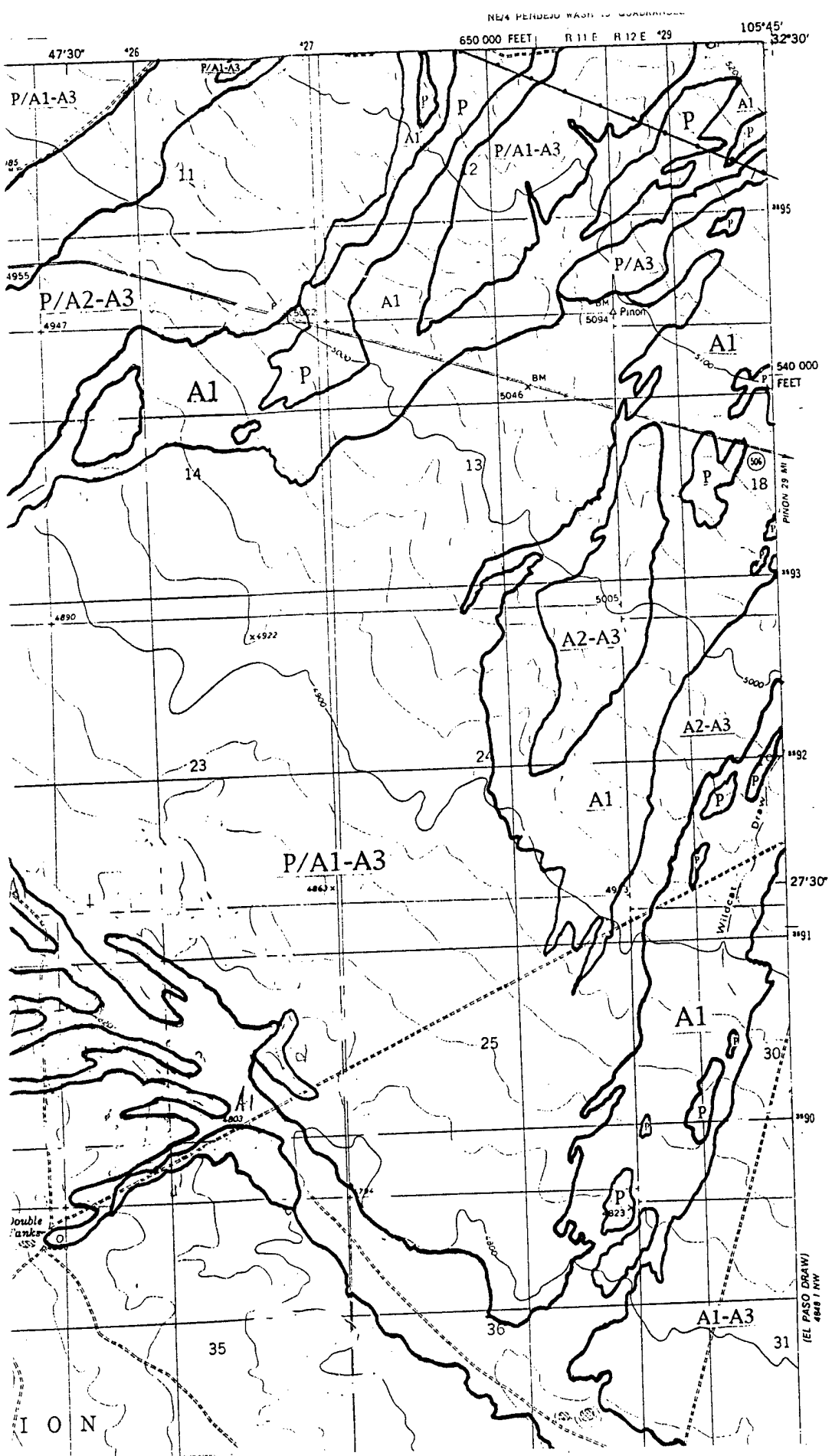
444 444 444
JOHN TANK
CANYON (WEST)

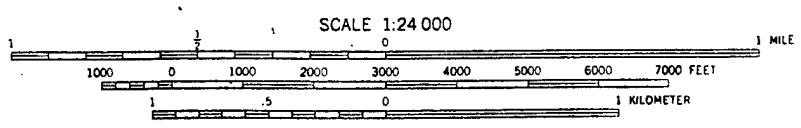
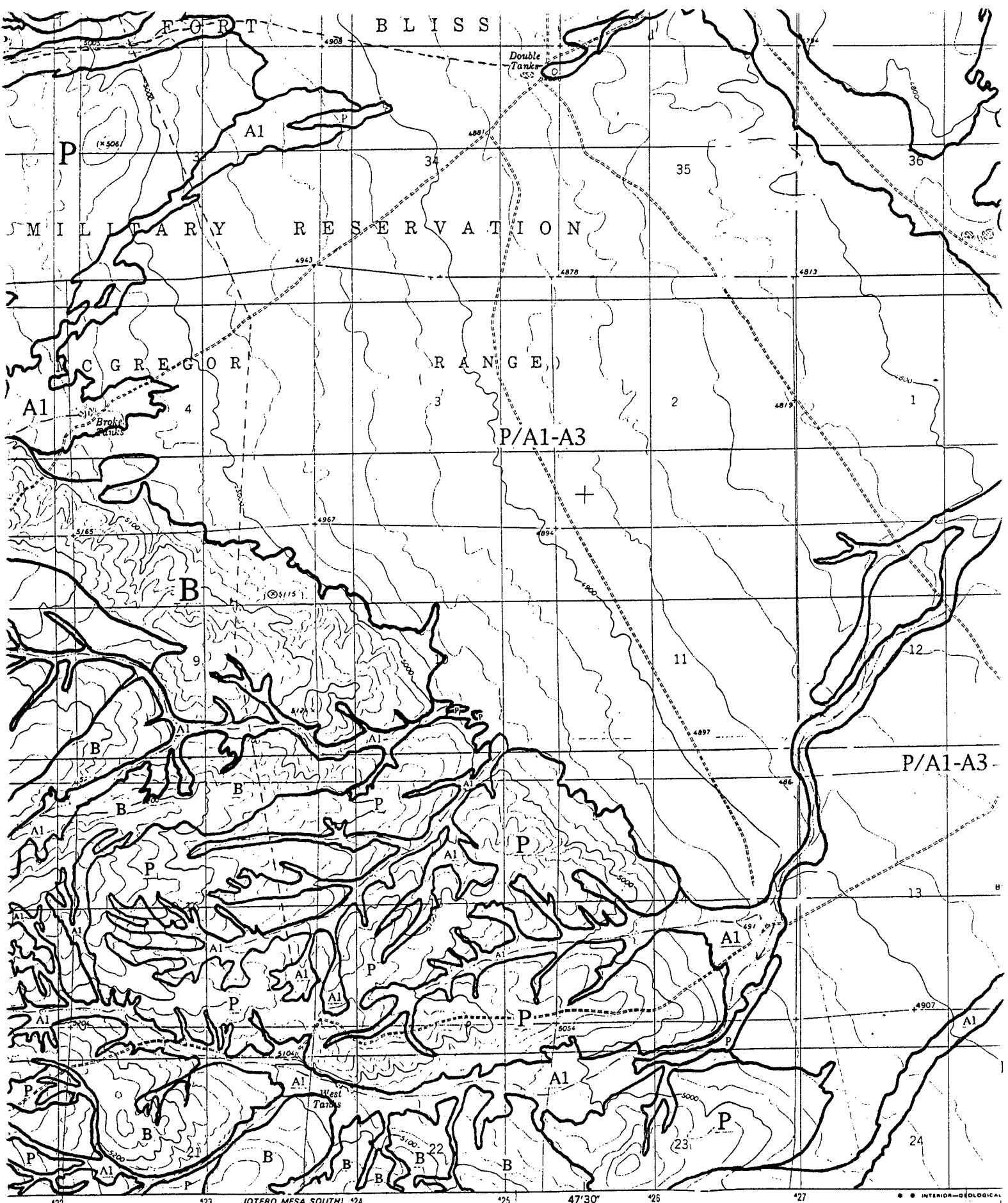
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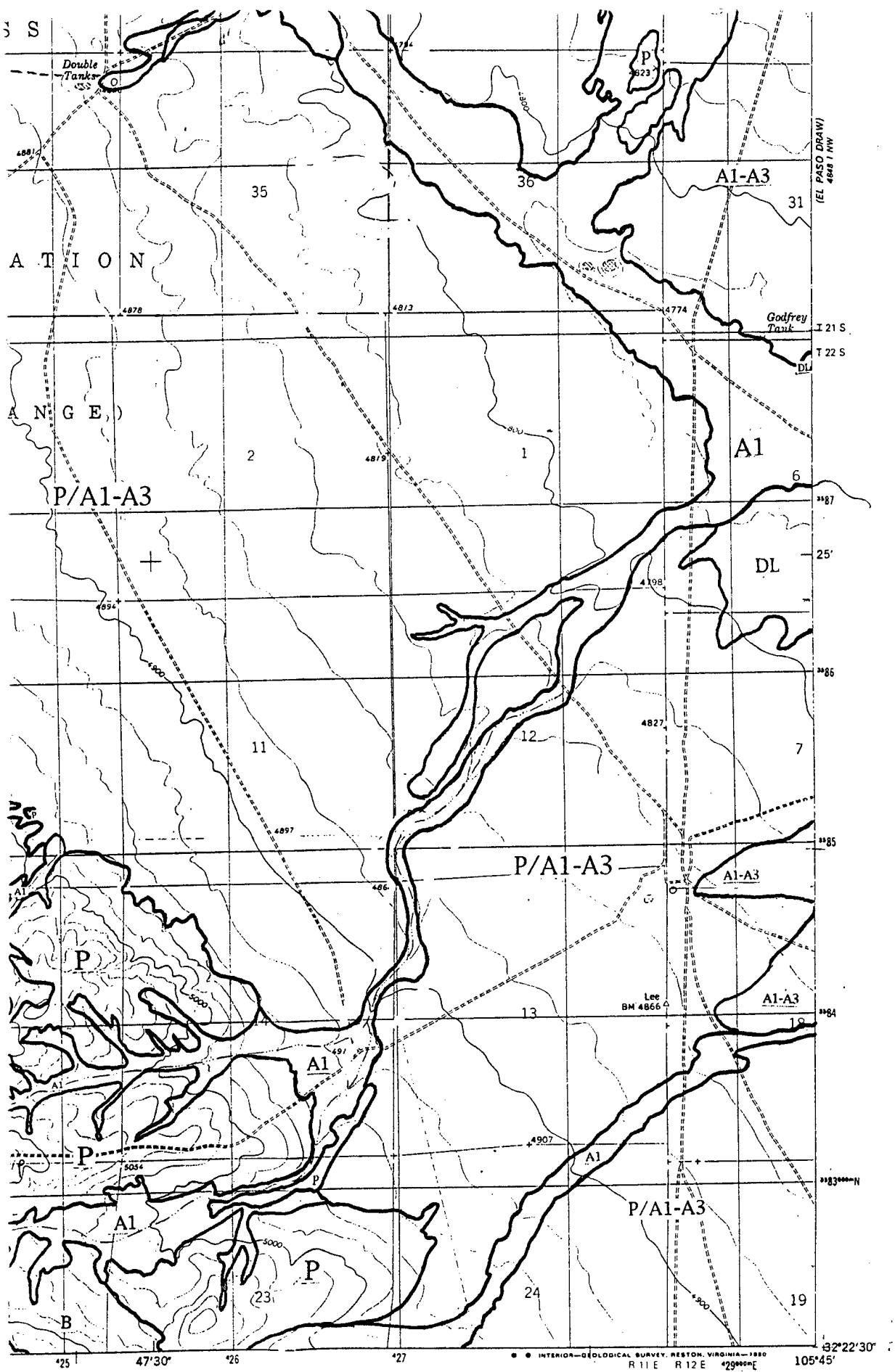




CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

- ROAD CL
- Primary highway, hard surface
 - Secondary highway, hard surface
 - Interstate Route





INTERIOR-GEOLOGICAL SURVEY, RESTON, VIRGINIA-1980
R 11 E R 12 E 4200000

ROAD CLASSIFICATION

- Primary highway, hard surface
- Secondary highway, hard surface
- Light-duty road, hard or improved surface
- Unimproved road
- Interstate Route
- U. S. Route
- State Route

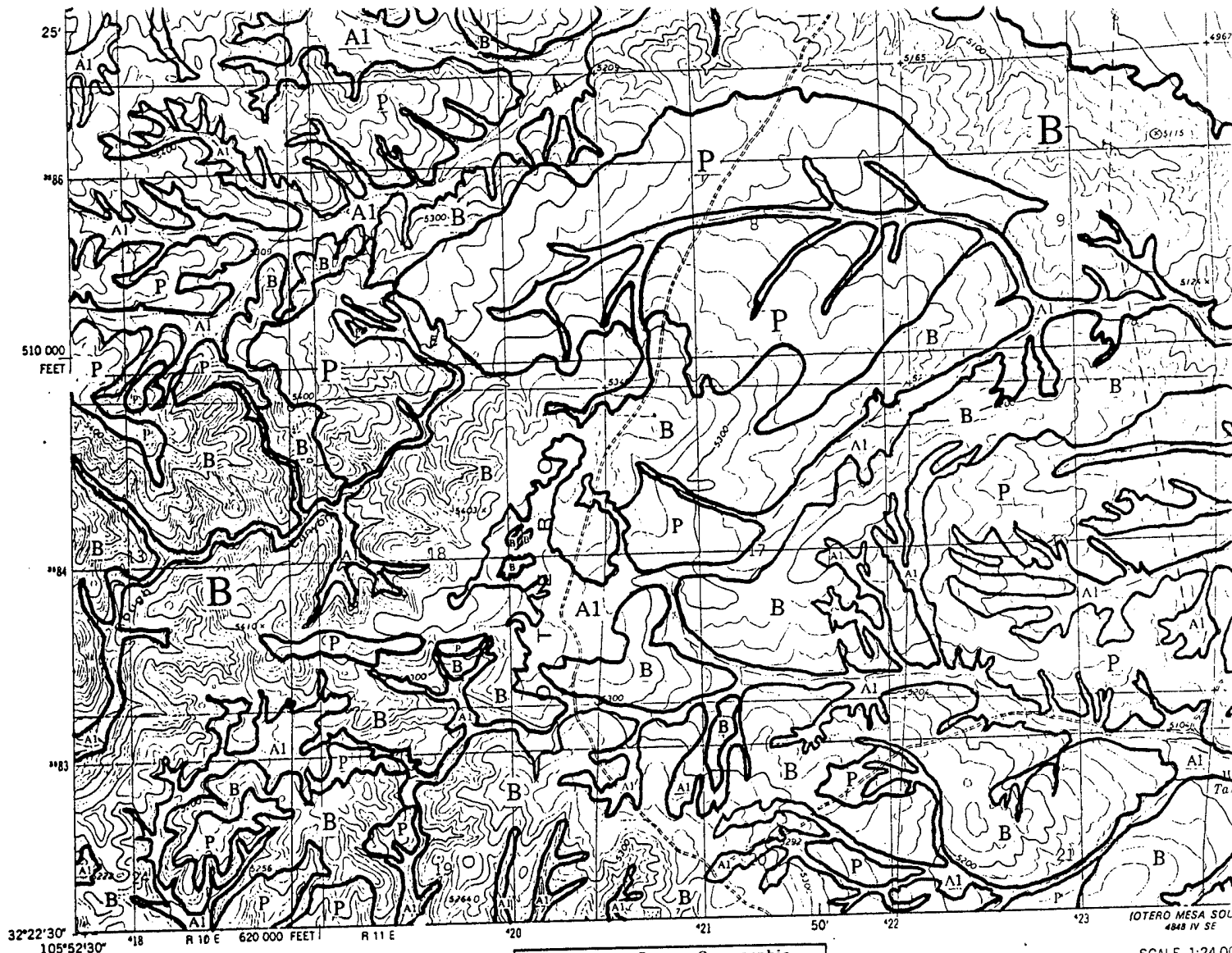
1 MILE
7000 FEET
Kilometer

NEW MEXICO

GN MN

(STONE WELL)
4848 1 NW

6



(MACK TANKS)
4848 IV SW

Mapped, edited, and published by the Geological Survey
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Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1976. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

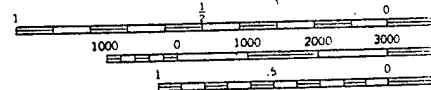
There may be private inholdings within the boundaries of the
National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR•••
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet	DSC
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	

¹See text for explanation

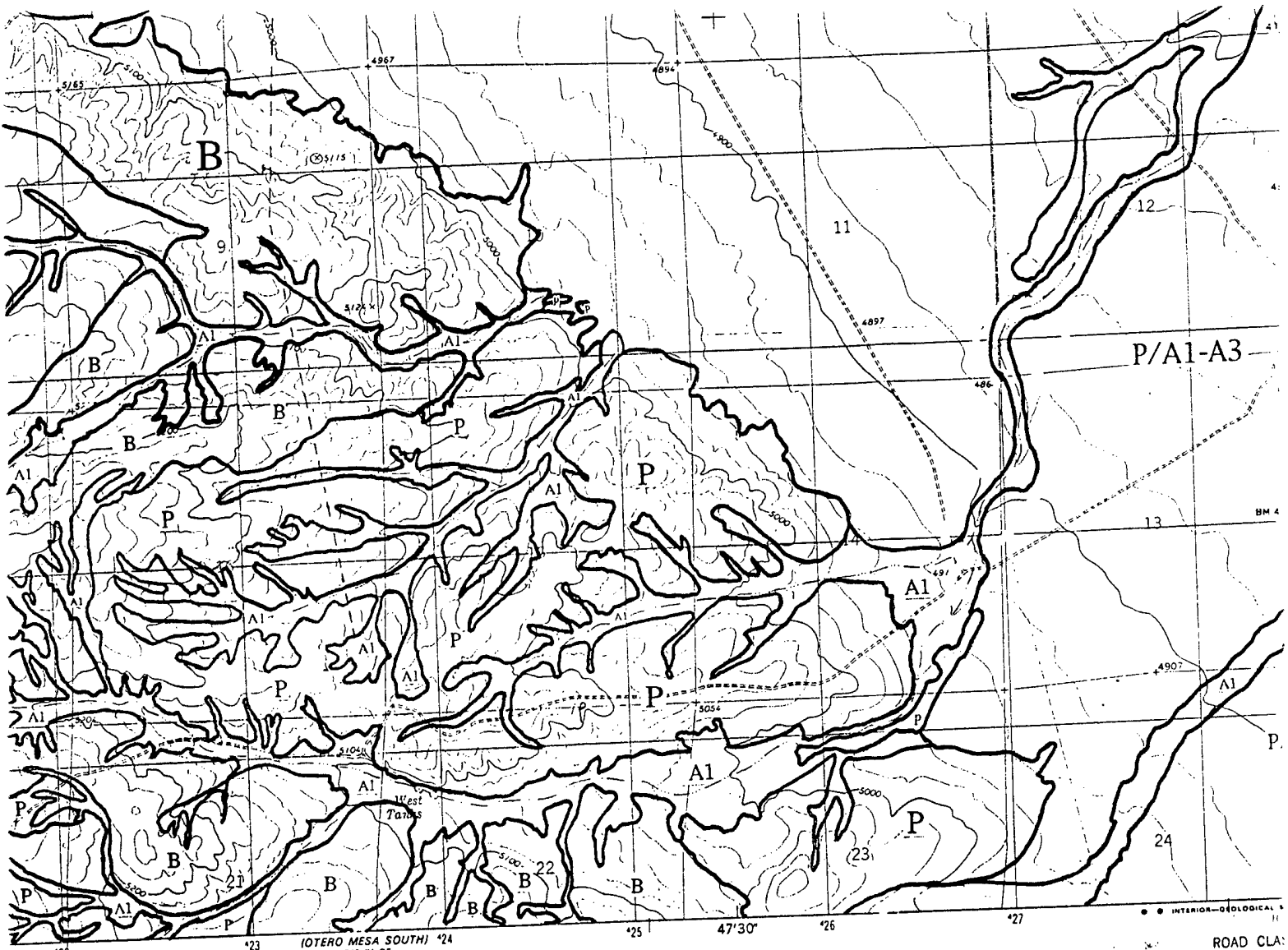
SCALE 1:24 000



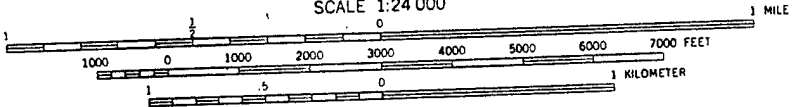
CONTOUR INTERVAL
NATIONAL GEODETTIC VERTICAL

THIS MAP COMPLIES WITH NATIONAL MAP
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COL
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND S

7



SCALE 1:24 000

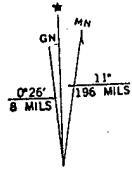


CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION



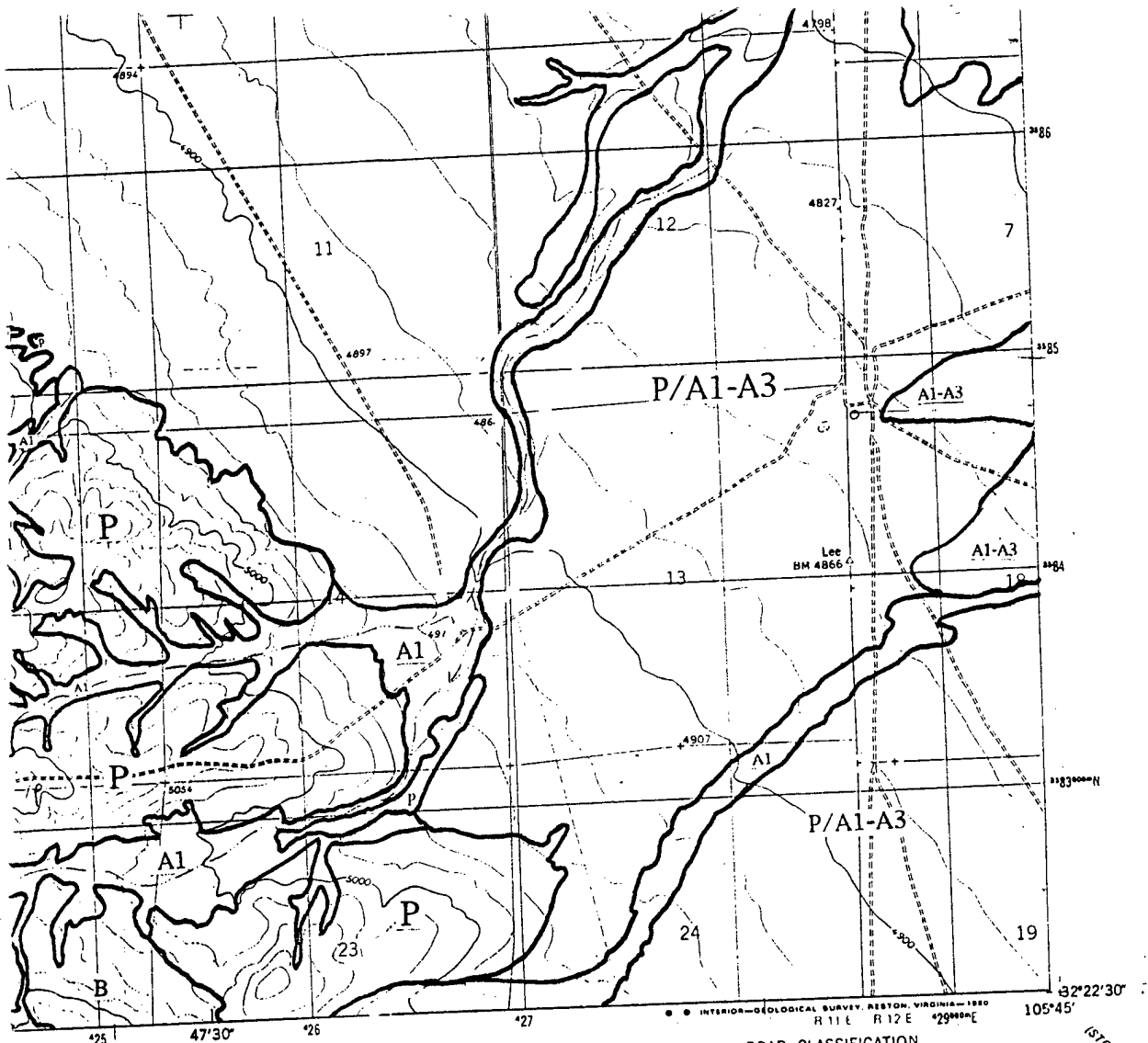
UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Interstate Route

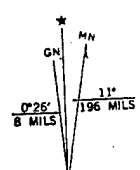
OTERO MESA
NE 1/4 PENDE
N32°

DMA 484

8



1 MILE
7000 FEET
KILOMETER



ROAD CLASSIFICATION
 Primary highway, hard surface ——— Light-duty road, hard or improved surface ———
 Secondary highway, hard surface ——— Unimproved road - - - - -
 () Interstate Route () U. S. Route () State Route

OTERO MESA NORTH, N. MEX.
 NE/4 PENDEJO WASH 15' QUADRANGLE
 N3222.5-W10545/7.5

1980

DMA 4848 IV NE-SERIES V881

TON, VIRGINIA 22092
 ON REQUEST

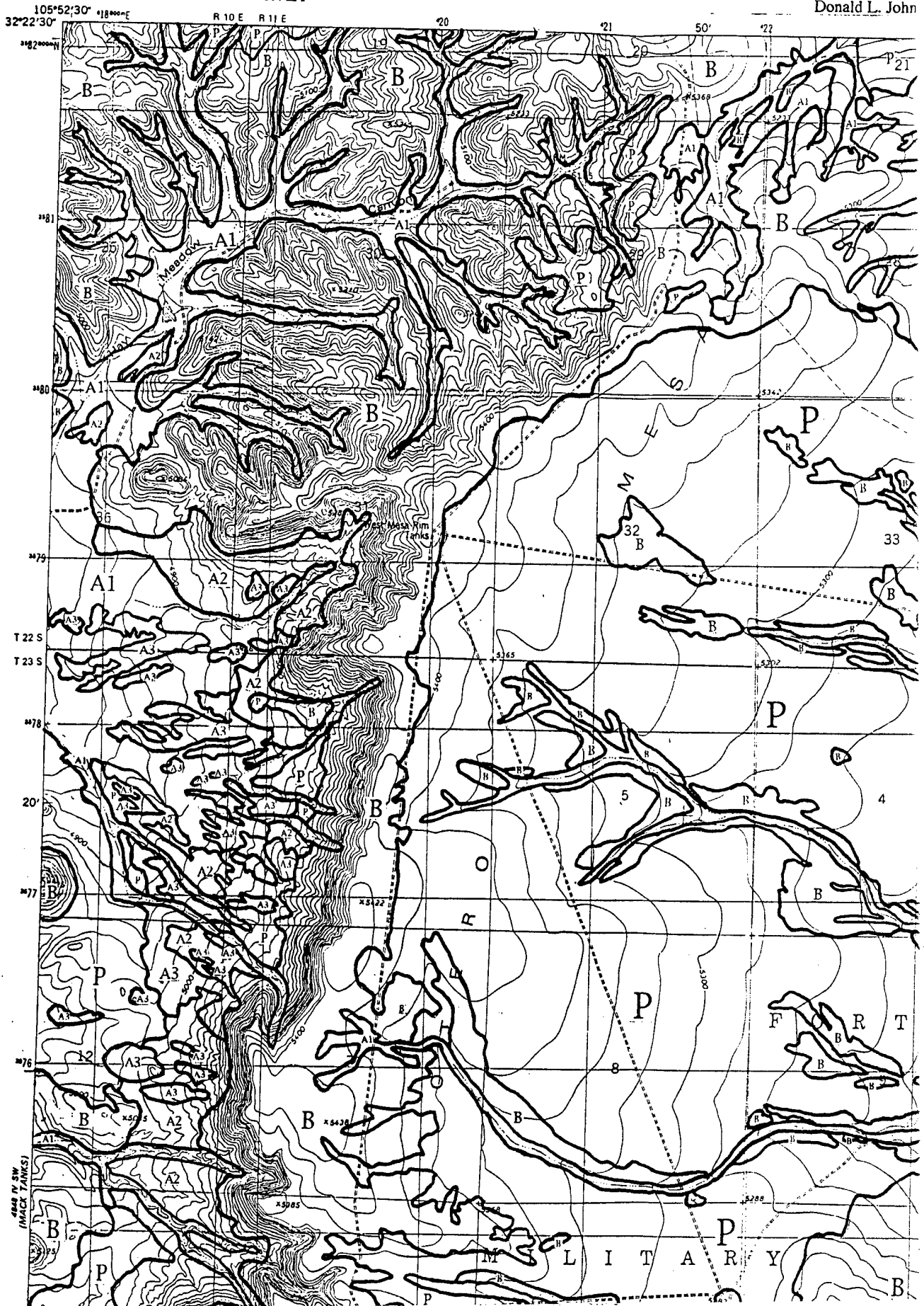
UTM GRID AND 1980 MAGNETIC NORTH
 DECLINATION AT CENTER OF SHEET

(STONE WELL)
 4848 IV NE

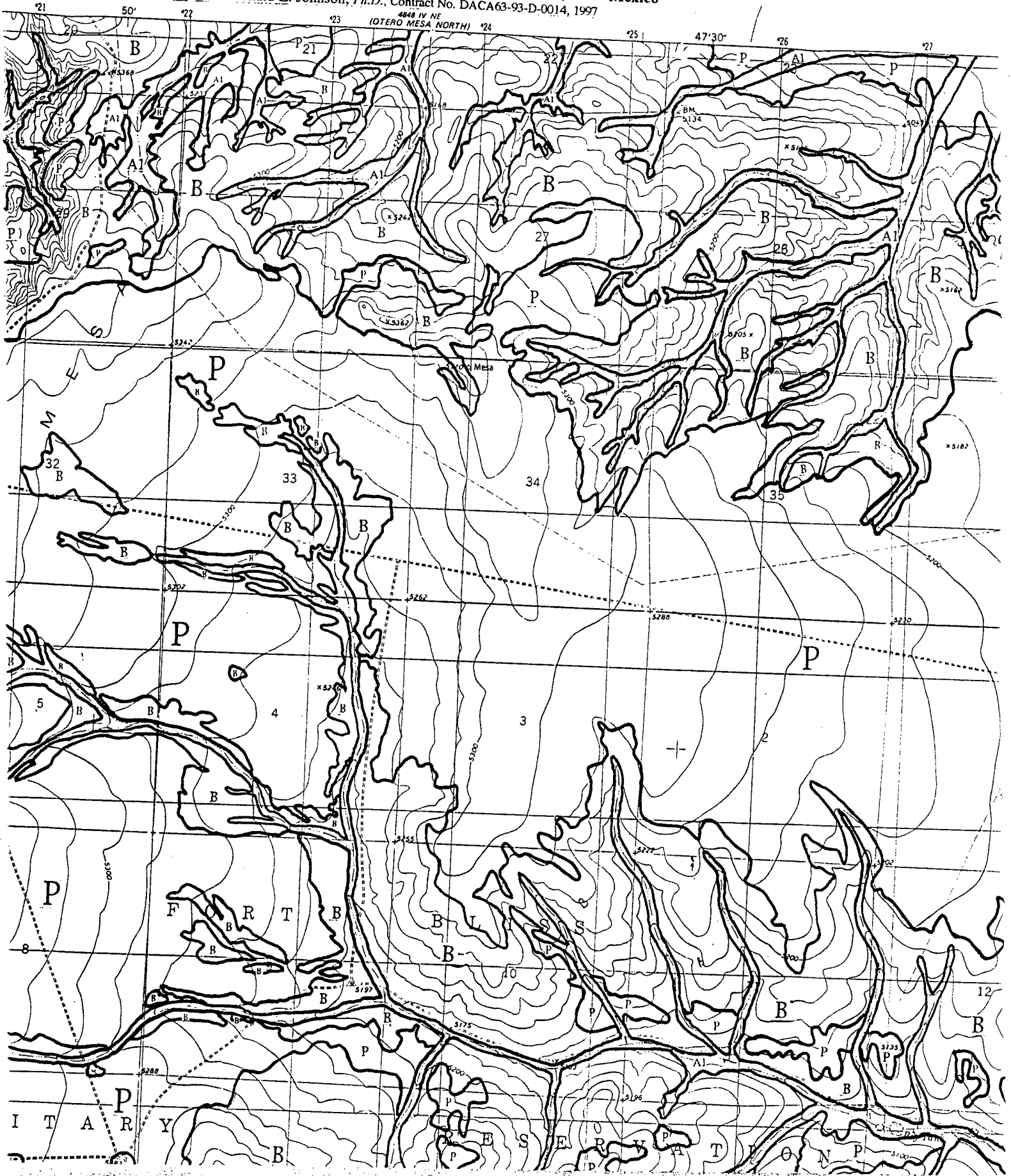
41

242

Donald L. John



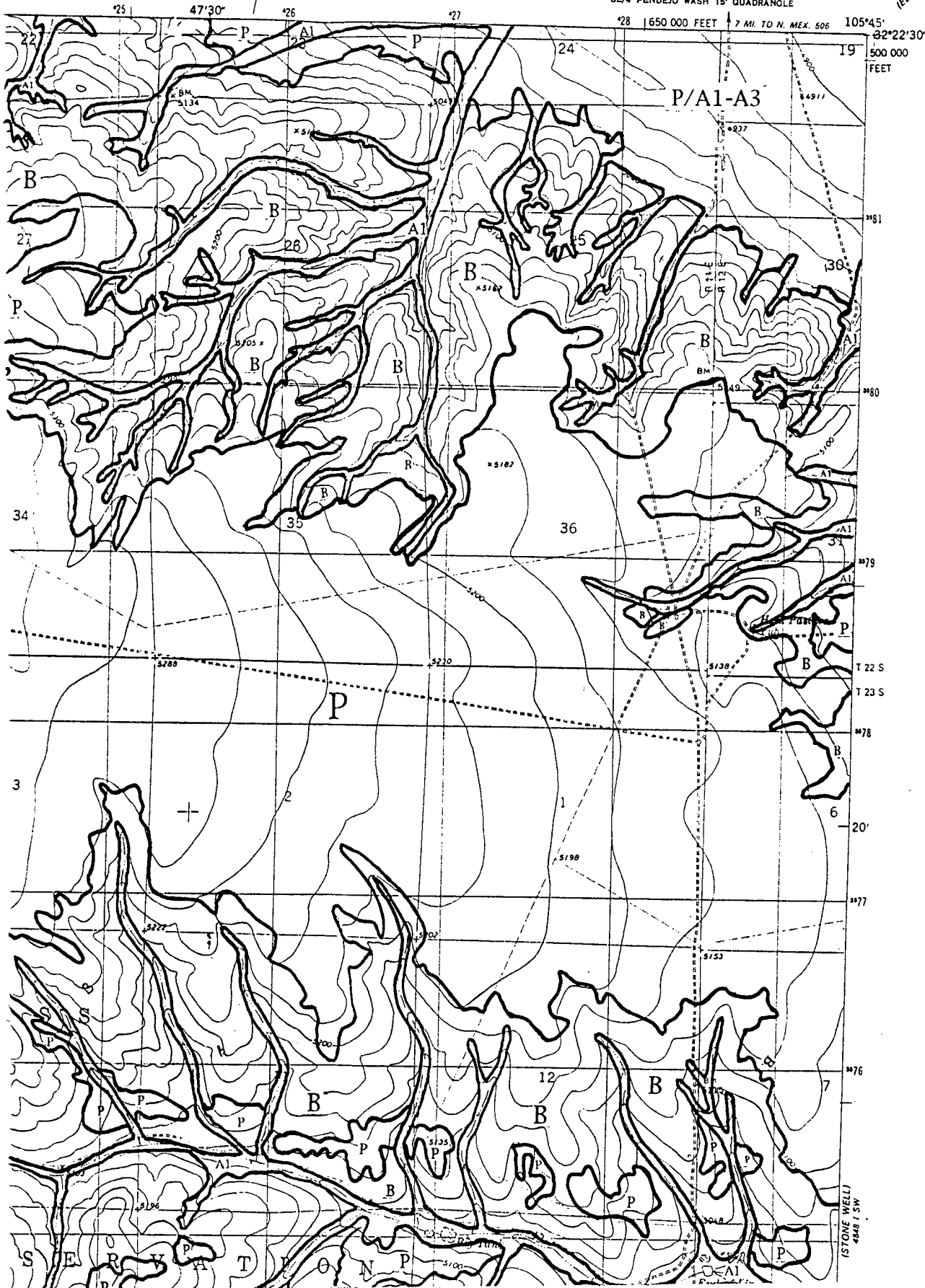
Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997



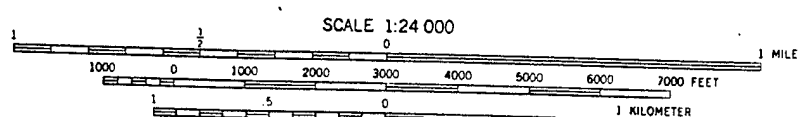
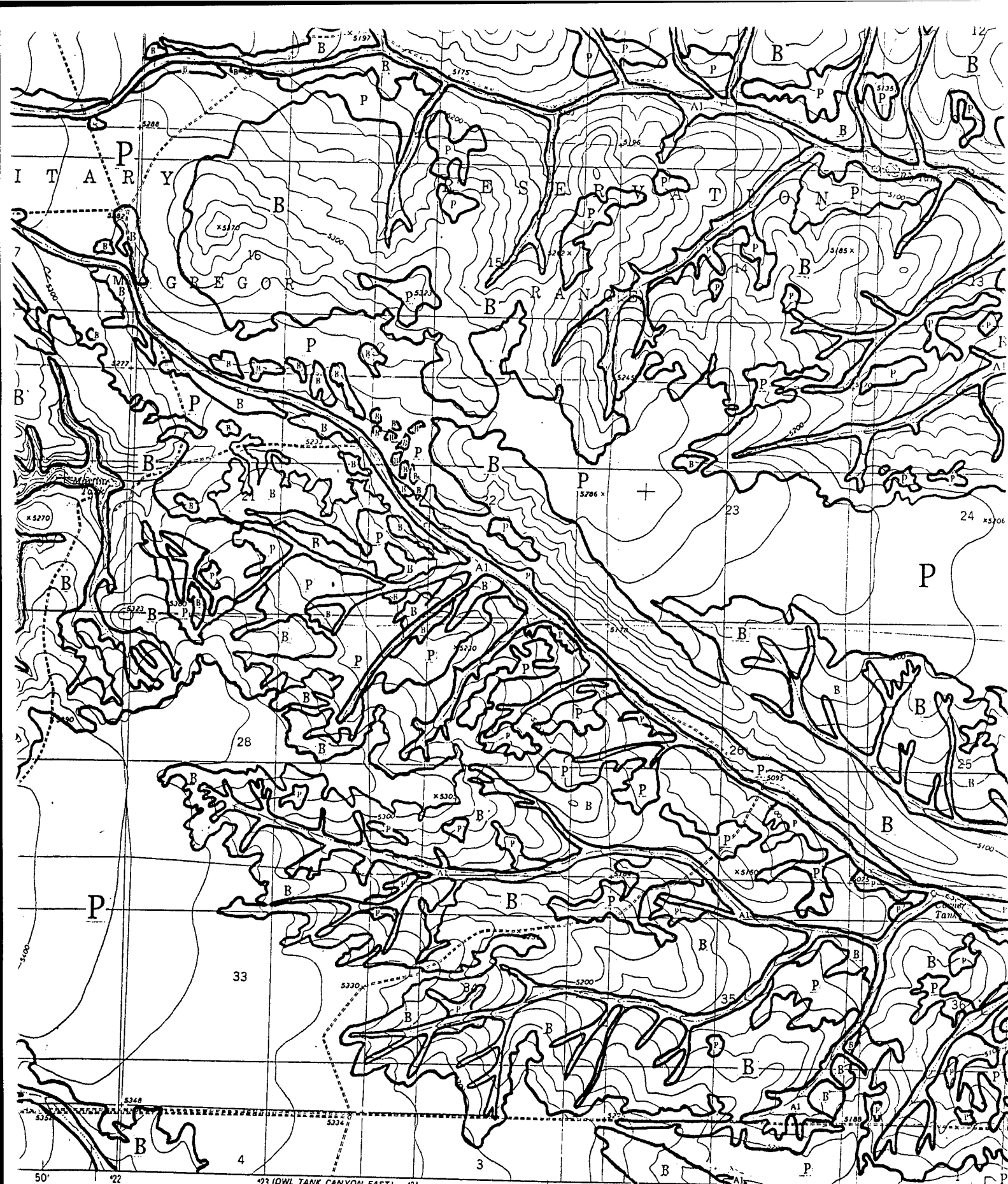
and Surficial Mapping
Bliss, New Mexico
D-0014, 1997

OTERO MESA SOUTH QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 PENDEJO WASH 15' QUADRANGLE

4948 1 NW
(EL PASO DRAW)

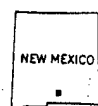


3

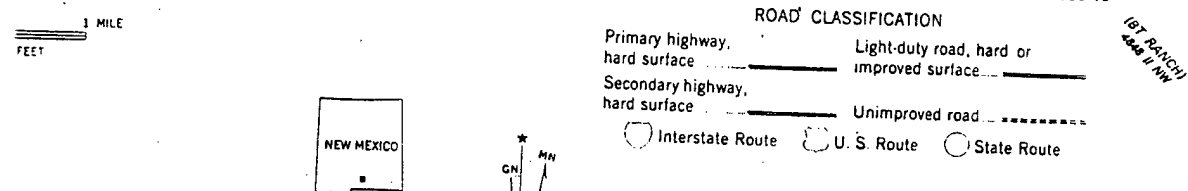
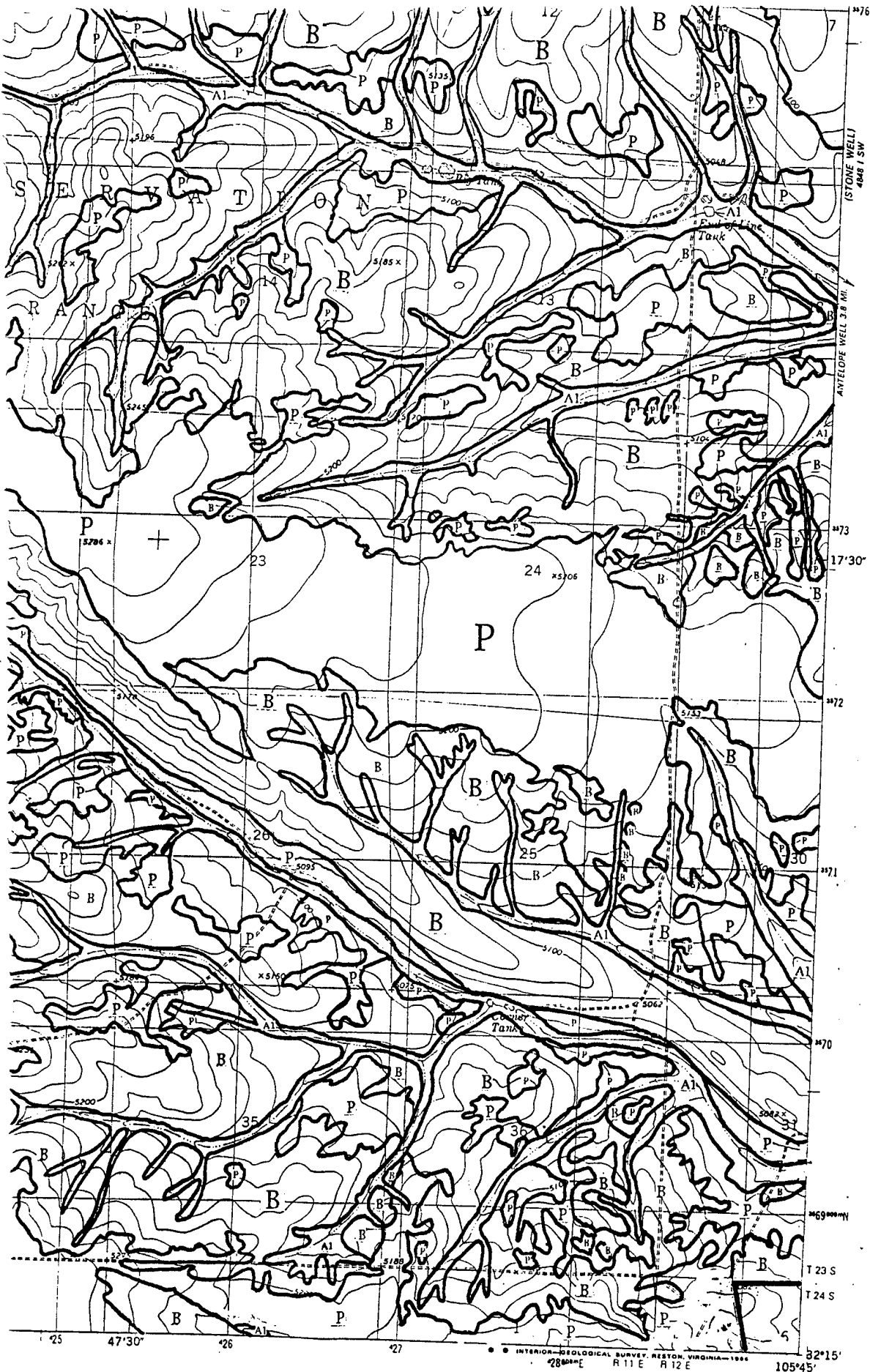


CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

5.



- Primary highway, hard surface
- Secondary highway, hard surface
- Interstate Route



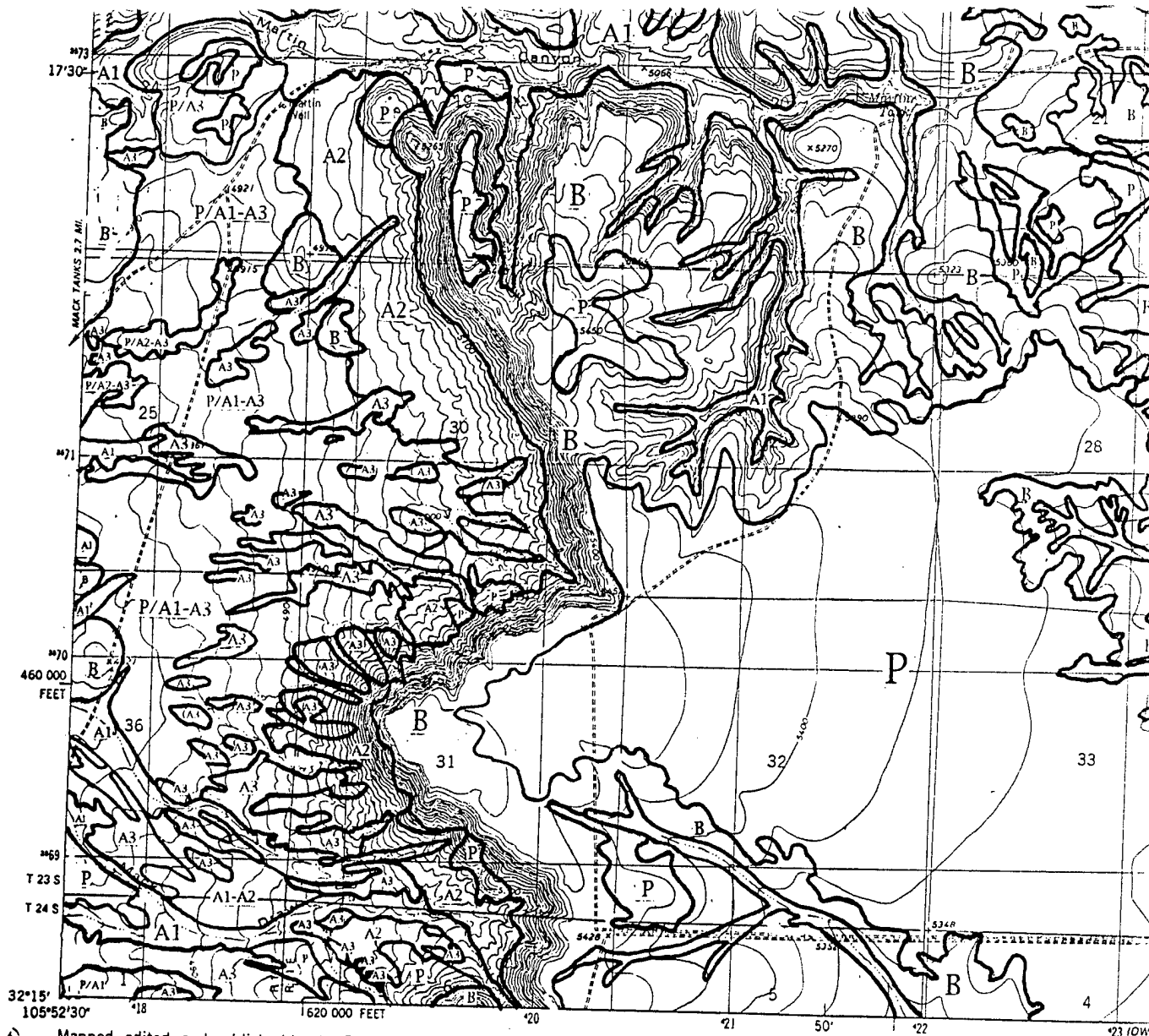
ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road

○ Interstate Route ○ U. S. Route ○ State Route

6.

107°15' 44" W



Mapped, edited, and published by the Geological Survey
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Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1979

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American Datum

Fine red dashed lines indicate selected fence lines

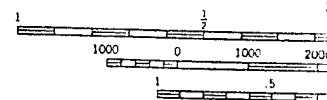
There may be private inholdings within the boundaries of the
National or State reservations shown on this map

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
50 meters east as shown by dashed corner ticks

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR...
Dune, Local	DL
Dune Pile	DP
Dune Sheet	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	
Pediment	P
Playa	P1
Playa Lunette	PIL

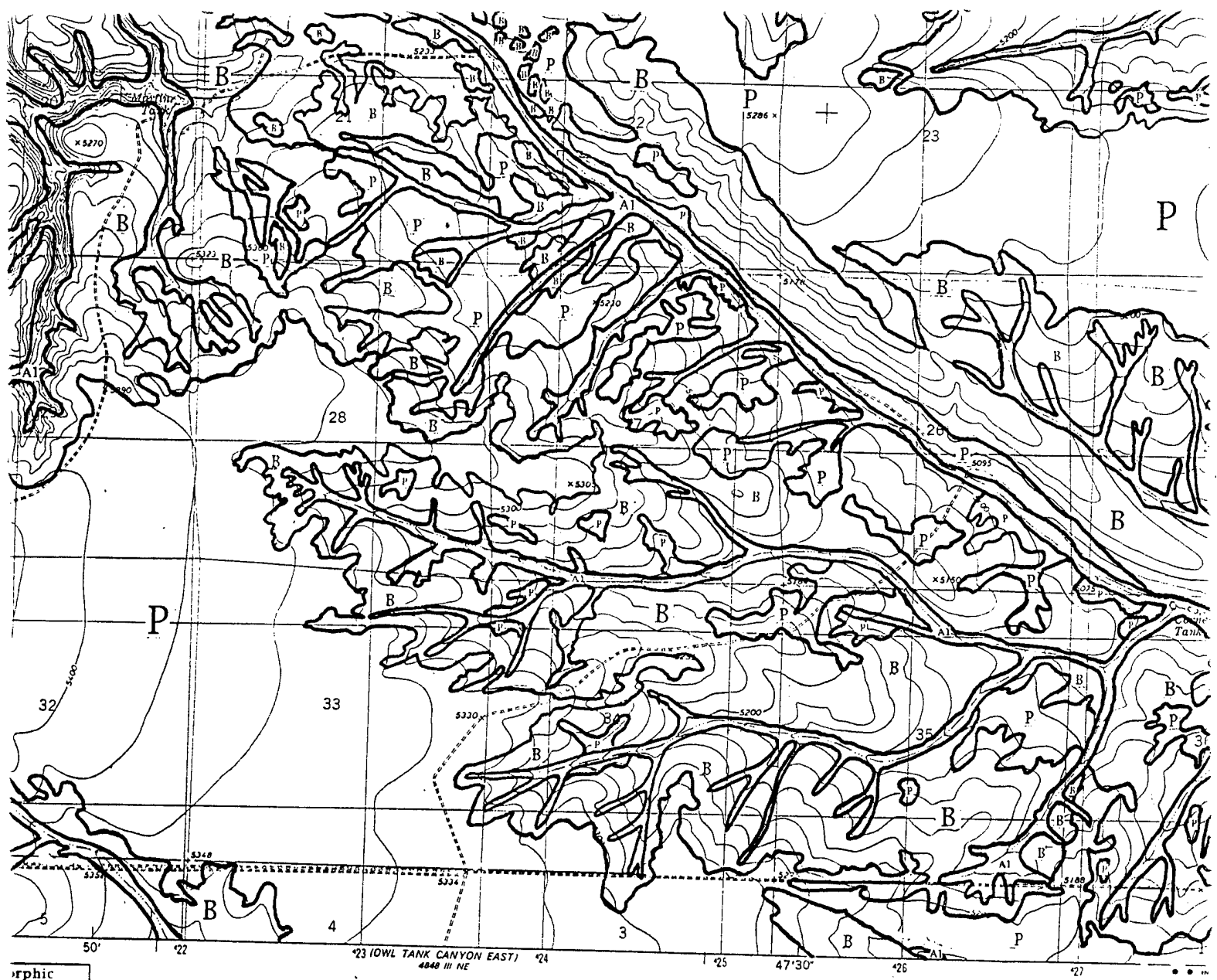
¹See text for explanation



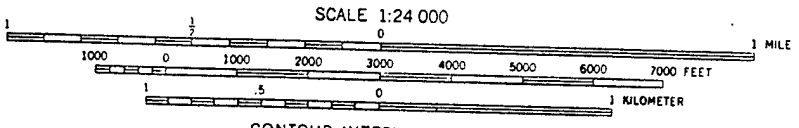
CONTOU
NATIONAL GEOG.

THIS MAP COMPLIES WITH
FOR SALE BY U. S. GEOLOGICAL SURVEY,
A FOLDER DESCRIBING TOPOGRAPHY

7

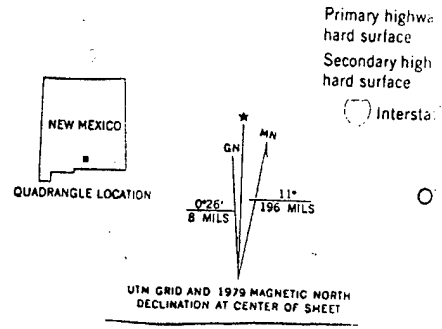


- Topographic symbols
- A1
 - A2
 - A3
 - B
 - CR
 - DL
 - DP
 - DS
 - DSC
 - DSG
 - P
 - PI
 - PIL



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



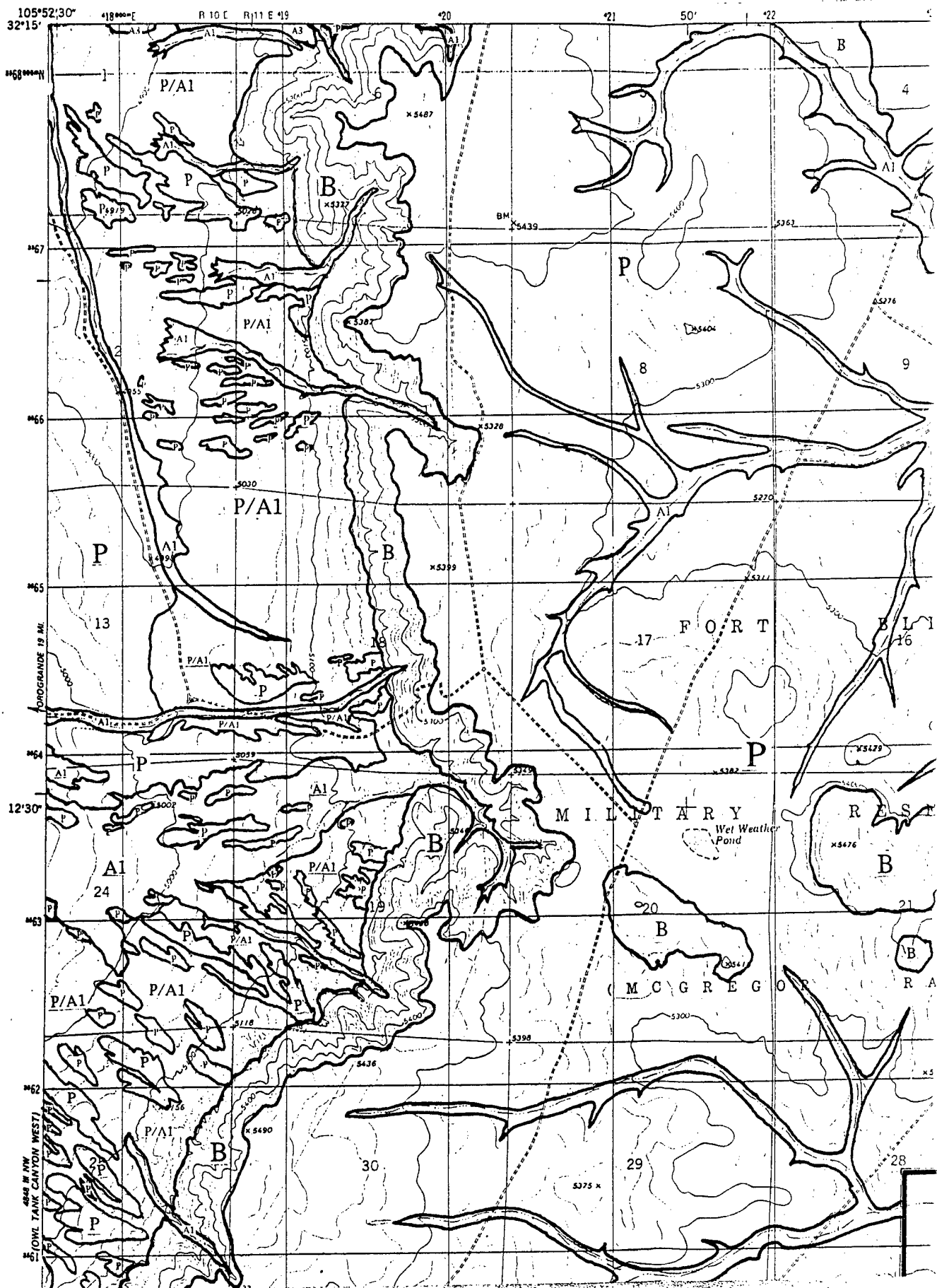
8

9.

105°52'30"
32°15'

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

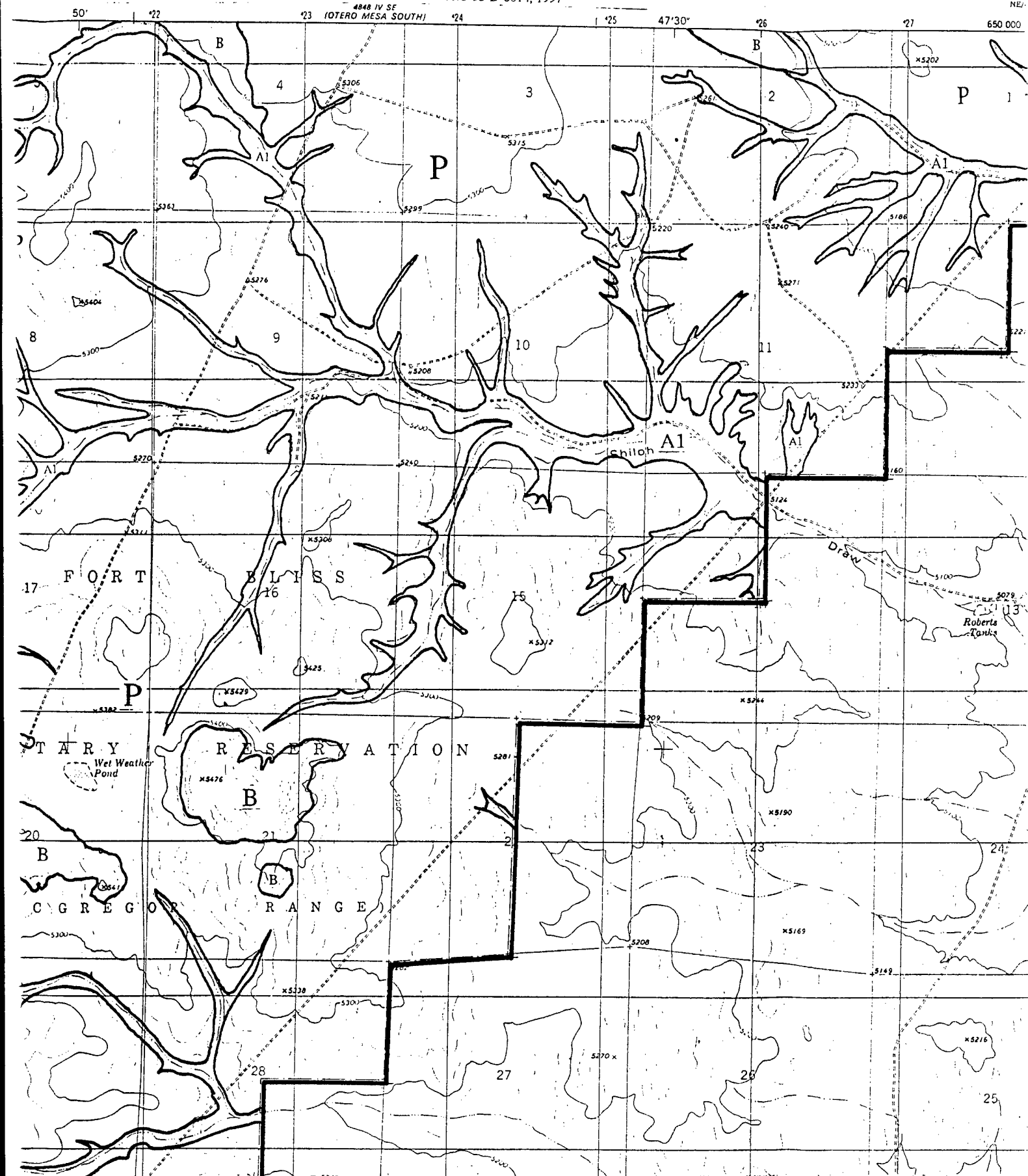
Geomorphological, Geocological
Study of McGregor Gulch
Donald L. Johnson.



1

NE/

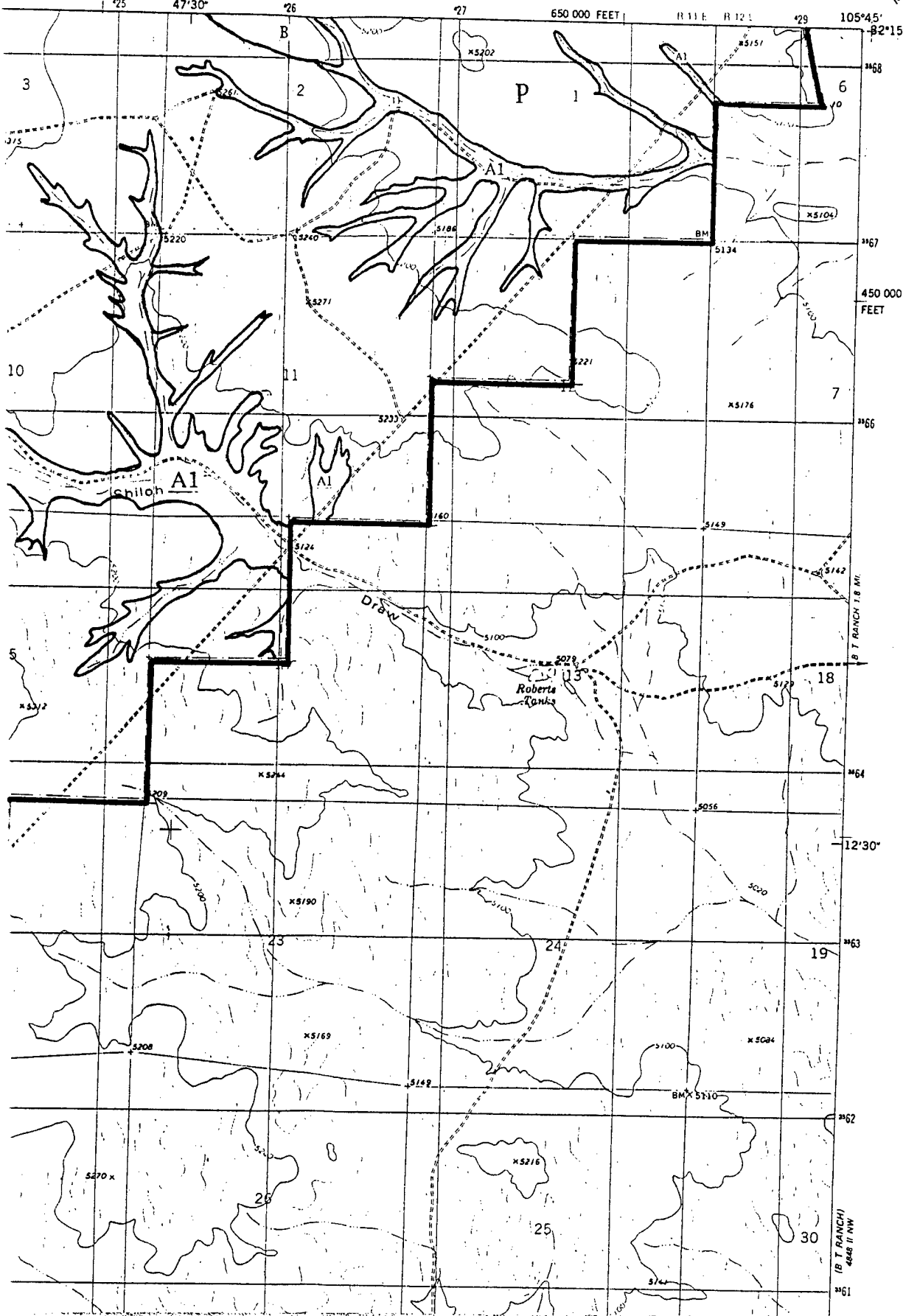
4848 IV SE



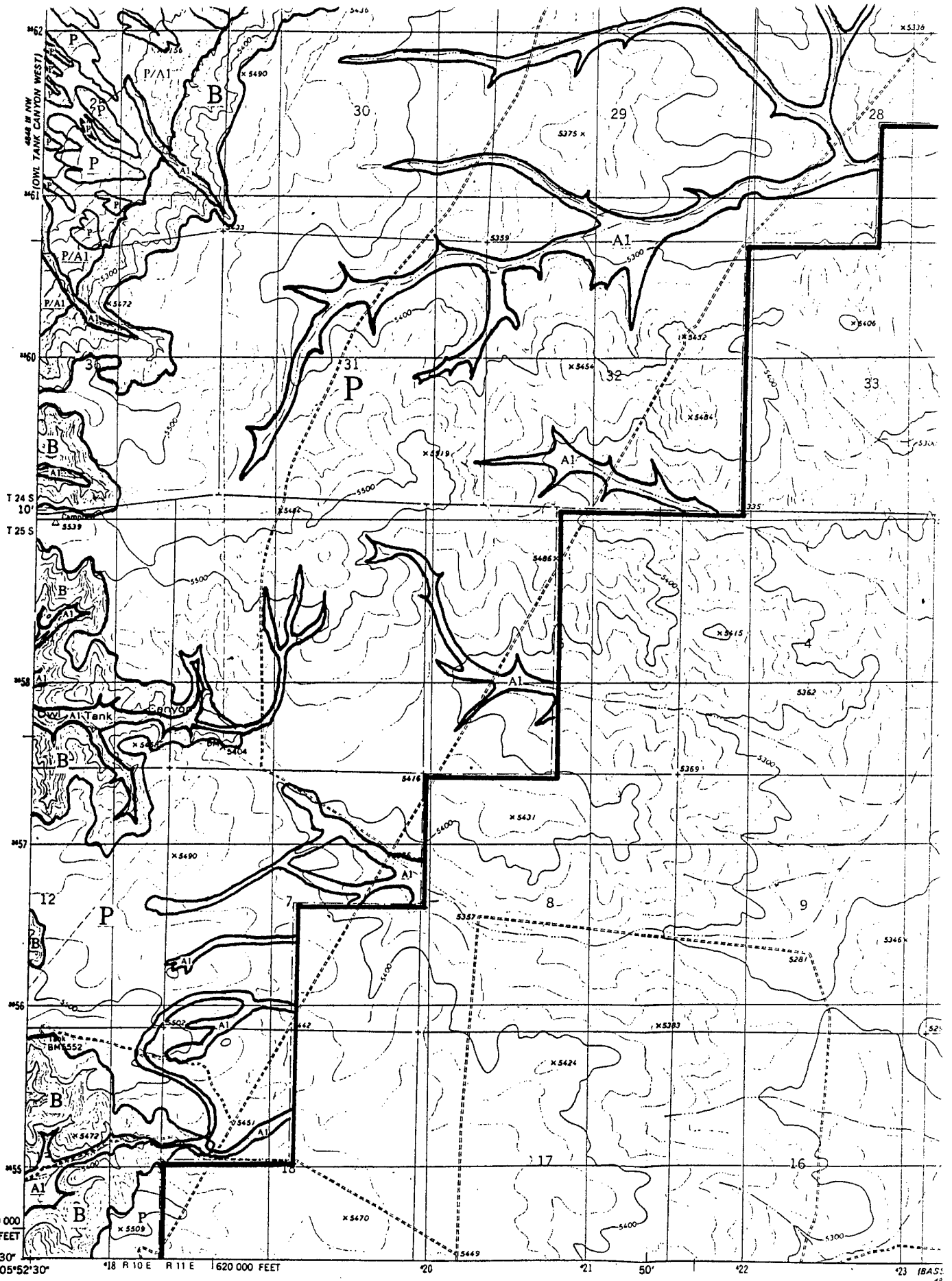
d Surficial Mapping
iss, New Mexico
0014, 1997

OWL TANK CANYON EAST QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 BASSETT LAKE 15' QUADRANGLE

AREA 1 SW
(STONE WELL)



3.



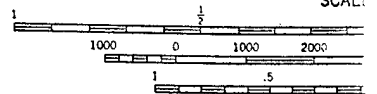
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975 Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
To place on the predicted North American Datum 1983

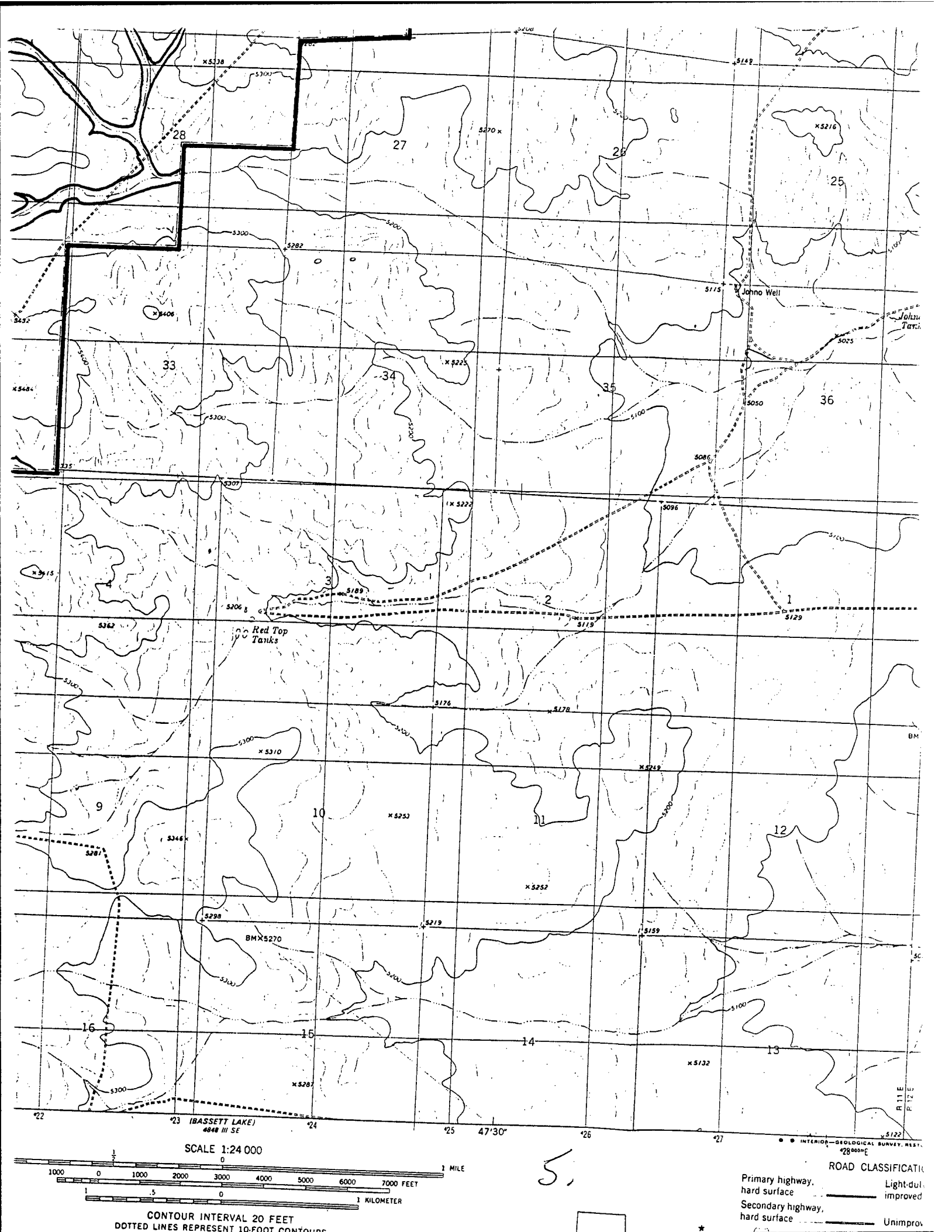
McGregor Range Geomorphologic Mapping Units and Symbols¹

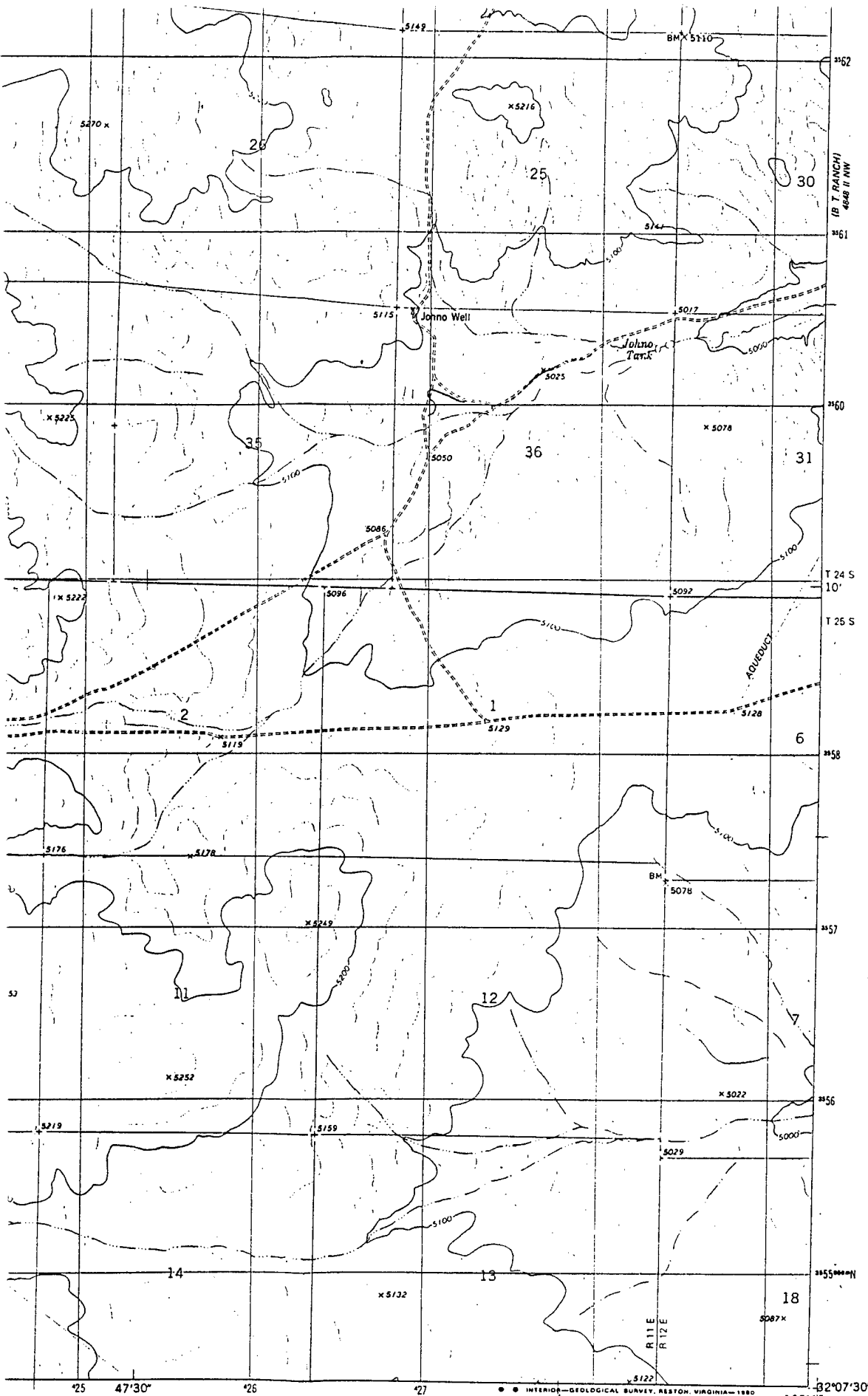
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DL
Dune Pile	DP



CONTOUR IN
DOTTED LINES REPRESENT
NATIONAL GEODETIC

(MOUNTAIN TANK)
4648 III SW

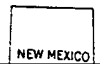




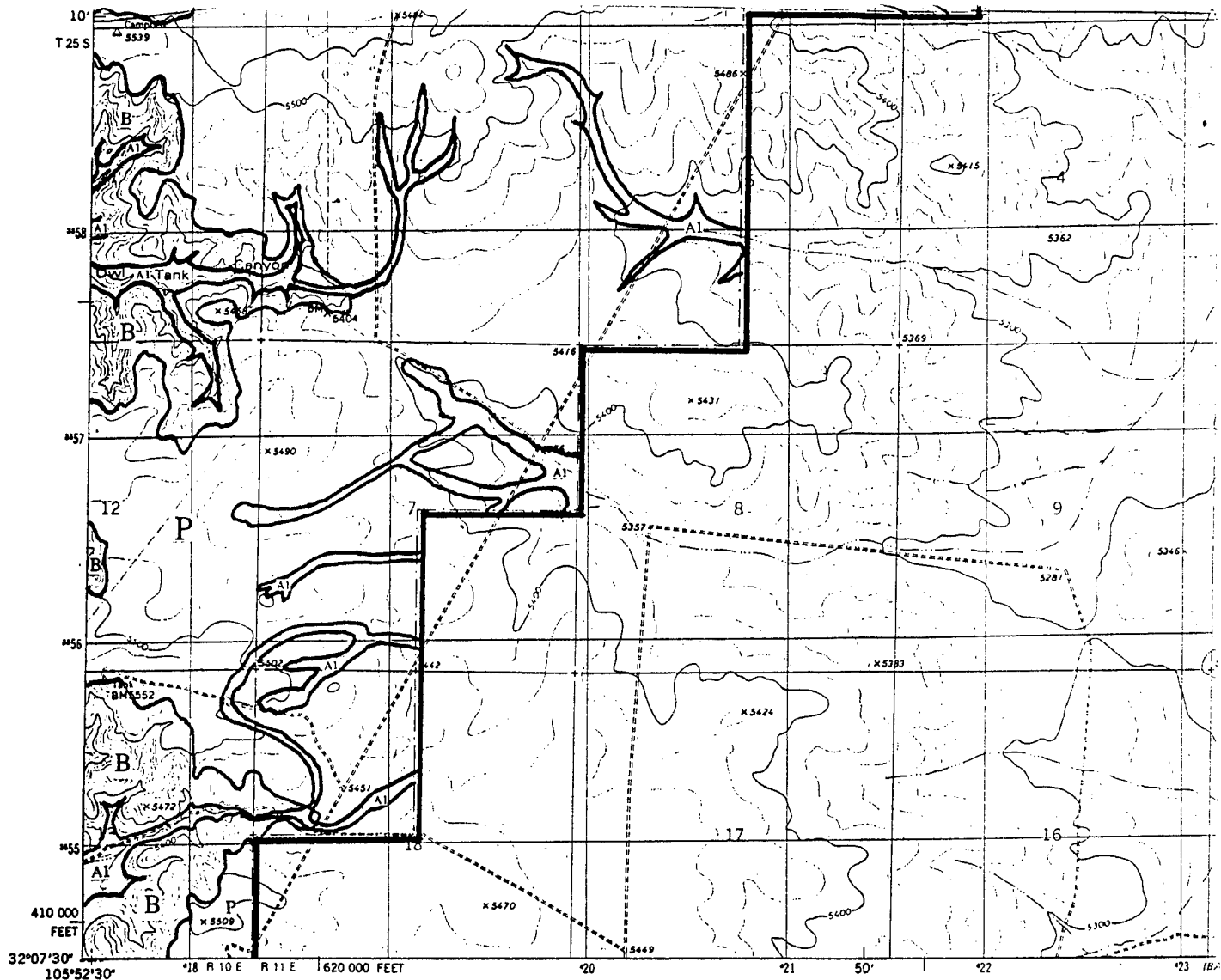
ROAD CLASSIFICATION

- | | |
|------------------------------------|--|
| Primary highway,
hard surface | Light-duty road, hard or
improved surface |
| Secondary highway,
hard surface | Unimproved road |
- () Interstate Route () U. S. Route () State Route

1 MILE
30 FEET
TER



6.



Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975 Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983
move the projection lines 7 meters south and
49 meters east as shown by dashed corner ticks

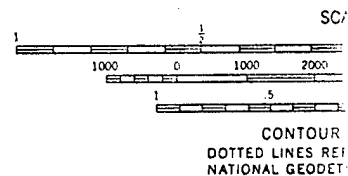
Fine red dashed lines indicate selected fence lines

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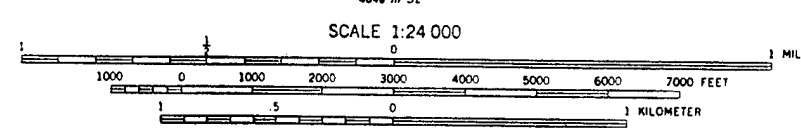
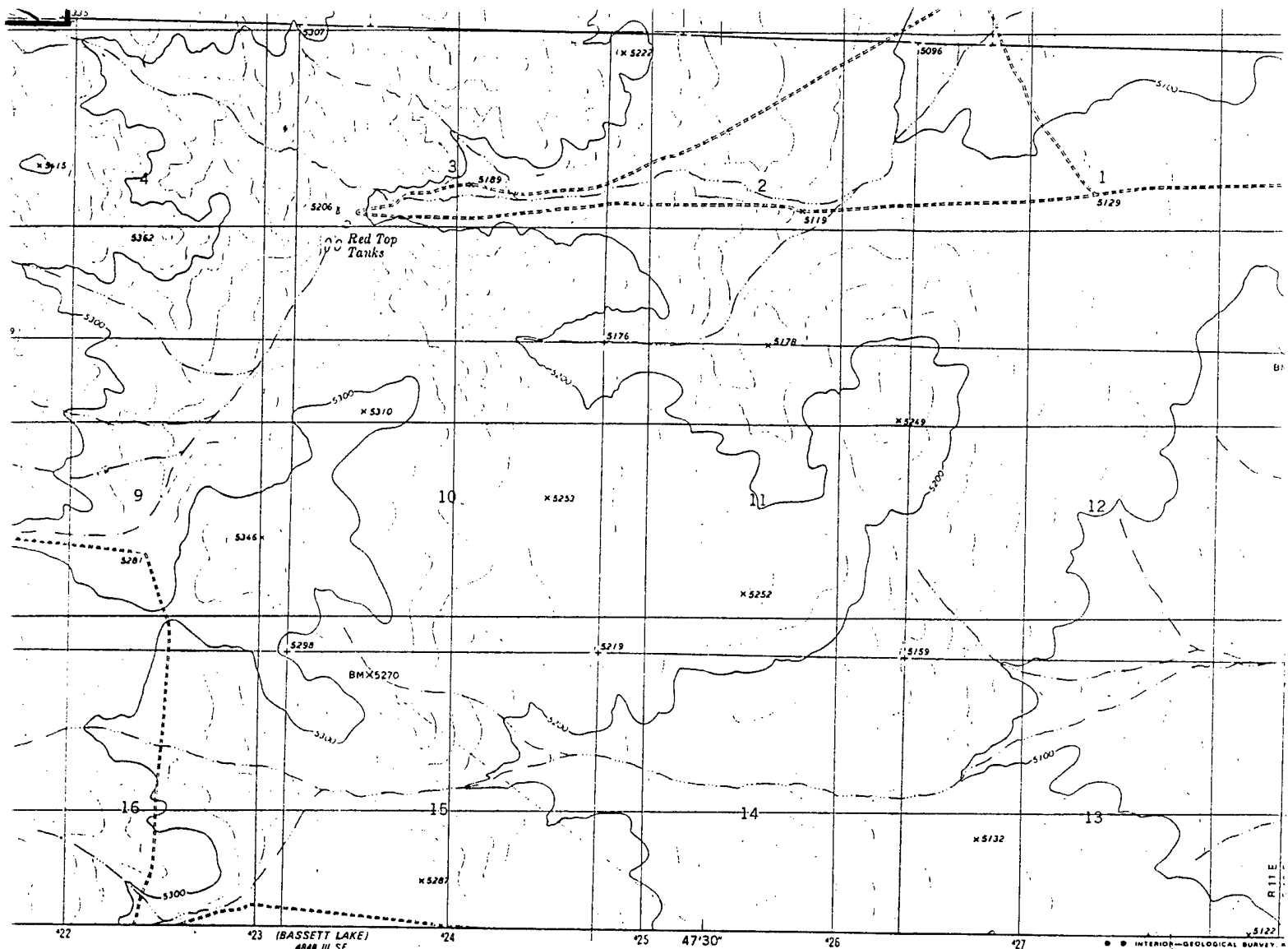
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Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR•••
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	—
Pediment	P
Playa	P1
Playa Lunette	PIL

¹See text for explanation



THIS MAP COMPLIES WITH N
FOR SALE BY U.S. GEOLOGICAL SURVEY, DE
A FOLDER DESCRIBING TOPOGRAPHIC N

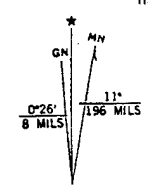


SCALE 1:24 000
 DOTTED LINES REPRESENT 10-FOOT CONTOURS
 NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION



UTM GRID AND 1980 MAGNETIC NORTH
 DECLINATION AT CENTER OF SHEET

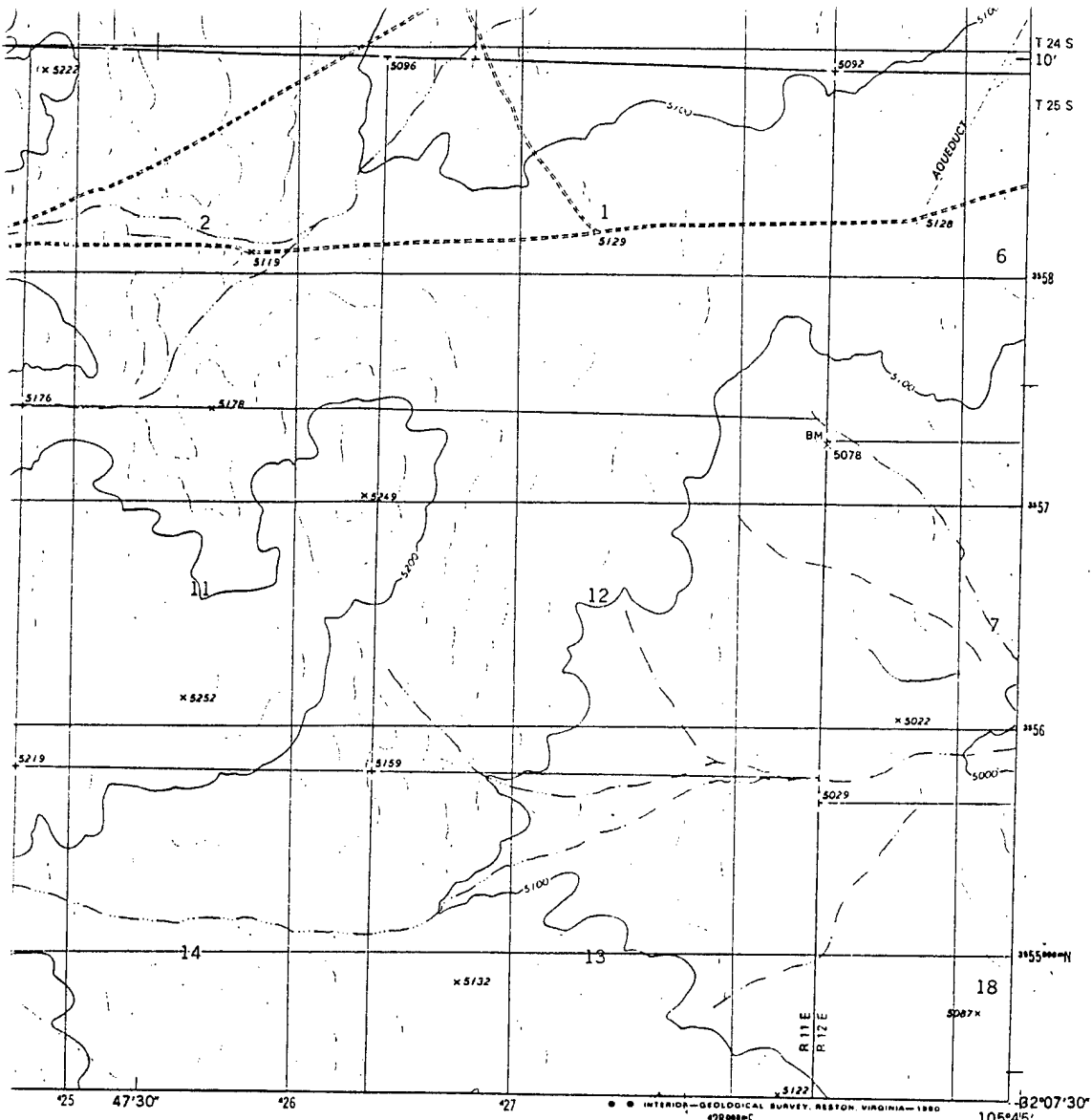
ROAD CLASSIFICATION
 Primary highway, hard surface ——— Light imprc
 Secondary highway, hard surface ——— Unim
 Interstate Route () U. S. Route ()

OWL TANK CANYON
 NE 1/4 BASSETT LAKE 15
 N3207.5-W105

1980

DMA 4948 III NE-SE

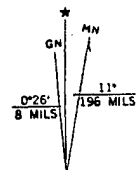
8.



1 MILE



NEW MEXICO
QUADRANGLE LOCATION



UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, hard surface ——— Light-duty road, hard or improved surface ———

Secondary highway, hard surface ——— Unimproved road - - - - -

() Interstate Route () U. S. Route () State Route

OWL TANK CANYON EAST, N. MEX.
NE 1/4 BASSETT LAKE 15' QUADRANGLE
N3207.5—W10545/7.5

1980

DMA 4848 III NE—SERIES V881

644.5 SW
(GLAND MOUNTAIN)

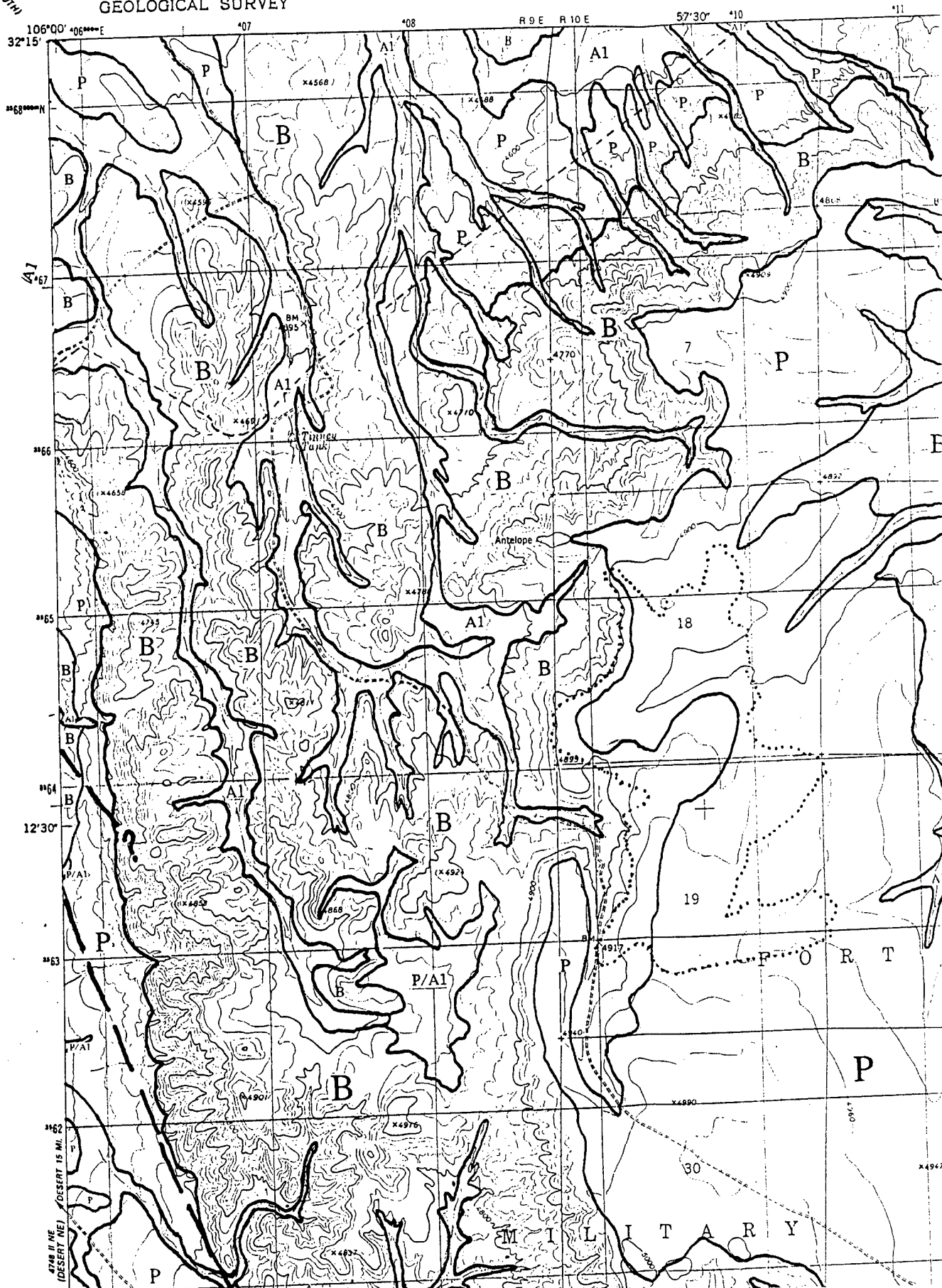
(61)

9.

4748 1 35
(OROGRAPHIC SOUTH)

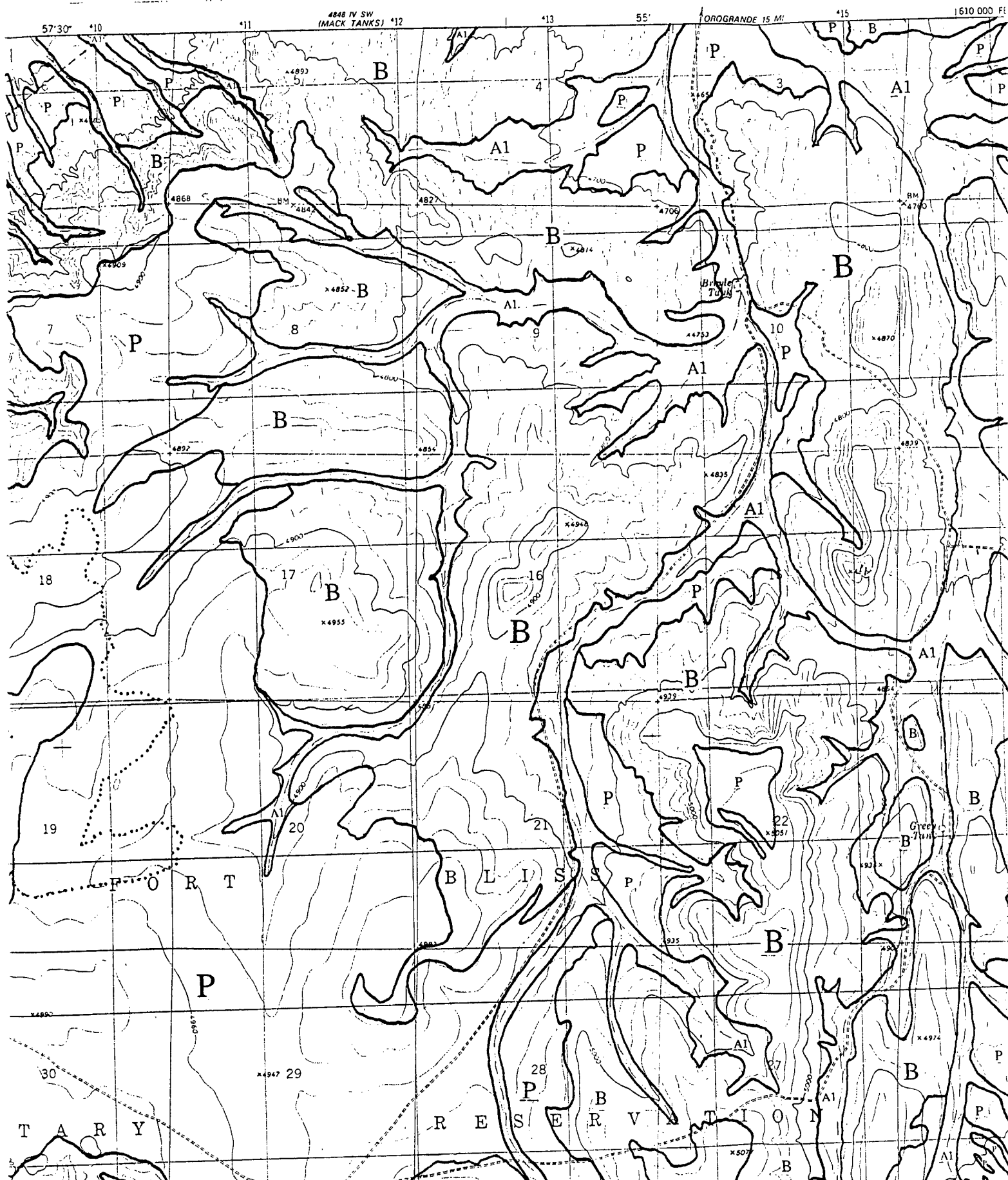
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geocological
Study of McGregor Gully
Donald L. Johnson.



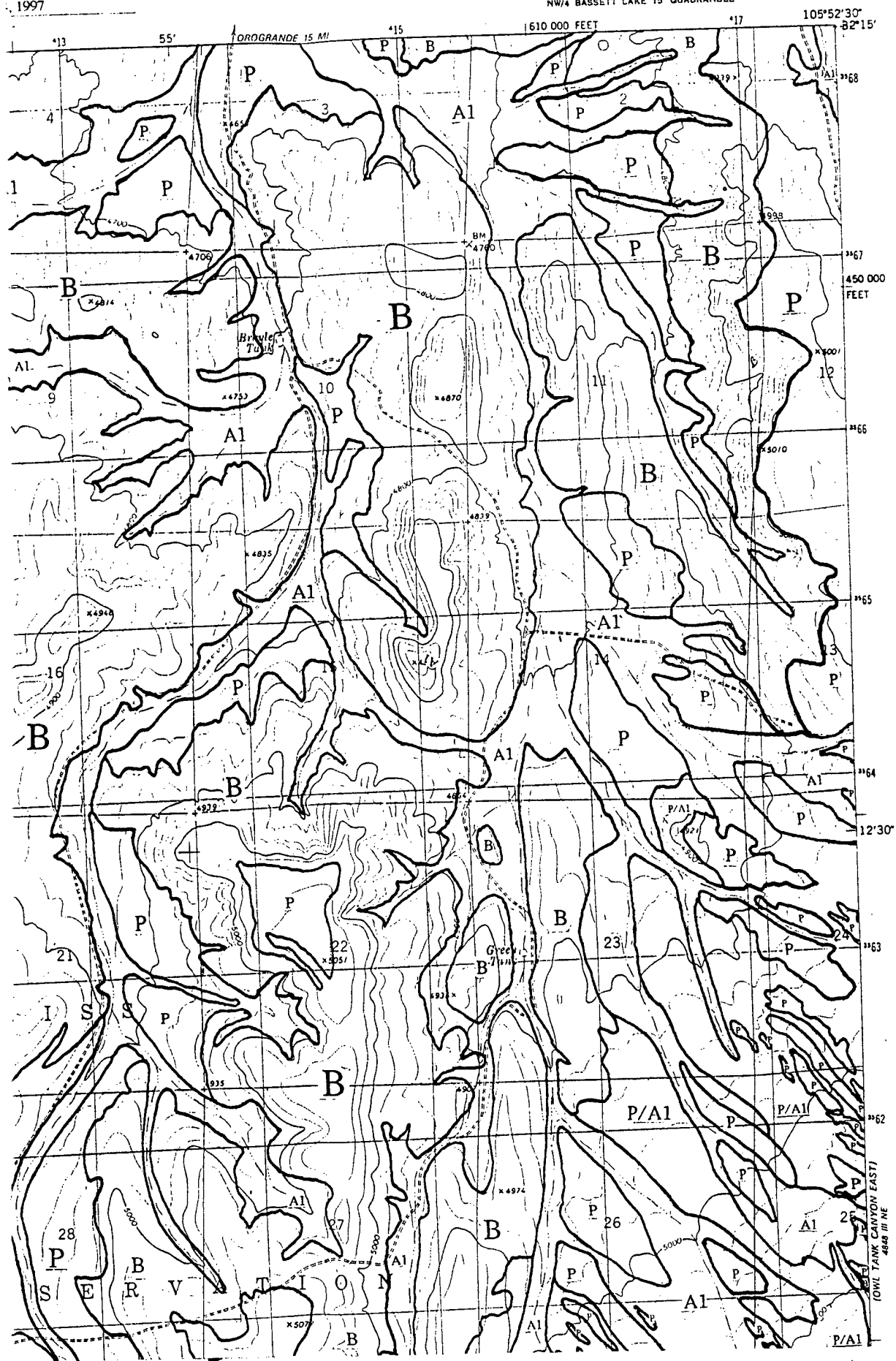
Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
 Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
 Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

OWL TANK CA.
 NEW :
 7.5 MINUTE
 NW/4 B:

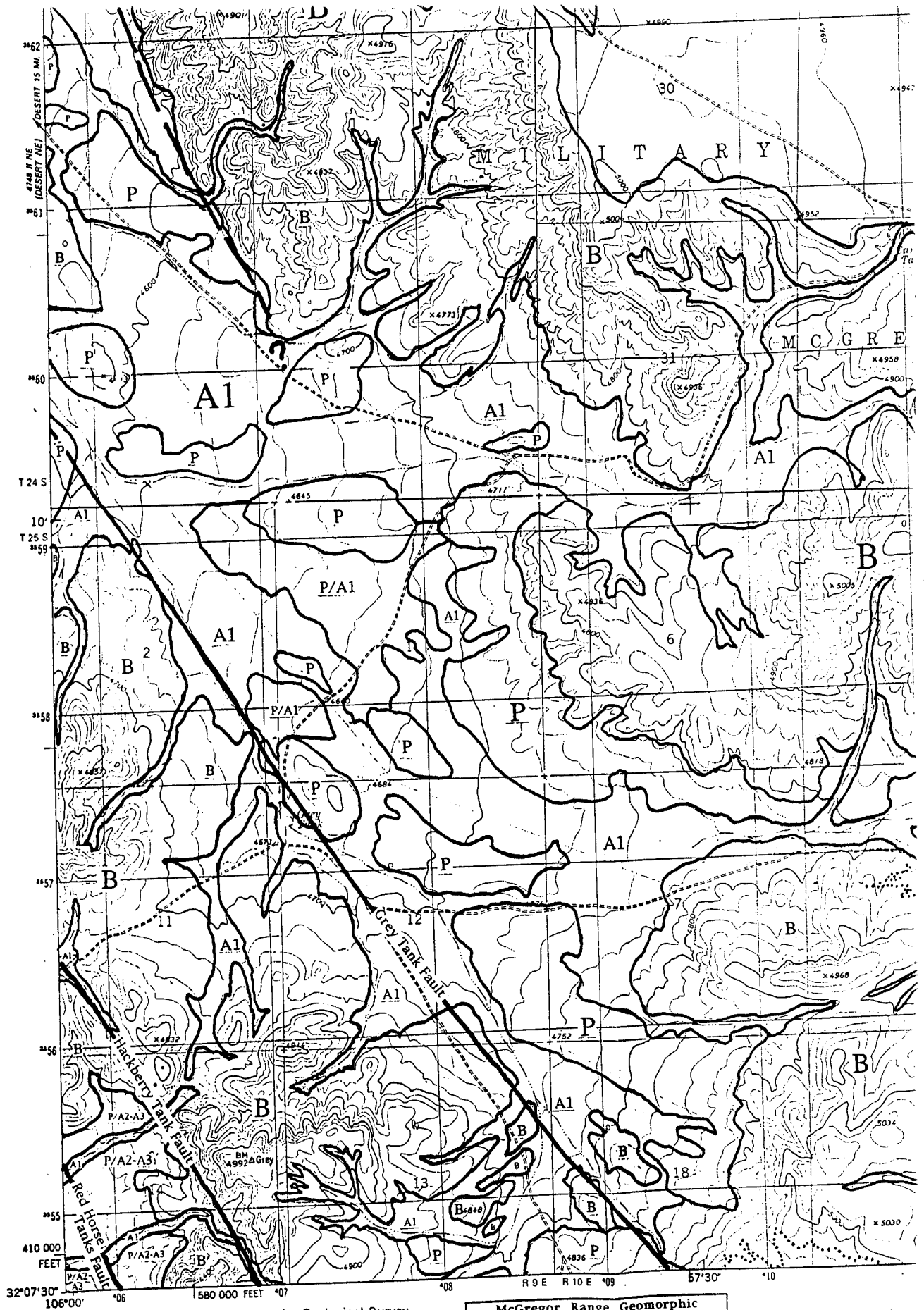


OWL TANK CANYON WEST QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 BASSETT LAKE 15' QUADRANGLE

4848 IV SE
OTERO MESA
SOUTH



3.



4.

DESERT SE
4748 N SE

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

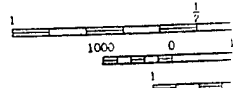
Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

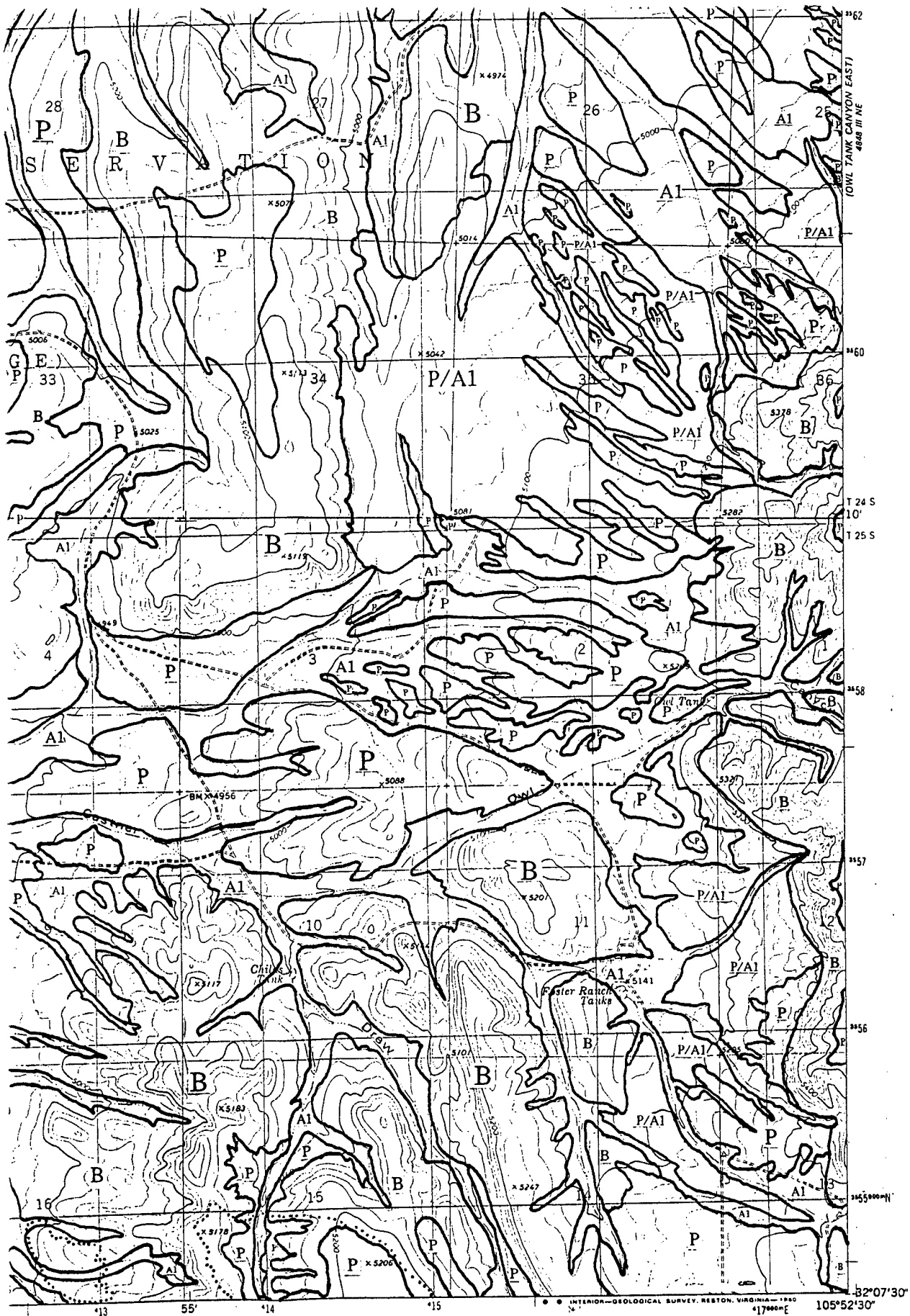
To place on the predicted North American datum 1983
move the projection lines 7 meters south and

McGregor Range Geomorphic Mapping Units and Symbols¹

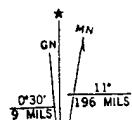
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR...
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet	DSC



NAT



QUADRANGLE LOCATION



ROAD CLASSIFICATION

Primary highway, hard surface _____ Light-duty road, hard or improved surface _____

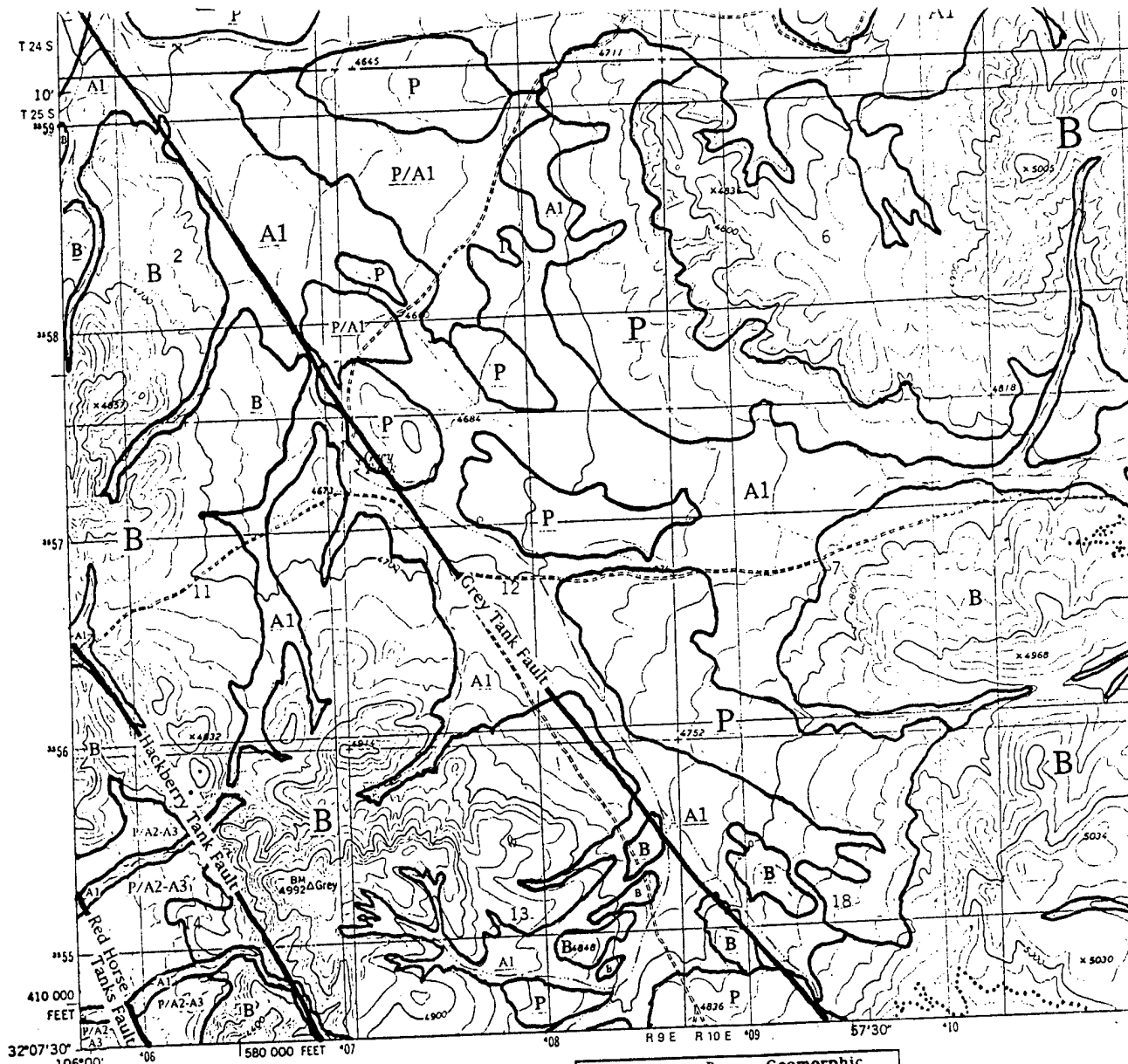
Secondary highway, hard surface _____ Unimproved road - - - - -

Interstate Route	U. S. Route	State Route
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	51
52	53	54
55	56	57
58	59	60
61	62	63
64	65	66
67	68	69
70	71	72
73	74	75
76	77	78
79	80	81
82	83	84
85	86	87
88	89	90
91	92	93
94	95	96
97	98	99
100	101	102
103	104	105
106	107	108
109	110	111
112	113	114
115	116	117
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121	122	123
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160	161	162
163	164	165
166	167	168
169	170	171
172	173	174
175	176	177
178	179	180
181	182	183
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190	191	192
193	194	195
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313	314	315
316	317	318
319	320	321
322	323	324
325	326	327
328	329	330
331	332	333
334	335	336
337	338	339
340	341	342
343	344	345
346	347	348
349	350	351
352	353	354
355	356	357
358	359	360
361	362	363
364	365	366

OWL TANK CANYON WEST, N. MEX.

NW/4 BASSETT LAKE 15' QUADRANGLE

IBASSETT LAKE
4845 IN SE



DESERT SEE
4748 B SE

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
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1000-meter Universal Transverse Mercator grid, zone 13

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50 meters east as shown by dashed corner ticks

Certain landlines are omitted because of insufficient data

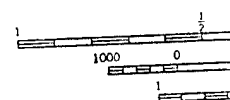
Fine red dashed lines indicate selected fence lines

There may be private inholdings within the boundaries of the
National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR•••
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet	DSC
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	
Wind Erosion (fire induced)	

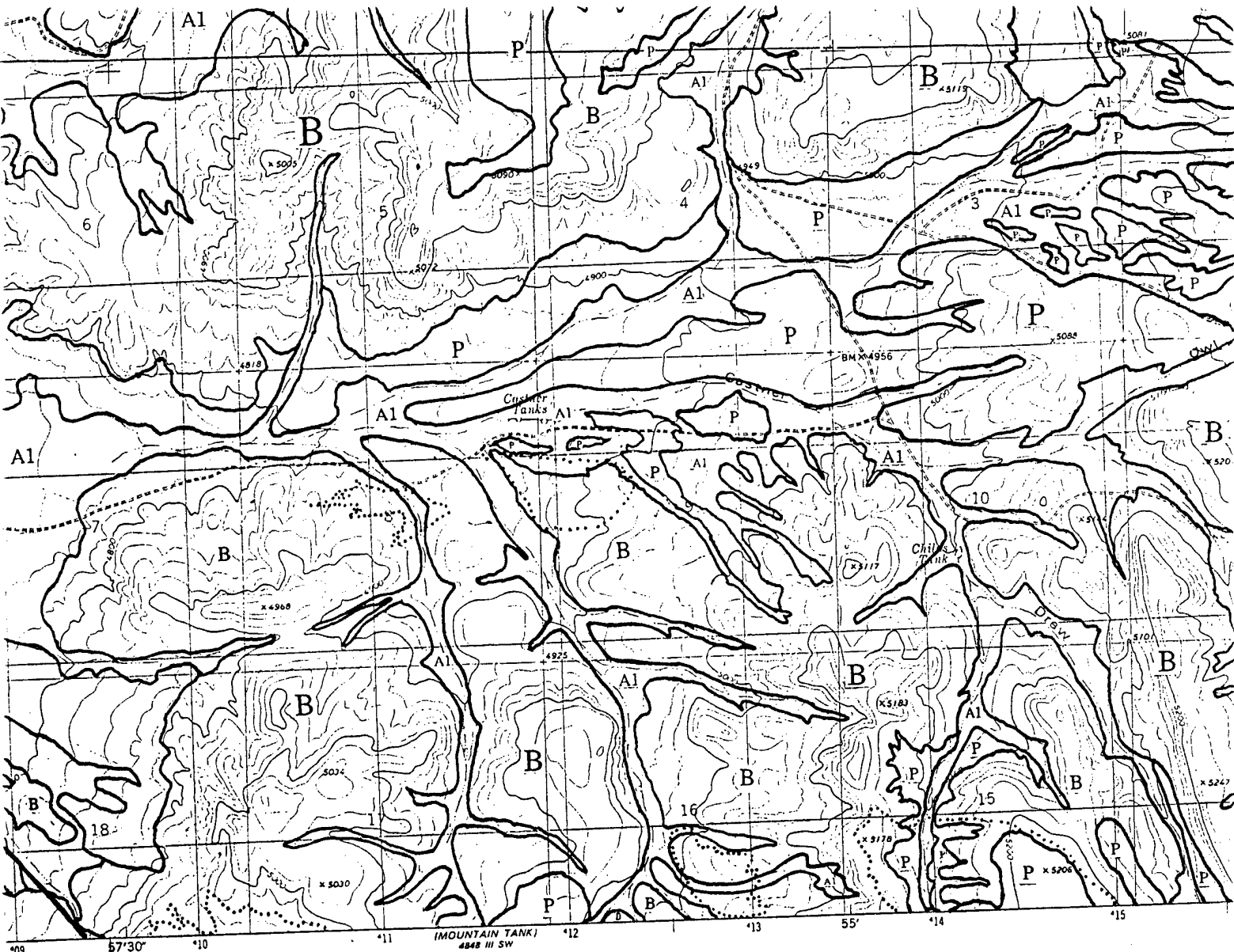
¹See text for explanation



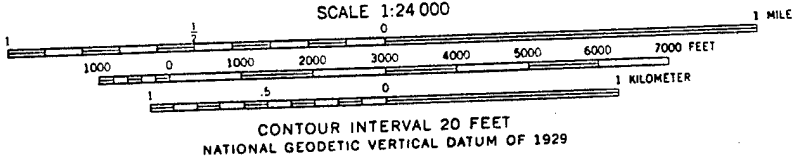
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THIS MAP
FOR SALE BY U.S. GEOLOGIC
A FOLDER DESCRIBING

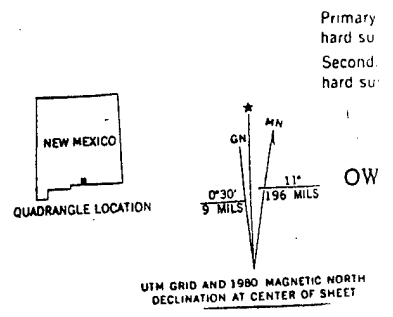
7



- Geomorphic and Symbols¹**
- A1
 - A2
 - A3
 - B
 - P
- (e) Sediments**
- CR...
 - DL
 - DP
 - DS
 - DSC
 - DSG
 - P
 - P1
 - PIL
- ous**
- e induced)**
- n**



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

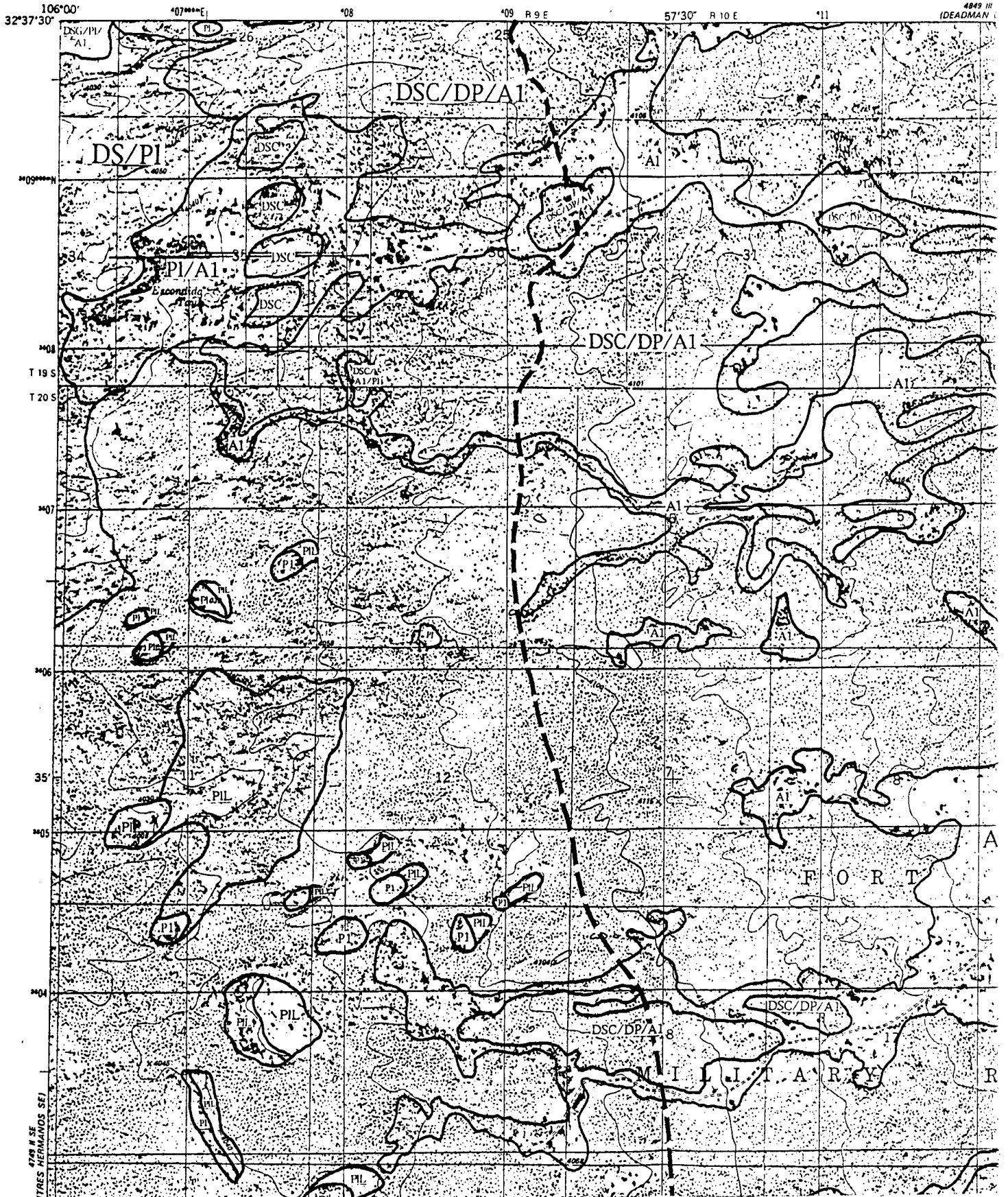


8

4749 N SE
(TRES HERMANOS)

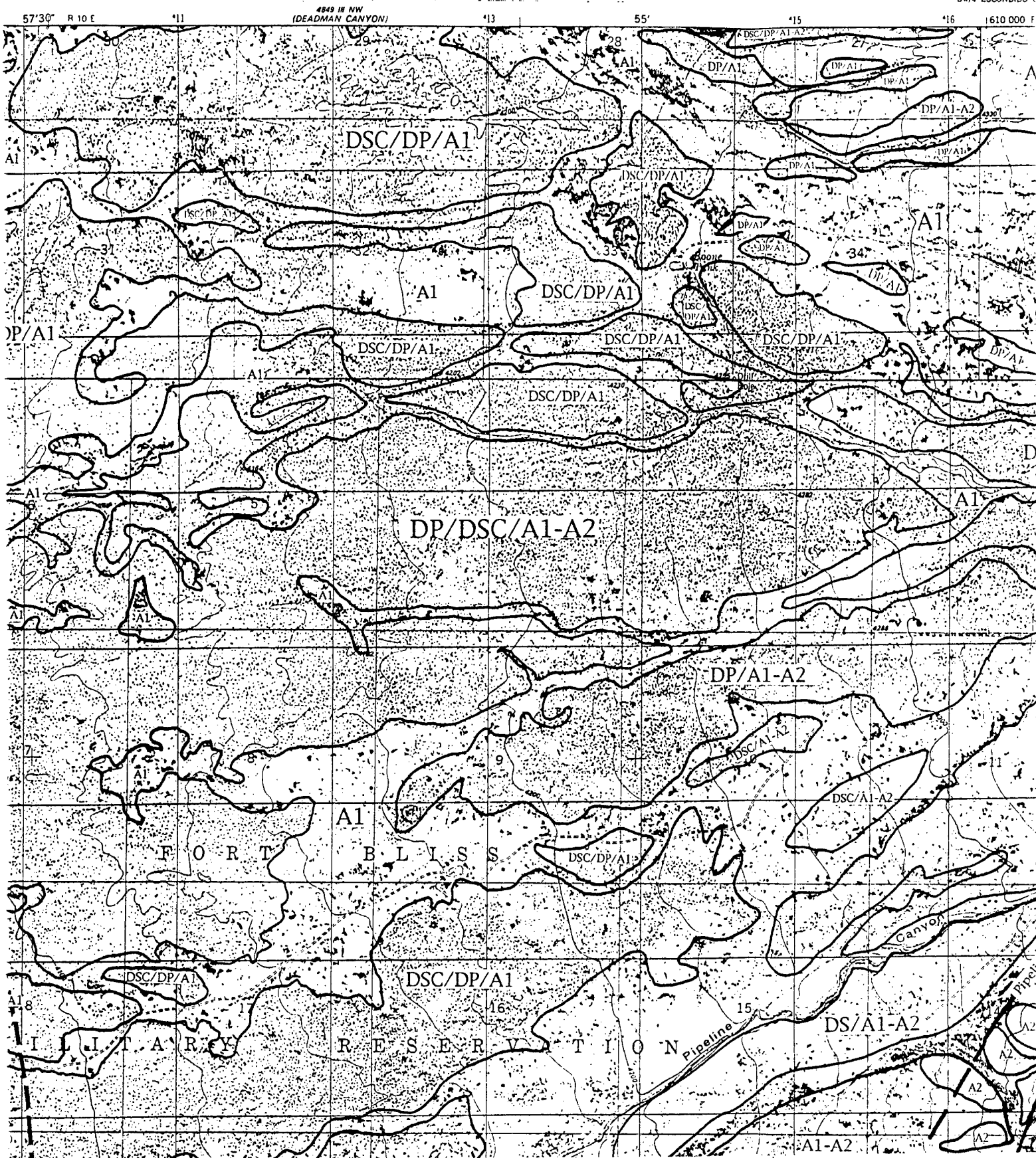
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geocological, Geoa
Study of McGregor Guided Missile
Donald L. Johnson, Ph.D., Contra



SW/4 ESCONDIDO (

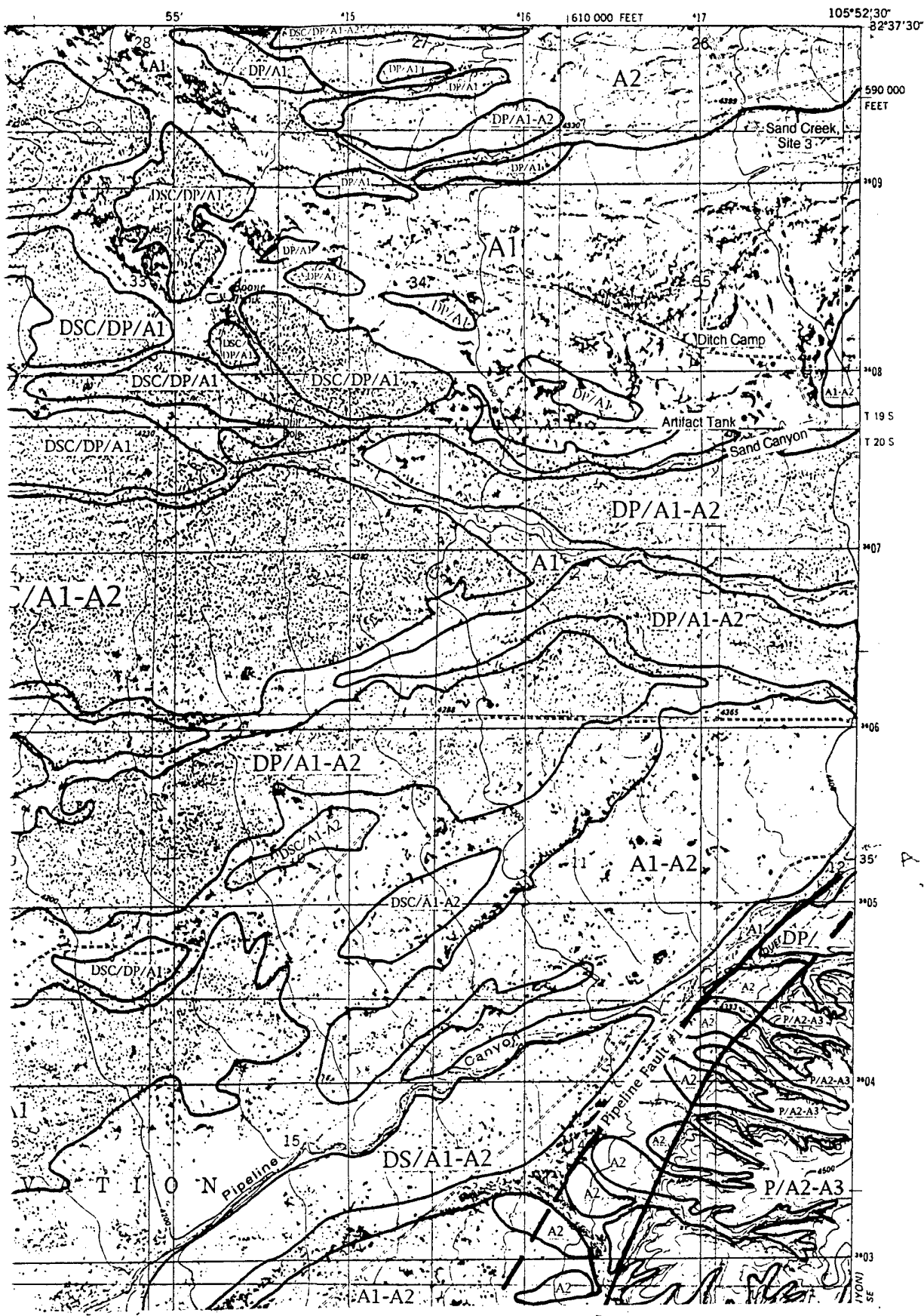
Donald L. Johnson, *Ph.D.*, Contract No. DACA63-93-D-0014, 1997



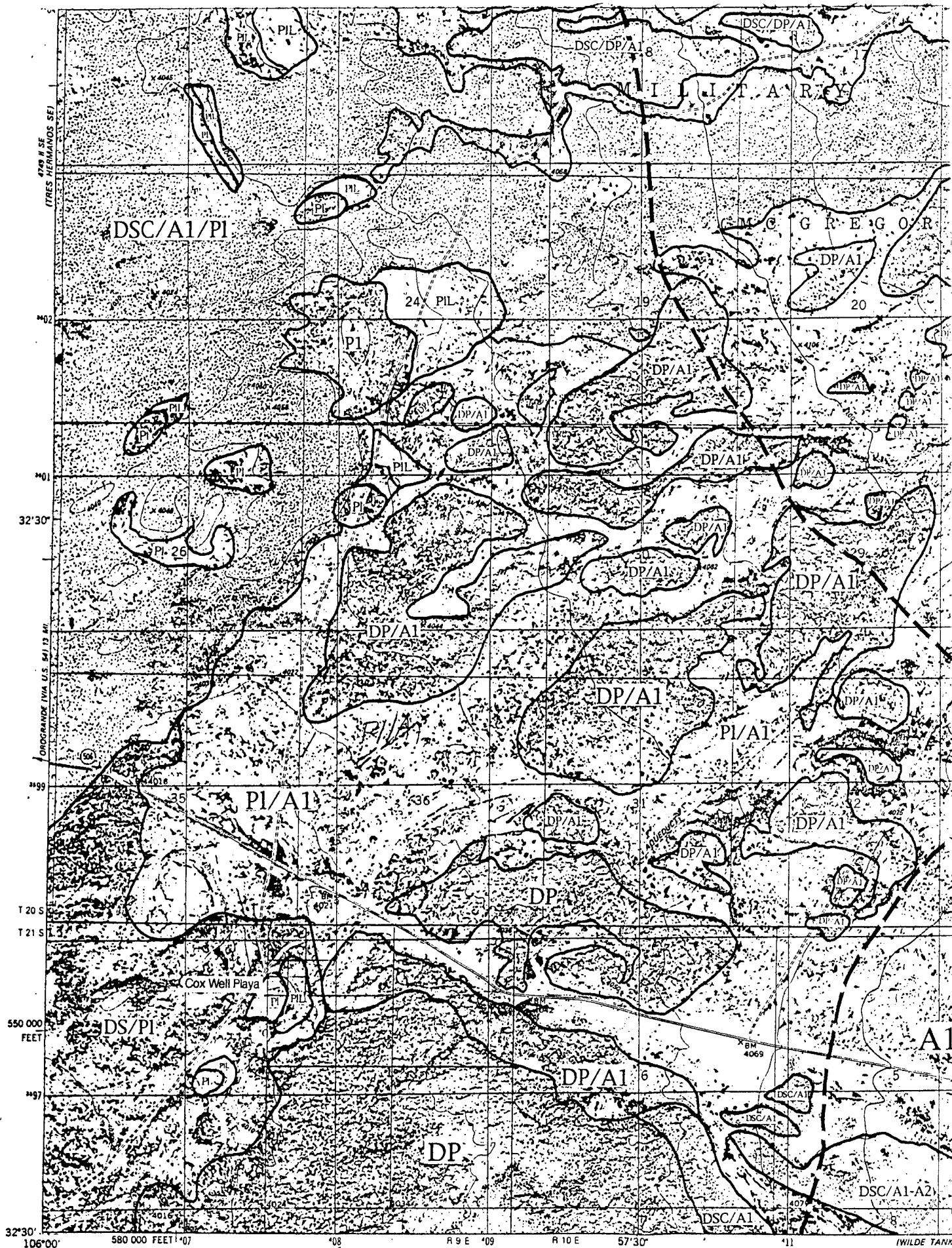
Surficial Mapping
New Mexico
1, 1997

PIPELINE CANYON QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SW/4 ESCONDIDO CANYON 15' QUADRANGLE

4849 III NE
BUG SCUFFLE
CANYON



3.



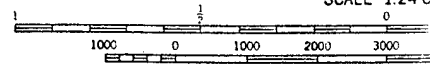
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1972. Orthophotomosaic from aerial photographs taken 1971
Field checked 1975. Map edited 1982

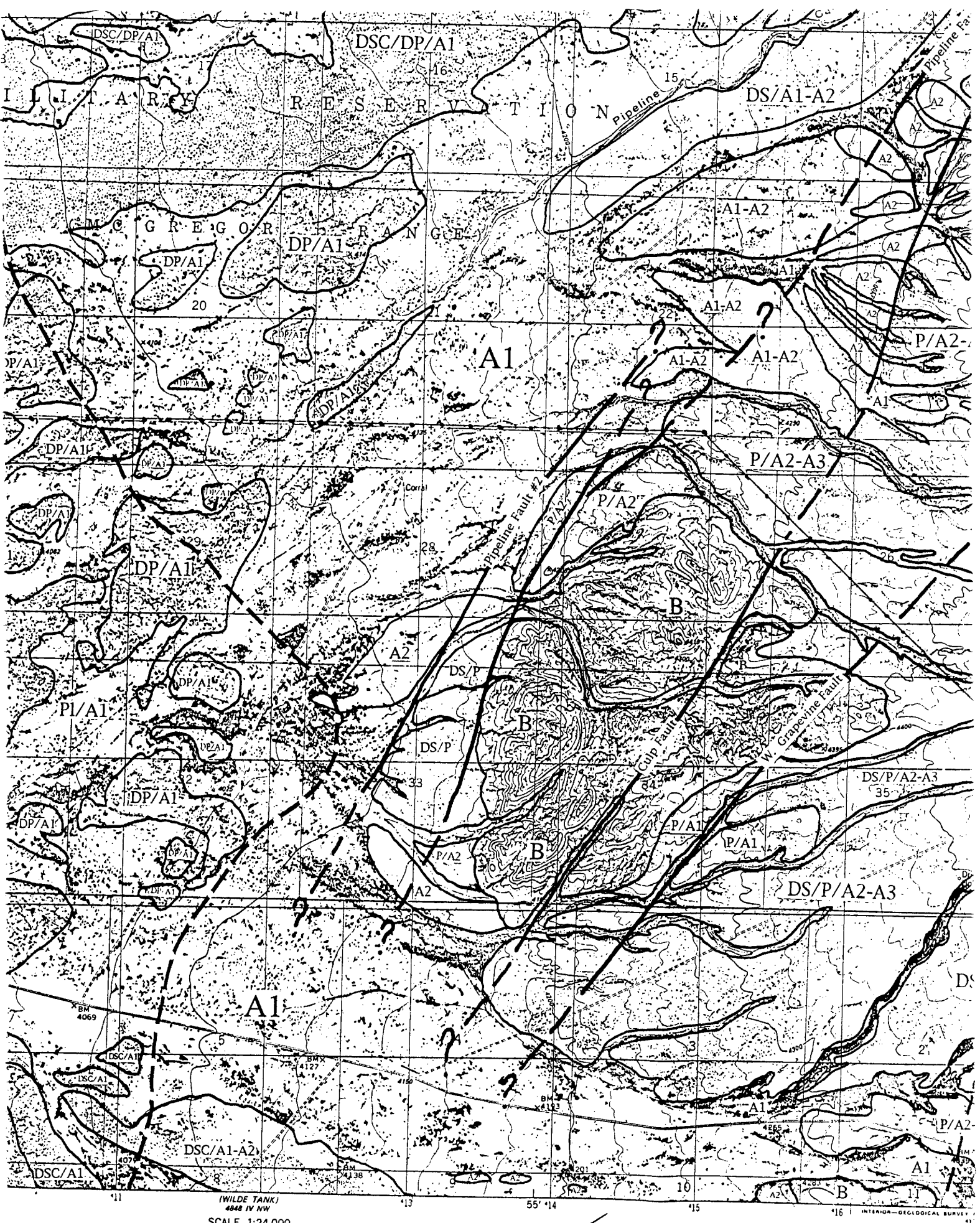
Projection and 10,000-foot grid ticks: New Mexico

McGregor Range Geomorphic Mapping Units and Symbols¹

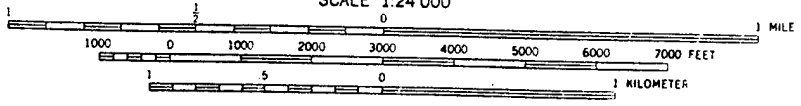
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	



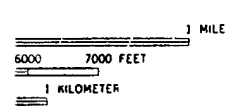
CONTOUR INTERVAL



(WILDE TANK)
4848 IV NW
SCALE 1:24 000



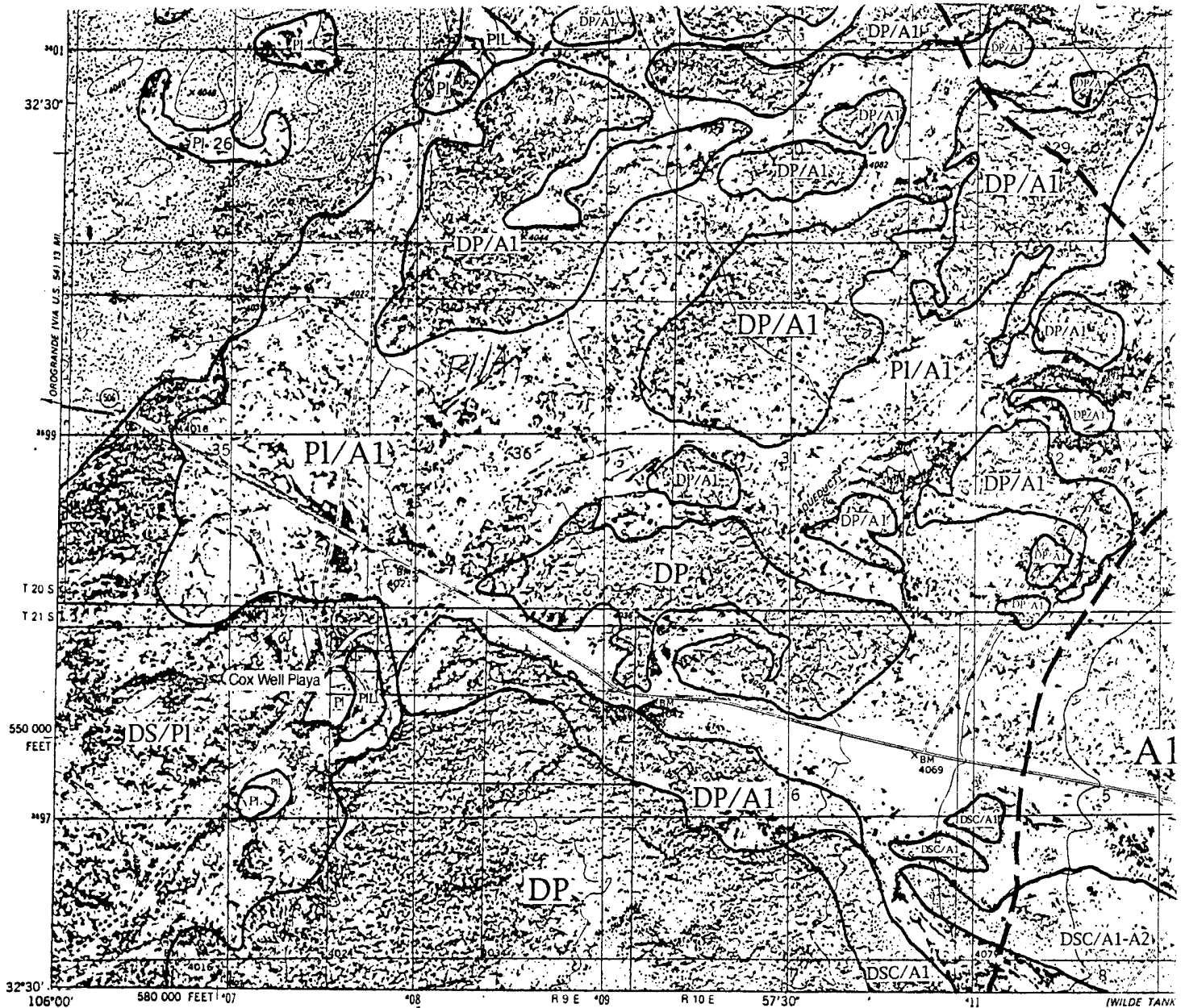
ROAD CLASSIFIC
Primary highway, hard surface
Secondary highway, hard surface
Light impr



ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road

488 ft ME
1070 ft ME
North



2411 NE
JROGRANDE
NORTH

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1972. Orthophotomosaic from aerial photographs taken 1971. Field checked 1975. Map edited 1982.

Projection and 10,000-foot grid ticks: New Mexico coordinate system, central zone (transverse Mercator) 1000-meter Universal Transverse Mercator grid, zone 13 1927 North American datum

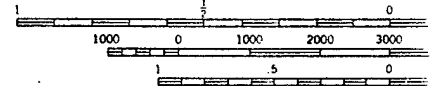
To place on the predicted North American Datum 1983 move the projection lines 7 meters south and 50 meters east as shown by dashed corner ticks

There may be private inholdings within the boundaries of the National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	
Pediment	P
Playa	PI
Playa Lunette	PIL

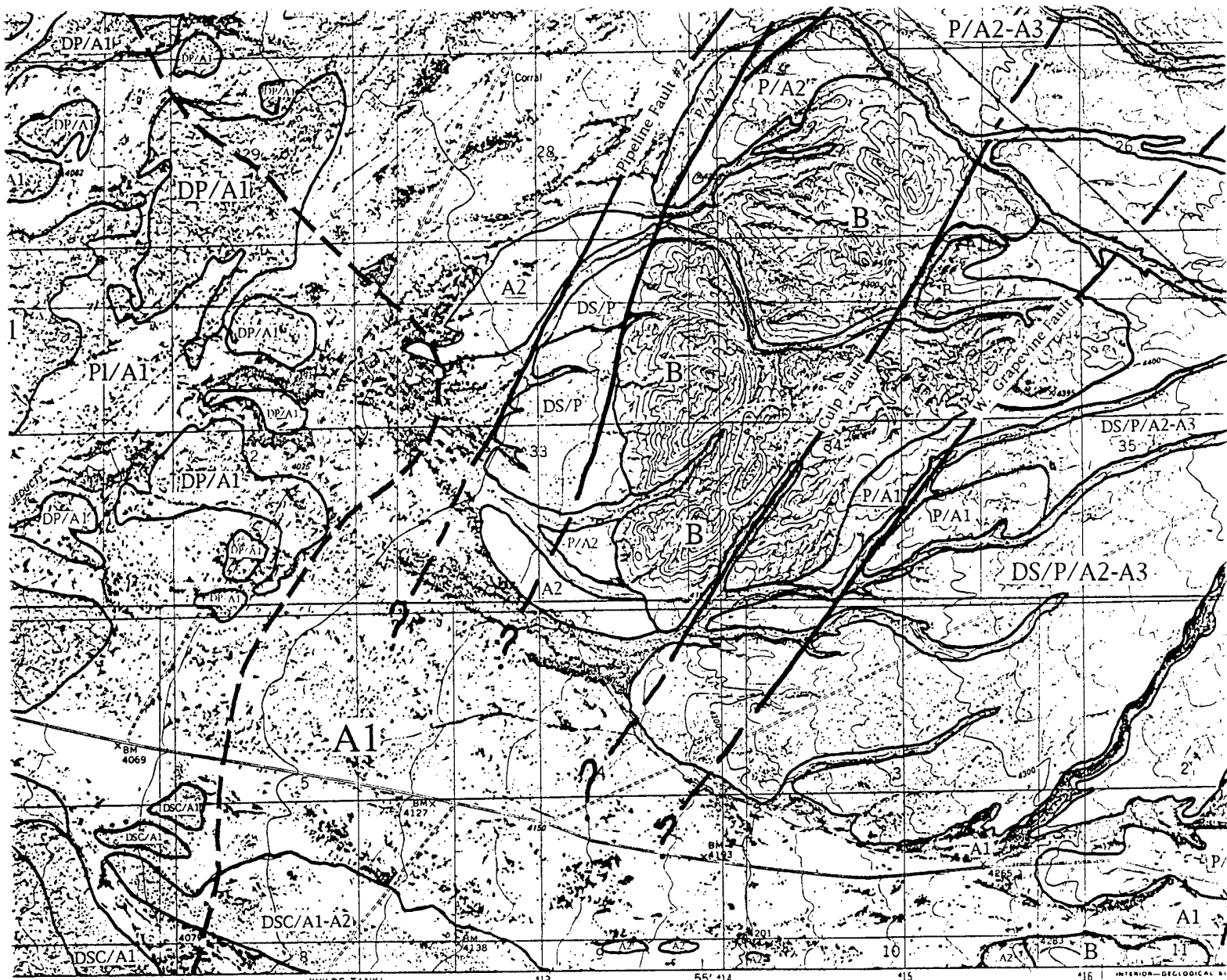
¹See text for explanation



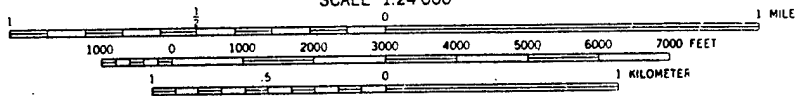
CONTOUR INTERVAL
DOTTED LINES REPRESENT 1:
NATIONAL GEODETIC VERTICAL

THIS MAP COMPLIES WITH NATIONAL MAP
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, CO
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND

7



(WILDE TANK)
4848 IV NW
SCALE 1:24 000



CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



ROAD CLAS

Primary highway, hard surface ————
Secondary highway, hard surface ————
Interstate Route ———— U

PIPELINE
SW/4 ESCON: N3:

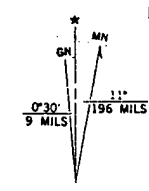
UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

DMA 48

8



1 MILE
7000 FEET
1 KILOMETER



ROAD CLASSIFICATION

Primary highway, hard surface	Light-duty road, hard or improved surface
Secondary highway, hard surface	Unimproved road
Interstate Route	U. S. Route
	State Route

PIPELINE CANYON, N. MEX.
SW/4 ESCONDIDO CANYON 15' QUADRANGLE
N3230-W10552.5/7.5

1982

DMA 4849 III SW-SERIES V881

STON, VIRGINIA 22092
ON REQUEST

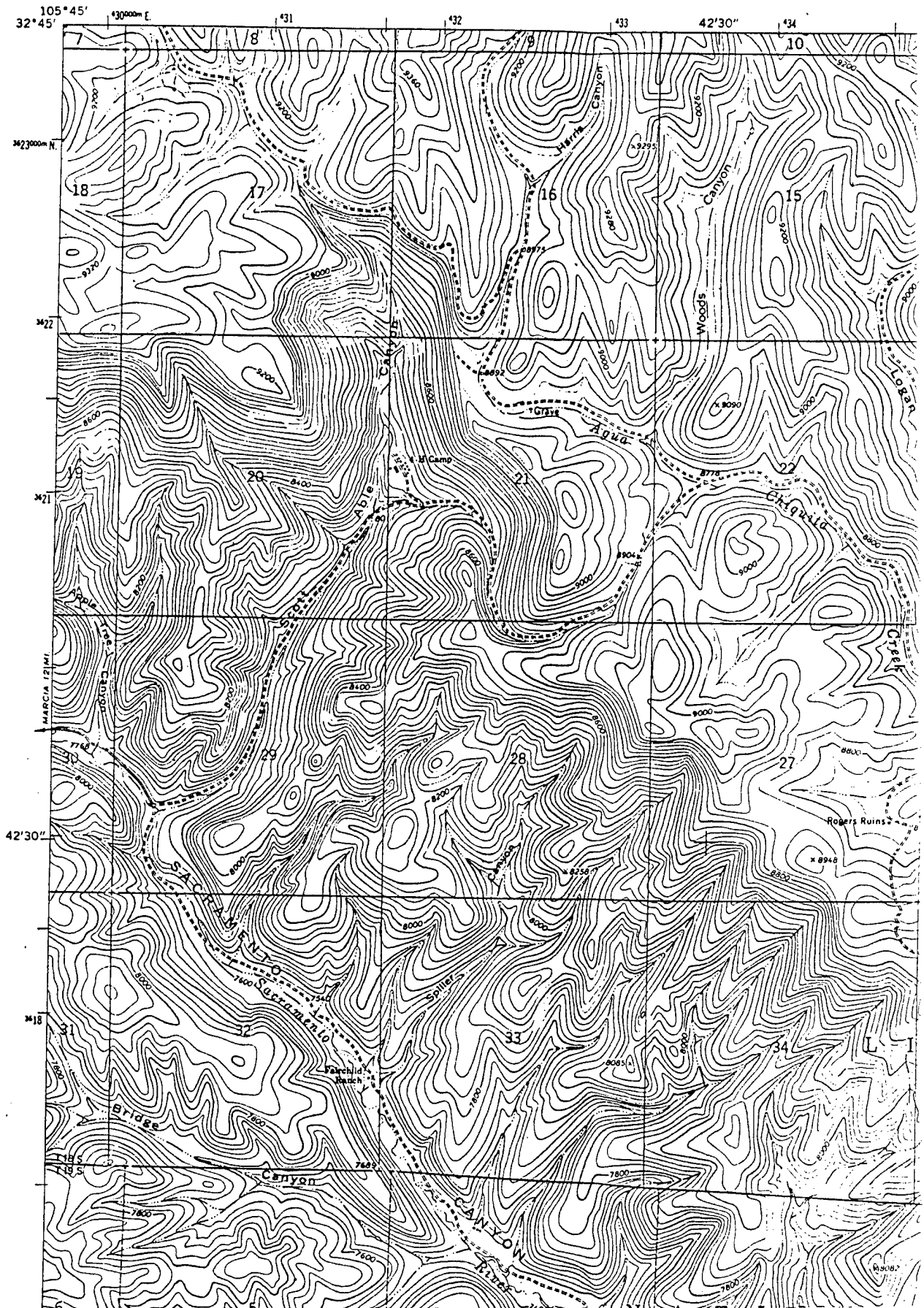
UTM GRID AND 1982 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

3481 N. MEX.
(OTERO MESA
NORTH)

Handwritten circled 'R' or 'C'.

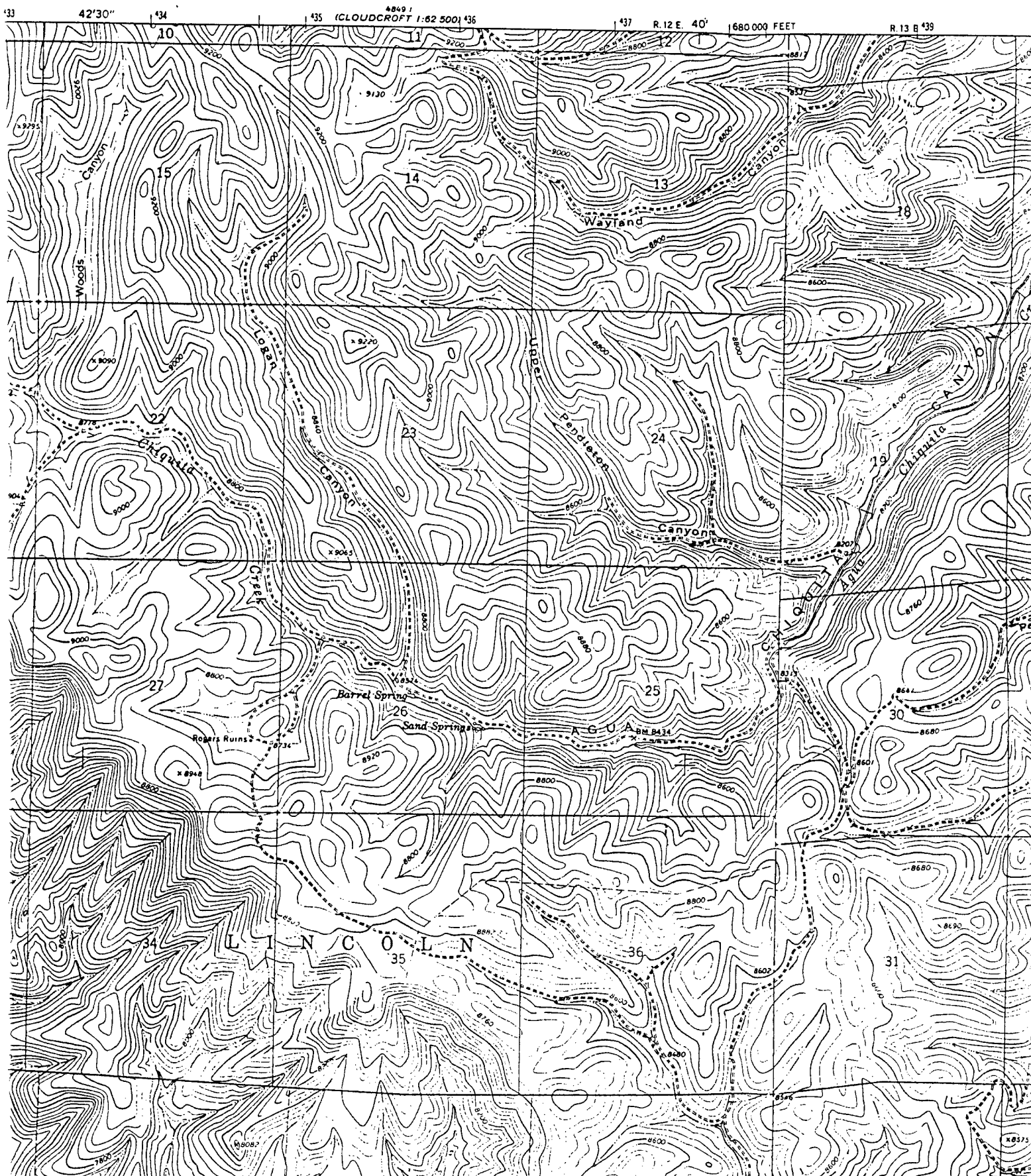
Handwritten number '9'.

**Geomorphological, Geochemical, and Geophysical
Study of McGregor**
Donald L. Johnson



Geomorphological, Geocological, Geoarchaeological and Surficial Mapping Study of McGregor Guided Missile Range, Fort Bliss, New Mexico

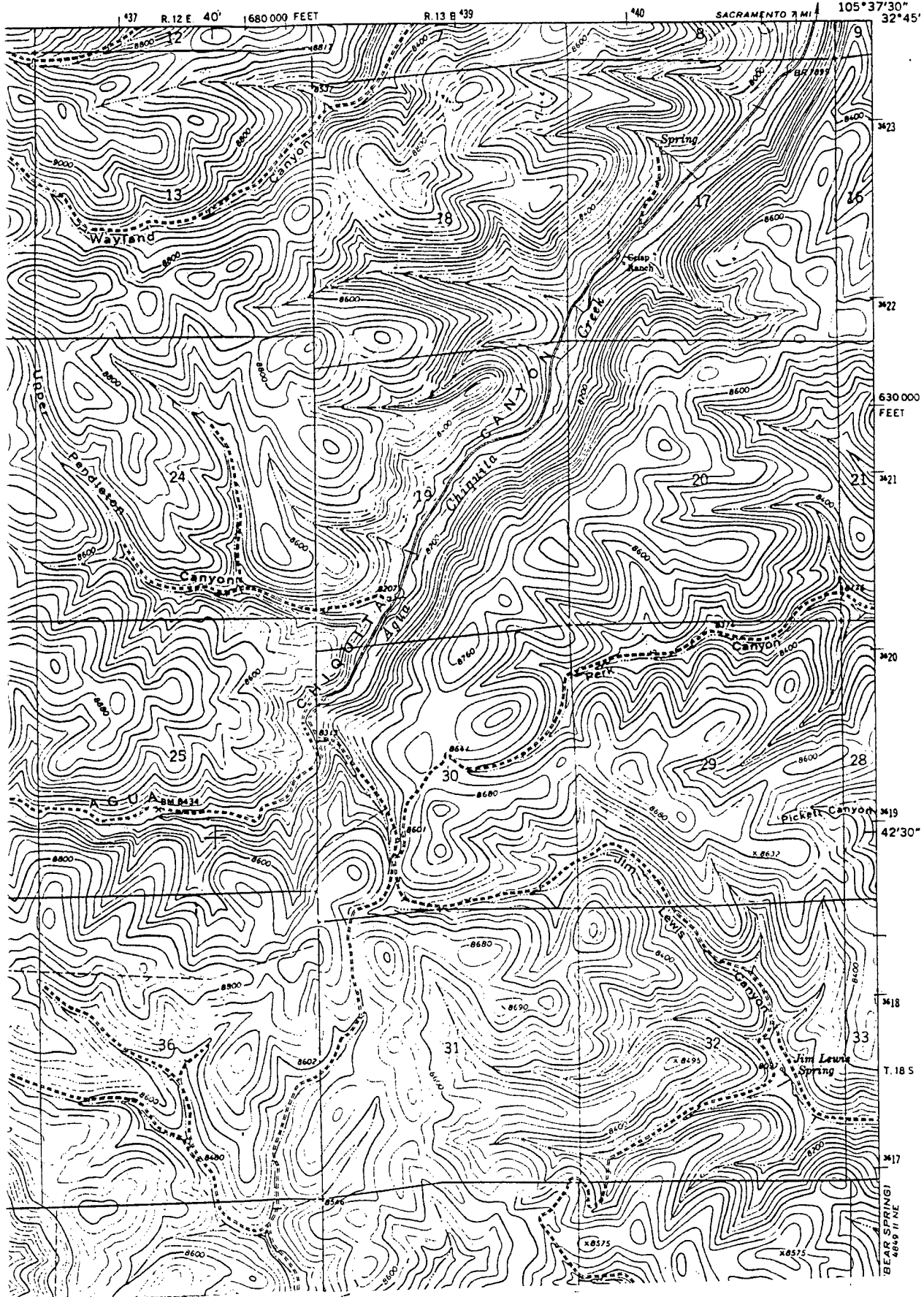
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

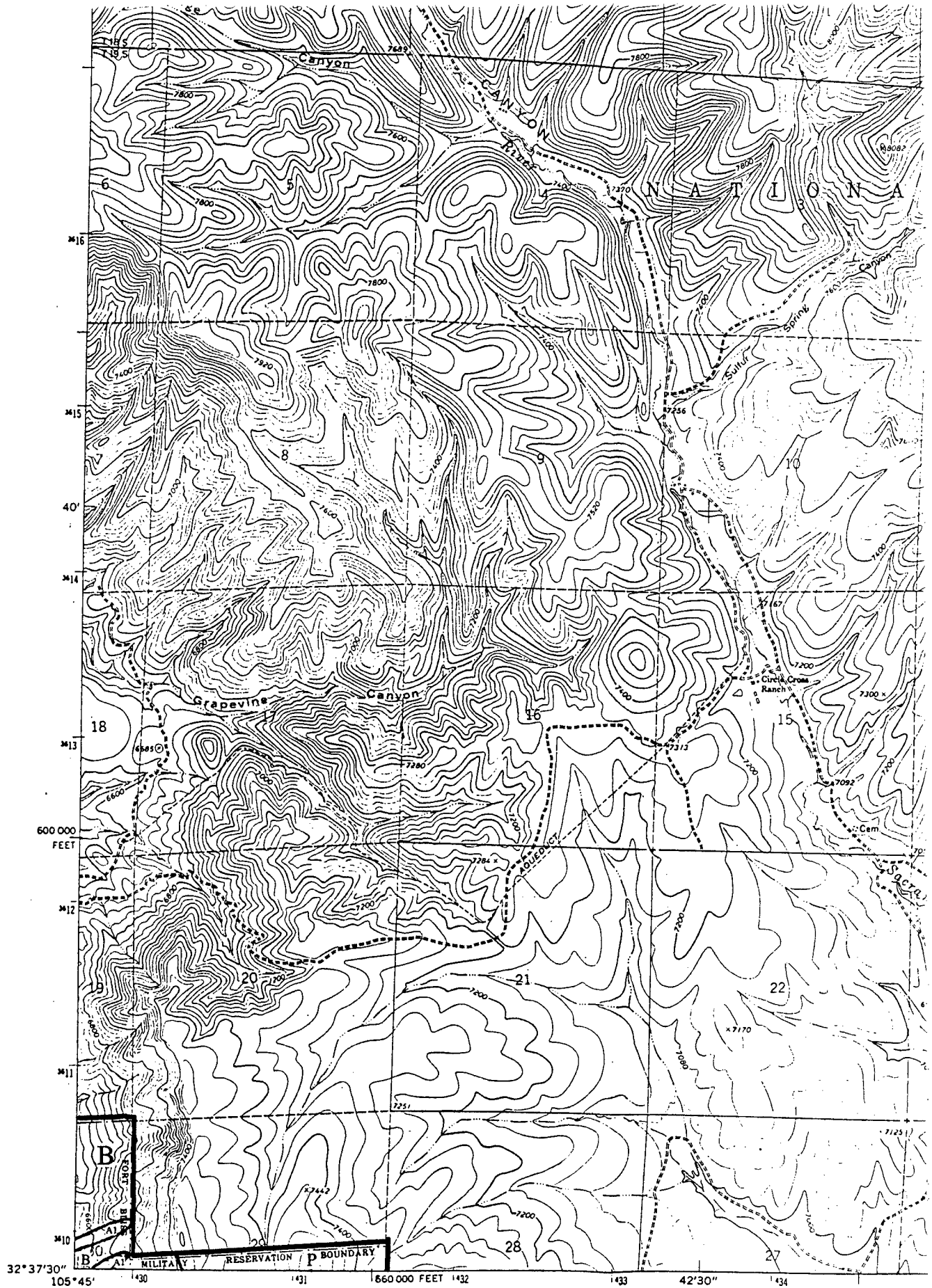


and Surficial Mapping
Bliss, New Mexico
D-0014, 1997

ROGERS RUINS QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

8889 I
CLOUDCROFT
1:62,500





Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

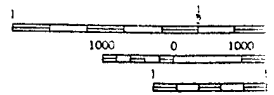
Topography by photogrammetric methods from aerial
photographs taken 1964 and 1965. Field checked 1965

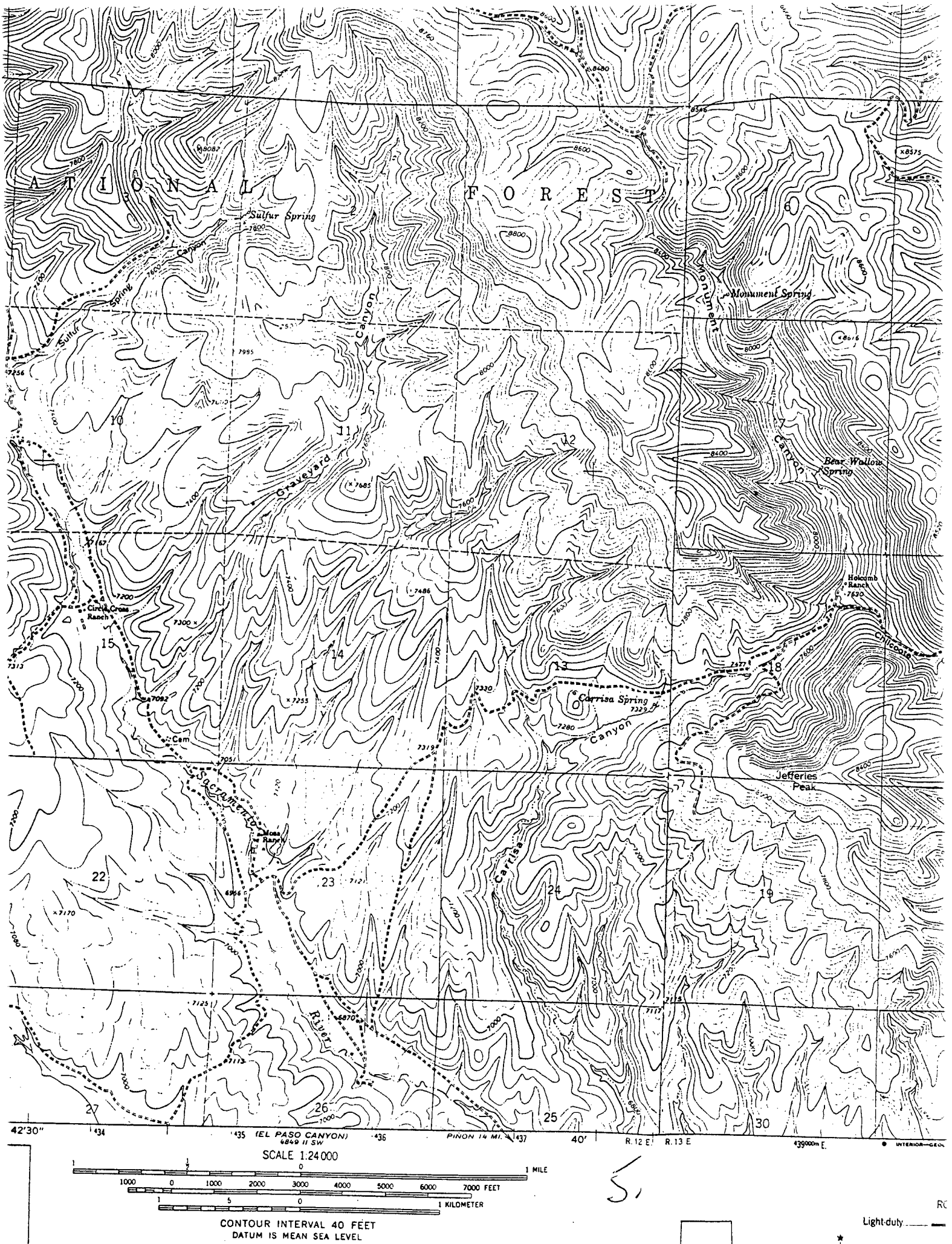
Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone

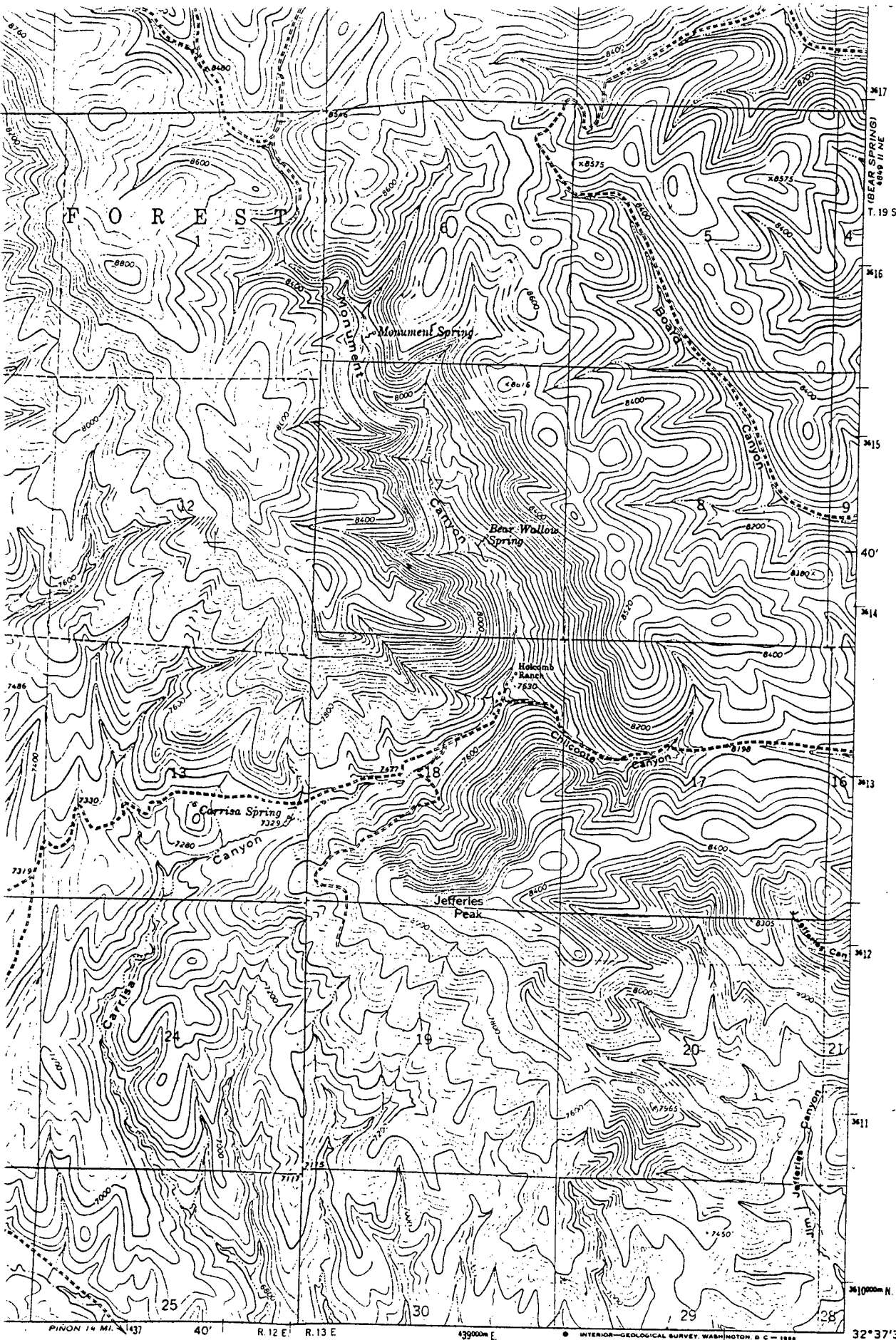
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	---
Camp Rice (Rio Grande) Sediments	CR
Dune, Local	DL
Dune Pile	DP







3617
3616
3615
3614
3613
3612
3611
3610000 N.
32°37'30"
105°37'30"



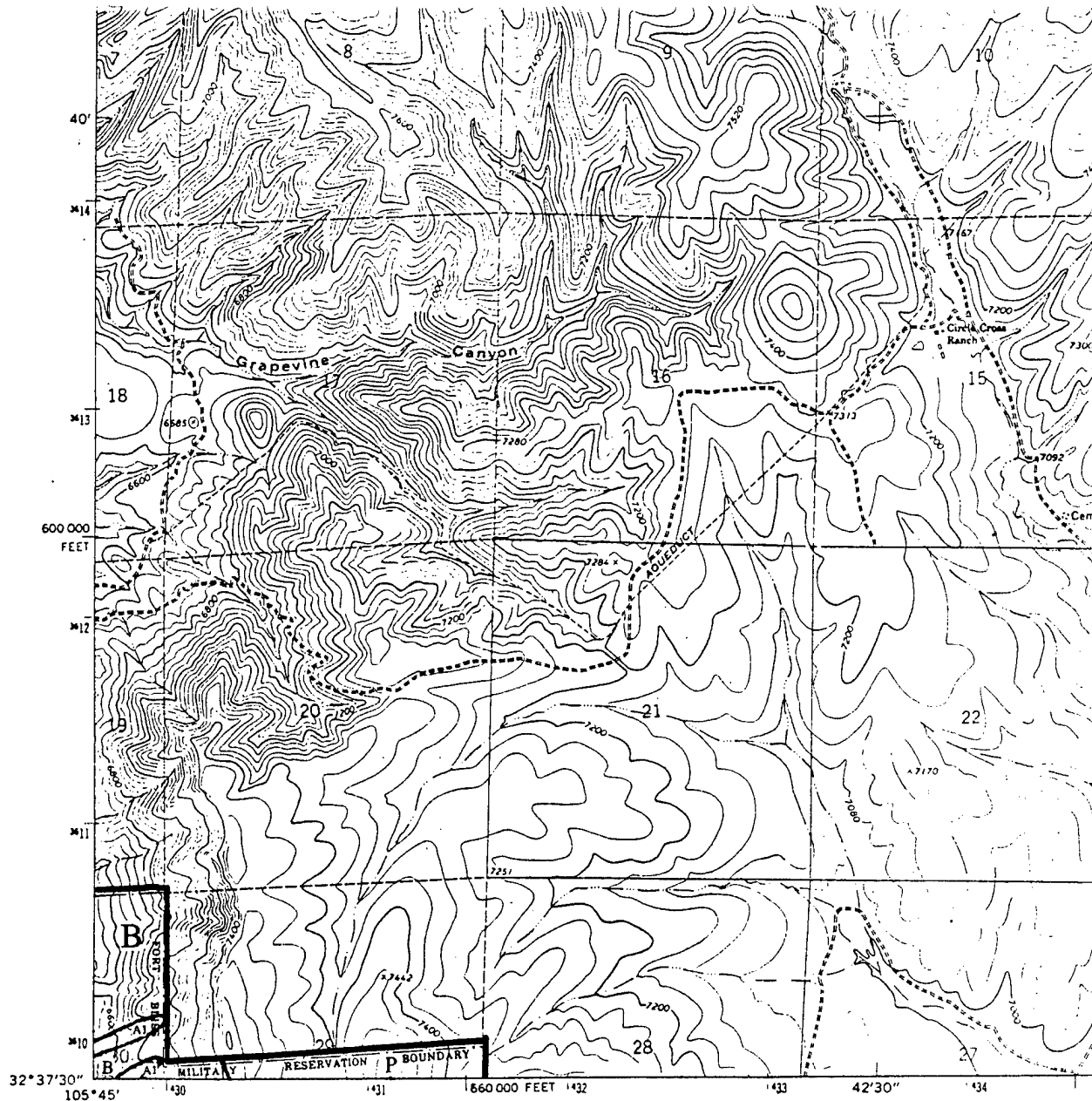
NEW MEXICO



ROAD CLASSIFICATION

Light-duty ————— Unimproved dirt - - - - -

See II SE
(SURREYORS
CANYON)

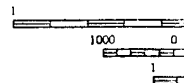


Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

Topography by photogrammetric methods from aerial
photographs taken 1964 and 1965. Field checked 1965

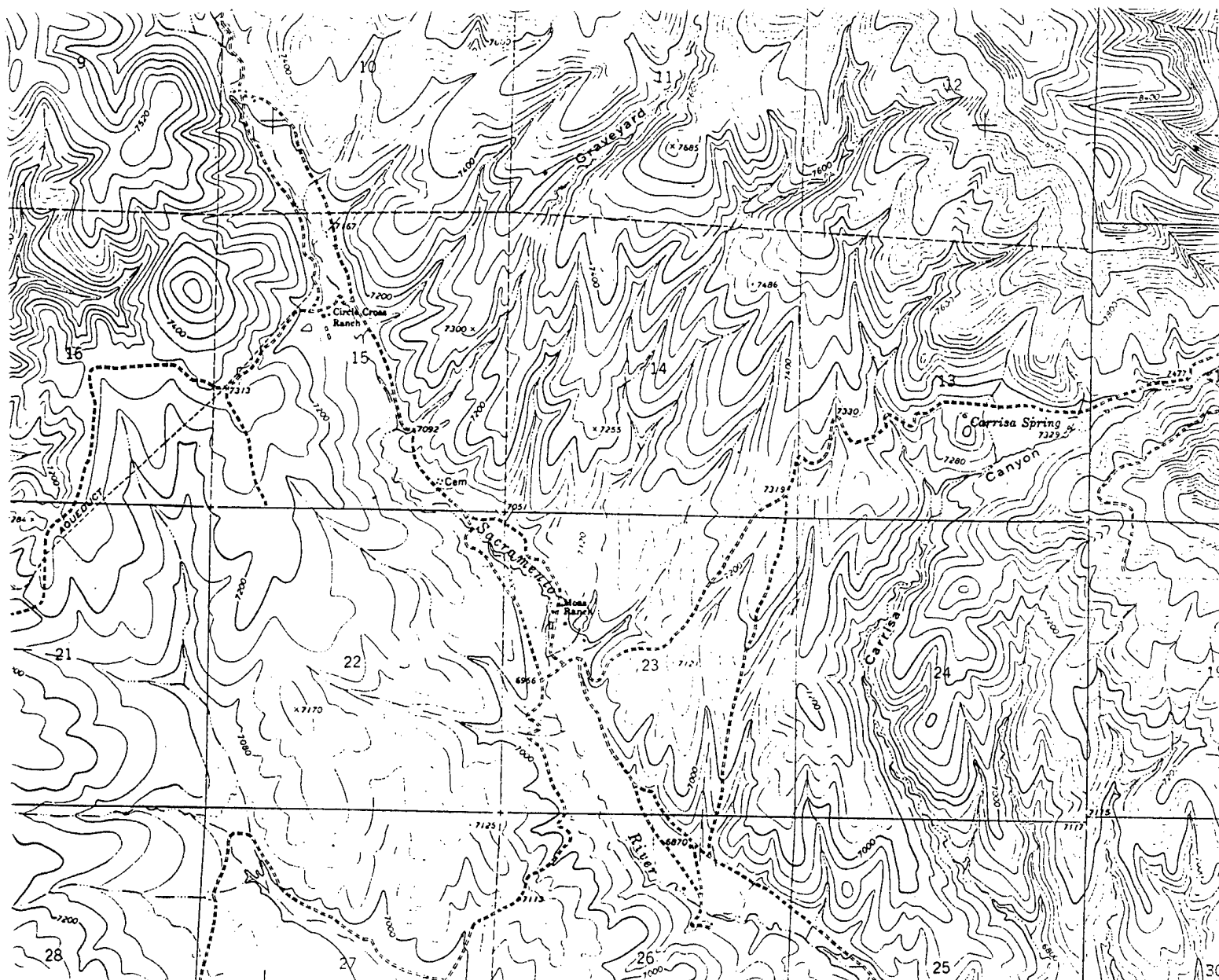
Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	---
Camp Rice (Rio Grande) Sediments	CR
Dune, Local	DL
Dune Pile	DP
Dune Sheet	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	---
Pediment	P
Playa	P1
Playa Lunette	PIL
¹ See text for explanation	



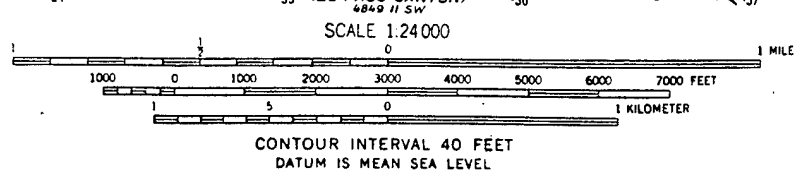
THIS MAP
FOR SALE BY U.S. GEOLOGICAL SURVEY
A FOLDER DESCRIPTION

7



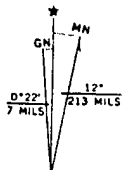
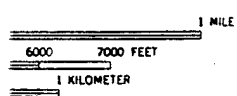
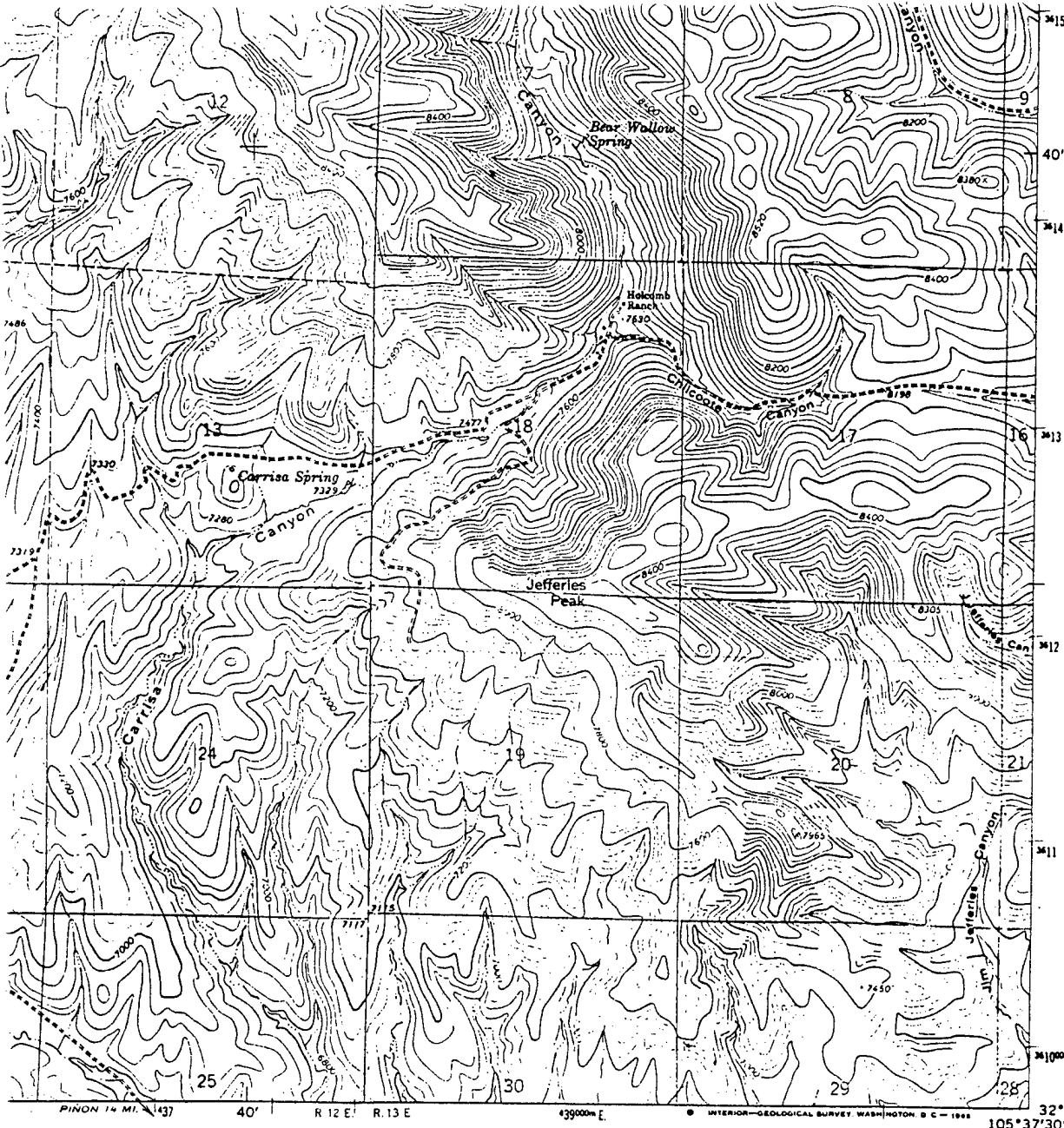
McGregor Range Geomorphic Mapping Units and Symbols

um (recent)	A1
um (relict)	A2
um (older relict)	A3
ck	B
Floor Complex	---
Rice (Rio Grande) Sediments	CR
Local	DL
Pile	DP
Sheet	DS
Sheet, Coppiced	DSC
Sheet, Gypsiferous	DSG
---	---
ent	P
	P1
Lunette	PIL
vt for explanation	



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

8



ROAD CLASSIFICATION

Light-duty ————— Unimproved dirt - - - - -

YDARDS
R WASHINGTON, D. C. 20242
ABLE ON REQUEST

UTM GRID AND 1965 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROGERS RUINS, N. MEX.
N3237.5—W10537.5/7.5

1965

AMS 4849 II NW—SERIES V881

105° 37' 30" N
SURVEYORS
CANYON

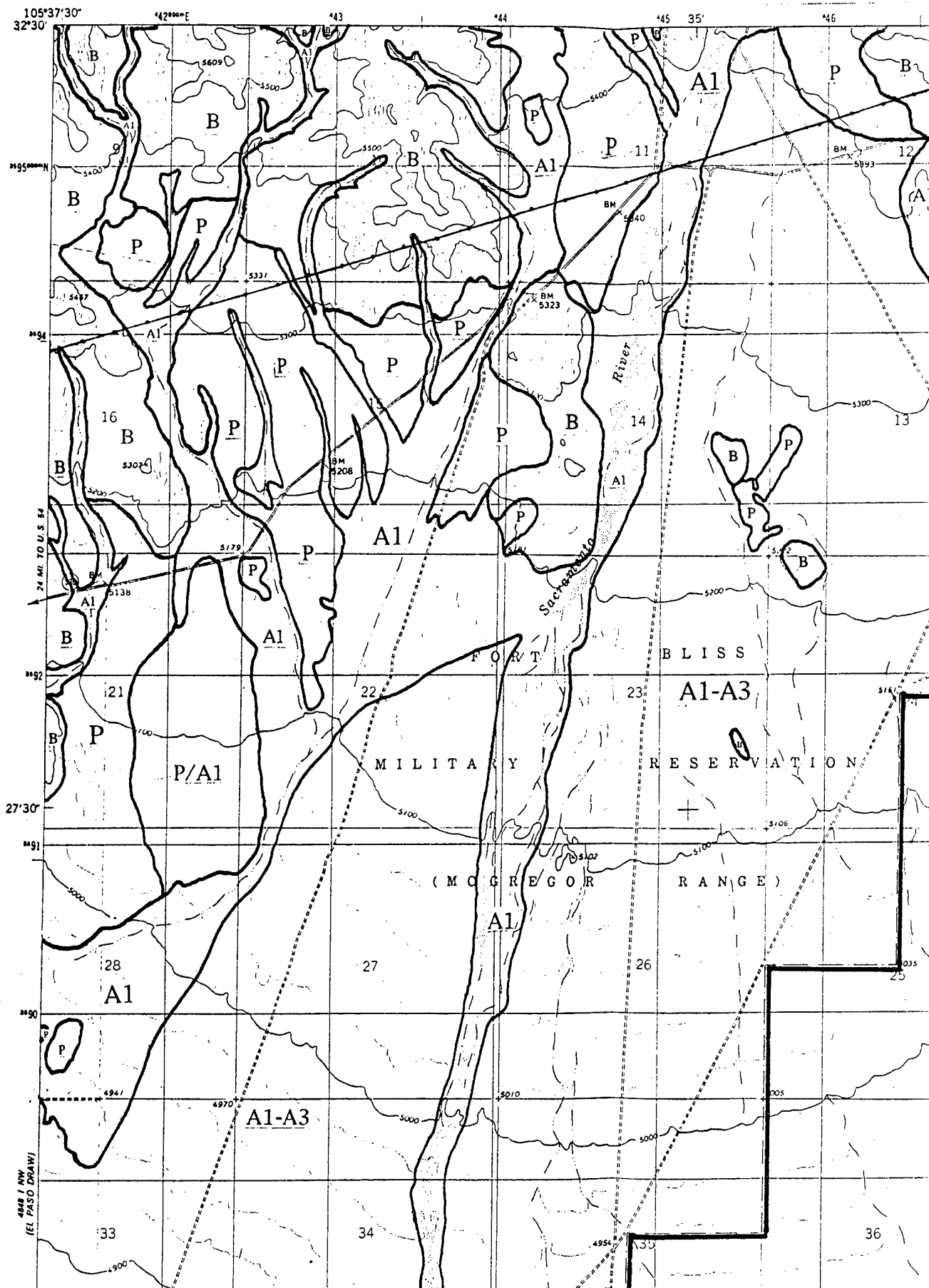
28

9

443.5 SW
(EL PASO CANYON)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geo-
Study of McGregor
Donald L. J



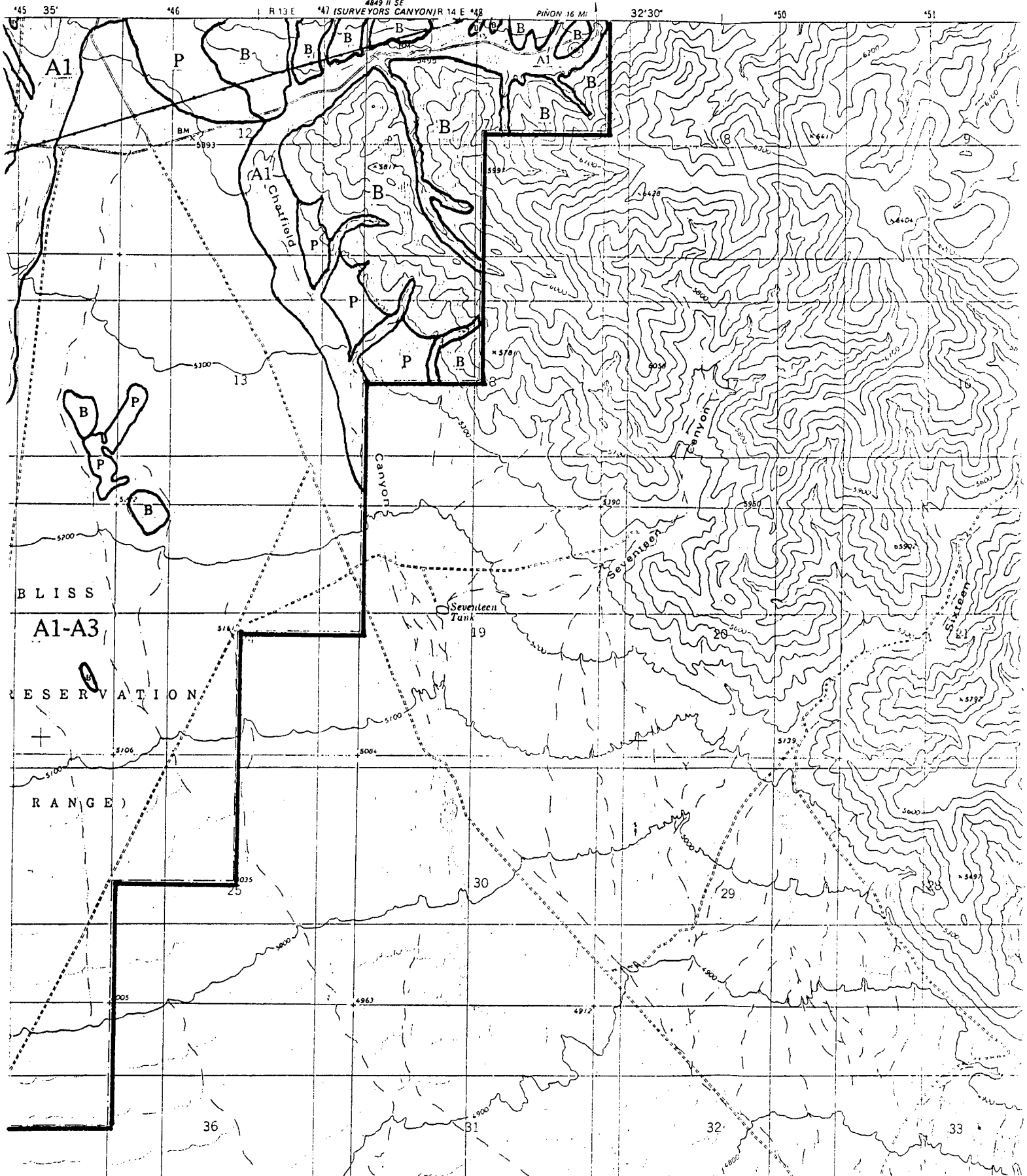
10

Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

SIXTEE

N

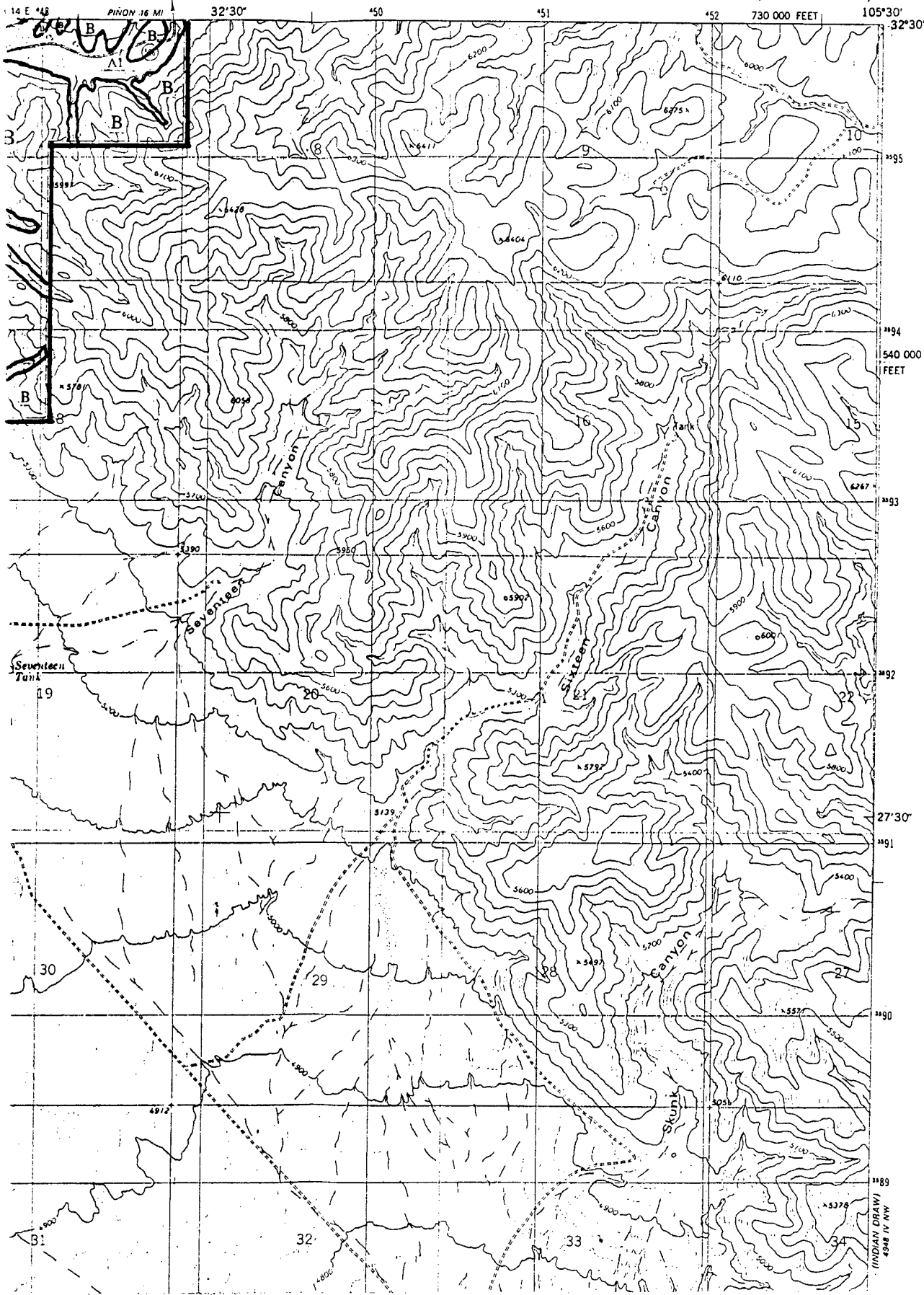
7.5 MI



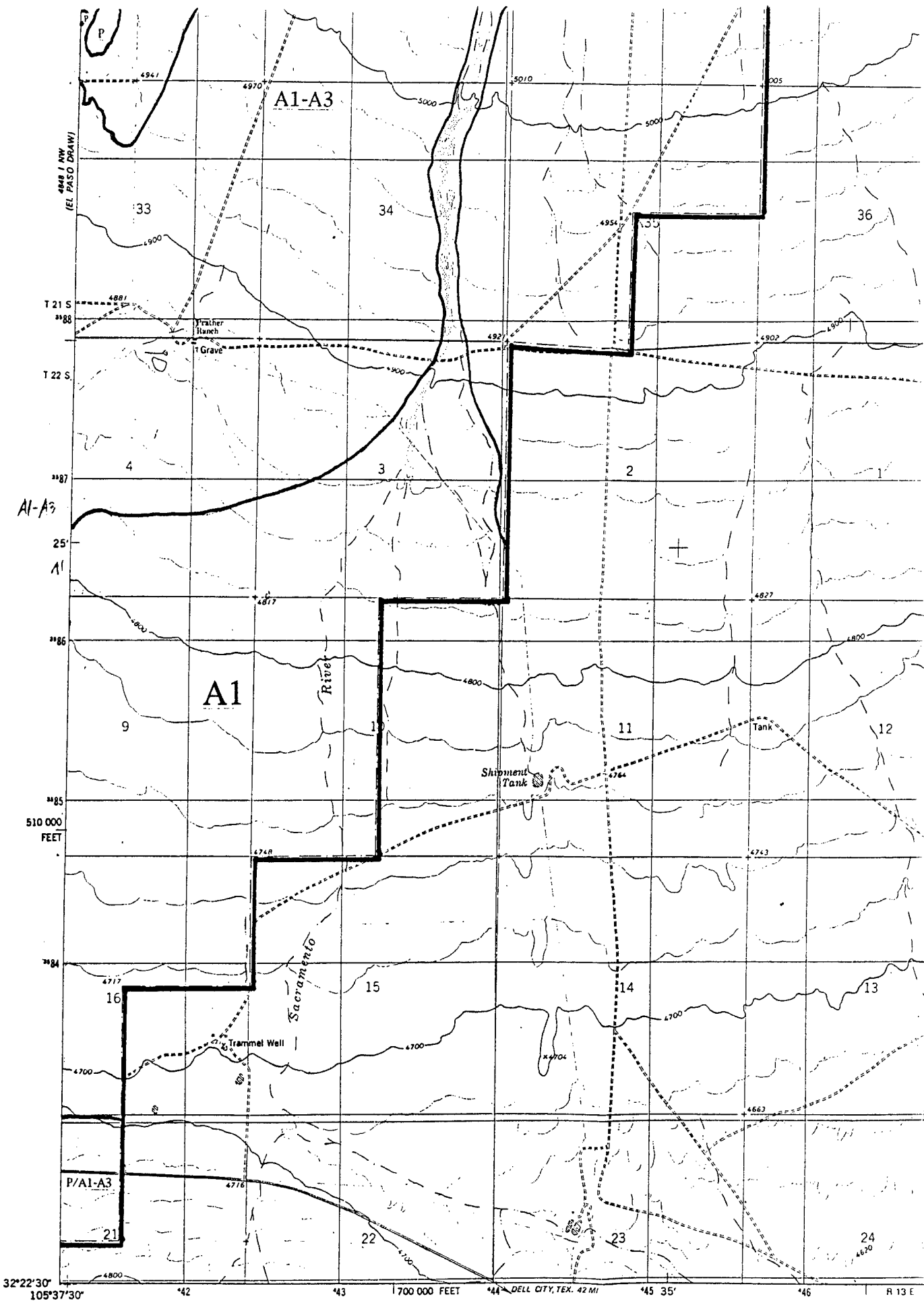
logical and Surficial Mapping
e, Fort Bliss, New Mexico
ACA63-93-D-0014, 1997

SIXTEEN CANYON QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

489 10 SW
PIÑON



3.

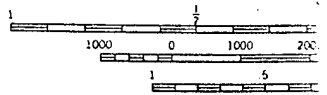


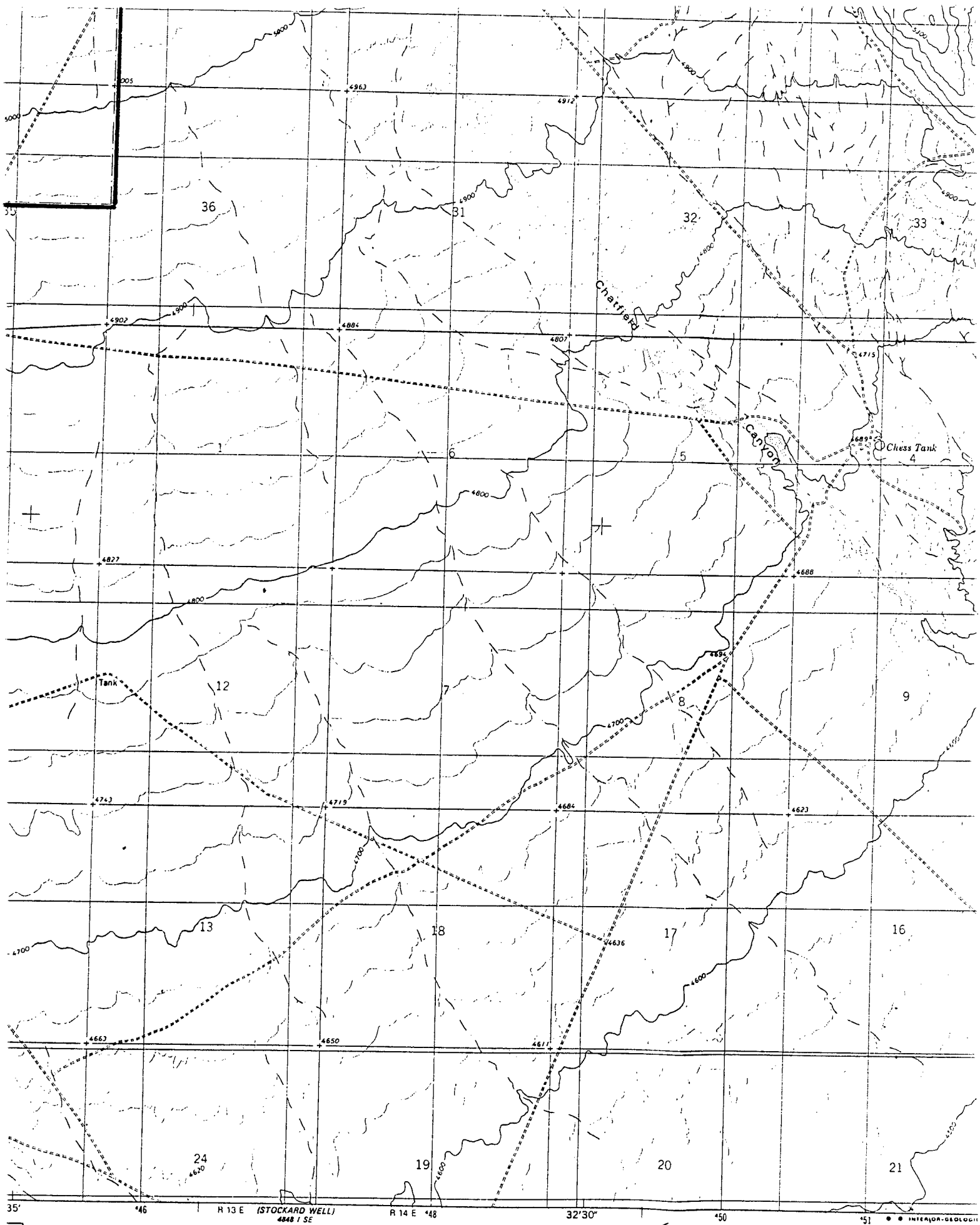
4

STONE WELL
4848 / SW

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central meridian 105°37'30"

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B

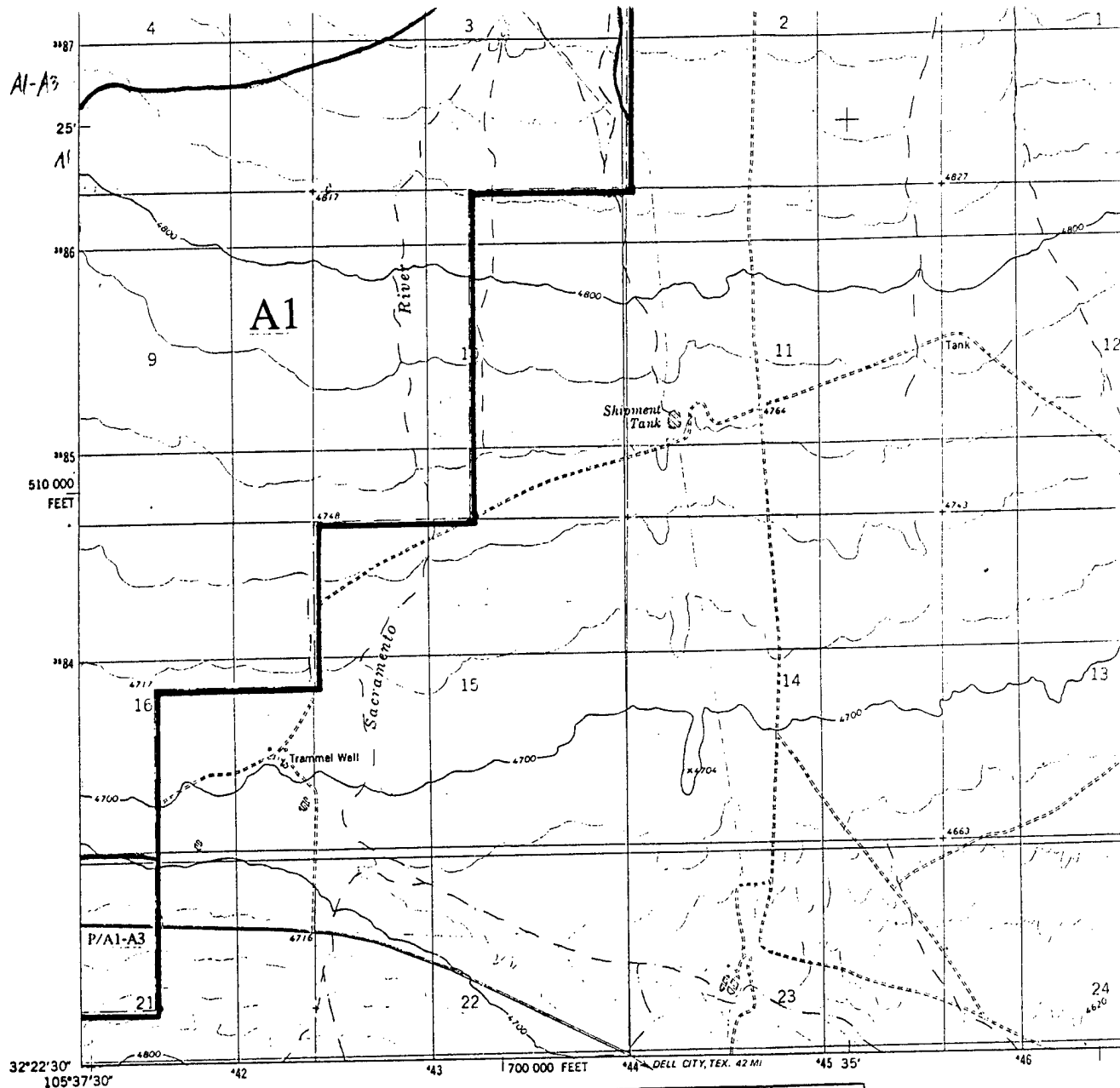




5.

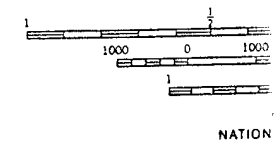
ROAD

Primary highway,
hard surface
Secondary highway.



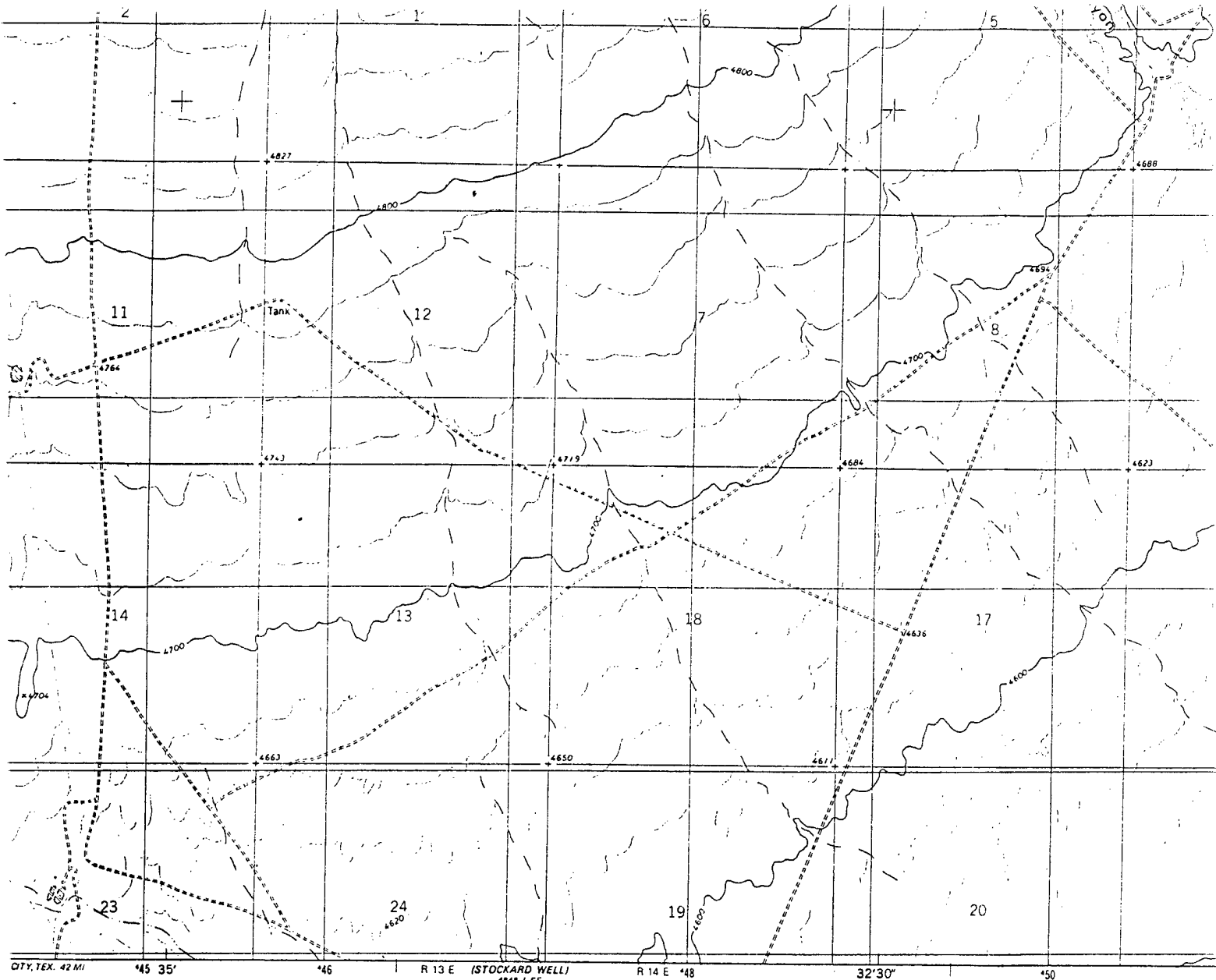
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1974. Field checked 1975. Map edited 1980
Projection and 10,000-foot grid ticks: New Mexico coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American Datum
The difference between 1927 North American Datum and North American Datum of 1983 (NAD 83) for 7.5 minute intersections is given in USGS Bulletin 1875. The NAD 83 is shown by dashed corner ticks
Fine red dashed lines indicate selected fence lines
There may be private inholdings within the boundaries of the National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	DL
Dune, Local	DP
Dune Pile	DS
Dune Sheet (Sand Sheet)	DSC
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	
Fault	P
Pediment	P1
Playa	PIL
Playa Lunette	
¹ See text for explanation	

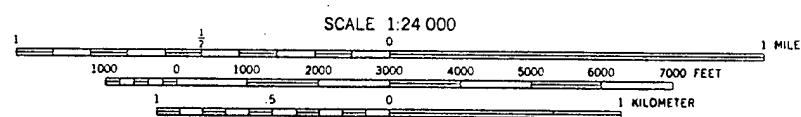


THIS MAP COM
FOR SALE BY U. S. GEOLOGICAL
A FOLDER DESCRIBING TO

7.

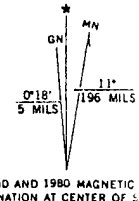


- ange Geomorphic
its and Symbols¹
- A1
 - A2
 - A3
 - B
 - CR
 - DL
 - DP
 - DS
 - DSC
 - DSG
 - P
 - P1
 - P1L
- tion

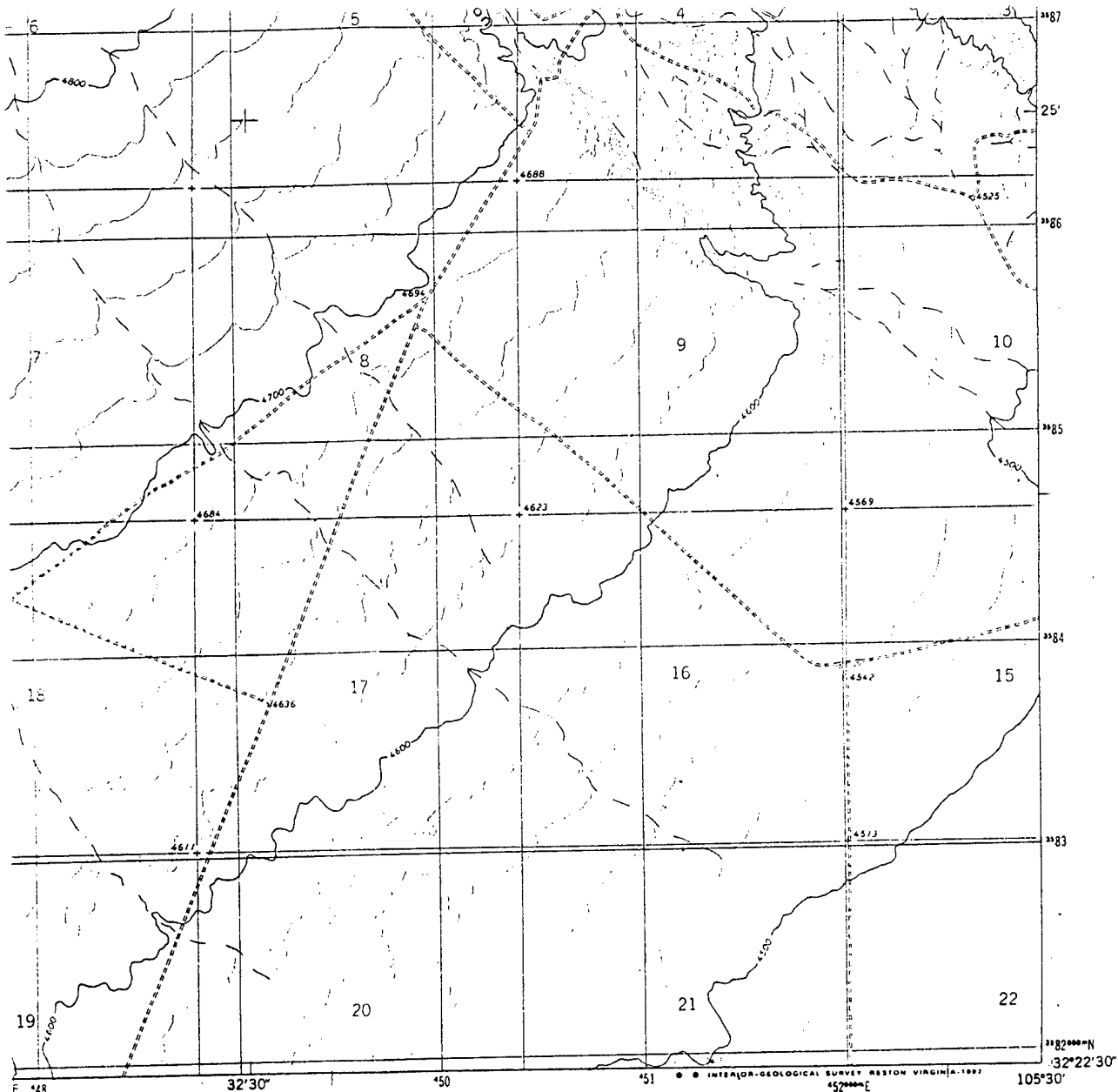


CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



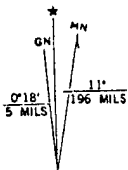
8



1 MILE
6000 7000 FEET
1 KILOMETER



QUADRANGLE LOCATION



UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, hard surface ——— Light-duty road, hard or improved surface ———
Secondary highway, hard surface ——— Unimproved road - - - - -
Interstate Route U. S. Route State Route

SIXTEEN CANYON, N. MEX.
32105-D5-TF-024

1980

DMA 4848 I NE-SERIES V881

STANDARDS
FOR RESTON, VIRGINIA 22092
AVAILABLE ON REQUEST

(CLEANES TANK)
4000 IN SW

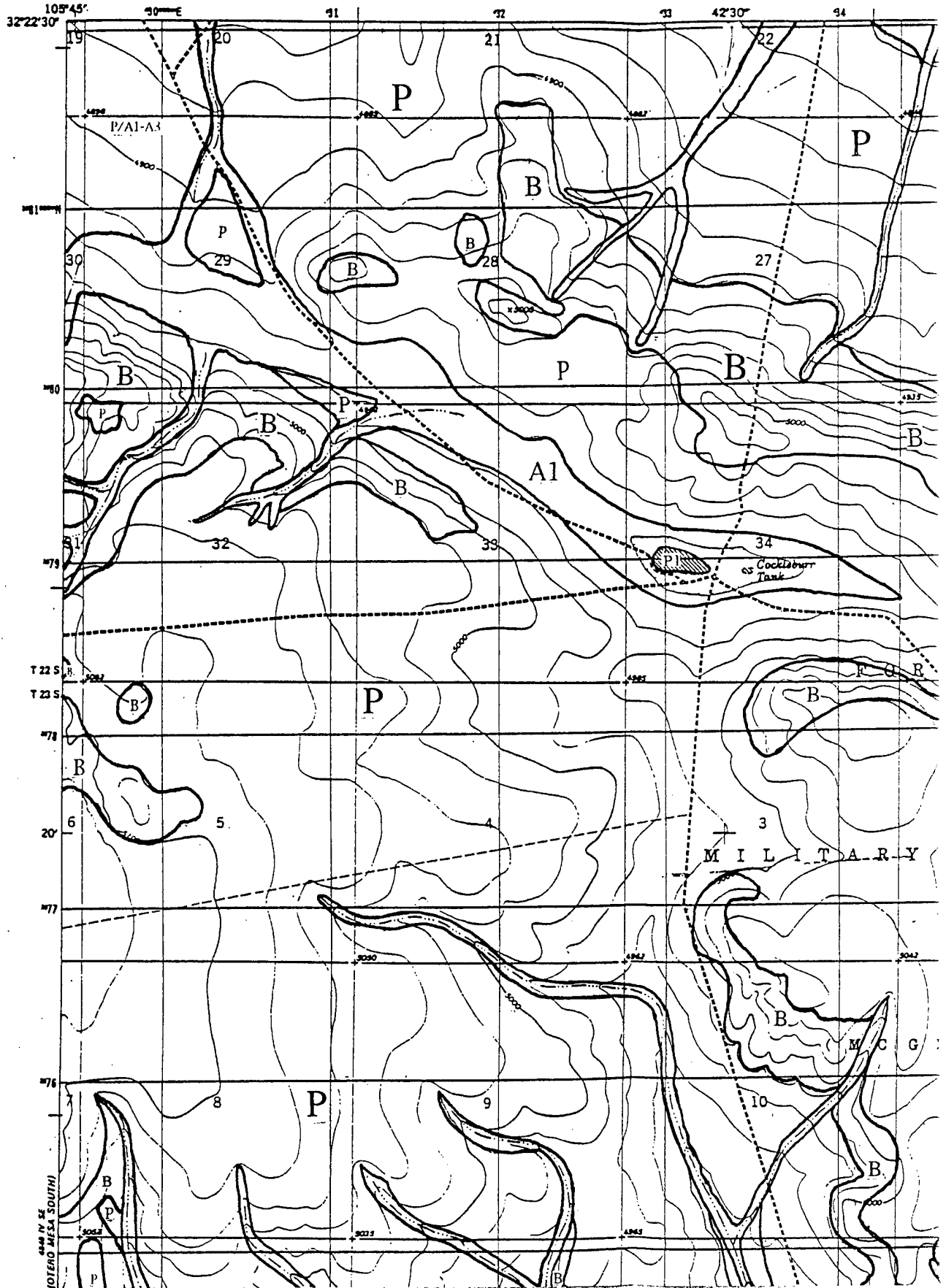
ET

9.

701000 1114
North

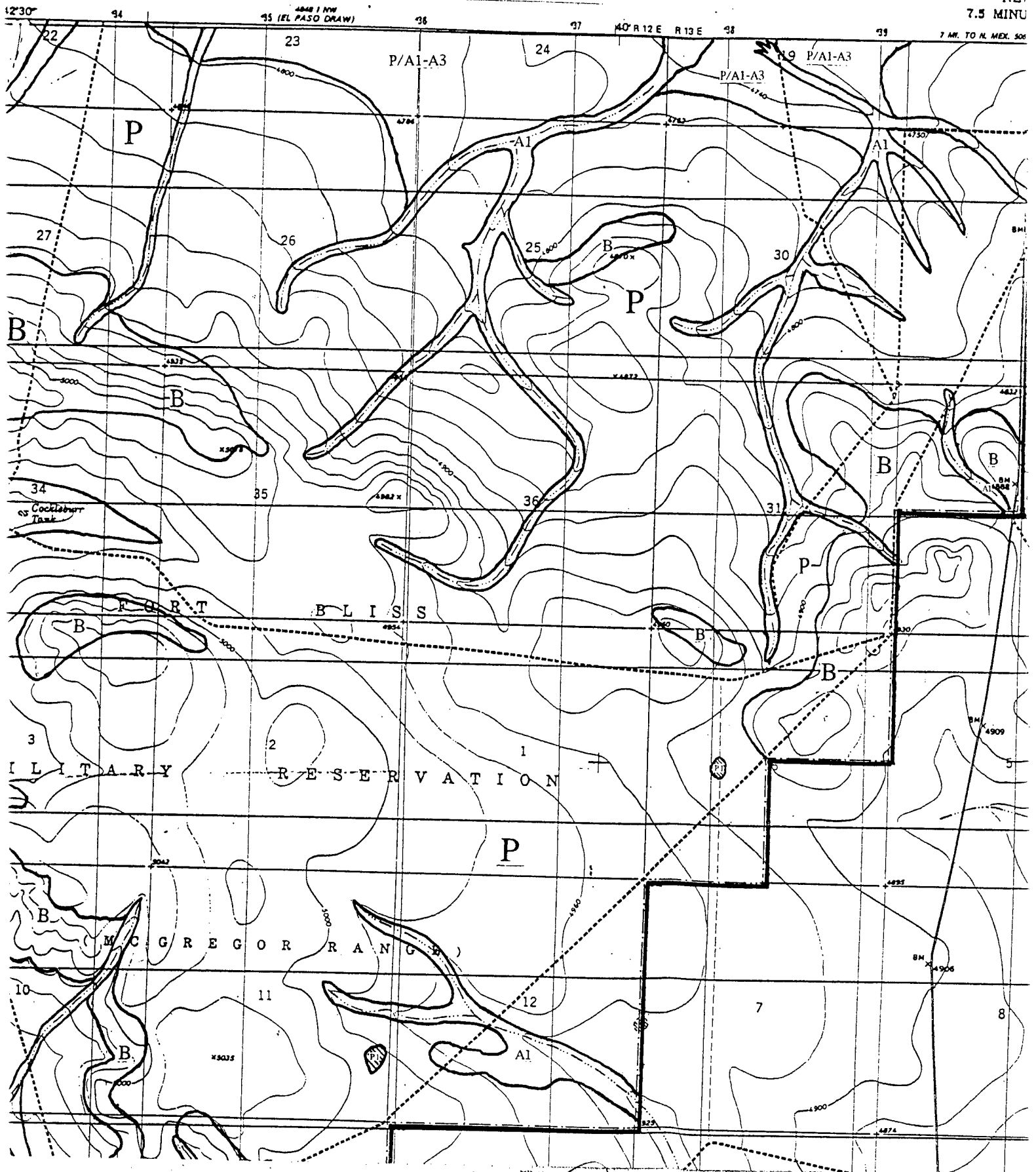
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Geomorphological, Geo
Study of Mcgrego
Donald L. Jo



Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

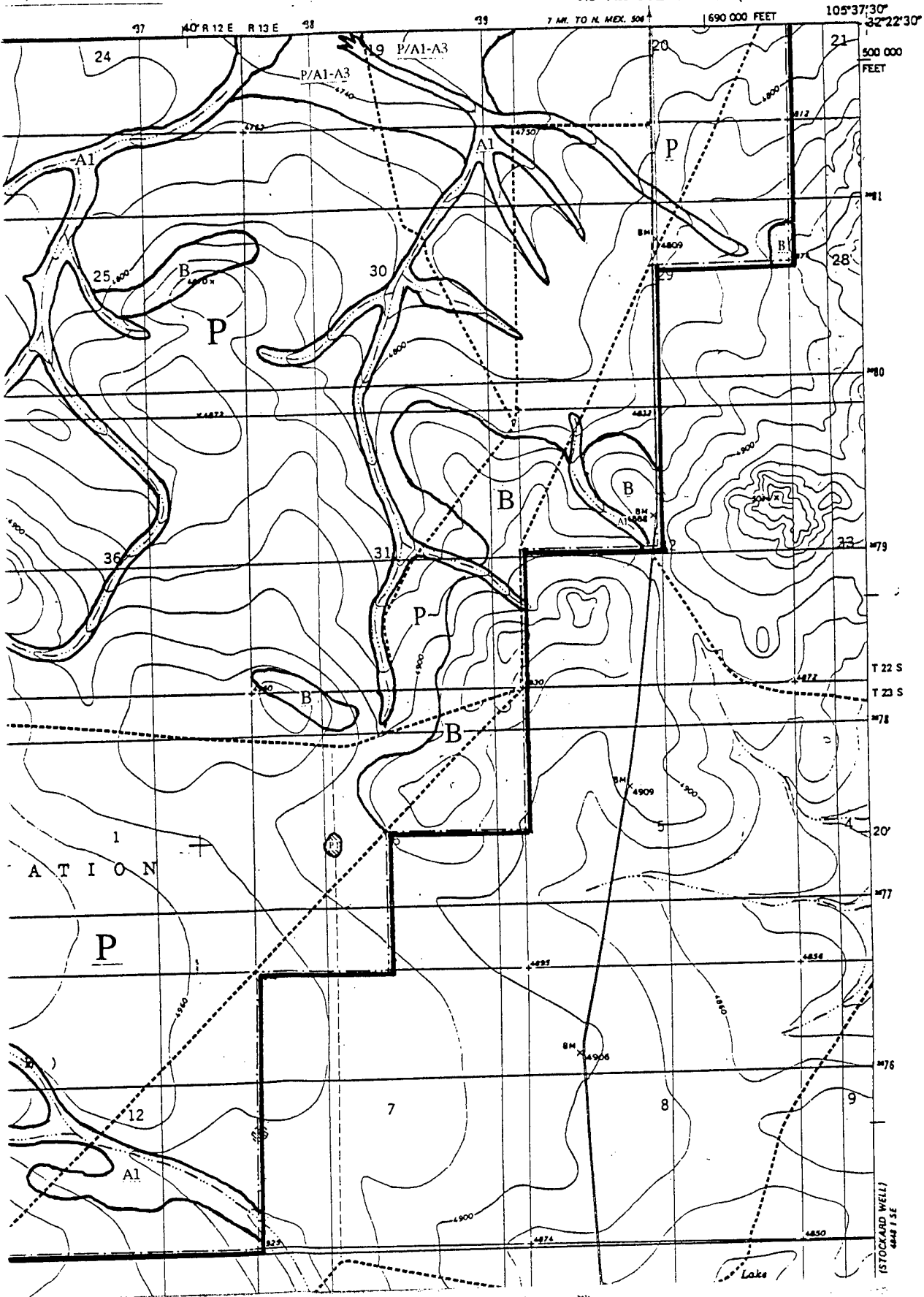
STONE
NEW
7.5 MINU



1 Surficial Mapping
1988, New Mexico
014, 1997

STONE WELL QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

1611 M
SIXTEEN CANYON



3.



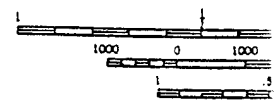
4448 N 2E
(LOTERO MESA SOUTH)

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

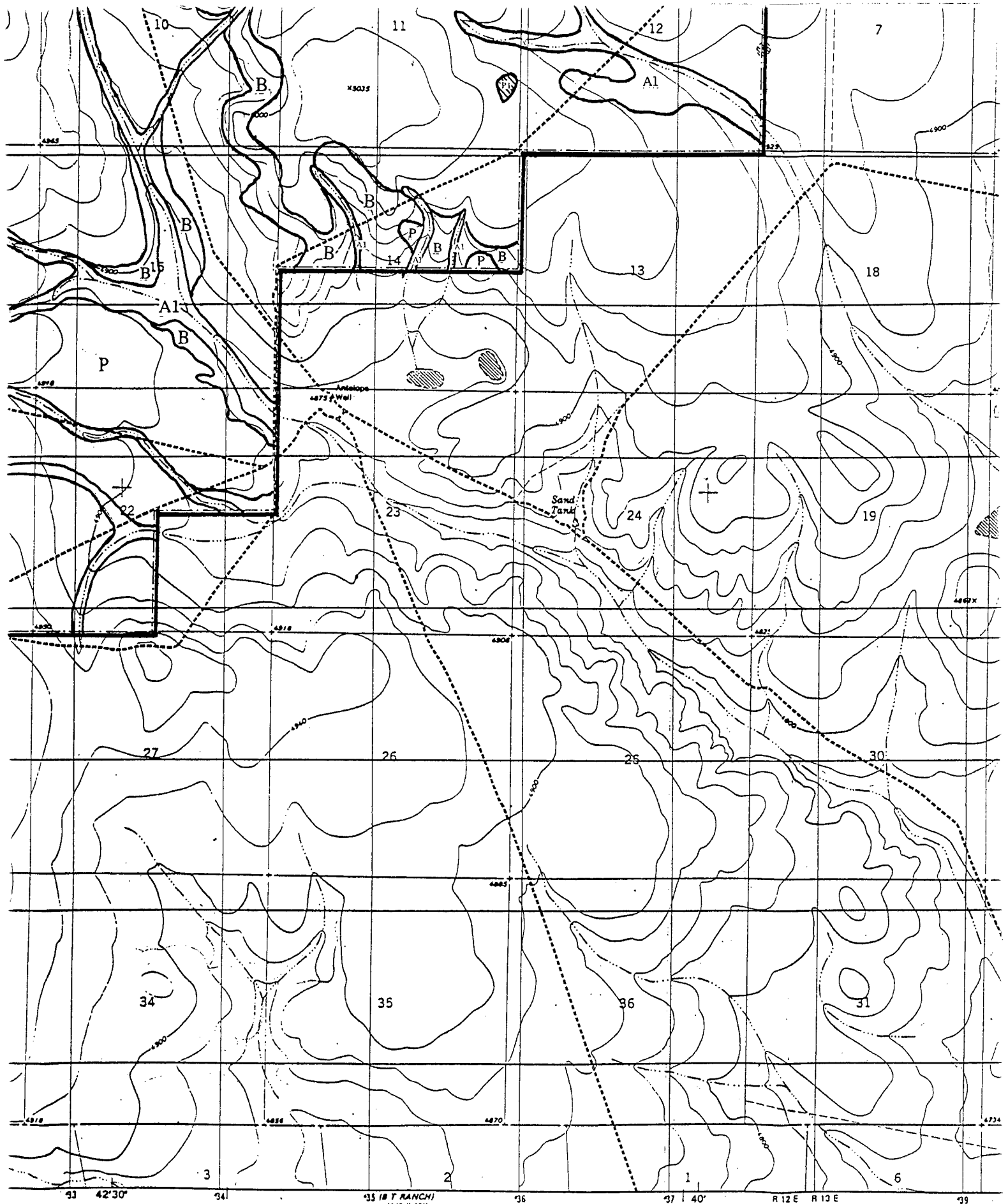
Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR...



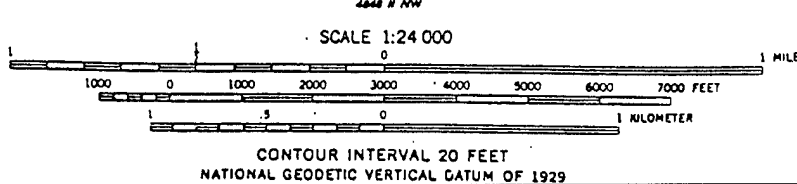
C



ge Geomorphic
and Symbols¹

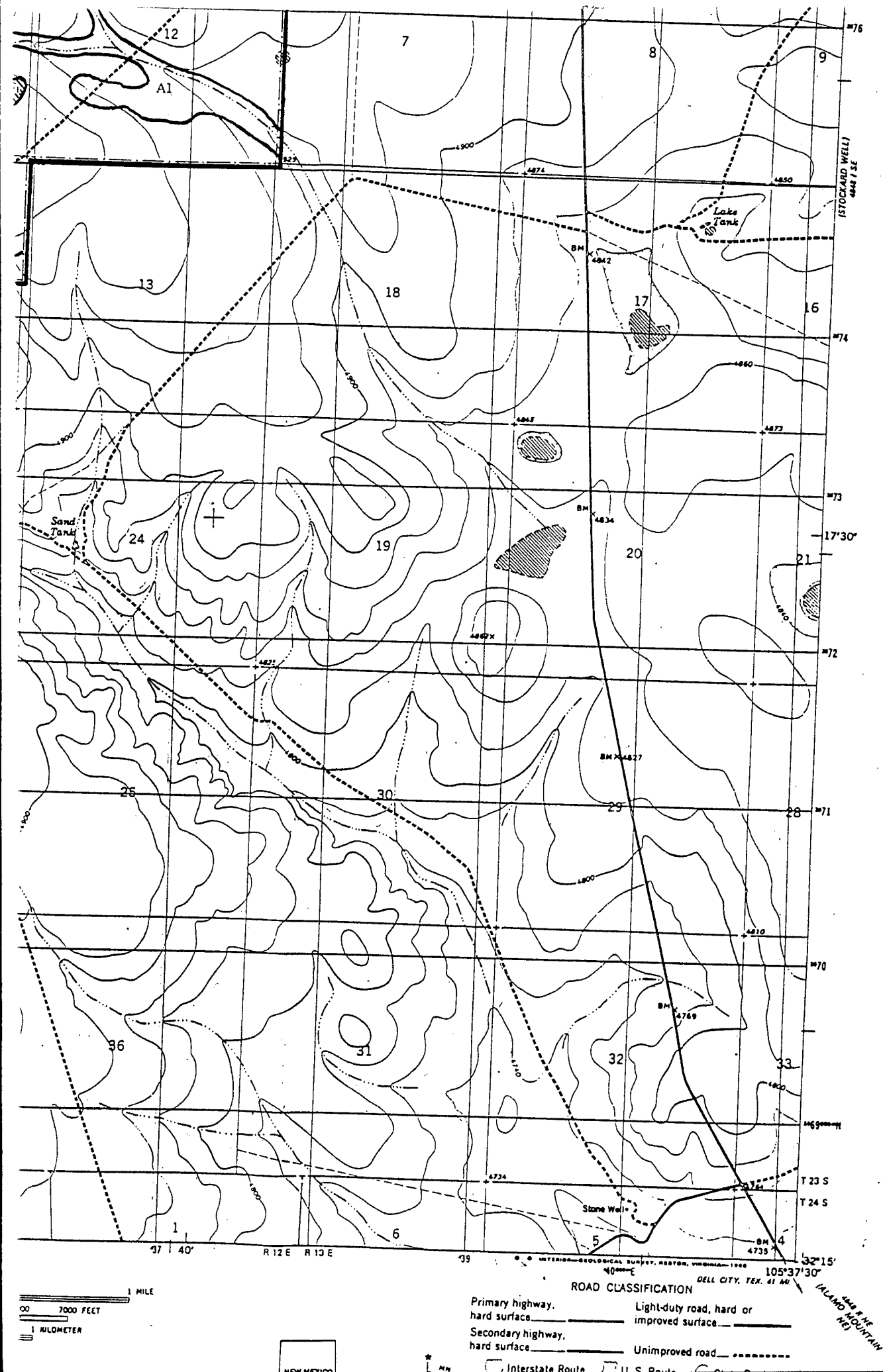
A1
A2
A3
B
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16
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B86
B87
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B90
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B93
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B95
B96
B97
B98
B99
B100

(e) Sediments CR...
DL



NEW MEXICO

Primar
hard st
Second
hard st





440 M NE
LOWE TANK CANYON
(EAST)

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

To place on the predicted North American Datum 1983:
move the projection lines 7 meters north and
49 meters east as shown by dashed corner ticks

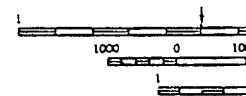
Fine red dashed lines indicate selected fence lines

There may be private inholdings within the boundaries of the
National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	—
Camp Rice (Rio Grande) Sediments	CR...
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	—
Pediment	P
Playa	P1
Playa Lunette	PIL

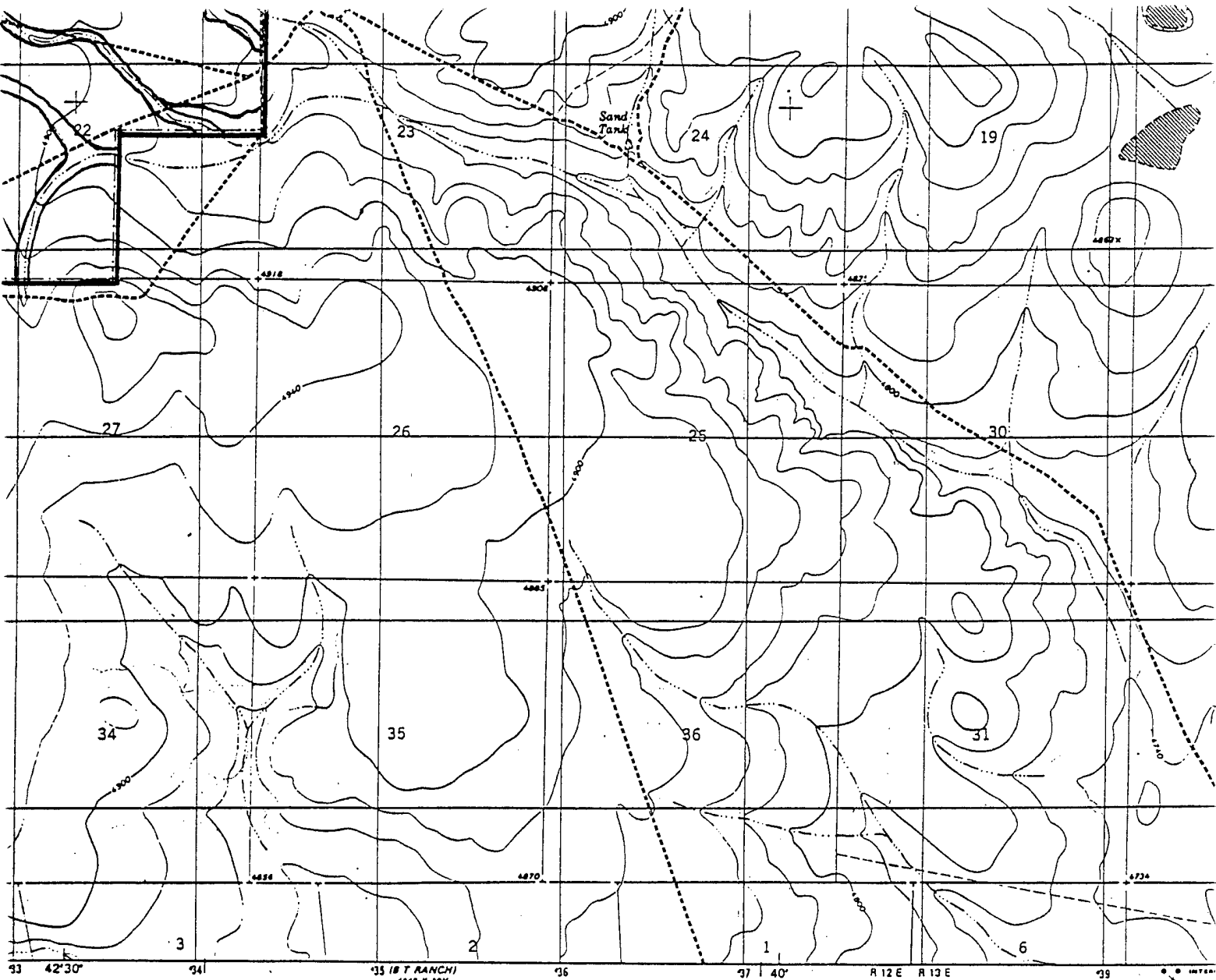
¹See text for explanation



NATIO:

THIS MAP COX
FOR SALE BY U.S. GEOLOGICAL
A FOLDER DESCRIBING TO

7



orphic
nbols

A1
A2
A3
B

11s CR...
DL
DP
DS
DSC
DSG

P
PI
PIL

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Primary highway,
hard surface

Secondary highway
hard surface

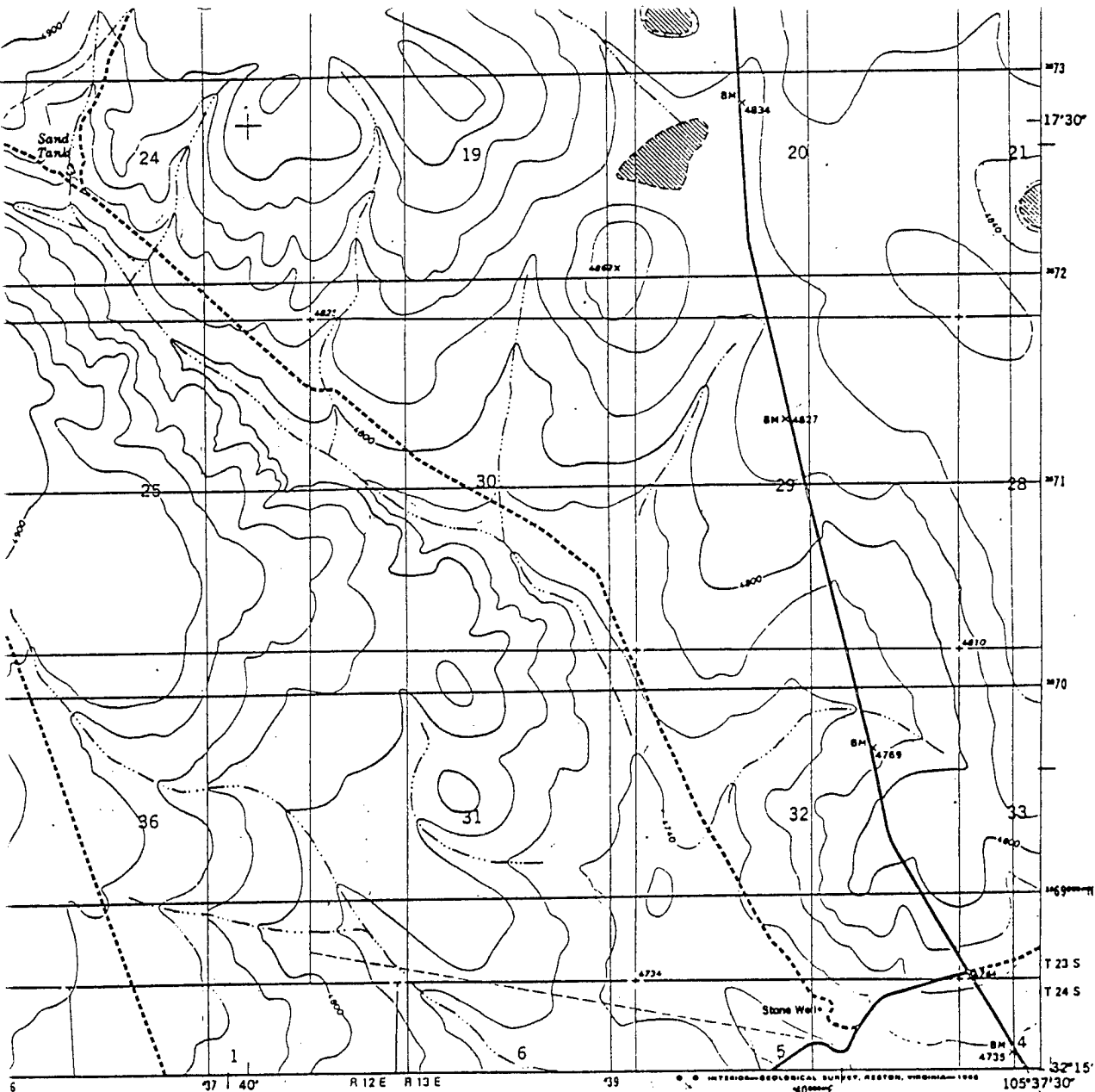
Interstate

NEW MEXICO

QUADRANGLE LOCATION

UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

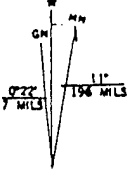
8



1 MILE
6000 7000 FEET
1 KILOMETER



QUADRANGLE LOCATION



ROAD CLASSIFICATION

Primary highway, hard surface _____ Light-duty road, hard or improved surface _____
Secondary highway, hard surface _____ Unimproved road _____
Interstate Route U. S. Route State Route

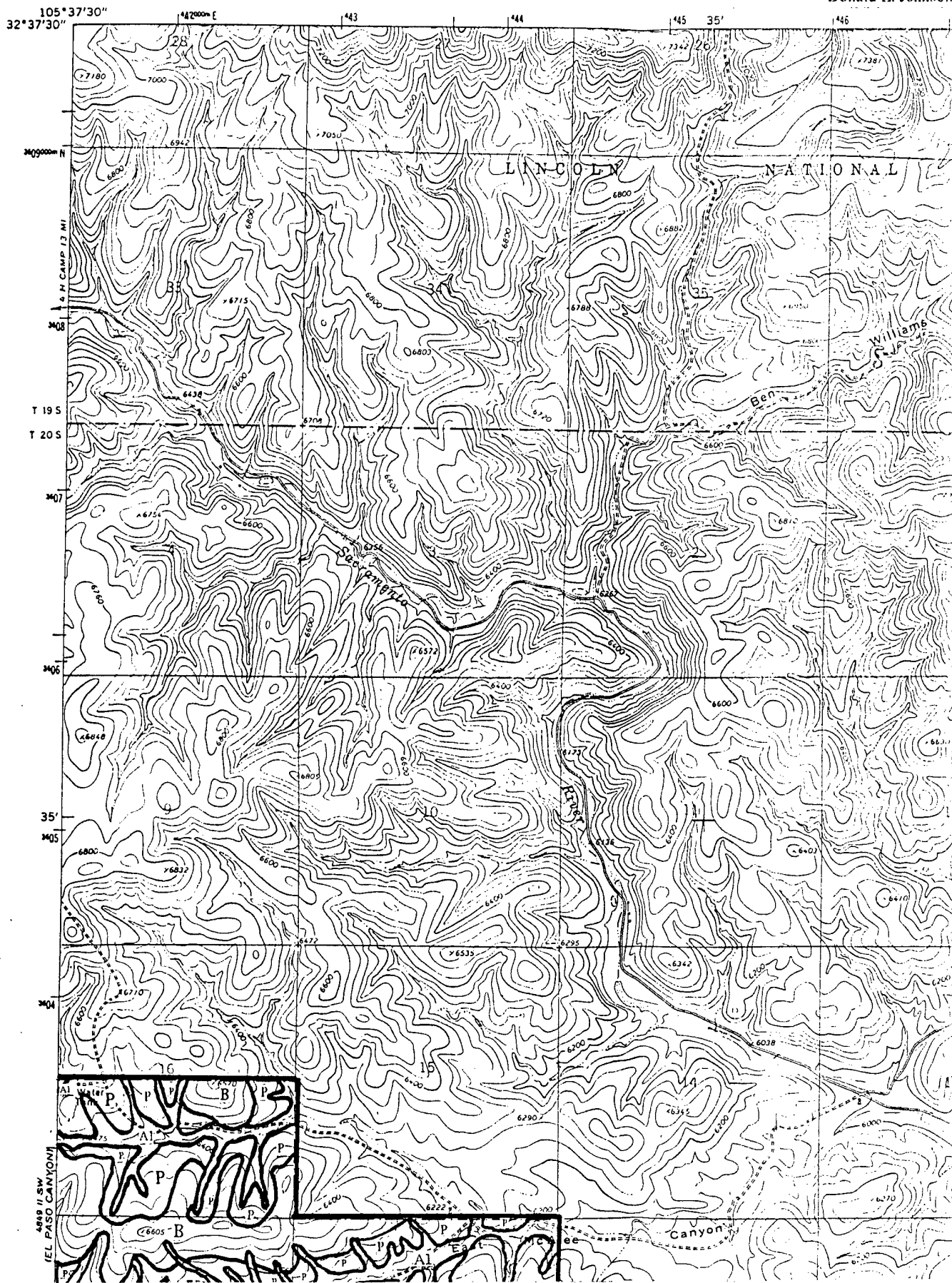
STONE WELL, N. MEX.
N3215-W10537.5/7.5

1980

DMA 4848 1 SW-SERIES Y881

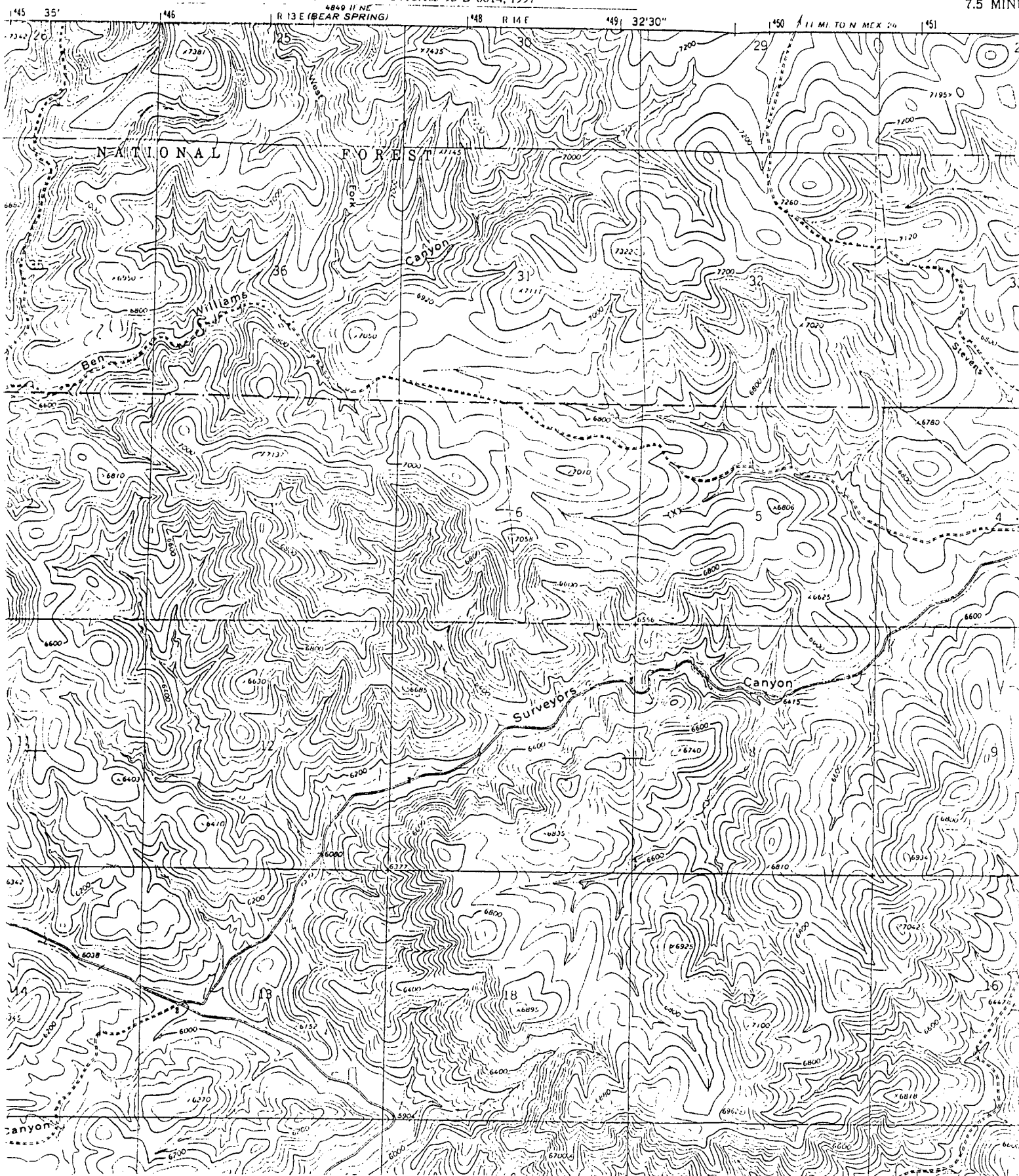
CARDS
R RESTON, VIRGINIA 22092
ABLE ON REQUEST

**Geomorphological, Geocological
Study of McGregor Gulch**
Donald L. Johnson



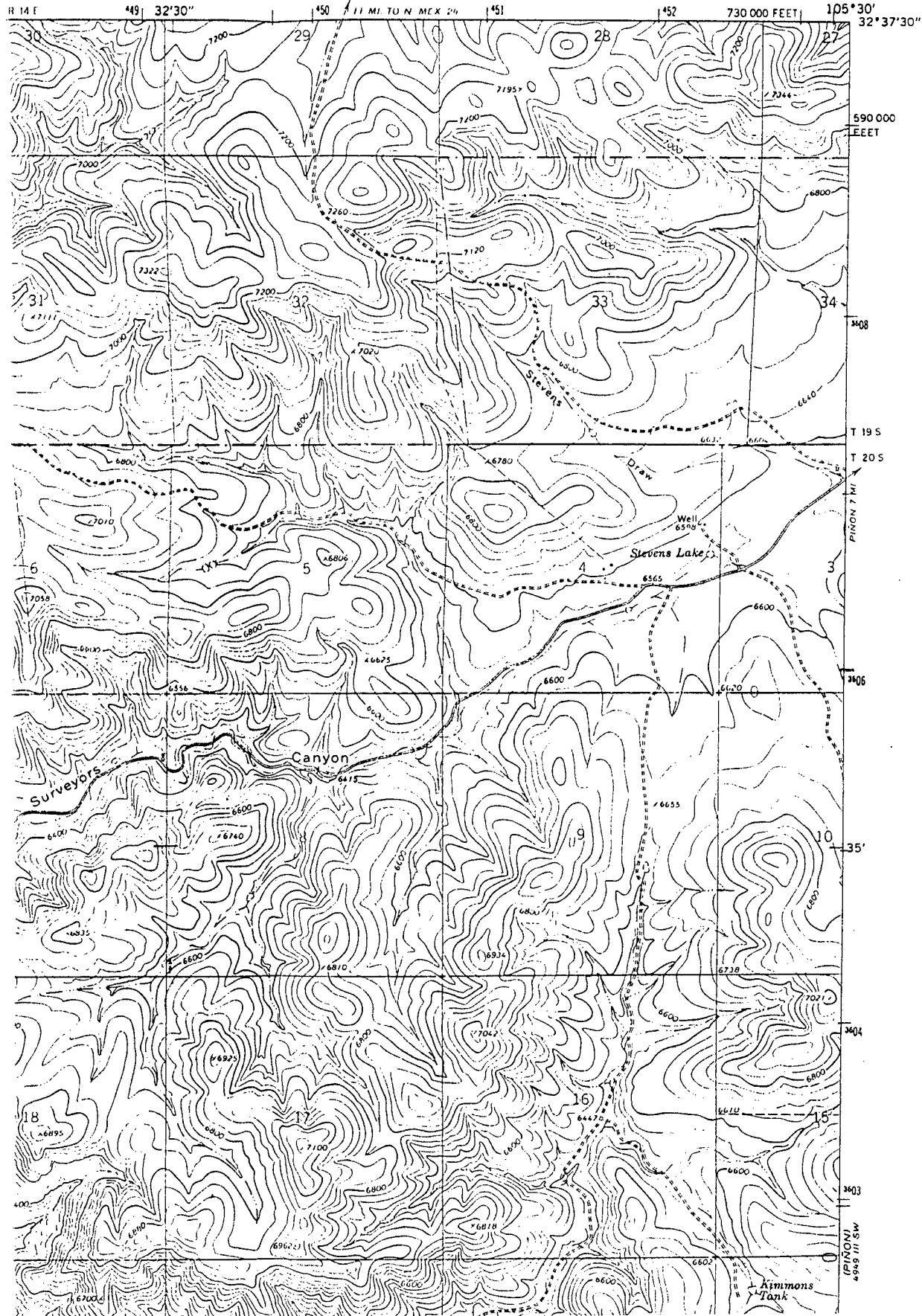
Geomorphological, Geoecological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

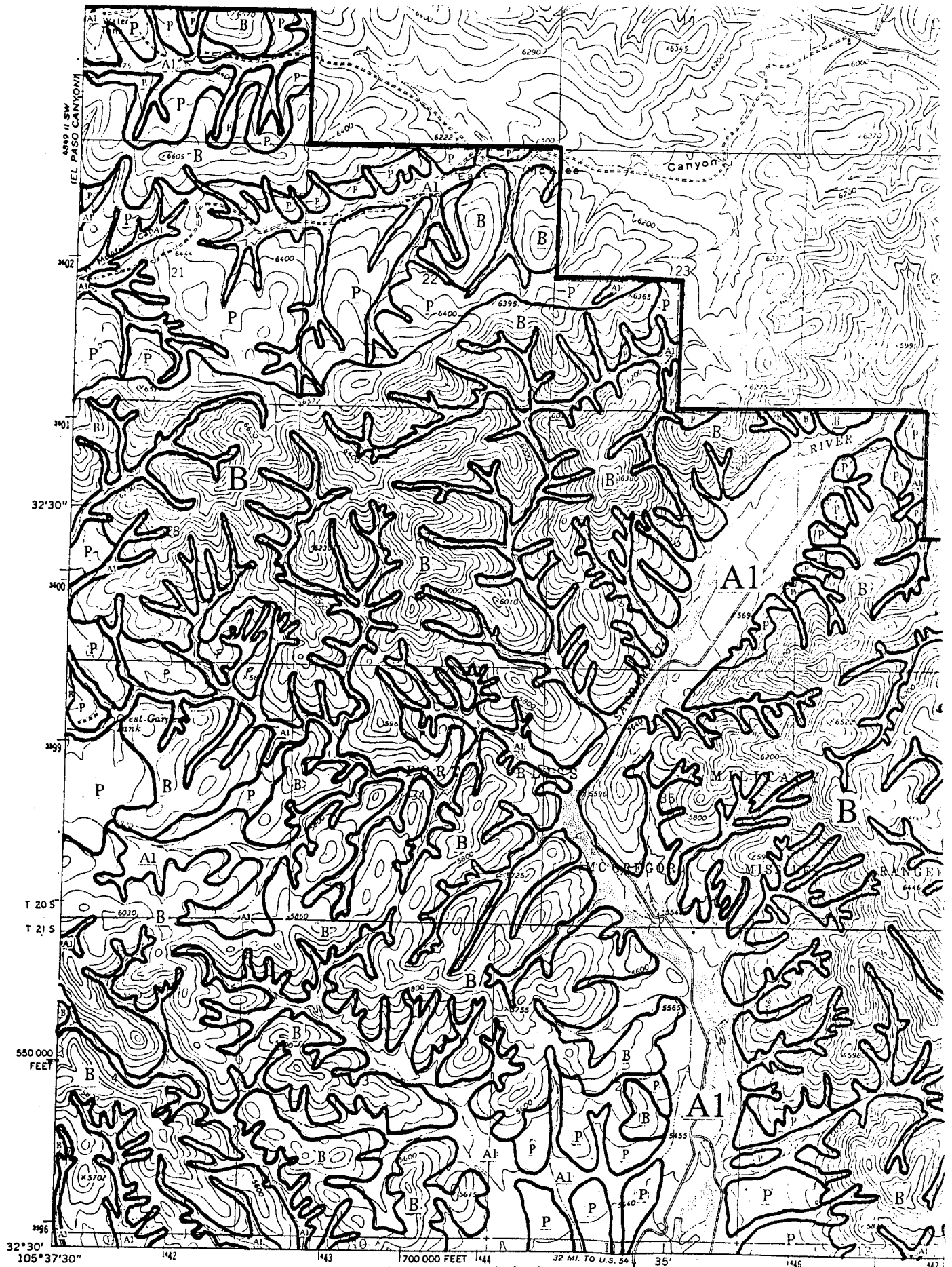
SURVEY
NE
7.5 MIN



SURVEYORS CANYON QUADRANGLE
NEW MEXICO—OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

49° 10' NW
(A15)





Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

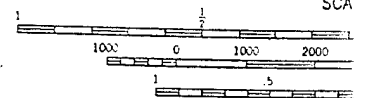
Topography by photogrammetric methods from aerial
photographs taken 1964. Field checked 1965

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone

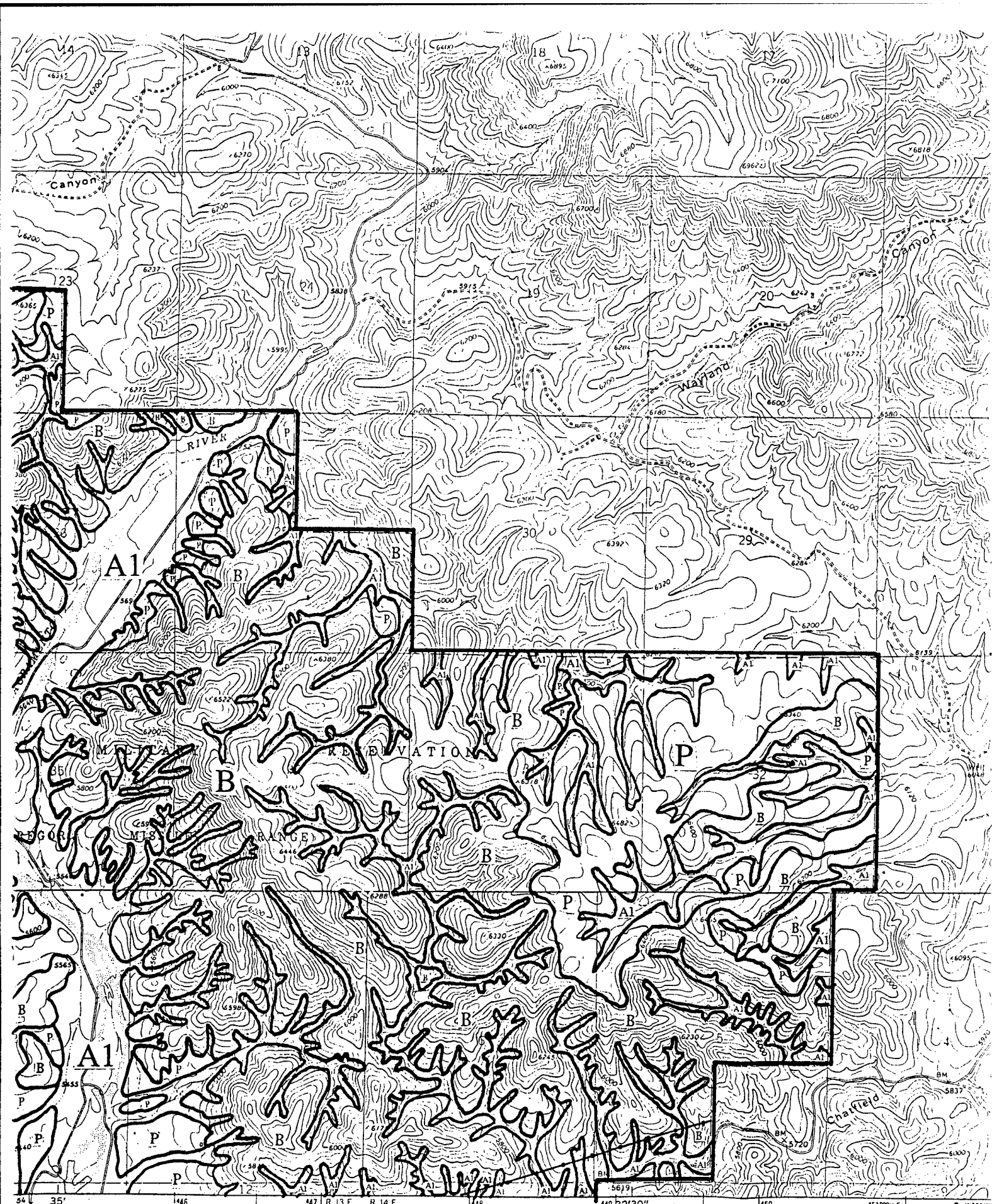
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue

McGregor Range Geomorphic Mapping Units and Symbols

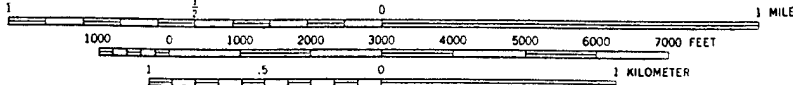
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	B
Camp Rice (Rio Grande) Sediments	CR...
Dune, Local	DL



CONTOUR 1
NATIONAL GEODETIC



SCALE 1:24 000

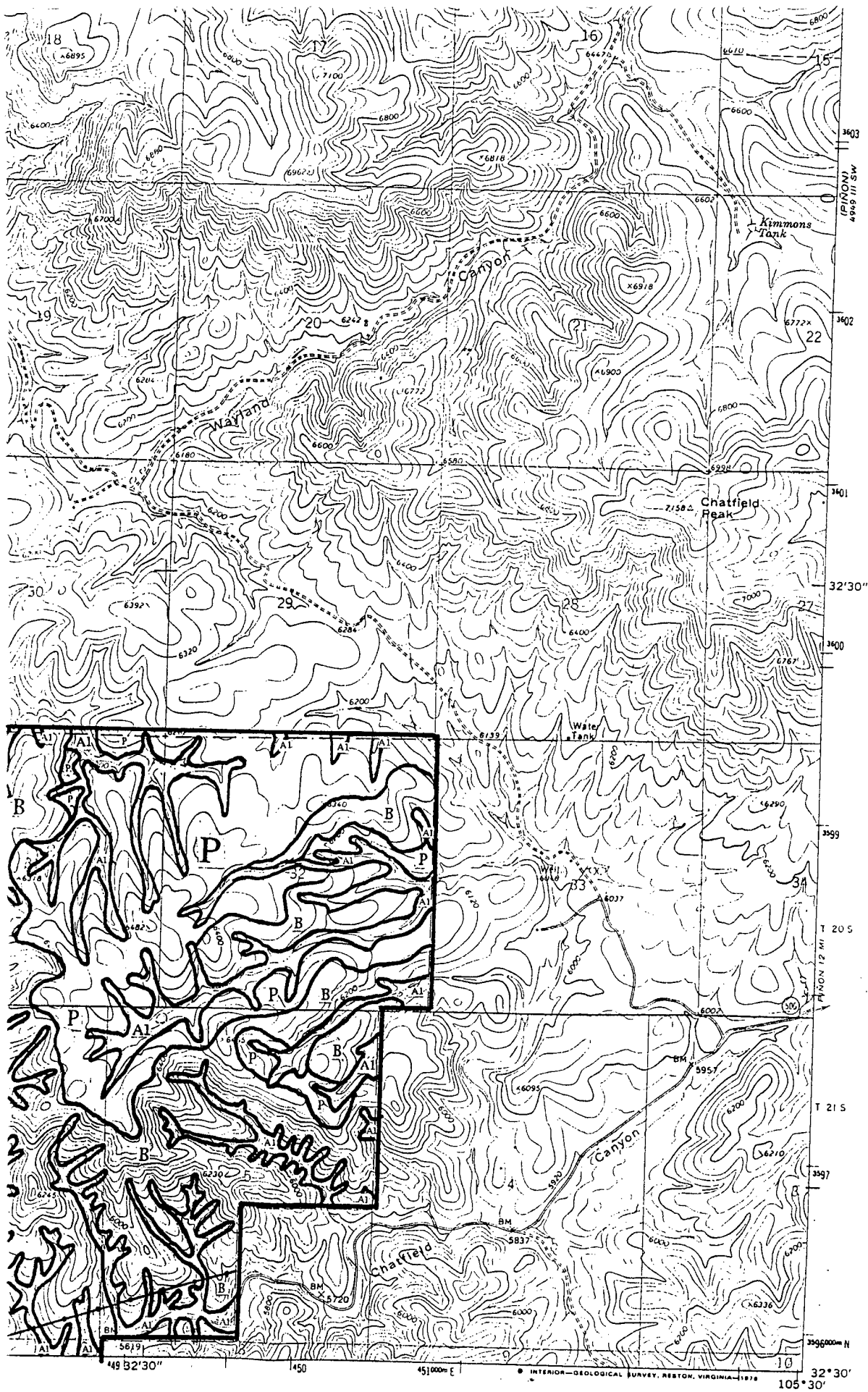


CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

NEW MEXICO

GN MN

Light-duty



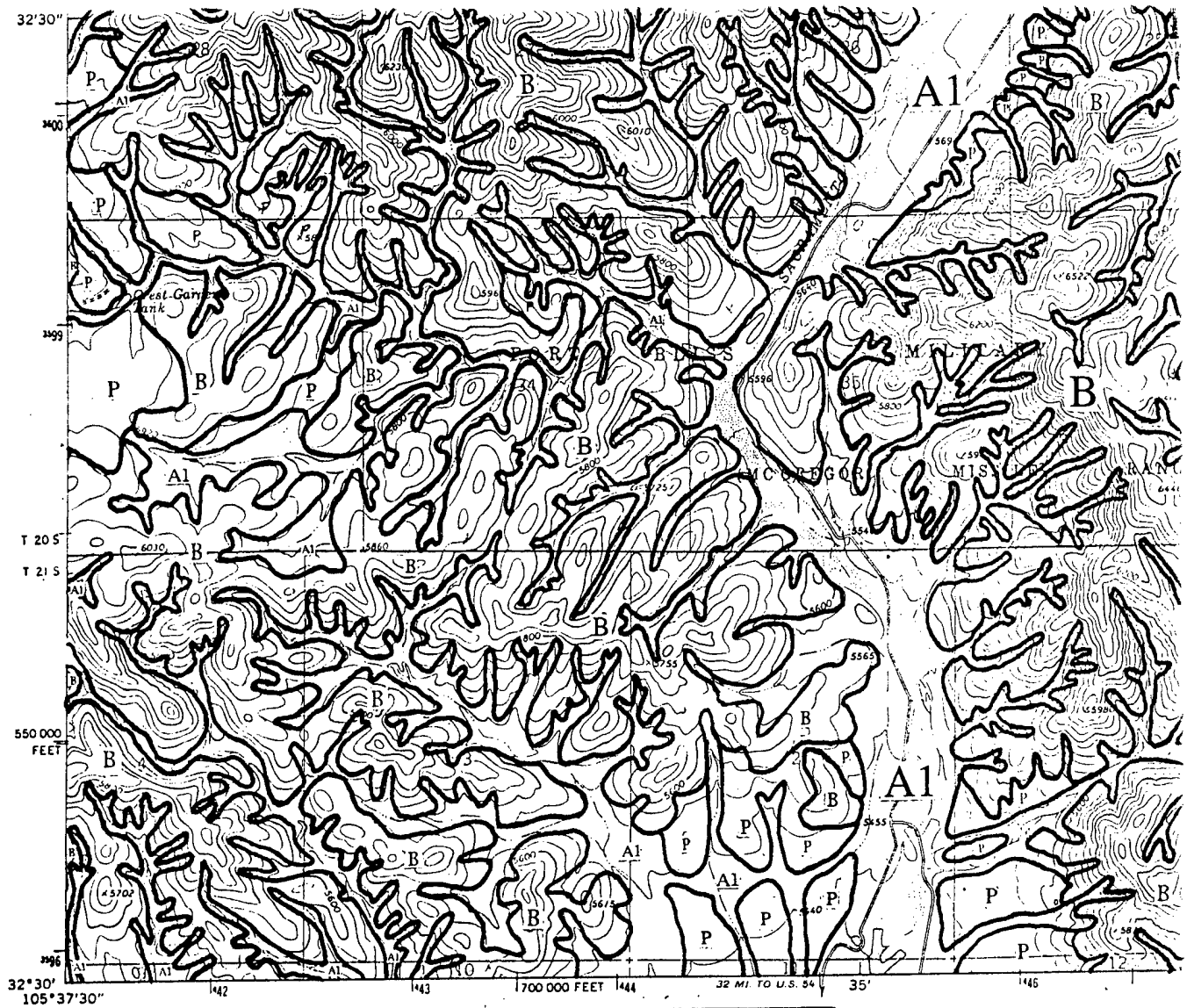
1 MILE
7000 FEET
4 METER

ROAD CLASSIFICATION

Light-duty Unimproved dirt

() State Route

INDIAN ORIGIN
1920-1940



Mapped, edited, and published by the Geological Survey
Control by USGS and USC&GS

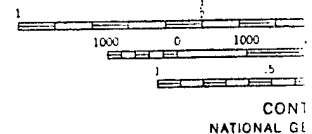
Topography by photogrammetric methods from aerial
photographs taken 1964. Field checked 1965

Polyconic projection. 1927 North American datum
10,000-foot grid based on New Mexico coordinate system,
central zone
1000-meter Universal Transverse Mercator grid ticks,
zone 13, shown in blue

Fine red dashed lines indicate selected fence lines

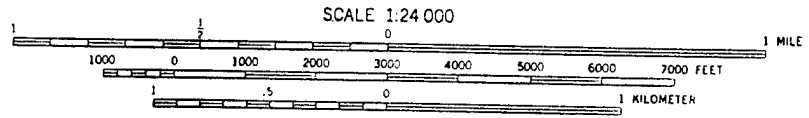
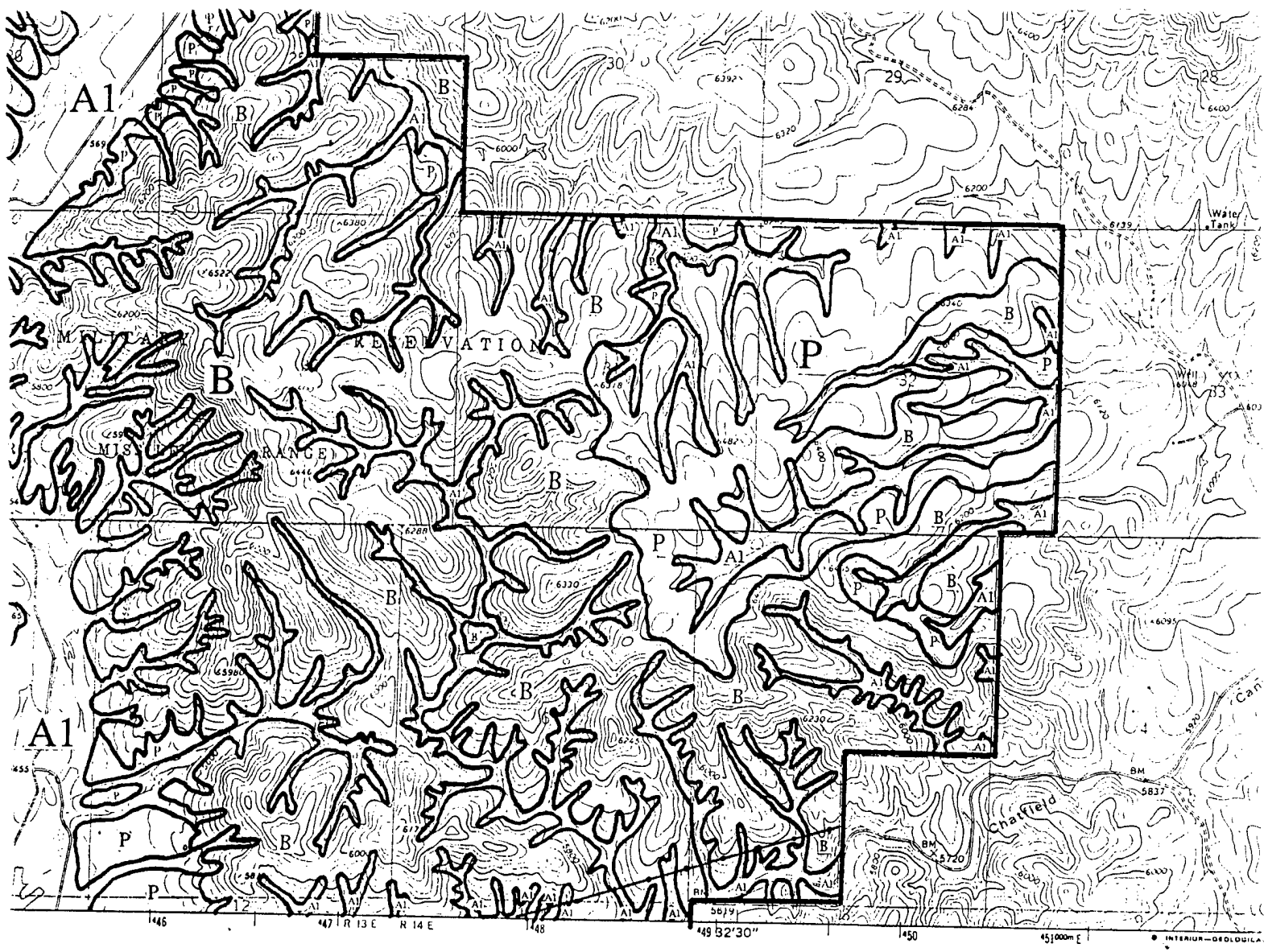
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Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	
Camp Rice (Rio Grande) Sediments	CR
Dune, Local	DL
Dune Pile	DP
Dune Sheet	DS
Dune Sheet, Coppiced	DSG
Dune Sheet, Gypsiferous	DSG
Fault	
Pediment	P
Playa	P1
Playa Lunette	P1L
See text for explanation	



THIS MAP COMPLIES
FOR SALE BY U. S. GEOLOGICAL SURVEY
A FOLDER DESCRIBING TOPOGRAPHY

7

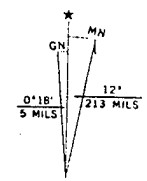


SCALE 1:24 000
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION

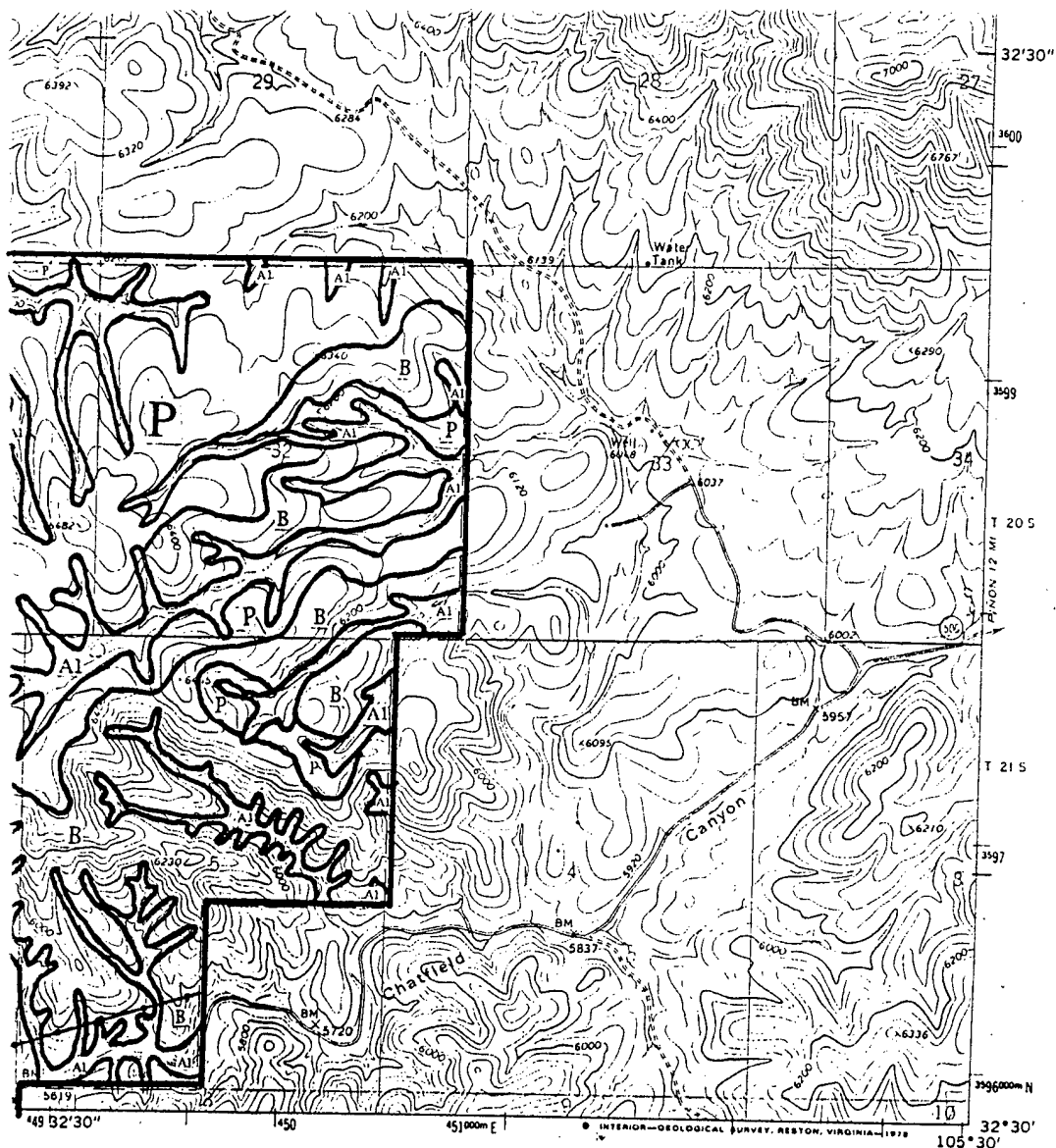


UTM GRID AND 1965 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SURVEYOR:
N32

AMS 484

8



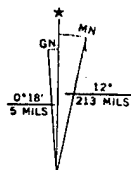
LE

ROAD CLASSIFICATION

Light-duty ———— Unimproved dirt
() State Route



QUADRANGLE LOCATION



UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SURVEYORS CANYON, N. MEX. N3230—W10530/7.5

1965

AMS 4849 II SE-SERIES V881

(INDIAN DRAWN)
4849 II SE-SERIES V881

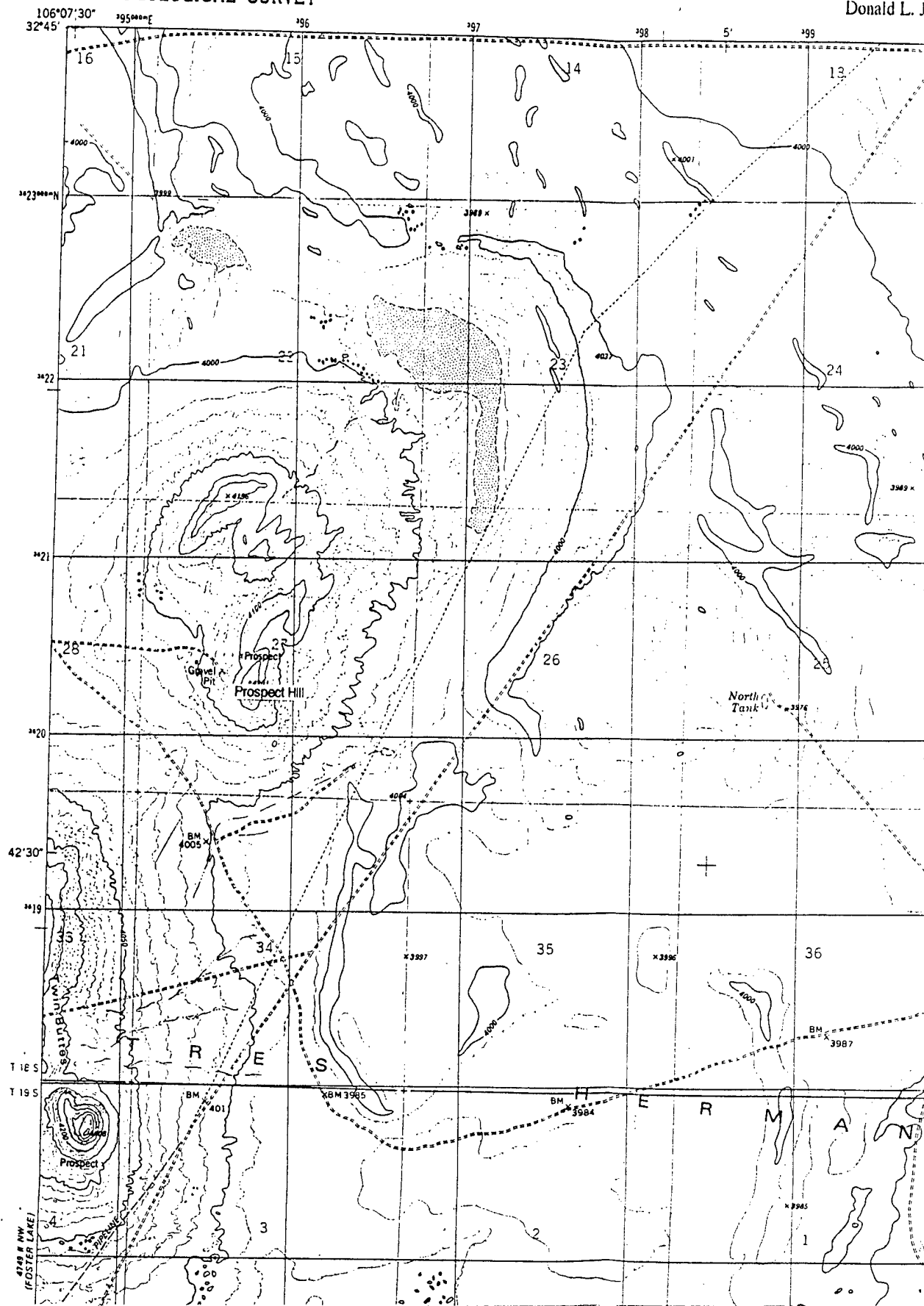
50

9

42° 15' N
(GARTON LAKE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

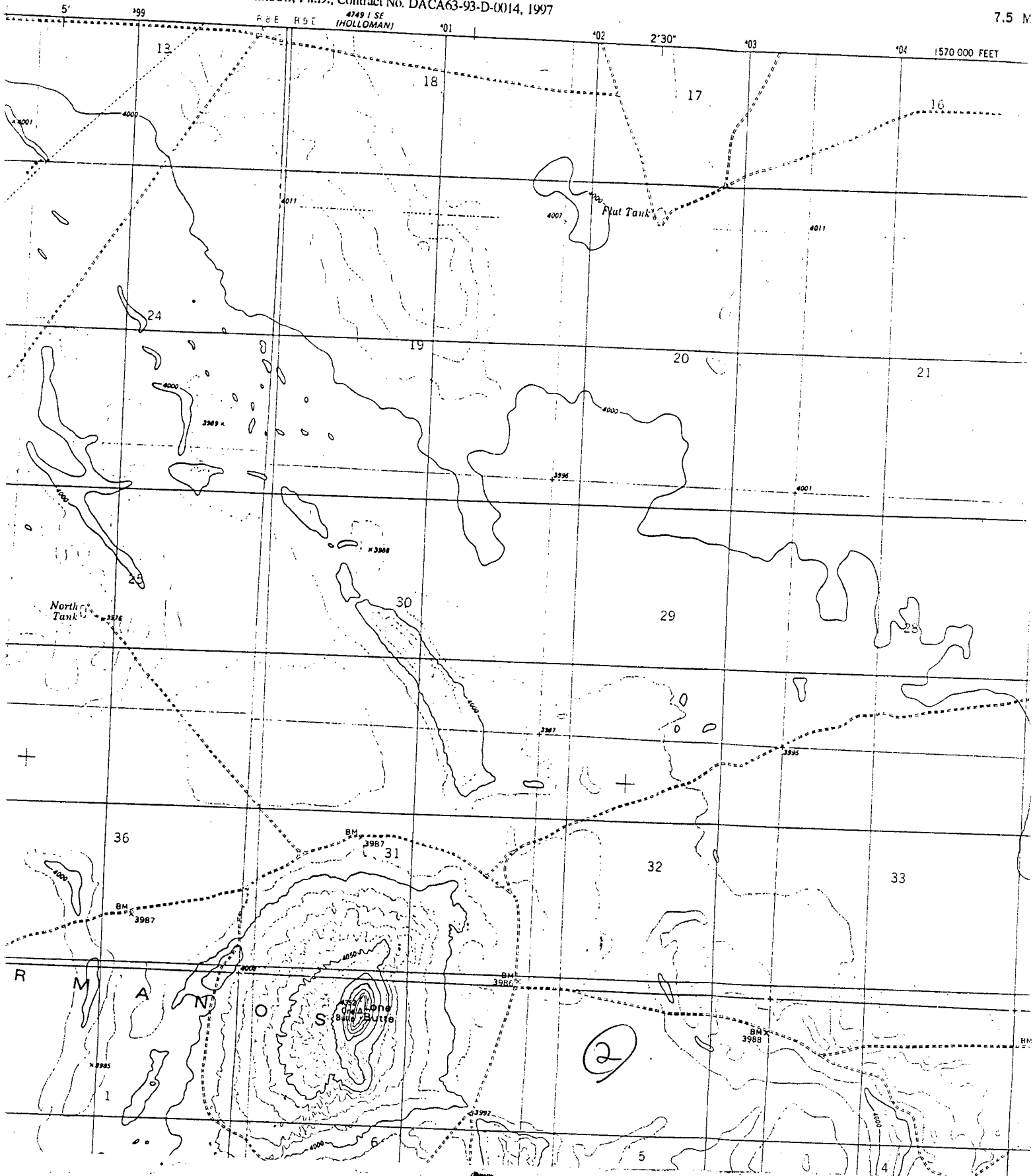
Geomorphological, Ge-
Study of McGregor
Donald L. J



Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
 Study of McGregor Guided Missile Range, Fort Bliss, New Mexico
 Donald L. Johnson, Ph.D., Contract No. DACA63-93-D-0014, 1997

TRES

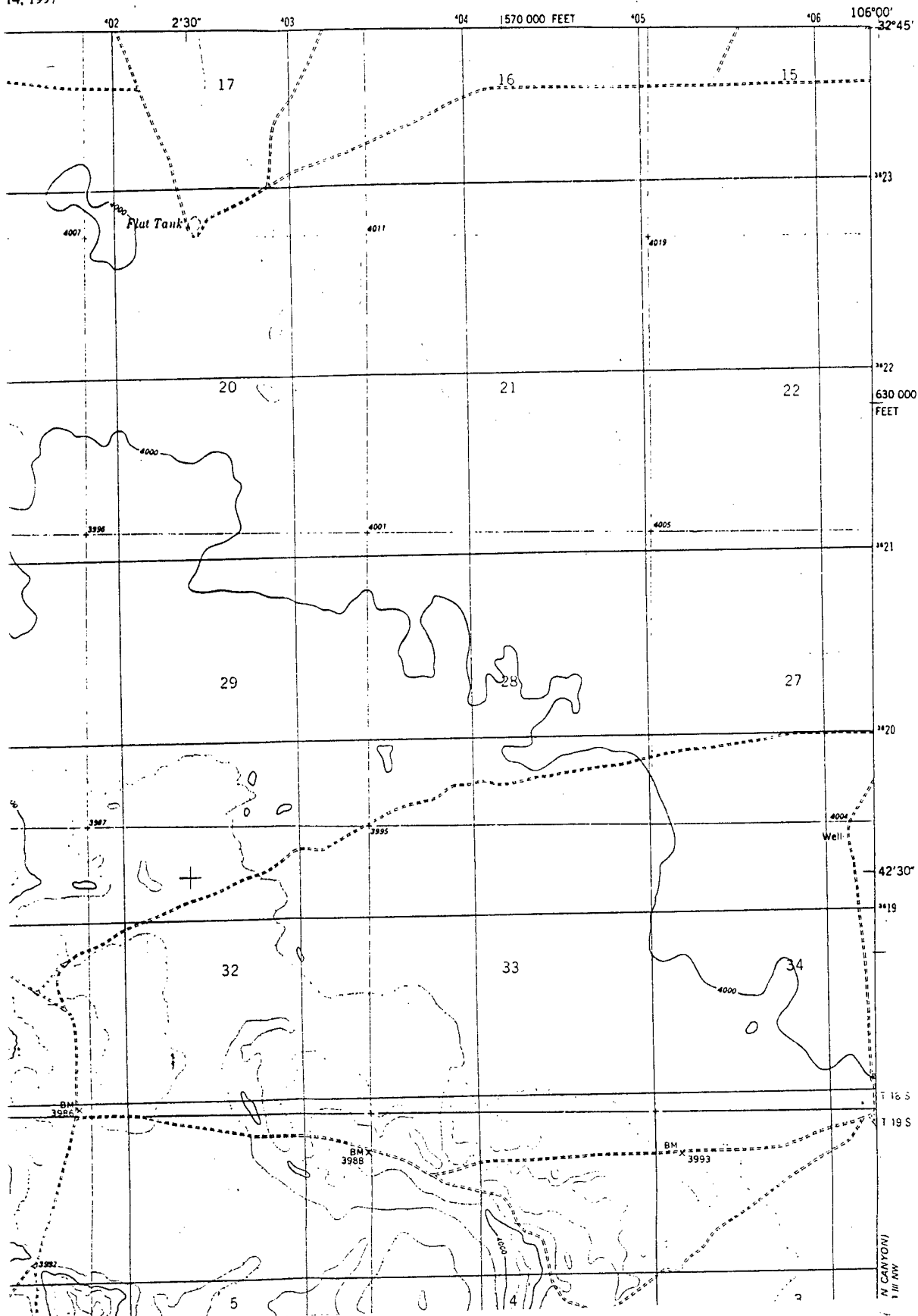
7.5 M

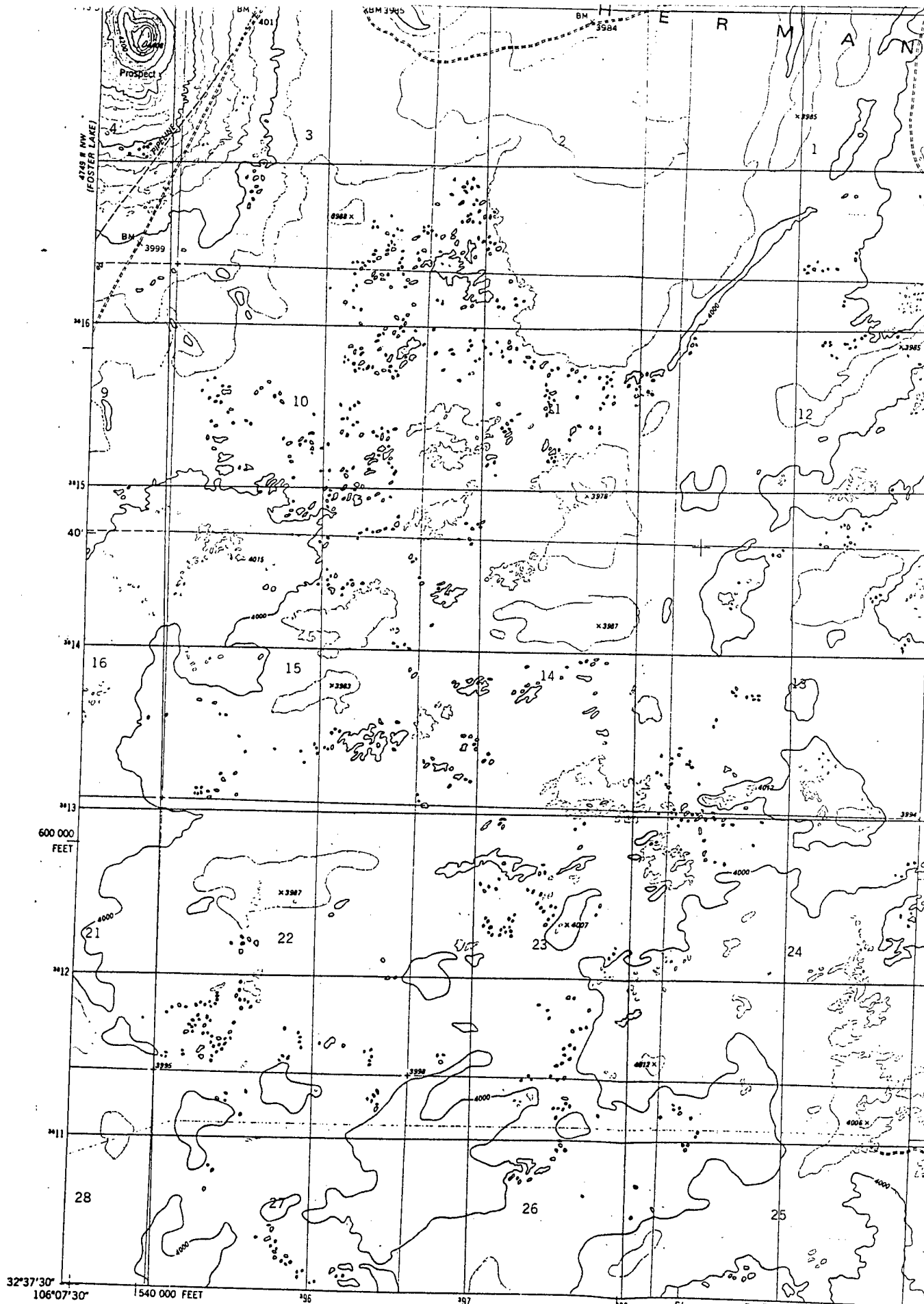


Surficial Mapping
s, New Mexico
14, 1997

TRES HERMANOS QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE 1/4 TRES HERMANOS 13' QUADRANGLE

144 N SW
(ALA MOGORDO
SOUTH)





4748 N SW
TRES
HERMANOS SW

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Control by USGS AND NOS/NOAA

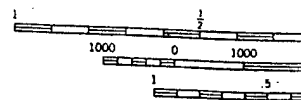
Topography by photogrammetric methods from aerial photographs
taken 1972. Field checked 1975. Map edited 1982

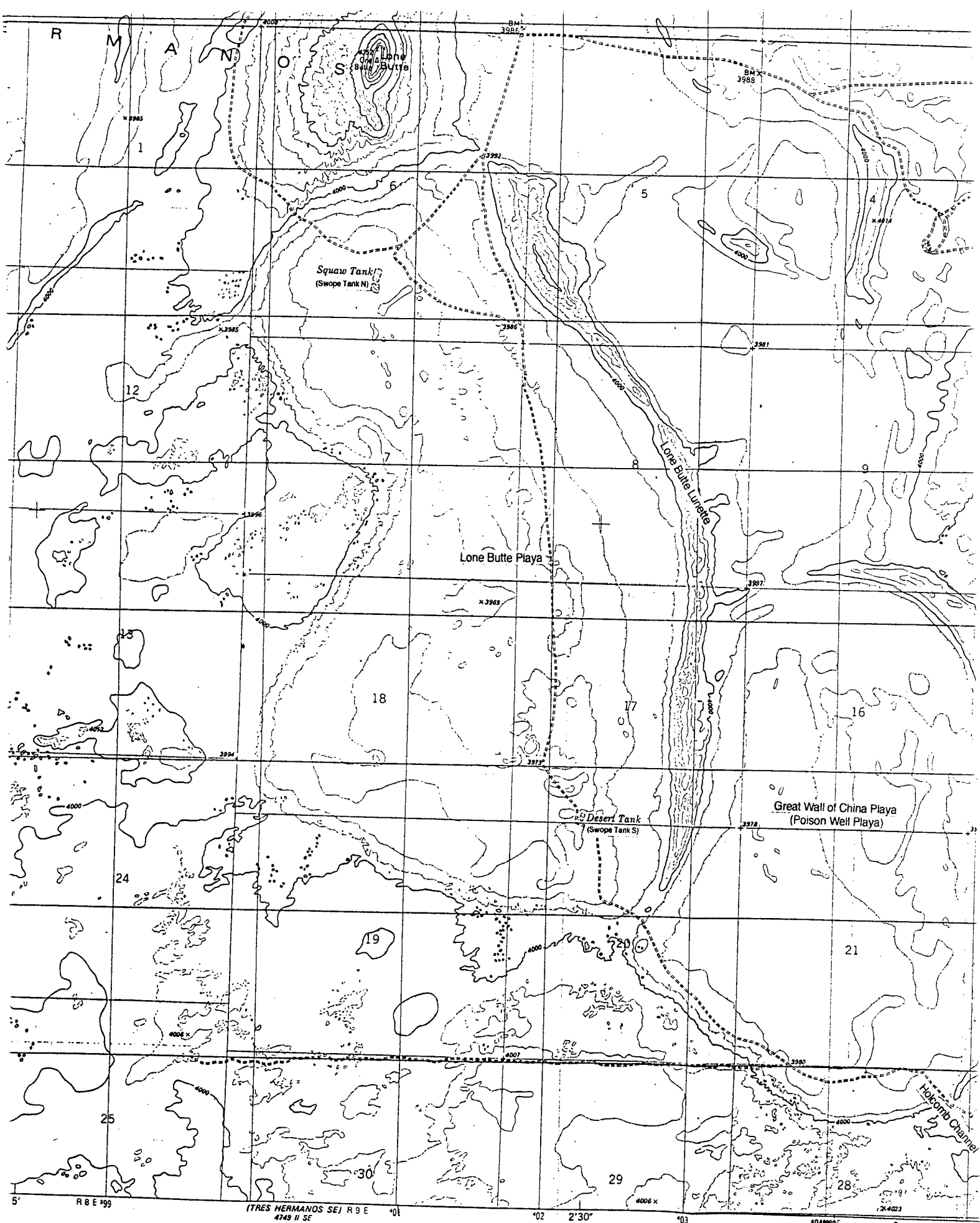
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator

McGregor Range Geomorphic Mapping Units and Symbols

Alluvium (recent)
Alluvium (relict)
Alluvium (older relict)
Bedrock
Bolson Floor Complex
Camp Rice (Rio Grande) Sediments

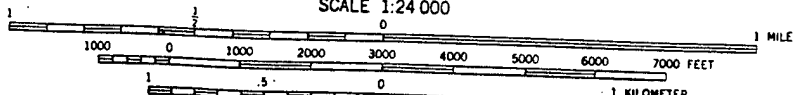
A1
A2
A3
B





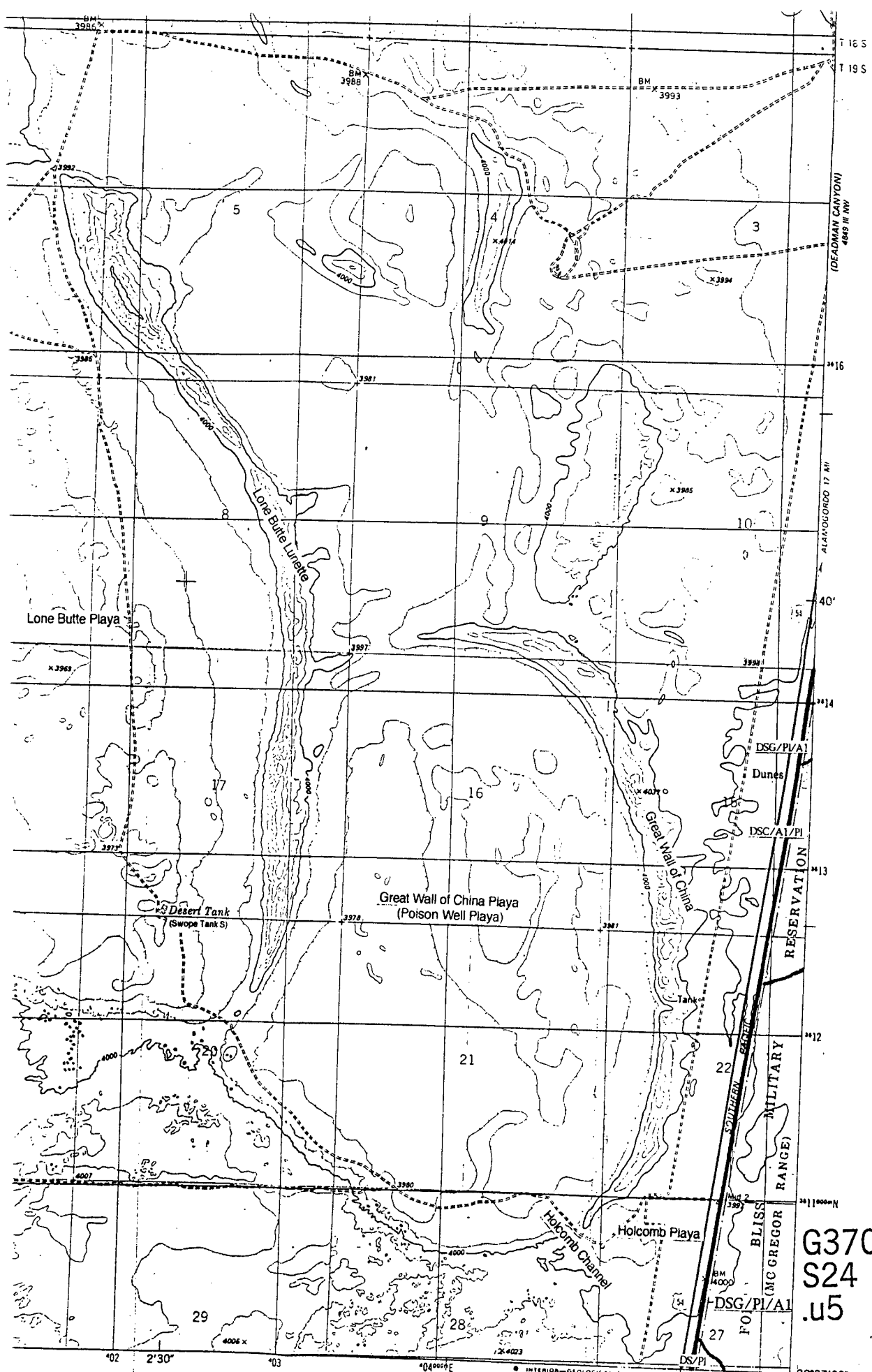
(TRES HERMANOS SE) R 8 E
4743 II SE

SCALE 1:24 000



Primary, highway,
hard surface

ROAD CL



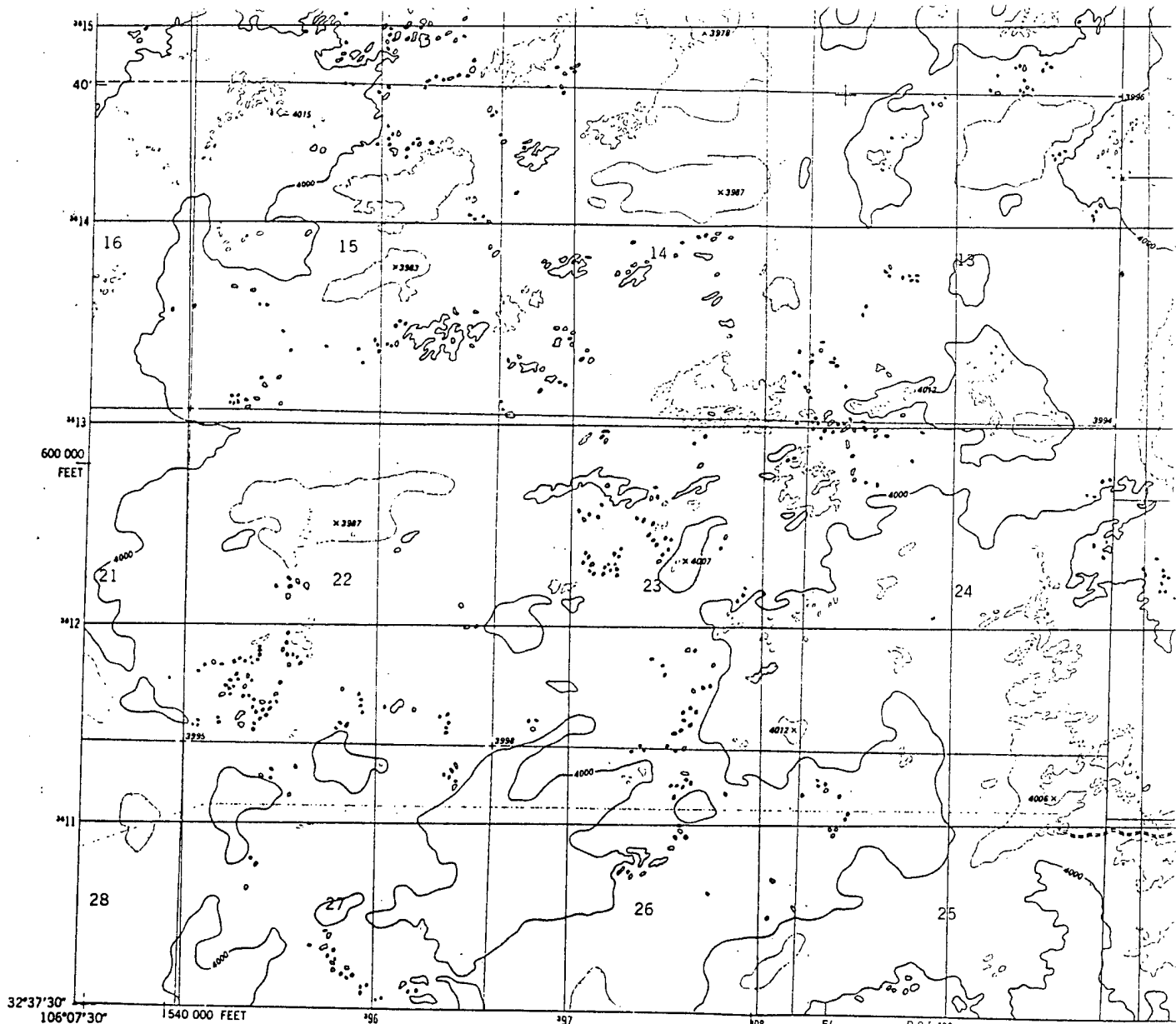
G3700
S24
.u5

1 MILE
7000 FEET
LOMETER

Primary highway, hard surface
Secondary highway
Light-duty road, hard or improved surface

INTERIOR GEOLOGICAL SURVEY REGION, VIRGINIA-1982
OROGRANDE 18 M, EL PASO 69 M, T
ROAD CLASSIFICATION
106°00' 32°37'30"

PIPELINE CAN



4700 N 4W
(TRES SW)
HERNANDEZ SW

Mapped, edited, and published by the Geological Survey
Control by USGS AND NOS/NOAA
Topography by photogrammetric methods from aerial photographs
taken 1972. Field checked 1975. Map edited 1982
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
To place on the predicted North American Datum 1983
move the projection lines 6 meters south and
50 meters east as shown by dashed corner ticks
Fine red dashed lines indicate selected fence lines
There may be private inholdings within the boundaries of
the National or State reservations shown on this map

McGregor Range Geomorphic Mapping Units and Symbols ¹	
Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	CR
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	—
Pediment	P
Playa	P1
Playa Lunette	PIL

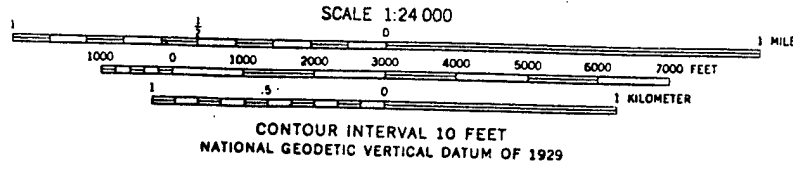
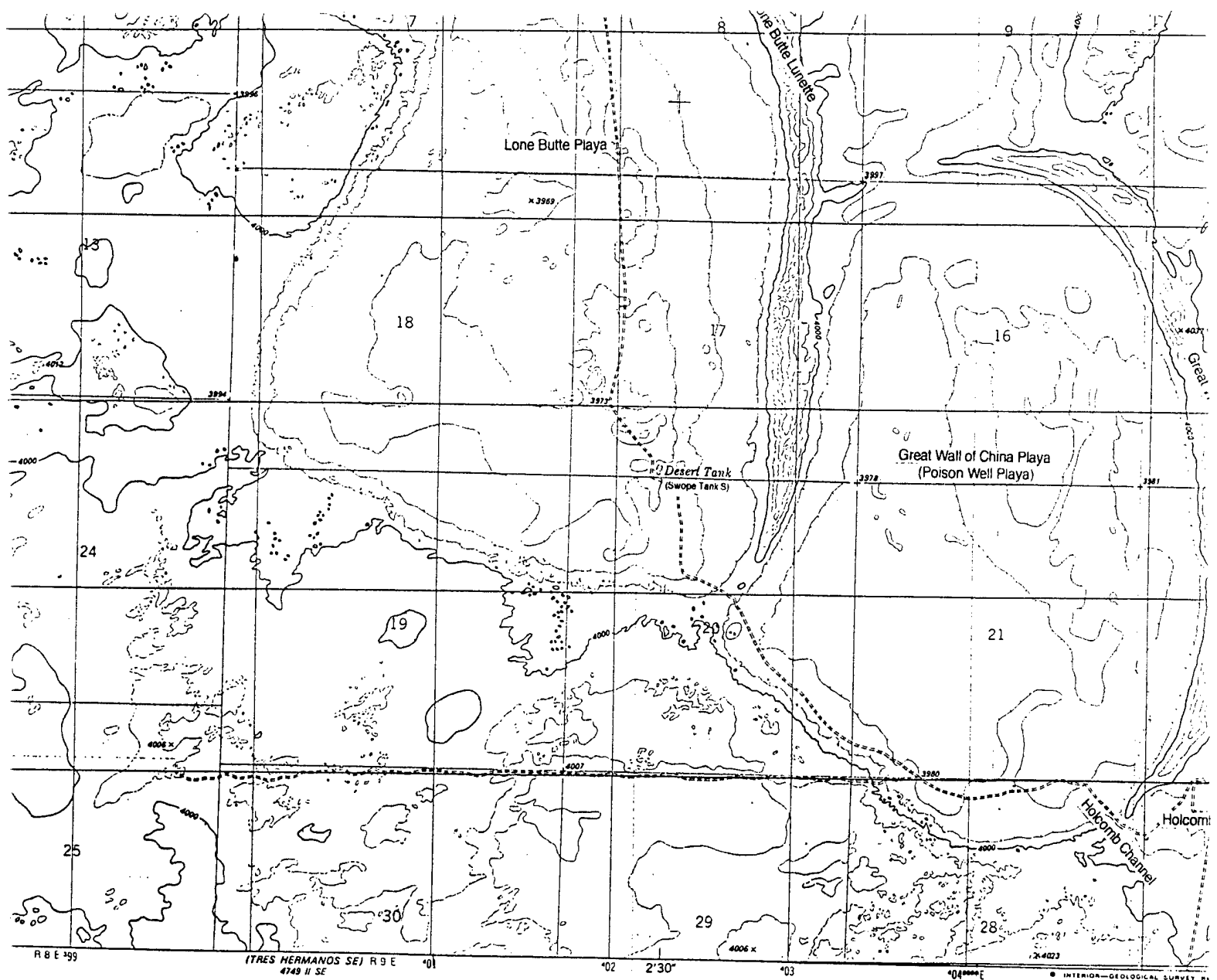
¹See text for explanation



CONTOUR IN
NATIONAL GEODETIC

THIS MAP COMPLIES WITH NAT
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENV
A FOLDER DESCRIBING TOPOGRAPHIC MA

7



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 R SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
 A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

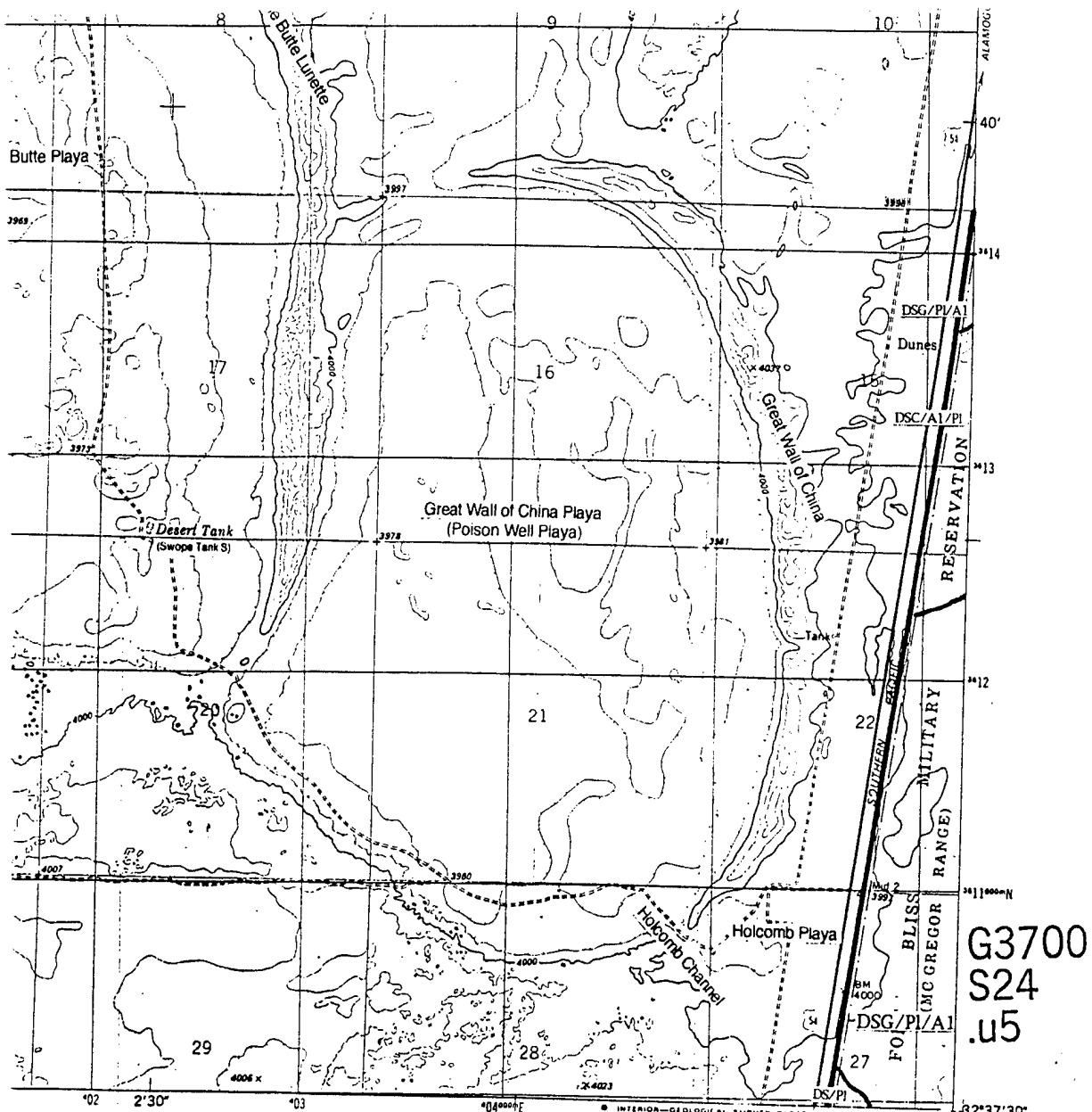
ROAD CLASSIFICATION

Primary highway, hard surface	Light-d improv
Secondary highway, hard surface	Unimp
Interstate Route	U. S. Route

QUADRANGLE LOCATION

UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

DMG 4749 II 7

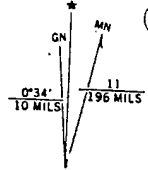


G3700
S24
.u5

1 MILE
FEET



QUADRANGLE LOCATION



UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

- ROAD CLASSIFICATION
- Primary highway, hard surface
 - Secondary highway, hard surface
 - Light-duty road, hard or improved surface
 - Unimproved road
 - Interstate Route
 - U. S. Route
 - State Route

TRES HERMANOS, N. MEX.
NE 1/4 TRES HERMANOS 15' QUADRANGLE
N3237.5-W10600/7.5

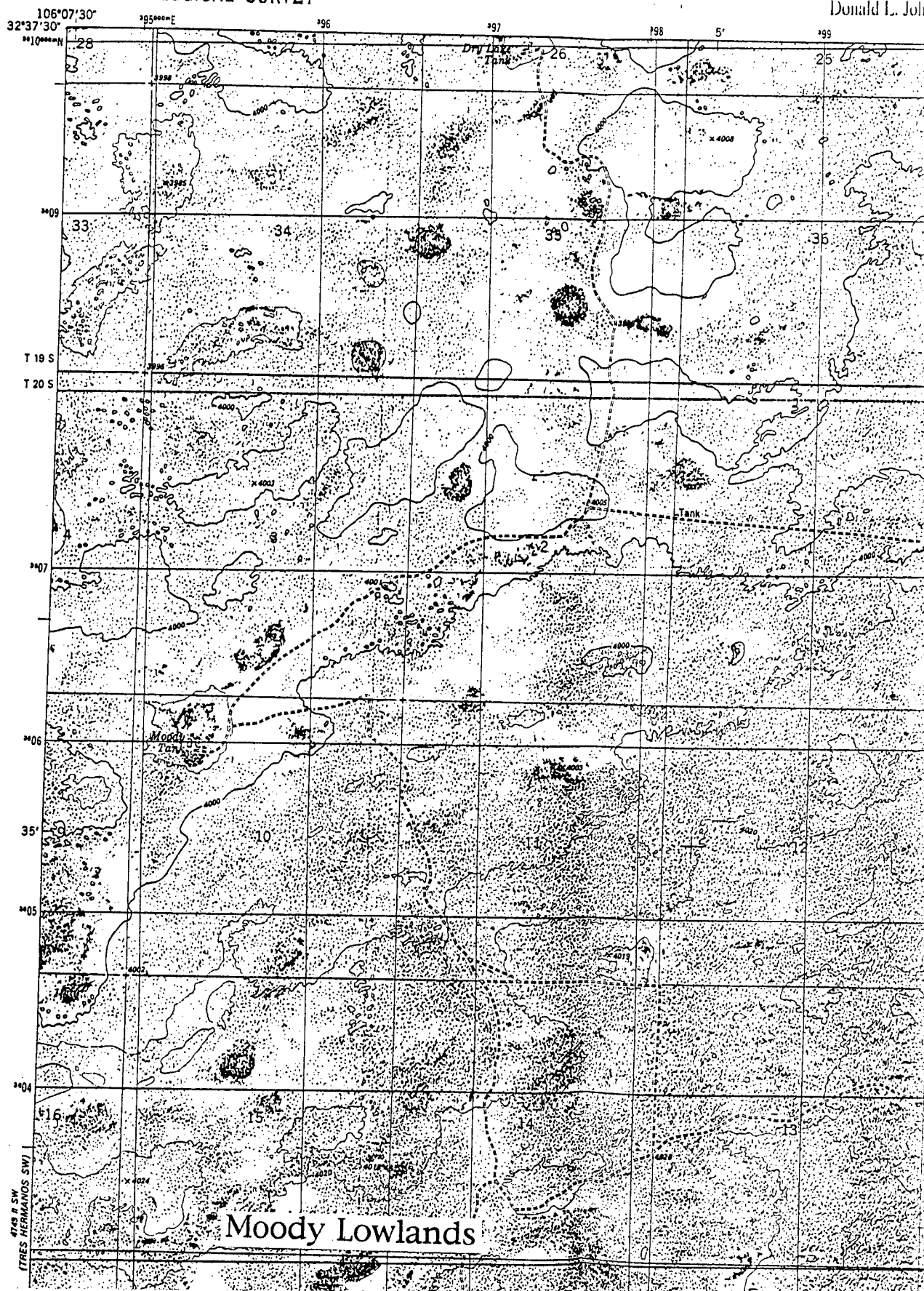
1982

DMA 4749 II NE-SERIES V881

INIA 22092

9

**Geomorphological, Geoelectrical and
Sedimentological Study of McGregor
Dam, South Africa**
Donald L. Johnson



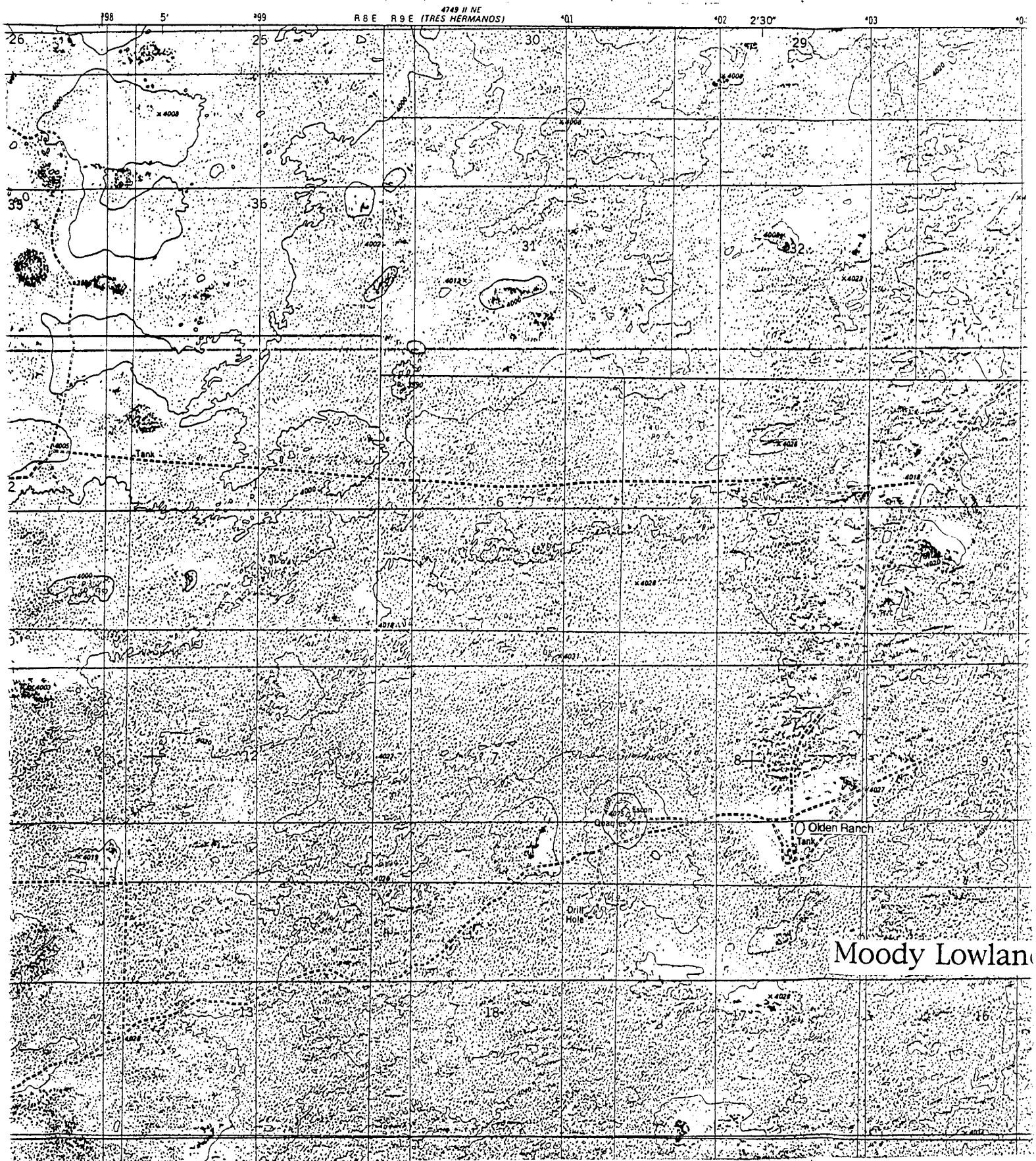
2

T

**Geomorphological, Geocological, Geoarchaeological and Surficial Mapping
Study of McGregor Guided Missile Range, Fort Bliss, New Mexico**

Donald L. Johnson, *Ph.D.*, Contract No. DACA63-93-D-0014, 1997

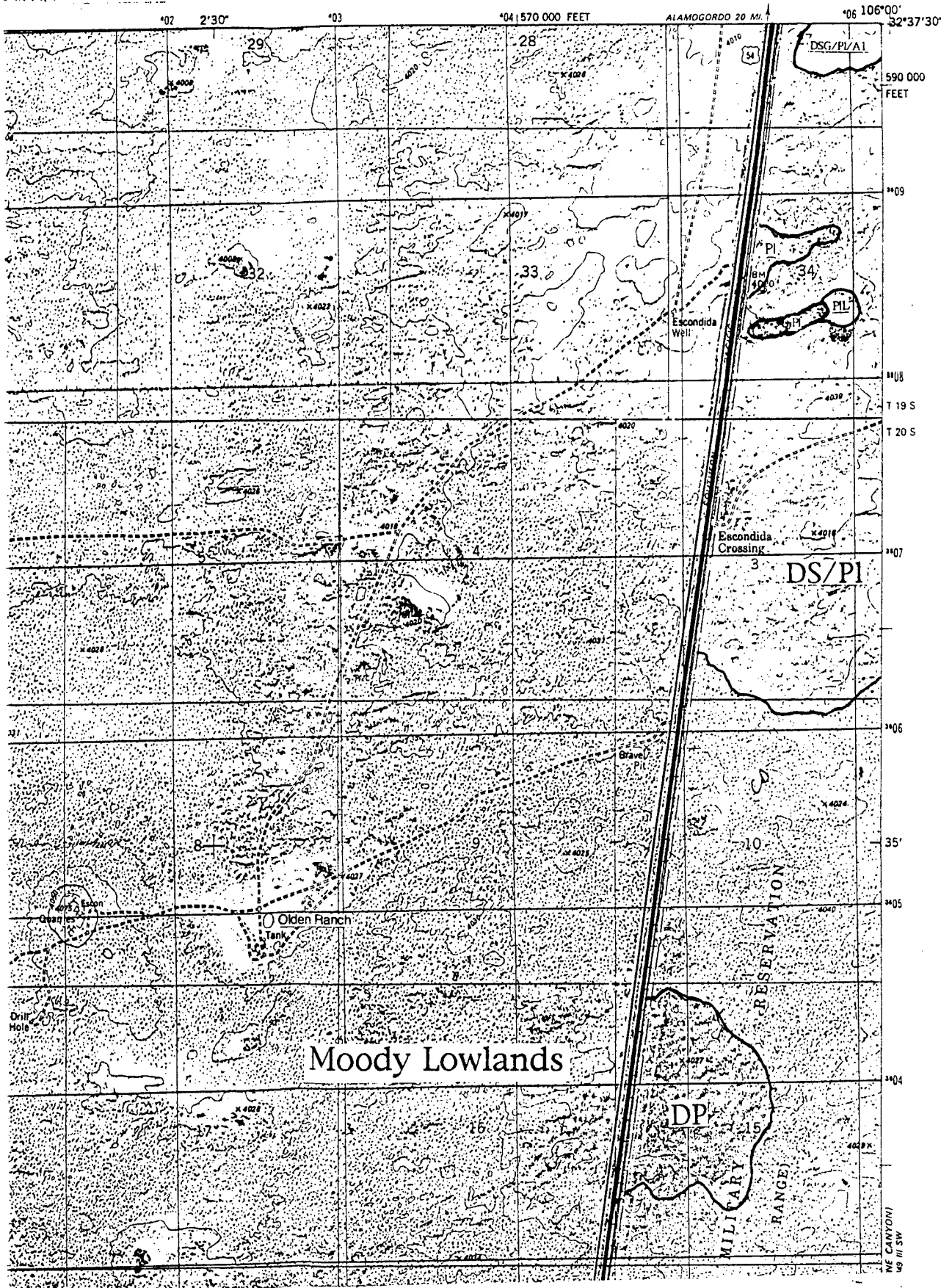
7.5 MIN



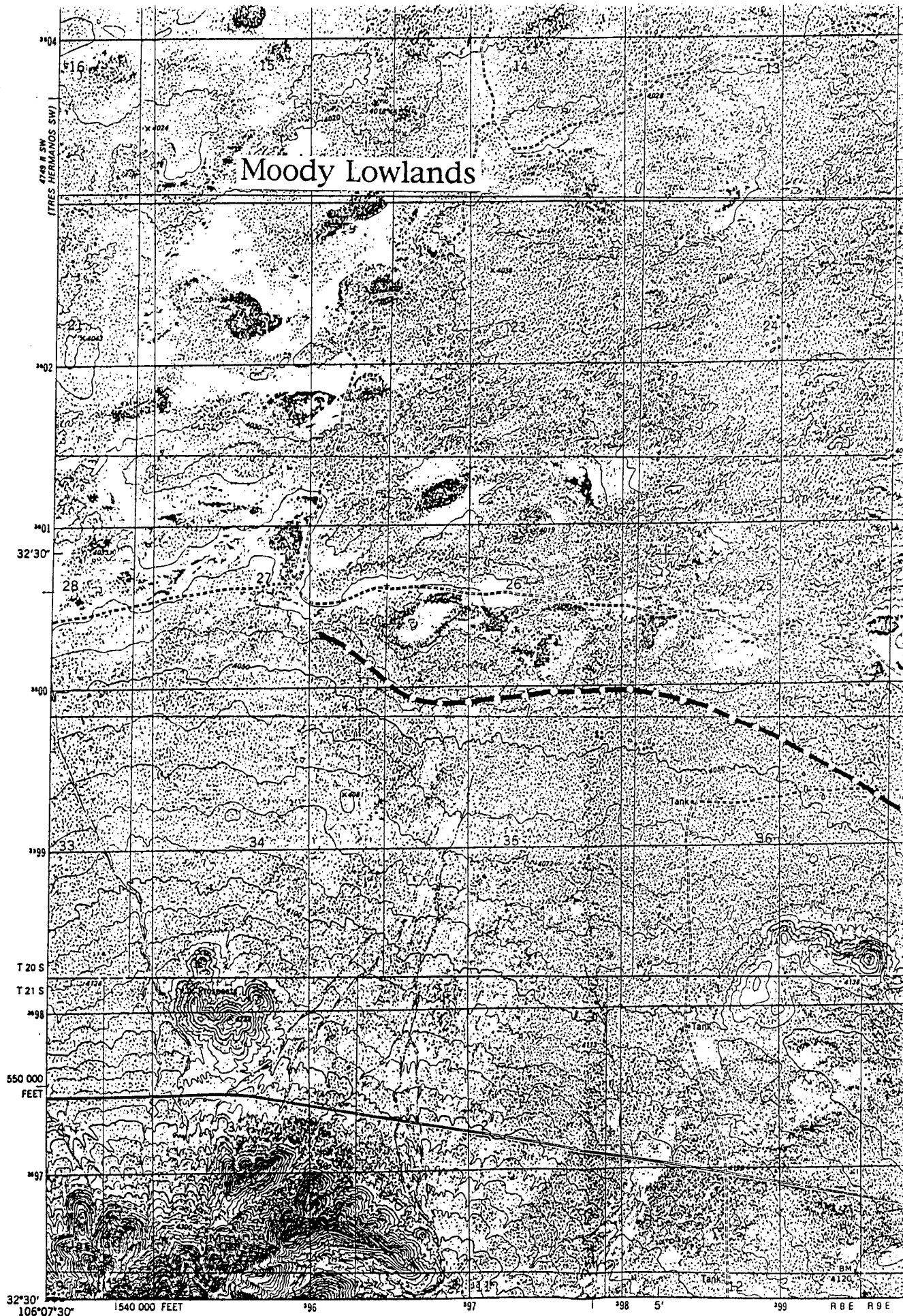
J-(X)14, 1997

SE/4 TRES HERMANOS 15' QUADRANGLE

4849 III NW
(DEADMAN CANYON)



3



478 1 MW
ELEPHANT
MOUNTAIN

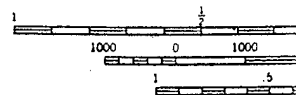
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1972. Orthophotomosaic from aerial photographs taken 1971
Field checked 1975. Map edited 1982

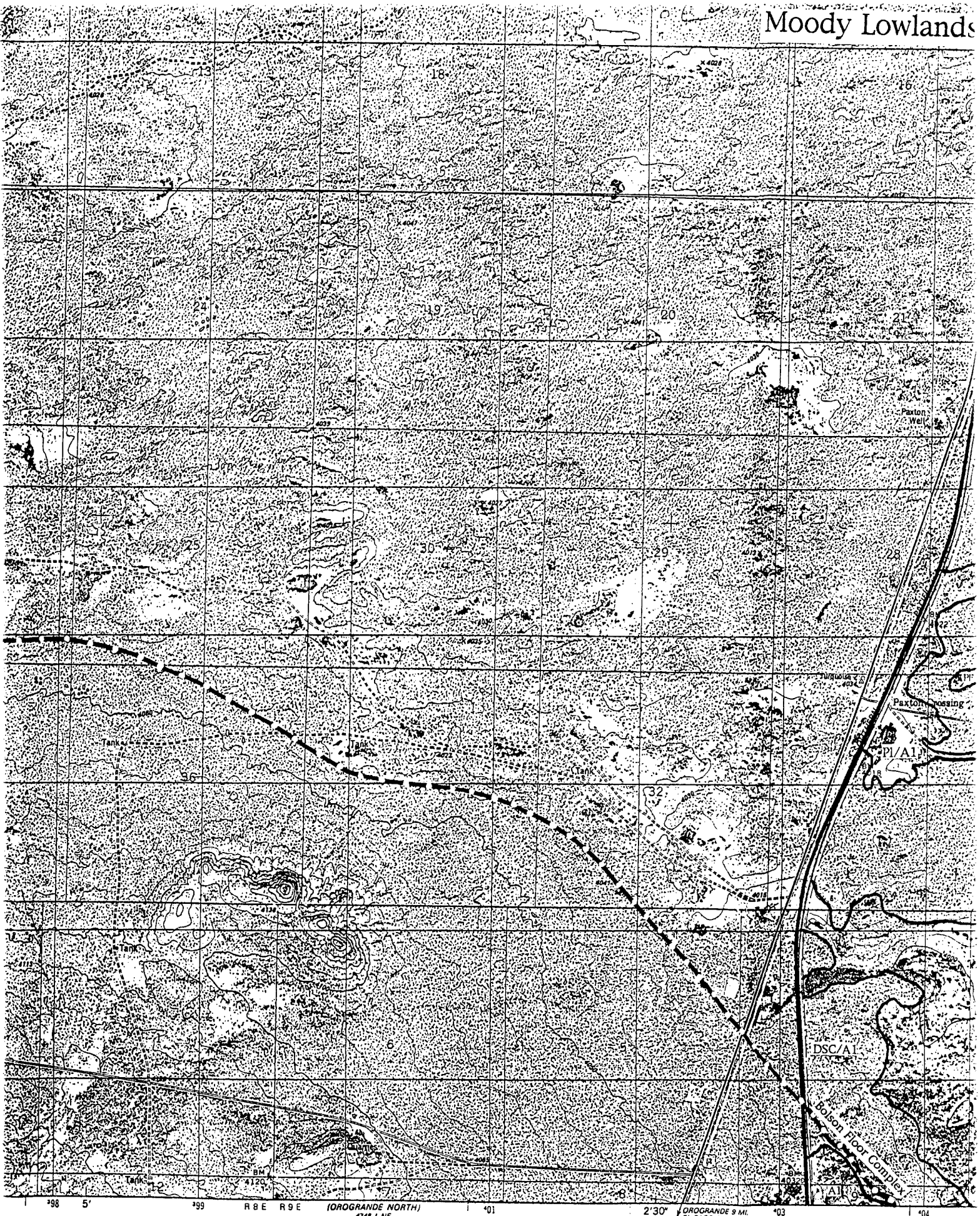
Projection and 10,000-foot grid ticks: NAD 83

McGregor Range Geomorphic
Mapping Units and Symbols¹

Alluvium (recent)	A1
Alluvium (relict)	A2
Alluvium (older relict)	A3
Bedrock	B



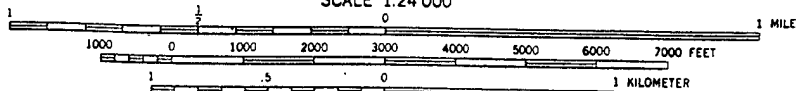
Moody Lowlands



Morphologic Symbols¹

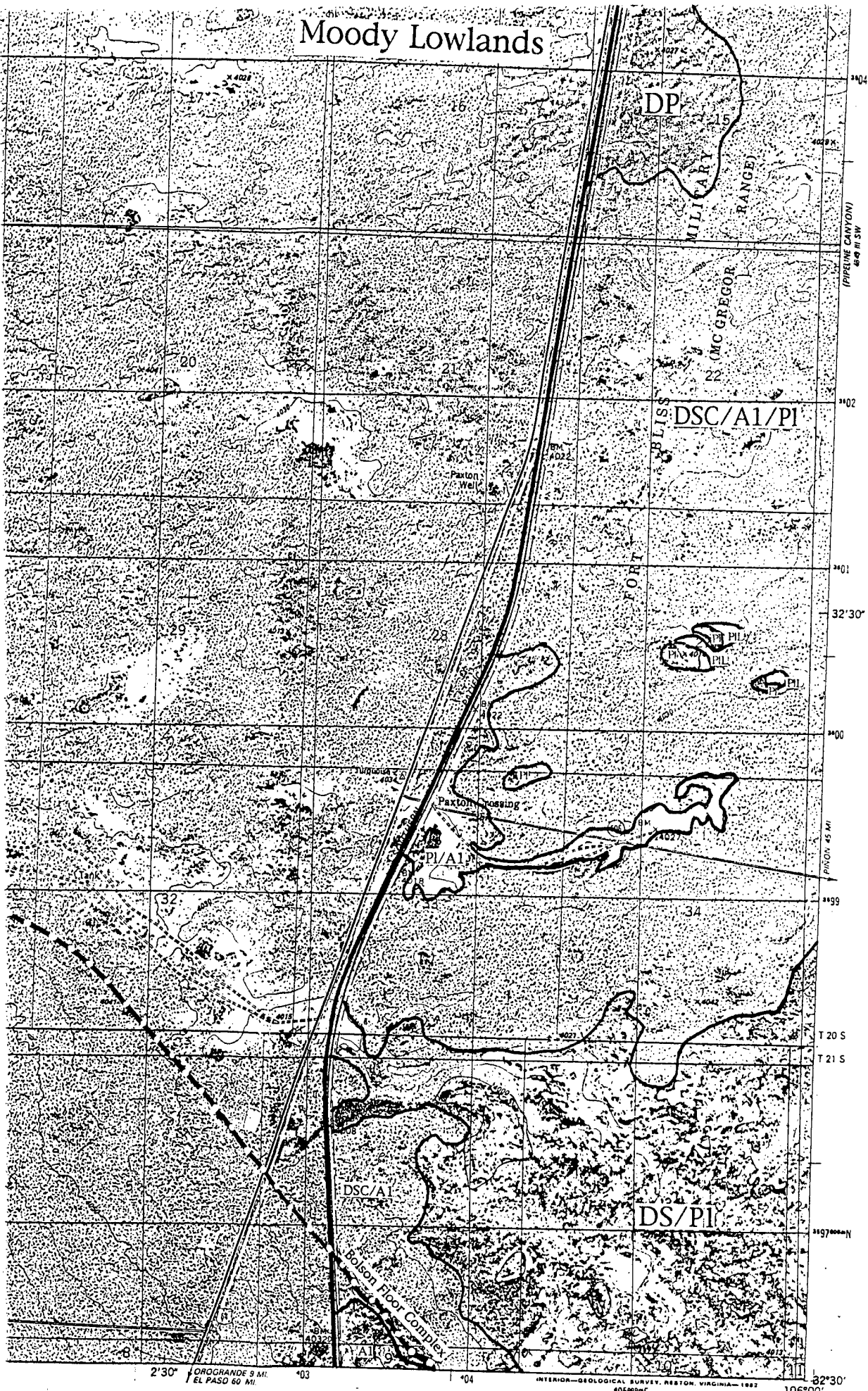
- A1
A2
A3
B

SCALE 1:24 000



Primary high:
hard surface
Secondary h.

Moody Lowlands

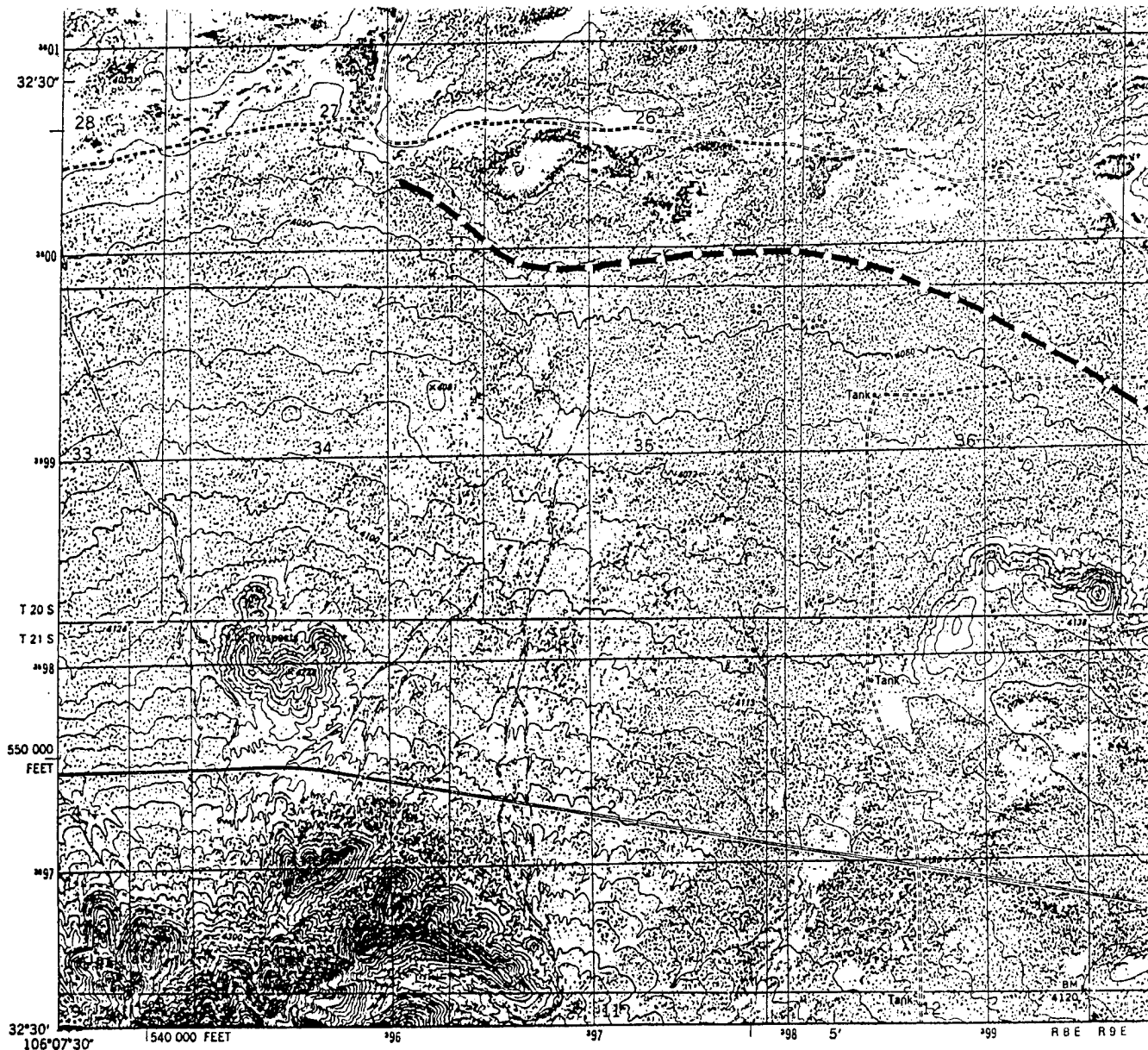


1 MILE
7000 FEET
1 KILOMETER

ROAD CLASSIFICATION

Primary highway*
hard surface
Secondary highway
Light-duty road, hard or improved surface

WIDE TANK
4000 FT



4741 MW
ELEPHANT
MOUNTAIN

Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1972. Orthophotomosaic from aerial photographs taken 1971
Field checked 1975. Map edited 1982

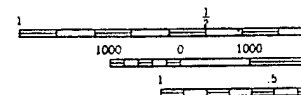
Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum

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Alluvium (older relict)	A3
Bedrock	B
Bolson Floor Complex	— — —
Camp Rice (Rio Grande) Sediments	CR • • •
Dune, Local	DL
Dune Pile	DP
Dune Sheet (Sand Sheet)	DS
Dune Sheet, Coppiced	DSC
Dune Sheet, Gypsiferous	DSG
Fault	— — —
Pediment	P
Playa	P1
Playa Lunette	P1L

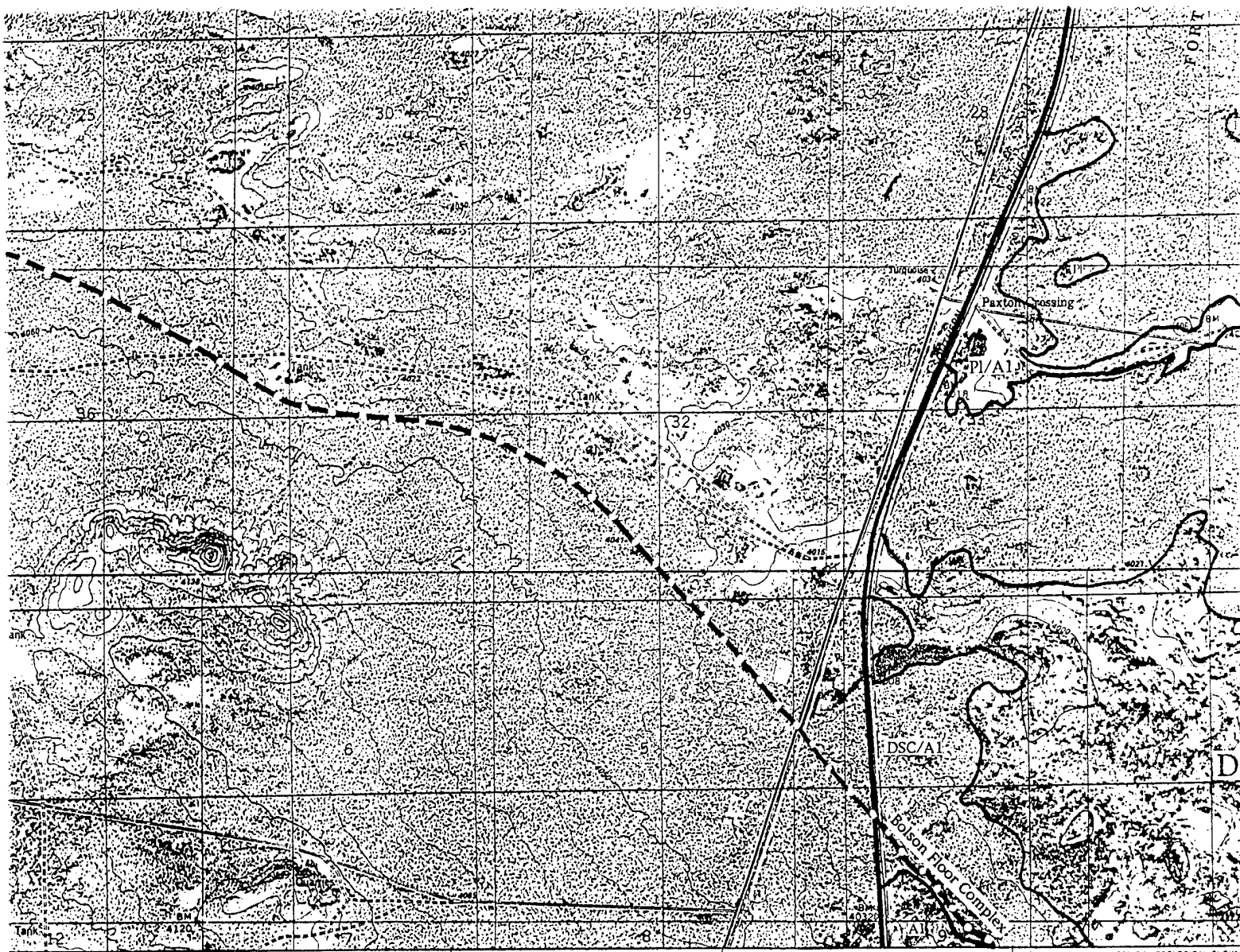
¹See text for explanation



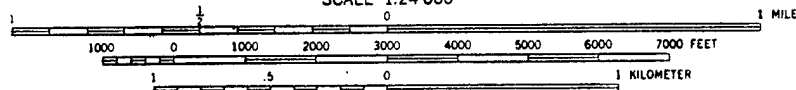
CONT
NATIONAL GE

THIS MAP COMPLIES
FOR SALE BY U.S. GEOLOGICAL SURV!
A FOLDER DESCRIBING TOPOGRA

7



SCALE 1:24 000

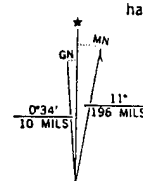


CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION



UTM GRID AND 1982 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

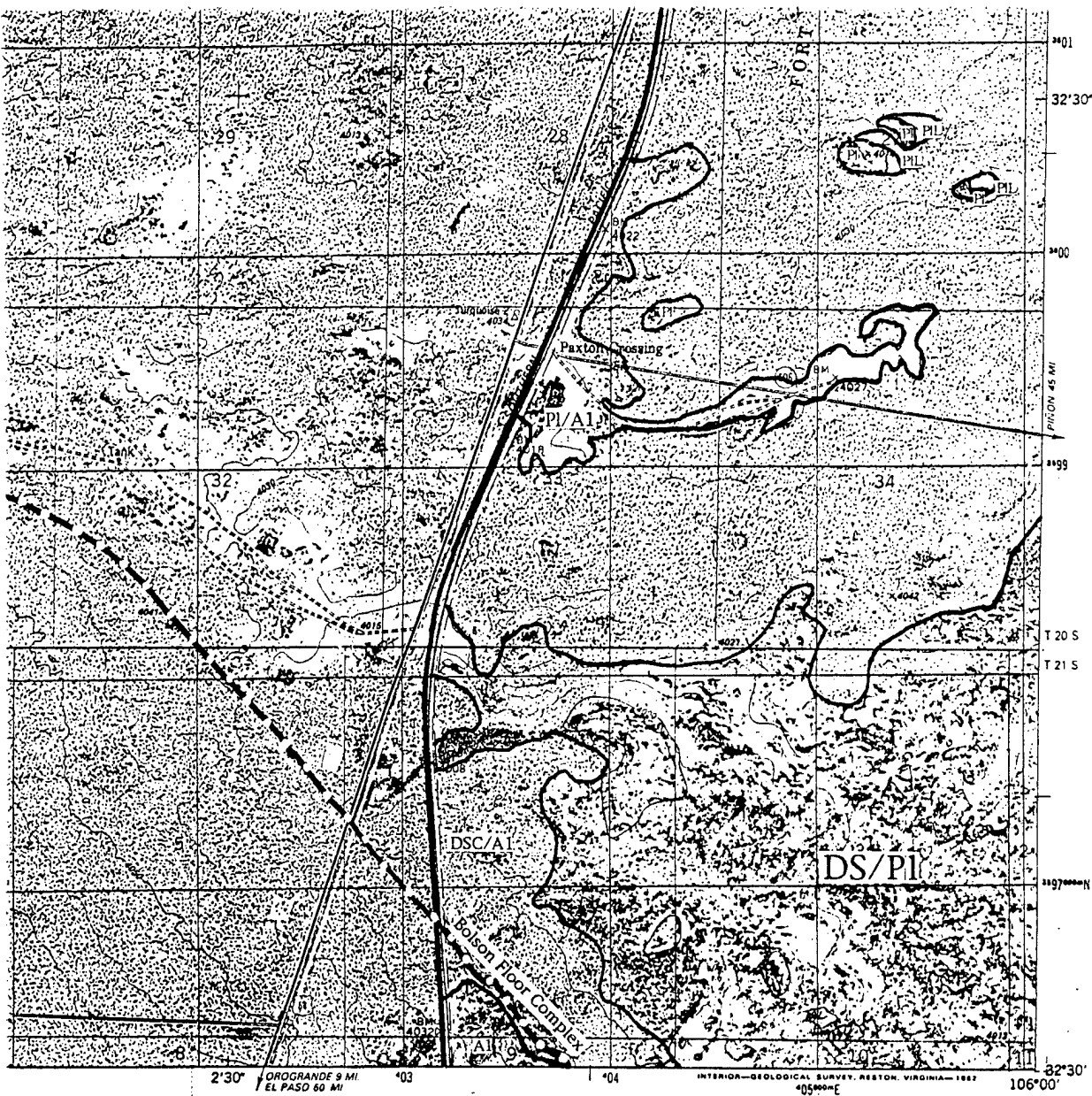
ROAD CLASSIFICATION

Primary highway, hard surface ——— Light imp.
Secondary highway, hard surface ——— Unim.
Interstate Route ——— U. S. I

TRES HERMANAS
SE/4 TRES HERMANAS
N3230-

DMA 4749 II

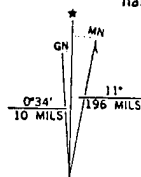
8



1 MILE
0 5000 7000 FEET
1 KILOMETER



QUADRANGLE LOCATION



UTM GRID AND 1982 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, hard surface _____
Secondary highway, hard surface _____
Light-duty road, hard or improved surface _____
Unimproved road - - - - -
Interstate Route (thick dashed line)
U. S. Route (dashed line)
State Route (thin solid line)

TRES HERMANOS SE, N. MEX.
SE/4 TRES HERMANOS 15' QUADRANGLE
N3230-W10600/7.5

1982

DMA 4749 II SE-SERIES V881

DS
RESTON, VIRGINIA 22092
E ON REQUEST

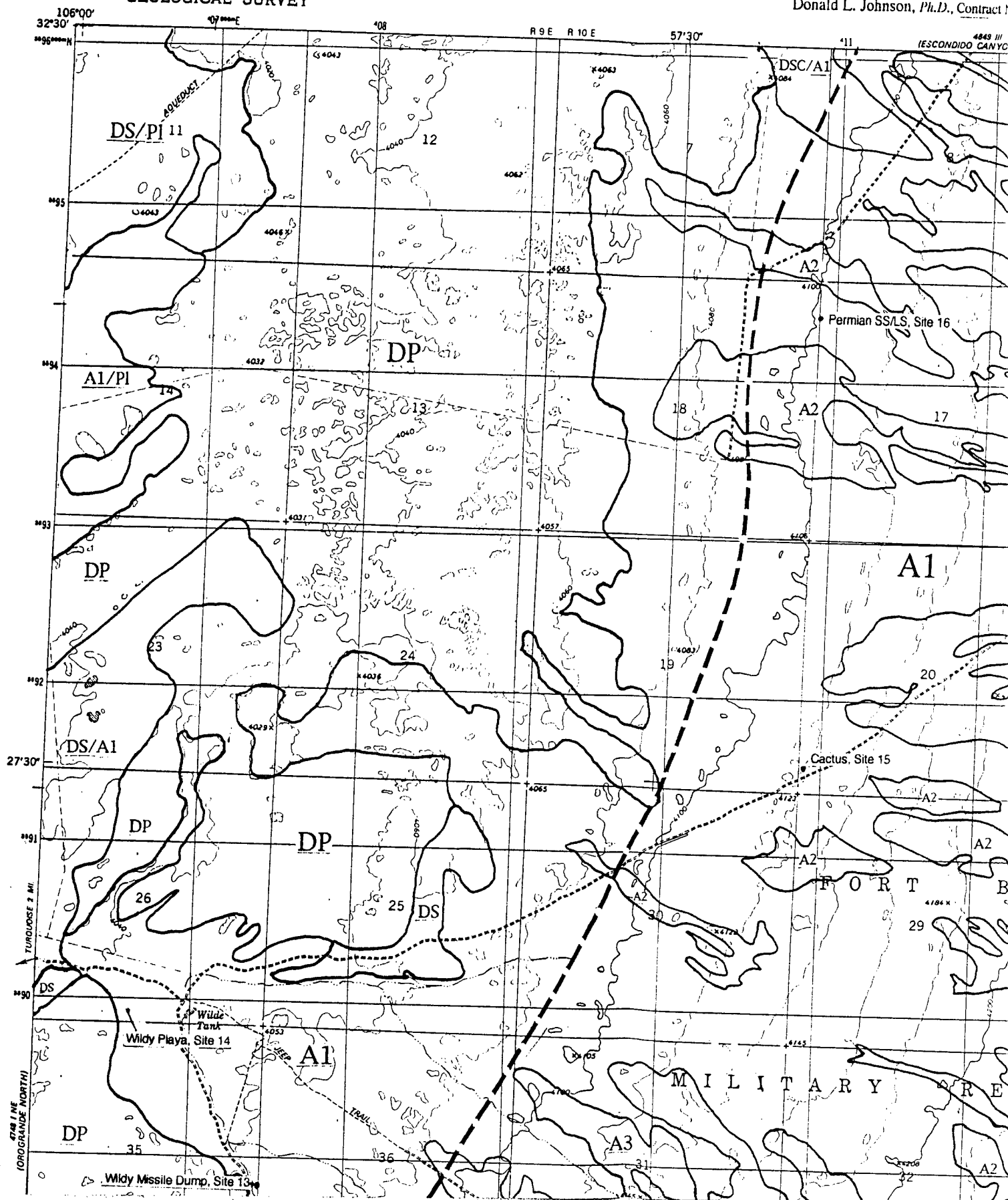
9

(WIDE TANK)
1000 IV 400

1:50,000
1:50,000
1:50,000

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

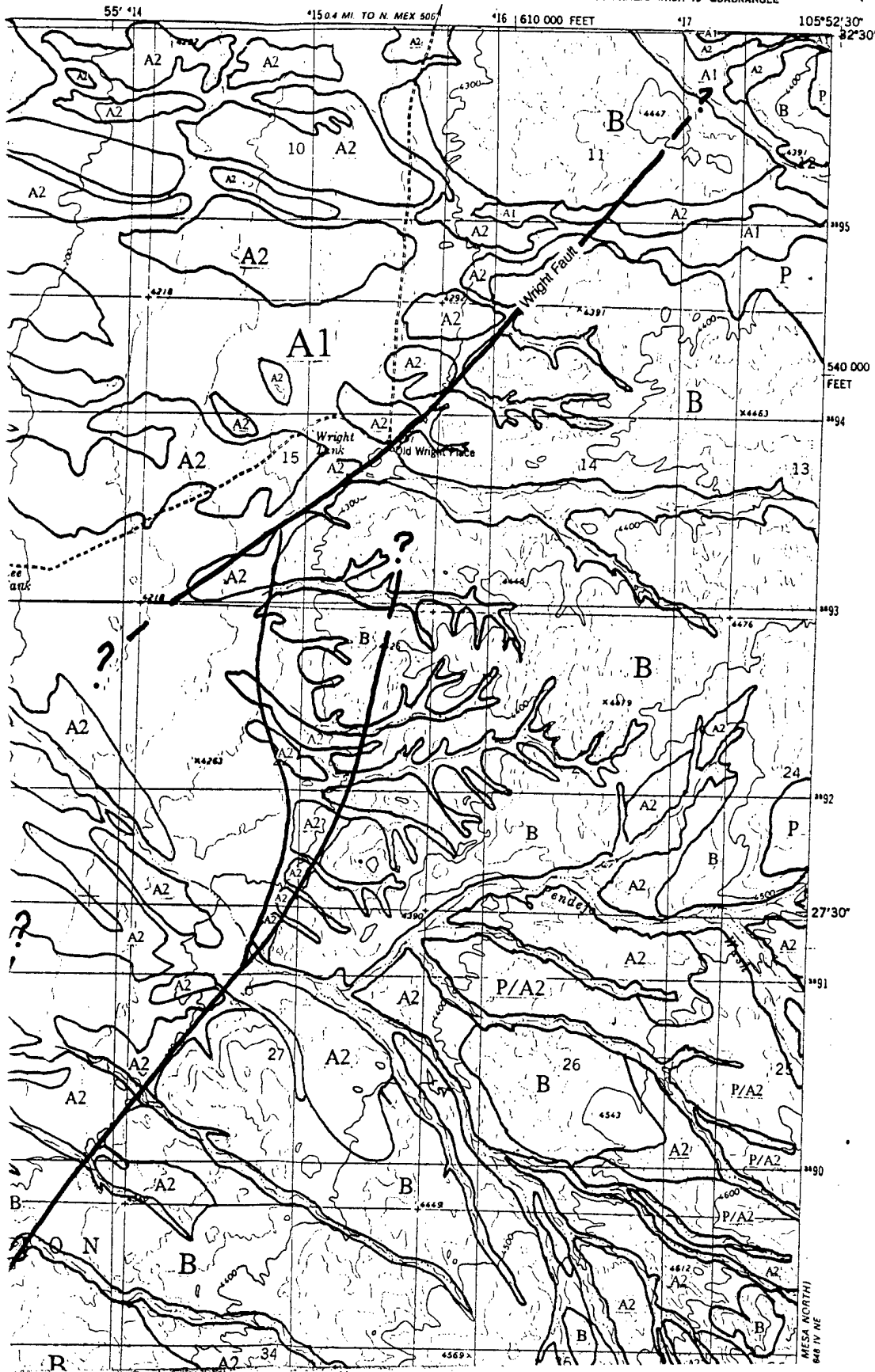
Geomorphological, Geoecological, Geoarc
Study of McGregor Guided Missile
Donald L. Johnson, Ph.D., Contract 1

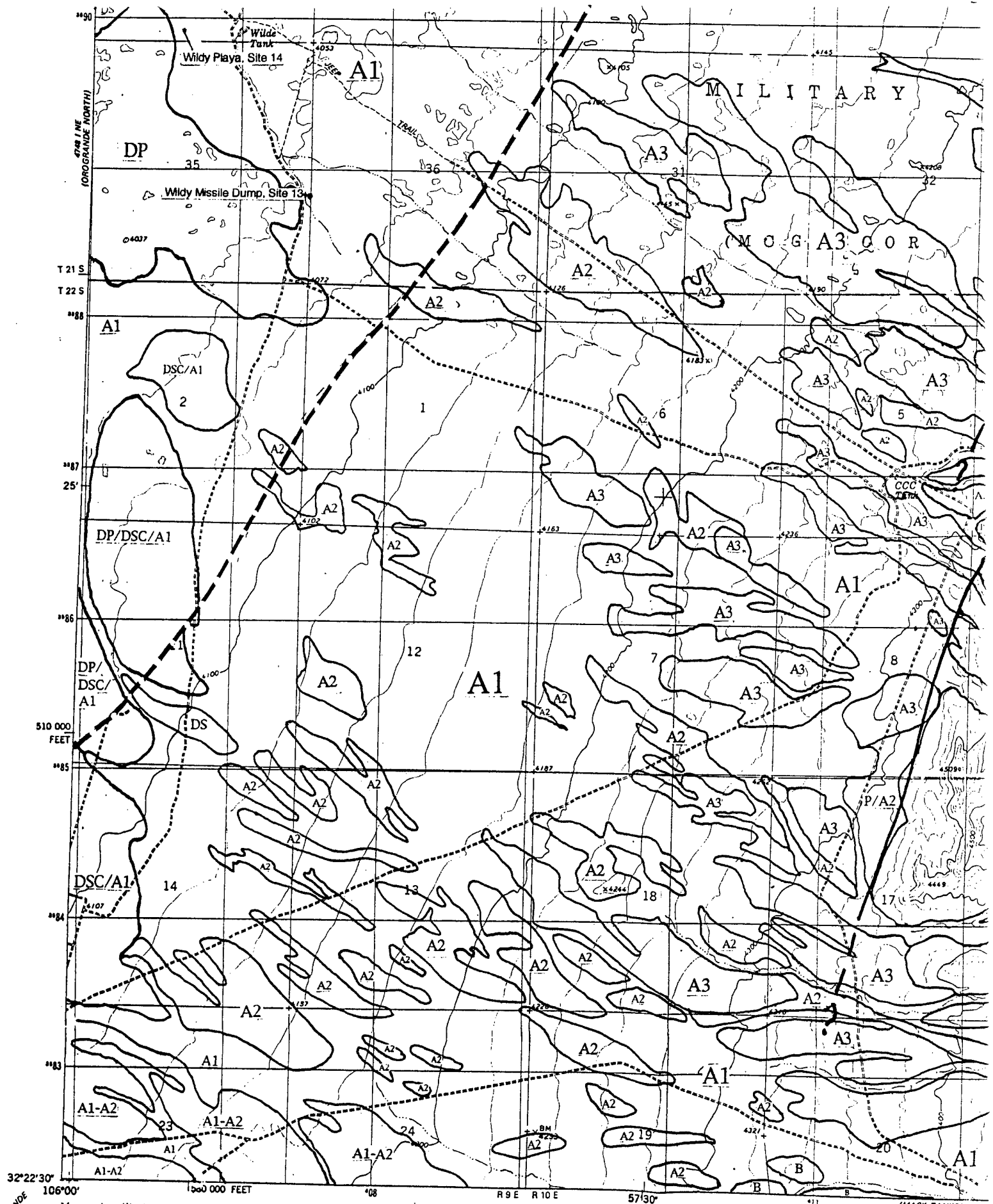


Mapping
exico

WILDE TANK QUADRANGLE
NEW MEXICO-OTERO CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 PENEJO WASH 15' QUADRANGLE

4848 N
IESCONDIDO CANYON
1:50,000





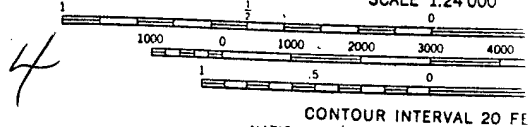
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs
taken 1974. Field checked 1975. Map edited 1980

Projection and 10,000-foot grid ticks: New Mexico
coordinate system, central zone (transverse Mercator)
1000-meter Universal Transverse Mercator grid, zone 13
1927 North American datum
To place on the predicted North

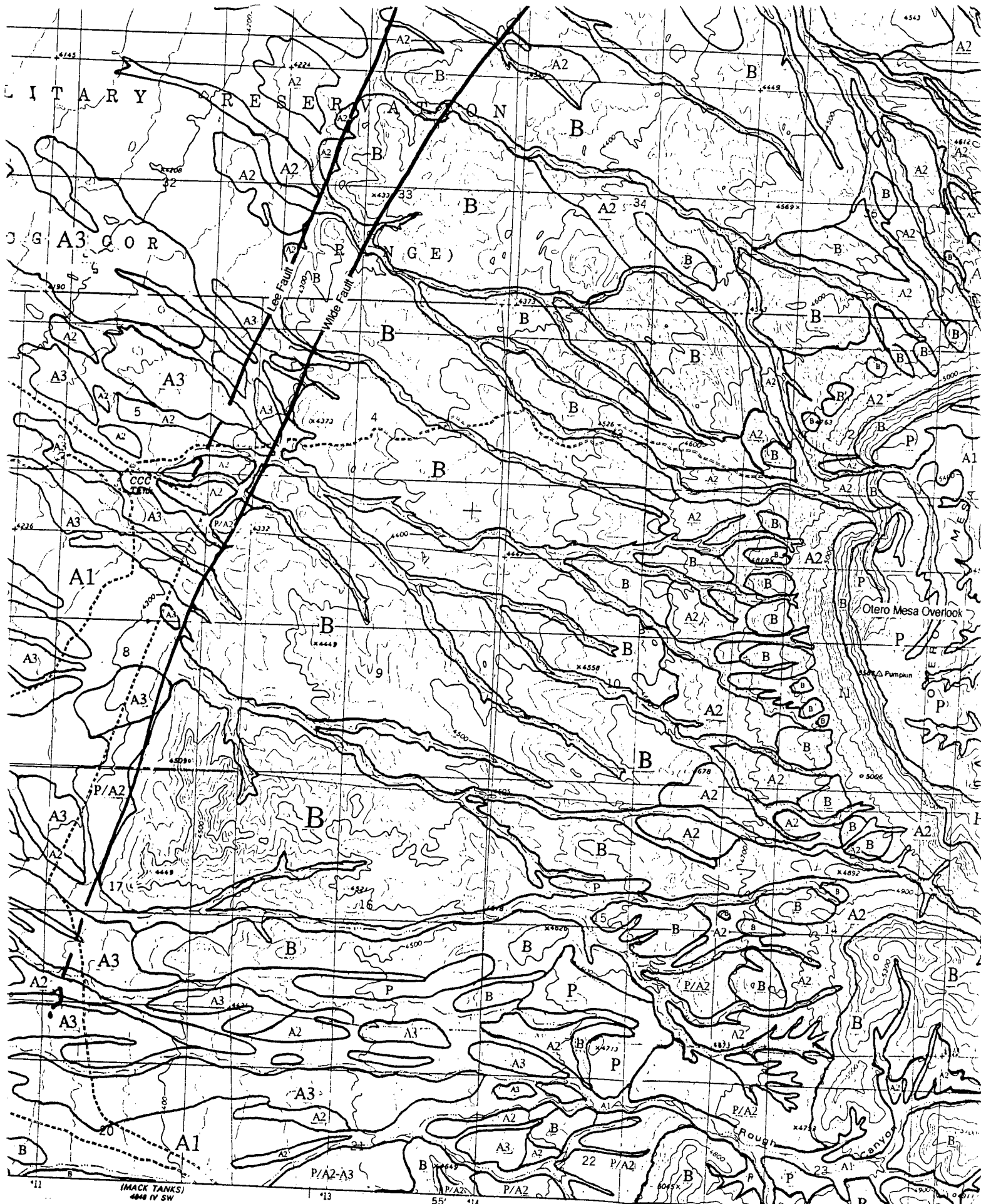
McGregor Range Geomorphic
Mapping Units and Symbols¹

- | | |
|----------------------------------|----|
| Alluvium (recent) | A1 |
| Alluvium (relict) | A2 |
| Alluvium (older relict) | A3 |
| Bedrock | B |
| Bolson Floor Complex | CR |
| Camp Rice (Rio Grande) Sediments | CR |
| Dune Land | CR |

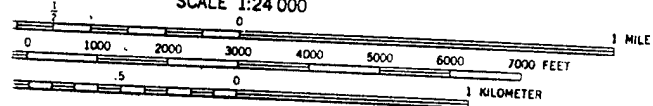


106°00' 32°22'30"

(MACK TANKS)
4848 IV SW



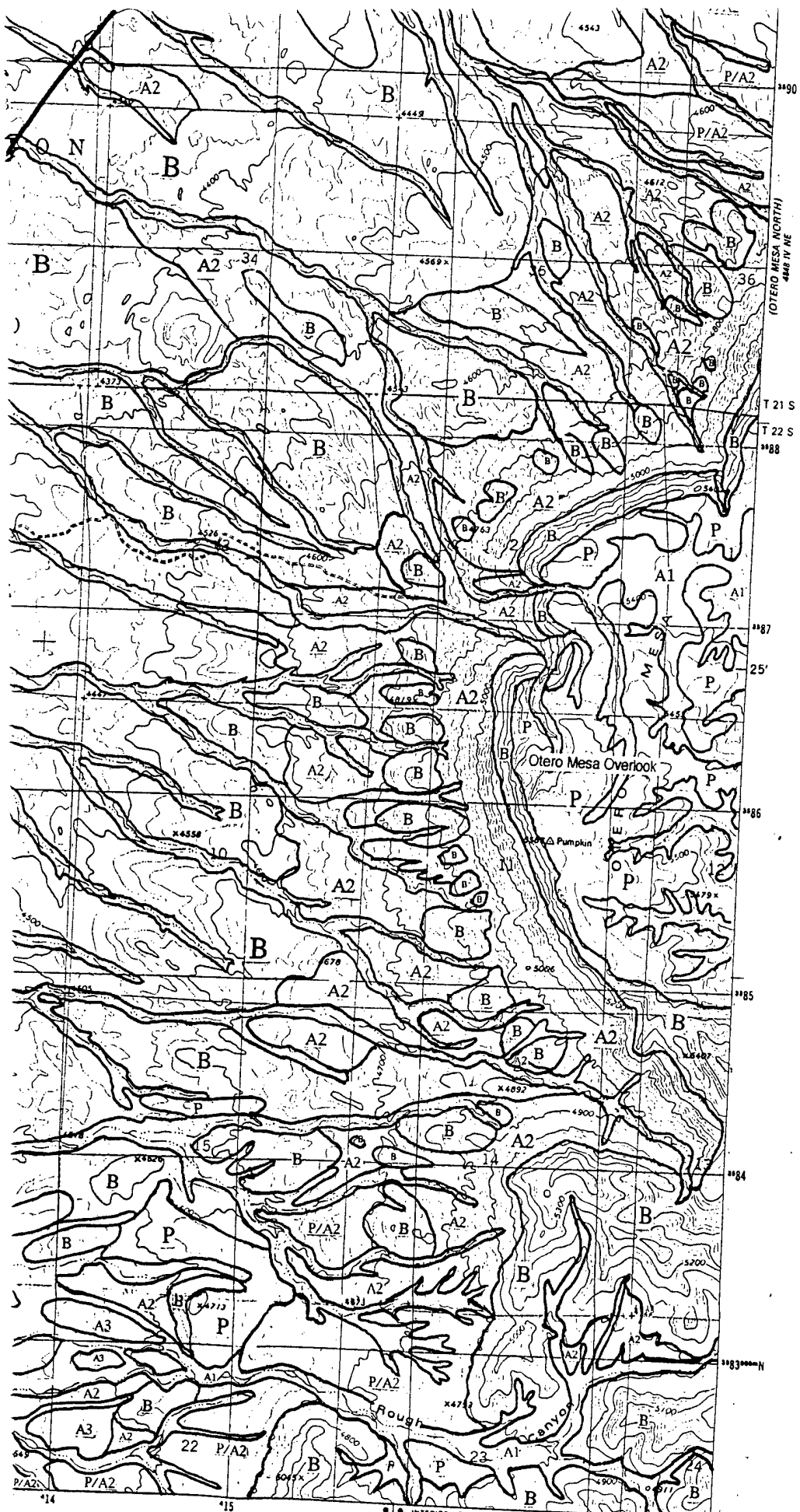
SCALE 1:24 000



CONTOUR INTERVAL 20 FEET

ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
base

U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA - 1980

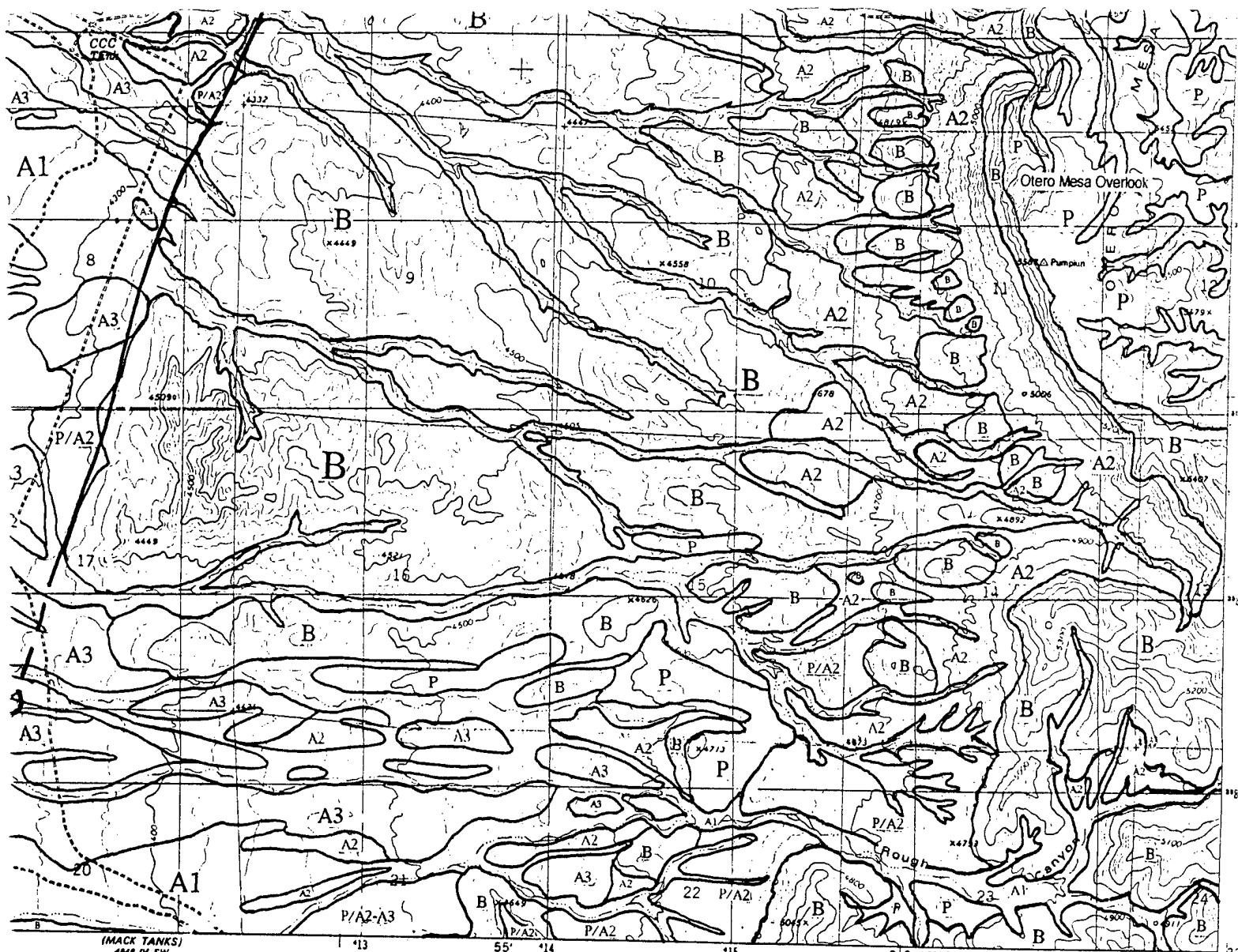


U.S. INTERIOR-GEOLOGICAL SURVEY, RESTON, VIRGINIA-1980
170000E 105° 52' 30"

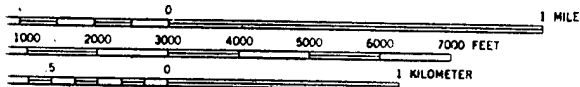
ROAD CLASSIFICATION

Primary highway, hard surface
Secondary highway
Light-duty road, hard or improved surface

105° 52' 30"
105° 52' 30"
105° 52' 30"



SCALE 1:24 000



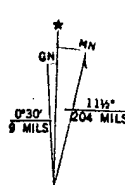
CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
AL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST



QUADRANGLE LOCATION



UTM GRID AND 1980 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Primary highway, hard surface ——— Light-duty road, hard or improved surface ———
Secondary highway, hard surface ——— Unimproved road ———
○ Interstate Route ○ U. S. Route ○ State Route

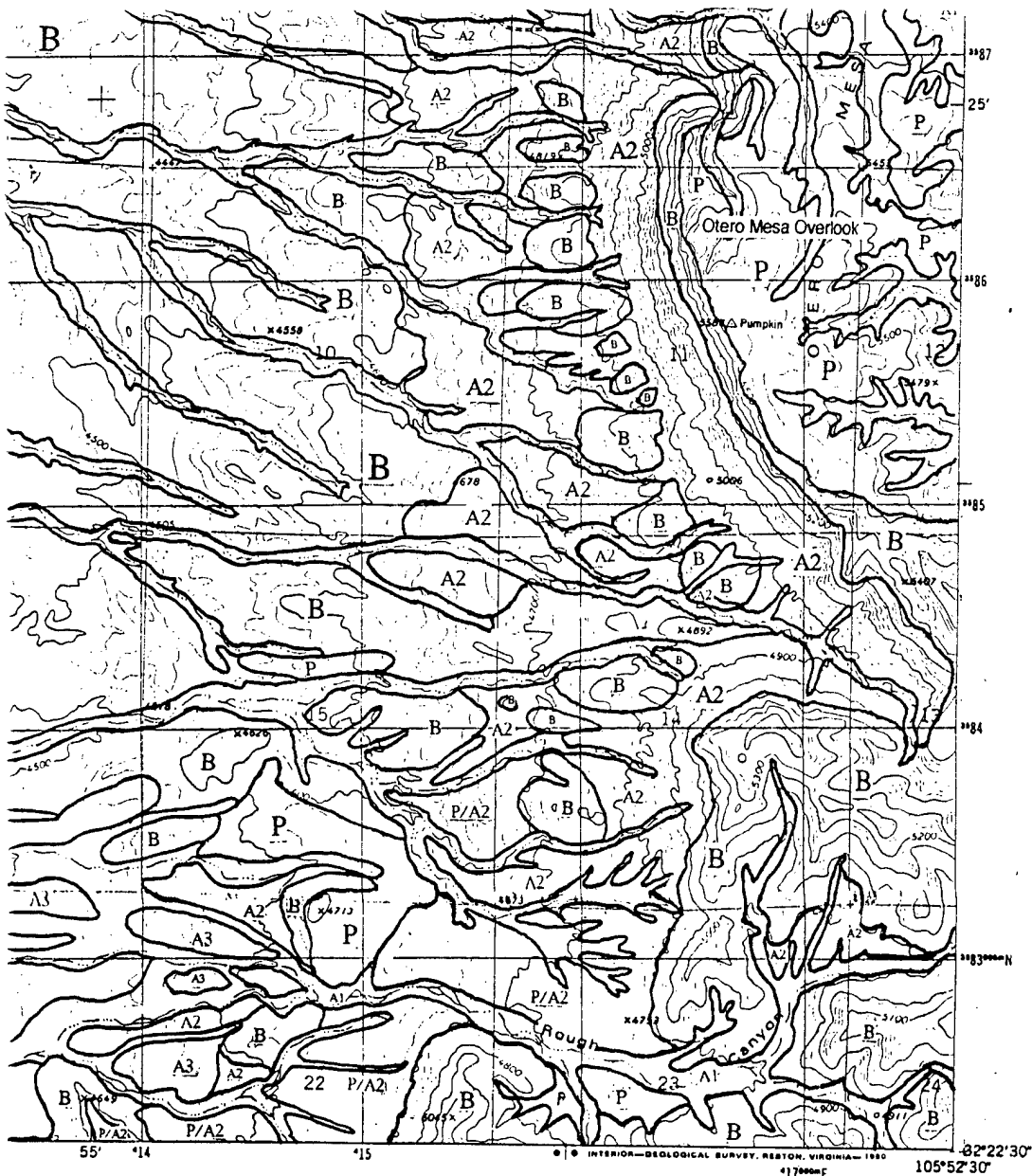
WILDE TANK, N. MEX.

NW/4 PENDEJO WASH 15' QUADRANGLE
N3222.5-W10552.5/7.5

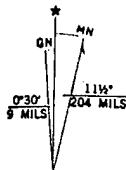
1980

DMA 4848 IV NW-SERIES V881

8



1 MILE



ROAD CLASSIFICATION

Primary highway, hard surface Light-duty road, hard or improved surface.....

Secondary highway, hard surface Unimproved road.....

○ Interstate Route ○ U. S. Route ○ State Route

WILDE TANK, N. MEX.

NW/4 PENDEJO WASH 13' QUADRANGLE
N3222.5-W10552.5/7.5

1980

DMA 4848 IV NW-SERIES V881

32°22'30" N
105°52'30" W
OTERO MESA
SOUTH

42

Handwritten signature or initials.

9