UTAH GEOLOGICAL AND MINERAL SURVEY

OPEN FILE REPORT 27

TAR SAND RESERVES, P. R. SPRING-DEPOSIT

UINTAH AND GRAND COUNTIES, UTAH

by

John N. Dahm

Consulting Geologist

This report was prepared under a contract between the University of Utah Engineering Experiment Station and the Division of State Lands, Department of Natural Resources, State of Utah

Includes Maps I through VII

November 1980

TAR SAND RESERVES - P. R. SPRING DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

by

John N. Dahm, Consulting Geologist

INTRODUCTION AND GEOLOGY

The P. R. Spring tar sand deposit is located in southeastern Uintah and northeastern Grand counties, Utah (Townships 11-17 South, Ranges 21-25 East). The area lies in the southeastern corner of the Uinta Basin, adjacent to the Utah-Colorado State line.

The regional dip in the area is gentle, generally 1-2° to the northwest. In the northeastern part of the area, the dip steepens to about 3° and is more westerly, reflecting the proximity of the north-south trending Douglas Creek Arch.

Map VI, Structure Map-Top of the Douglas Creek, indicates the lack of major surface structure in the area. The main feature is the Hill Creek anticline which transects the southwestern part of the area from northwest to southeast. Faulting is minor, with the few faults present striking westerly and having small displacements.

Map VII, Surface Geology and Overburden Thicknesses, shows the contacts of the three formations at the surface of the area. In ascending order, the stratigraphic units are: the Wasatch Formation, the Douglas Creek Member of the Green River Formation, and the Parachute Creek Member of the same formation.

The Wasatch Formation is exposed along the Roan Cliffs to the south. It also appears in the deeper canyons of the northerly running major streams which cut through the Douglas Creek Member.

The Douglas Creek Member has the major surface exposure whereas the overlying Parachute Creek Member is confined to a broad arc which swings around from the southwest through the north to the northeast. The Parachute Creek is intricately dissected and has left behind a number of remnants (outliers) in its northerly retreat.

The tar sands or oil-impregnated sandstones (OISS) are the major resource in the area. They are found in the lower part of the Parachute Creek and the upper part of the Douglas Creek. Locally, there is minor interbedded oil shale.

The foregoing geologic description is abstracted from the following authors, and it is recommended that their publications be consulted for greater detail: Cashion (1967), Byrd (1970), Gwynn (1971), Peterson and Ritzma (1974), and Peterson (1975).

OBJECTIVES

The primary purpose of this investigation was to determine the total reserves of the P. R. Spring tar sands under State lands. The quantity as well as the lateral and vertical distribution thereof are necessary for a variety of State planning procedures. Specifically, the State Land Board can use this reserve data to guide leasing procedures.

SCOPE

This investigation was not designed to be an exhaustive study of the geology of the area. Rather the intent was to generate the following data as expeditiously as possible:

1. Total reserves of OISS (proven, probable, and possible).
2. Vertical and lateral distribution of these reserves.
3. Certain other data which should be useful as development proceeds, such as:

   -zonation

   -depths and elevations

   -thicknesses (gross and net)

   -lithologies

   -physical characteristics of the oil.

   -barrels of oil per acre-foot and per section

   -tons and cubic yards of OISS

   -overburden and interburden data.

   -stripping ratios.

PROCEDURE

The investigation proceeded through a number of data gathering phases as follows:

Phase 1 consisted of preparing a new reproducible base map from an existing UGMS reproducible base map. The control points (core holes and measured sections) were plotted on the base map as well as the stratigraphic contacts.

Phase 2 was concerned with a tentative zonation and correlation grid of the 13 UGMS core holes and the four (4) Skyline Oil Corp. core holes.

Phase 3 carried the above zonations and correlation into the stratigraphic sections measured by Byrd (1970). Phases 2 and 3 were based on previous work by Byrd (1970), Gwynn (1971), Peterson and Ritzma (1974), and Peterson (1975). These two phases established the basic geometry of the tar sand deposits and form the foundation of the entire study.

Phase 4 consisted of drawing the following maps:

Map I, Isopach Map - Zone A, Net Pay

Map II, " " " B, " "

Map III, " " " C, " "

Map IV, " " " D, " "

Map V, " " " E, " "

Map VI, Structure Map - Top Douglas Creek

Map VII, Surface Geology and Overburden Map

Maps VI & VII were based on Cashion's map. See Cashion (1967).

Phase 5 was the modeling and filling out of the 8½ x 11 inch data sheets (example attached). The data generated are listed in SCOPE under item 3.

Phase 6 was the compilation of the State reserve data by land grid (section, township, and range) and by zones. An abbreviated summary follows under RESERVES

DATA-DISCUSSION AND INTERPRETATION

Phase 1 (base map). It is important to note that most of the measured sections,

from 27-38, have inexact locations (to the nearest quarter section). These non-specific locations introduce errors into the isopach maps.

Phases 2 and 3 (zonation and correlation). It is emphasized that the zonation and correlations of the OISS zones are provisional. They are based, largely, on distinctive algal, ostracodal, or oolitic limestones and oolitic sandstones which often bound the OISS.

Much additional control (core holes and surface sections) is needed to firm up these correlations. Full suites of mechanical logs (electrical, gamma-ray/neutron/density, etc.) should be run in future core holes to improve these correlations and to supply other needed data.

Phase 4 (maps). Concerning the maps, there are a number of cautions and observations.

The isopach lines (Maps I-V) are dashed rather than solid due to the inexact locations of certain measured sections discussed under Phase 1, and due to the lack of control points in much of the area. Thus, many of the isopach lines are inferred and subject to differing interpretations.

The net effect of the foregoing is that the bulk of the reserves is in the probable and possible category, rather than the proven category. There will need to be many more core holes and surface sections in order to firm up the reserve estimates. This additional control will result in substantial lateral shifts from the possible-probable categories to the probable-proven end of the spectrum.

It should be mentioned that no isopach map of the F Zone net pay has been made due to lack of information on its upper limit and distribution. Net pays are shown on the data sheets of the control points; and the probable and possible reserves should be significant, though highly dissected and often deep.

Map VI, Structure Map, Top Douglas Creek, is only approximate and should not be used for detailed work. Sources of error are changes in map scale, the

generally wide spacing of the control points, and the extreme lack of control where the Douglas Creek is exposed at the surface and eroded.

Additionally, measured sections 27-38 have no elevation control and the elevations of many of the rest of the sections were measured by aneroid barometer and are of insufficient accuracy for structure mapping.

Map VII, Surface Geology and Overburden Map. A detailed overburden map and interburden maps were not drawn due to insufficient hard data. As more control becomes available and as areas suitable for surface mining become better defined, it will be possible to compile localized cover maps.

Overburden thicknesses to the uppermost tar sand are shown at the control points. Additionally, best estimates have been made of the overburden thickness to the top of the Douglas Creek (top E Zone) in certain sections which have the Parachute Creek at the surface. These numbers are approximate only.

Map VII indicates that roughly one-half of the P. R. Spring area has Douglas Creek at the surface. Further, there are broad exposures of Zone E with OISS within 50 feet of the surface.

The other one-half of the P. R. Spring area has highly dissected Parachute Creek at the surface. Generally, depths to the F and lower OISS, here, are greater than those in the area where the Douglas Creek is at the surface.

Depths to the E Zone under Parachute Creek cover are in the 200-400 foot or more range in the northeast (T.12 S., R.24, 25 E.) and in the southwest (T.17 S., R.21, 22 E.). In the area between, the depth to the E Zone is, generally, in the 100-200 foot range.

Phase 5 (data sheets). The following explanations and sources of the data will aid in their use (See page 1 of attached data form).

Elevations. Two are given for each control point. The Average Elevation is a quick estimate of the entire section from USGS topographic sheets.

Net Pay in Zone. In the control points, this is the accumulative amount down to a one foot minimum, regardless of the apparent degree of saturation (whether very weak or very rich). The pay is often non-continuous and may occur anywhere within the zone. In the data sheets from the sections without control, the minimum net pay is five (5) feet (one-half a contour interval on the isopach maps).

The degree of saturation (visual estimate) is from the cores, and the gravity (°API), and percent sulfur are from the Core Lab core analyses.

On page 2 of the data form, under Resource Evaluation, several explanations are in order:

The barrels per acre-foot (bbl/ac.-ft) for the USGS core holes and SKL-79 are calculated as follows:

$$\text{Bbl/ac.ft.} = \frac{\text{oil volume (bbl)}}{\text{acres x net pay}}$$

The acreage unit is one full section (640 ac.), except in T.15½ S., where it is 320 acres (fractional township and sections therein).

For the State sections, without control, the barrels per acre-foot are assumed from zonal averages calculated for the core holes as shown above. The reserve, gross barrels of oil (bbl, gross), is calculated as follows: (100% recovery assumed). Bbl (gross) = net pay (ft) x 640 (ac/mi.^{2}) x bbl./ac.ft.

The stripping ratio on p. 2 of the data sheets is the quotient of the ratio of the overburden down to the first pay divided by that net pay.

The basic data for this report is found in the 8½ x 11 inch data sheets and in the large green data sheets on file. In cases of conflict of data, the 8½ x 11 inch data forms should be assumed as correct.

The APPENDIX (attached) gives the formulas used for calculating the percent of oil saturation by weight and the tons of OISS. These may be useful as development proceeds in the future.

RESERVES

The total reserves on State land of the P. R. Spring area have been compiled from the data sheets and are shown in an abbreviated form below. The reserves are based on data from the core holes, the measured sections, and the isopach maps.

These reserves are a best estimate of the presently known total resource. They include the widely used classifications of proven (or measured), probable (or indicated), and possible (or inferred).

TABLE I

Tn. Rge.	(bbl. x 10^3) Reserves	Gross State Acre	($x10^3$) Bbl./Acre	Main Zones
12S., 24E.	29,996	1,320	22.7	E
12S., 25E.	19,264	1,280	15.1	E
13S., 22E.	41,120	1,280	32.1	E
13S., 23E.	80,146	1,400	57.2	E
13S., 24E.	54,107	2,040	26.5	E
14S., 21E.	47,164	1,280	36.8	E, C
14S., 22E.	192,161	2,560	75.1	E, D, C
14S., 23E.	67,401	1,920	35.1	E, D, C
14S., 24E.	2,640	640	4.1	B
15S., 21E.	42,208	1,920	22.0	C
15S., 22E.	184,920	2,560	72.2	E, C
15S., 23E.	289,295	5,360	54.0	E, C, B, A
15S., 24E.	20,115	640	31.4	E, B
15½S., 22E.	108,188	1,600	67.6	E, C, B, A
15½S., 23E.	84,304	1,440	58.5	E, C, B, A
15½S., 24E.	31,502	760	41.4	E, B
16S., 22E.	208,610	9,520	21.9	E, C
16S., 23E.	326,830	8,880	36.8	E, C
16S., 24E.	59,786	2,000	29.9	E, B
17S., 21E.	8,800	1,440	6.1	F
17S., 22E.	4,364	640	6.8	F
TOTALS	1,902,921	50,480		

TABLE I indicates that T.14 S., R.22 E., T.15 S., R.22 E., 23 E., T.15½ S., R.22 E., 23 E., and T.16 S., R.22 E., 23 E., a total of seven (7) contiguous townships, contain the bulk of the reserves (73%) and, generally, are the highest in barrels/acre.

The average barrels/acre for all the above townships is 37,700, including the above-mentioned "rich" townships. The average barrels/acre, excluding the "rich" townships, is 27,400, and the average barrels/acre of the "rich" townships only is 43,700.

The 50,430 gross State acres are equal to 79 square miles, approximately. This would be equivalent to an area of about eight by ten miles square. The gross State acres have been reduced to an estimated 47,280 net acres, a 6% reduction, due to the following: a) erosion along the Roan Cliffs and in the deeper canyons of the major northerly flowing streams has cut through and removed the tar sands, and b) where the O isopach line passes through a State section, the State land is reduced accordingly. This would be termed a (lateral) pinchout.

The F Zone reserves are considerably greater than herein shown, even though the zone is severely dissected by erosion. As previously discussed, no isopach map was made of this zone due to insufficient data. Thus, only the reserves for the measured sections in T.17 S., R.21, 22 E. are shown. The zone needs more study particularly on the placement of the upper boundary.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The OISS are found in the lower part of the Parachute Creek and the upper part of the Douglas Creek. Locally, there are minor amounts of oil shale.

The zonation and correlation of the OISS zones is based, largely, on distinctive algal, ostracodal, and oolitic limestones and oolitic sandstones. The zonation and correlation of the zones is provisional and will be modified, undoubtedly, as control in the area increases.

Extensive additional control (core holes and surface sections) is needed to pinpoint the best areas for future development and to firm up the reserves.

It is recommended that a full suite of geophysical logs be run on future core holes to facilitate the zonation and correlation, and to supply other needed data.

The F Zone needs additional work so that an isopach map may be made and additional reserves assigned. The main task, here, is determining a consistent upper limit.

The estimated total reserves of oil (proven, probable, possible) in P. R. Spring of 1.90 billion barrels are particularly significant in that they involve State lands only. The Federal reserves are not included, nor are the interbedded oil shales.

At present, there are seven (7) contiguous townships in the south-central part of the area that have the bulk of the reserves (73%). These are T.14 S., R.22 E., T.15, 15½ S., 16 S., R.22, 23 E.

APPENDIX

$$\% \text{ oil saturation by Wt.} = \frac{\text{Vol. oil/sect. (bbl)} \times \text{oil SG (avg.)} \times \frac{350.16 \text{ (lb./bbl. water)}}{2{,}000 \text{ (lb./ton)}}}{\text{OISS wt. (tons/sect.)}}$$

The average specific gravity of the oil (oil S.G., avg.) is either from the Core Lab analyses of U.G.M.S. core holes or is an assumed average (0.995).

$$\text{Tons of OISS} = \frac{\text{Vol. (ft}^3\text{/sect.)} \times \text{S.G. (saturated)} \times 62.43 \text{ (wt. of wtr. in lb./ft}^3\text{)}}{2{,}000 \text{ (lb./ton)}}$$

The specific gravities (S.G., saturated) are the bulk densities, saturated (g/cm^3) obtained from the Bureau of Mines Reports of Investigations. RI 7923 (1974), 8003 (1975), 8030 (1975), and LERC/RI-75/6 (1975)

REFERENCES

Byrd, W. D., II, 1970, P. R. Spring Oil-impregnated sandstone deposit, Uintah and Grand Counties, Utah: U.G.M.S. Special Studies 31.

Cashion W. B., 1967, Geology and fuel resources of the Green River Formation, southeastern Uintah Basin, Utah and Colorado; U.S.G.S. Prof. Paper 548.

Gwynn, J. W., 1971, Instrumental analysis of tars and their correlations in oil-impregnated sandstone beds, Uintah and Grand Counties, Utah: U.G.M.S. Special Studies 37.

Johnson, L. A., et al, 1975, Properties of Utah tar sands - South Seep Ridge area, P. R. Spring deposit: U.S.B.M. R.I. 8003.

_____, et al, 1975, Properties of Utah tar sands - Asphalt Wash area, P. R. Spring deposit: U.S.B.M. R.I. 8030.

_____, et al, 1975, Properties of Utah tar sands - North Seep Ridge area, P. R. Spring deposits LERC/RI 75/6.

Marchant, L. C., et al, 1974, Properties of Utah tar sands - Threemile Canyon area, P. R. Spring deposit: U.S.B.M. R.I. 7923.

Peterson, P. R. and H. R. Ritzma, 1974, Informational core drilling in Utah's oil-impregnated sandstone deposits, southeast Uinta Basin, Uintah County, Utah: U.G.M.S. R.I. No. 88.

_____ , 1975, Lithologic logs and correlations of corcholes P. R. Spring and Hill Creek oil-impregnated sandstone deposits, Uintah County, Utah, U.G.M.S. R. I. No. 100.

SECTION

TOWNSHIP RANGE COUNTY GRAND

OWNERSHIP OF MINERALS :

SOURCE OF DATA :

CORE HOLE (LOCATION)

MEASURED SECTION (LOCATION)

ELEVATIONS: MAXIMUM MINIMUM AVERAGE

ELEVATION OF SOURCE OF DATA

ZONATION OF OIL-IMPREGNATION

ZONE	F	E	D	C	B	A
Top (depth)						
Top (elevation, MSL)						
Base (depth)						
Base (elevation, MSL)						
Thickness (gross)						
Net pay in zone						
Lithologies in zone						
Character of oil						
Degree of saturation						
% saturation (weight)						
Gravity (°API)						
% sulfur						

RESOURCE EVALUATION

RESOURCE ESTIMATE		ZONE F	ZONE E	ZONE D	ZONE C	ZONE B	ZONE A	TOTALS
Bbls (gross) Bbls/Ac.Ft. Tons of OISS Cu. yds. of OISS								
OVERBURDEN*								
Maximum Minimum Average								
ENTERBURDEN		BETWEEN F &	BETWEEN E &	BETWEEN D &	BETWEEN C &	BETWEEN B & A		
Maximum Minimum Average								
STRIPPING RATIO*								
* surface to upper-most zone present								

REMARKS

PREPARED BY: Dahm

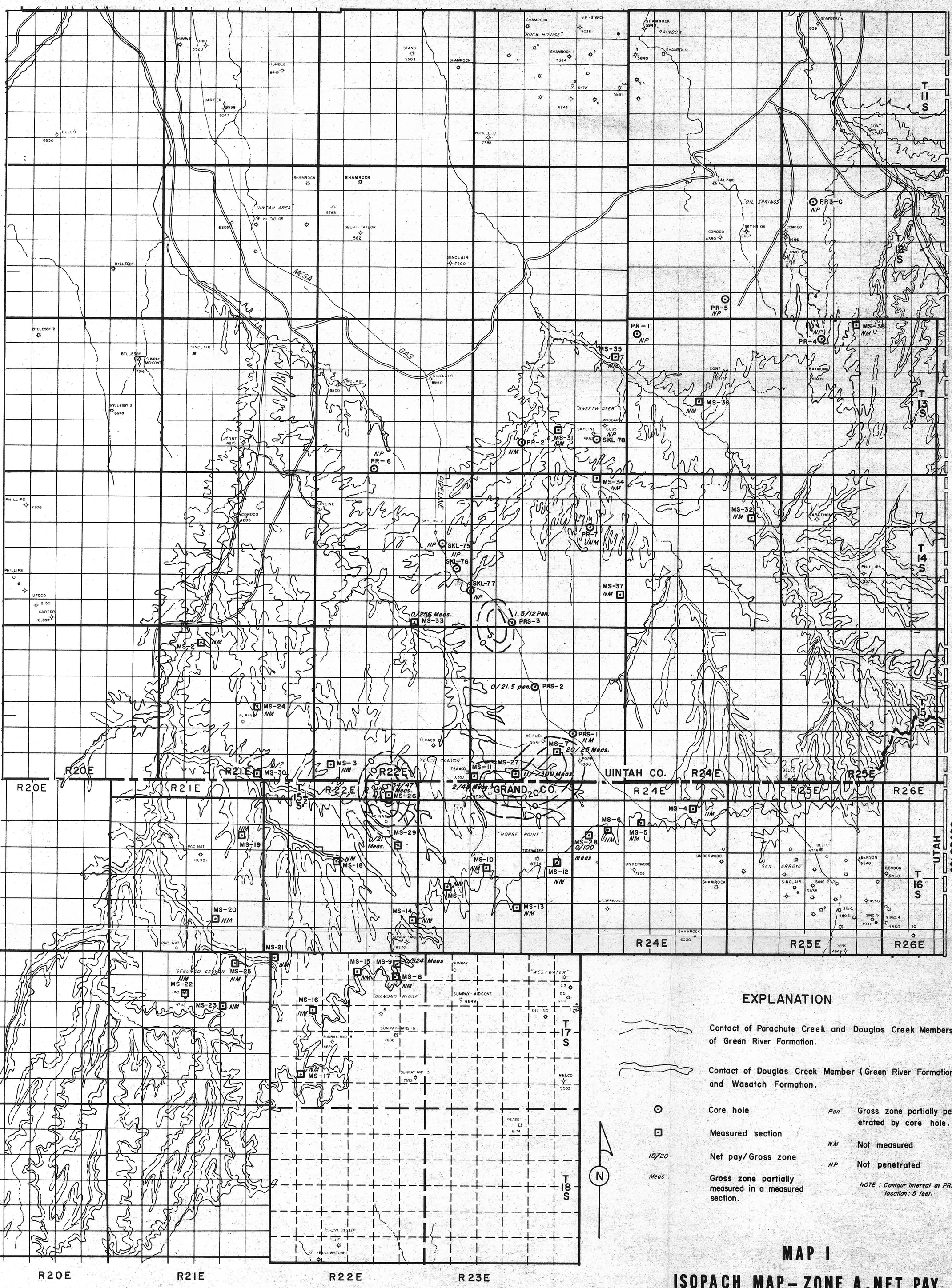
DATE 4/24/81

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP I

R20E R21E R22E R23E R24E R25E

T11S T12S T13S T14S T15S T16S T17S T18S



EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙ Core hole

⊡ Measured section

10/20 Net pay/Gross zone

Meas Gross zone partially measured in a measured section.

Pen Gross zone partially penetrated by core hole.

NM Not measured

NP Not penetrated

NOTE : Contour interval at PRS-3 location: 5 feet.

Surface geology based on Cashion's map (1967).
Drafted by: D. Powers

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL 10 FEET

MAP I

ISOPACH MAP – ZONE A, NET PAY
P.R. SPRING TAR SAND DEPOSIT,
UINTAH AND GRAND COUNTIES, UTAH

1980

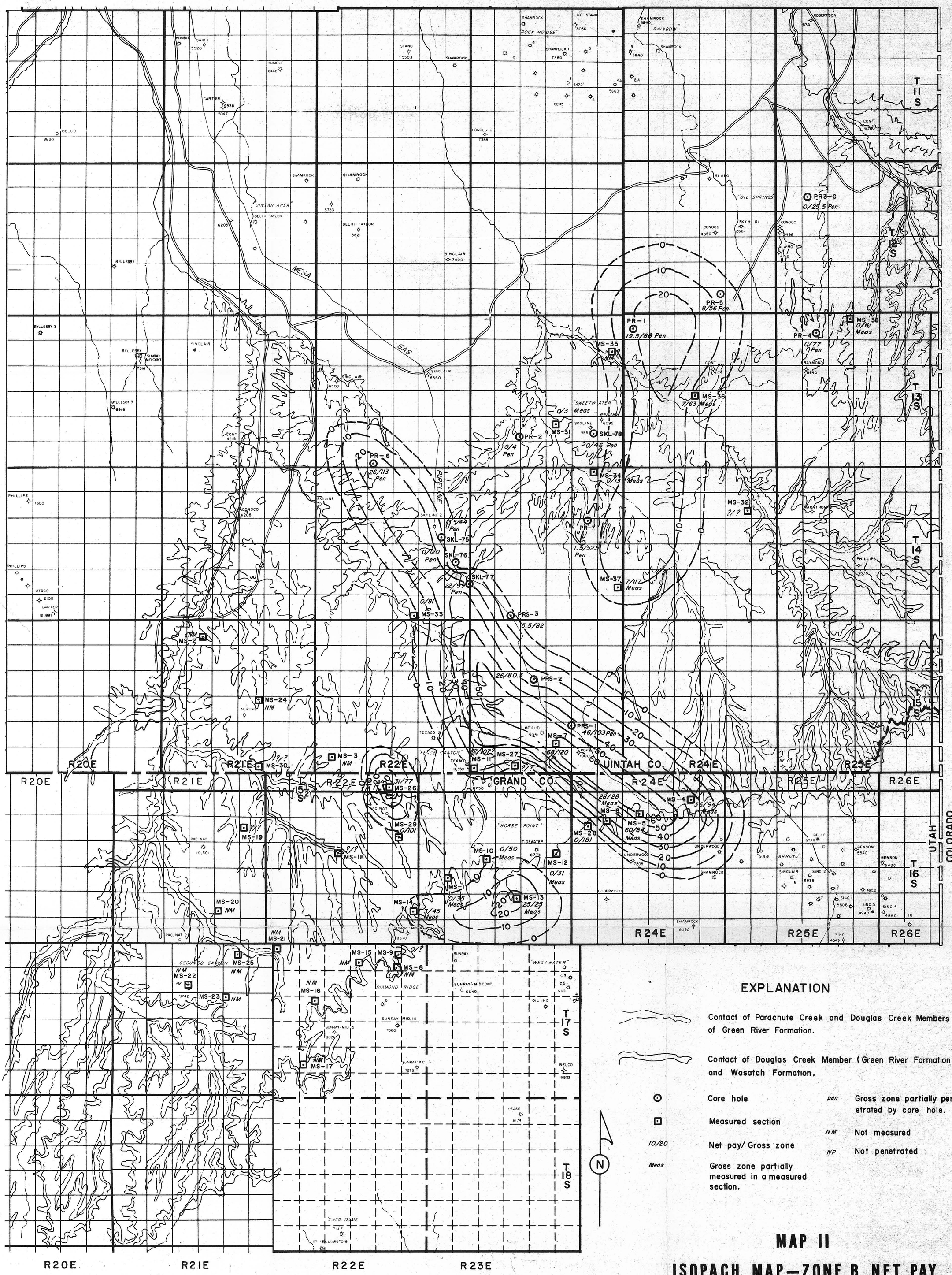
Geology compiled by J. N. Dahm

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP II

R20E R21E R22E R23E R24E R25E

T11S T12S T13S T14S T15S T16S T17S T18S



Surface geology based on Cashion's map (1967).
Drafted by: D. Powers.

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL : 10 FEET

EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙ Core hole

⊡ Measured section

10/20 Net pay/ Gross zone

Meas Gross zone partially measured in a measured section.

pen Gross zone partially penetrated by core hole.

NM Not measured

NP Not penetrated

MAP II

ISOPACH MAP—ZONE B, NET PAY P.R. SPRING TAR SAND DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

1980

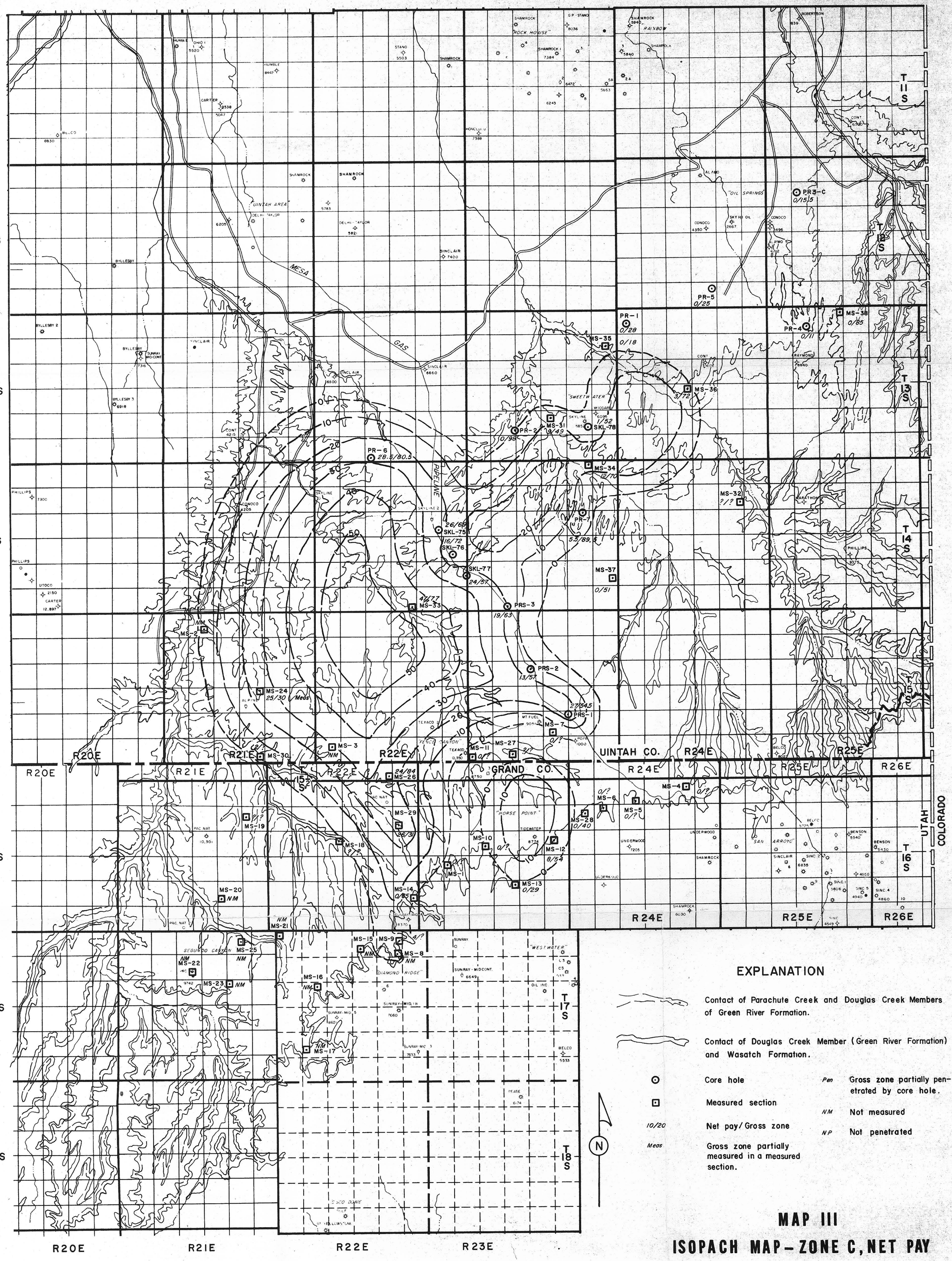
Geology compiled by: J. N. Dahm

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP III

R20E R21E R22E R23E R24E R25E

T11S T12S T13S T14S T15S T16S T17S T18S



Surface geology based on Cashion's map (1967).
Drafted by: D. Powers

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL 10 FEET

EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙ Core hole

⊡ Measured section

10/20 Net pay/Gross zone

Meas Gross zone partially measured in a measured section.

Pen Gross zone partially penetrated by core hole.

NM Not measured

NP Not penetrated

MAP III

ISOPACH MAP – ZONE C, NET PAY

P.R. SPRING TAR SAND DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

1980

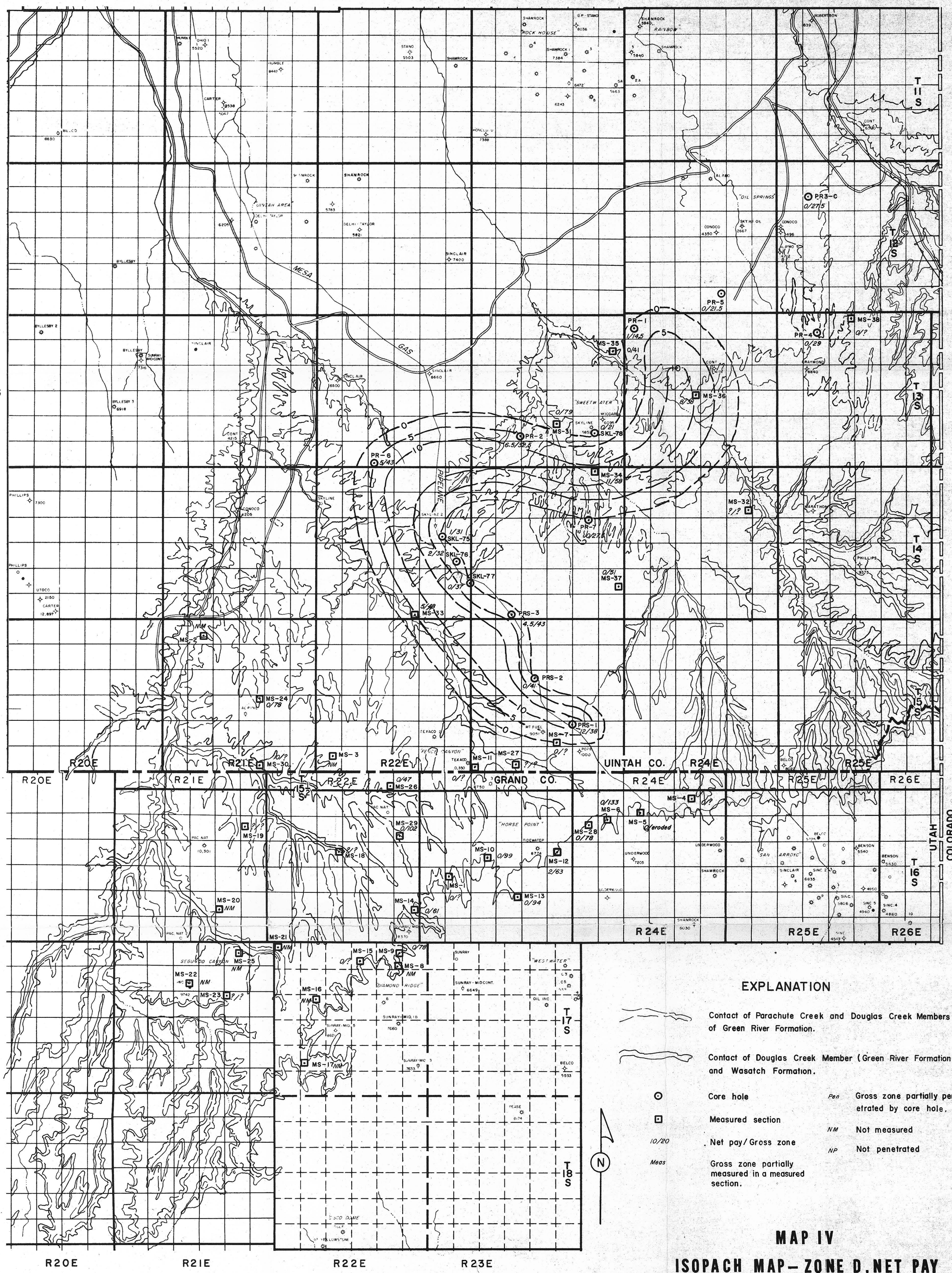
Geology compiled by: J. N. Dahm

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP IV

R20E R21E R22E R23E R24E R25E

T11S T12S T13S T14S T15S T16S T17S T18S



EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙ Core hole

⊡ Measured section

10/20 Net pay/Gross zone

Meas Gross zone partially measured in a measured section.

Pen Gross zone partially penetrated by core hole.

NM Not measured

NP Not penetrated

Surface geology based on Cashion's map (1967).
Drafted by: D. Powers

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL 5 FEET

MAP IV
ISOPACH MAP – ZONE D, NET PAY
P.R. SPRING TAR SAND DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

1980

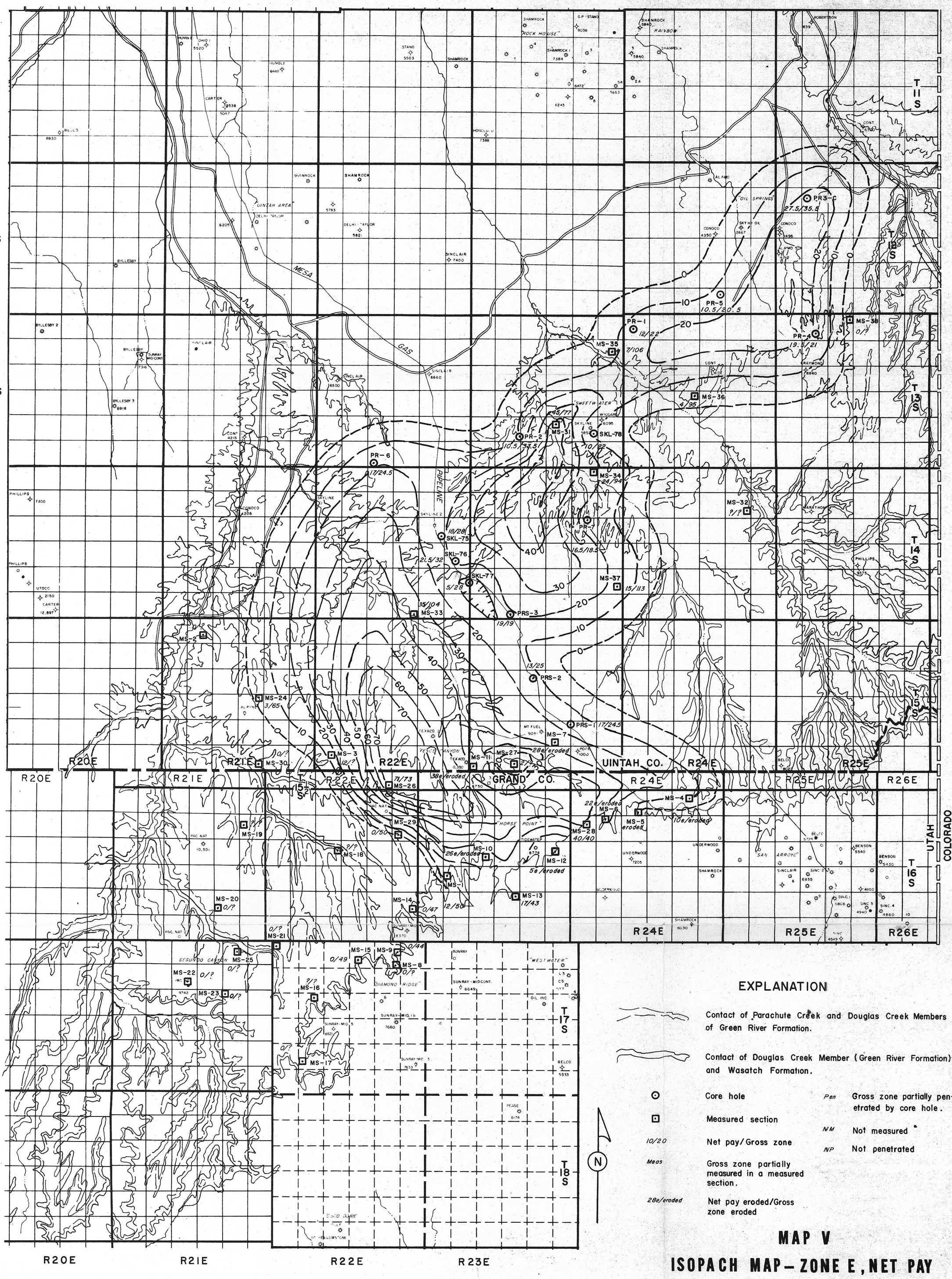
Geology compiled by: J N Dahm

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP V

R20E R21E R22E R23E R24E R25E

T11S T12S T13S T14S T15S T16S T17S T18S



Surface geology based on Cashion's map (1967).
Drafted by: D. Powers

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL 10 FEET

EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙ Core hole

⊡ Measured section

10/20 Net pay/Gross zone

Meas Gross zone partially measured in a measured section.

28e/eroded Net pay eroded/Gross zone eroded

Pen Gross zone partially penetrated by core hole.

NM Not measured

NP Not penetrated

MAP V

ISOPACH MAP—ZONE E, NET PAY

P.R. SPRING TAR SAND DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

1980

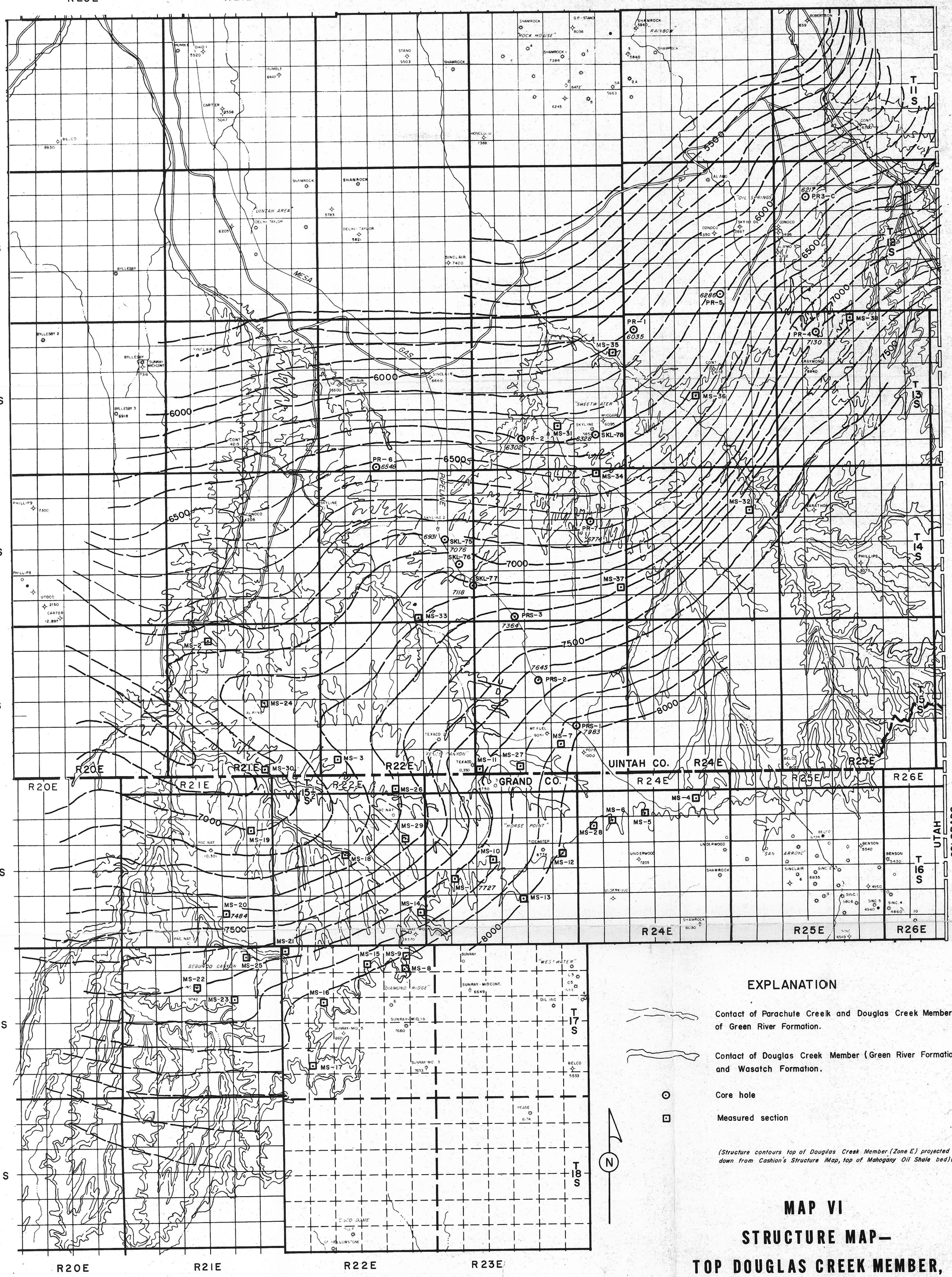
Geology compiled by J. N. Dahm

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP VI

R20E R21E R22E R23E R24E R25E

T11S T12S T13S T14S T15S T16S T17S T18S



Surface geology based on Cashion's map (1967).
Drafted by: D. Powers

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL: 100 FEET

EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙ Core hole

⊡ Measured section

(Structure contours top of Douglas Creek Member (Zone E) projected down from Cashion's Structure Map, top of Mahogany Oil Shale bed)(1967).

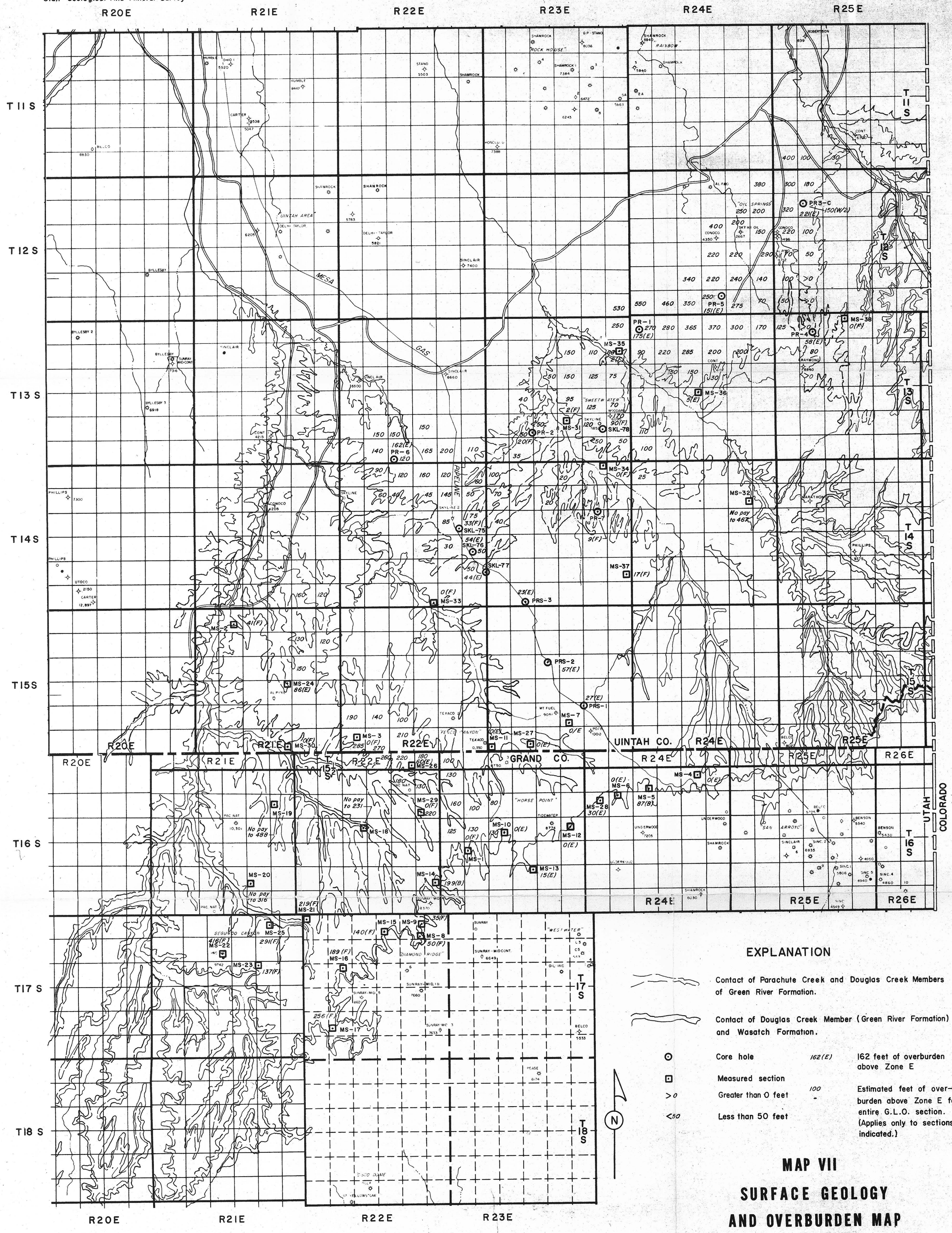
MAP VI
STRUCTURE MAP— TOP DOUGLAS CREEK MEMBER, P.R. SPRING TAR SAND DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

1980

Geology compiled by: J. N. Dahm

STATE OF UTAH
Department Of Natural Resources
Utah Geological And Mineral Survey

MAP VII



Surface geology based on Cashion's map (1967).
Drafted by: D. Powers

SCALE 1 : 125 000

2 0 2 4 6 8 10 MILES

2 0 2 4 6 8 10 KILOMETERS

EXPLANATION

Contact of Parachute Creek and Douglas Creek Members of Green River Formation.

Contact of Douglas Creek Member (Green River Formation) and Wasatch Formation.

⊙	Core hole	*162(E)*	162 feet of overburden above Zone E
⊡	Measured section		
>0	Greater than 0 feet	*100*	Estimated feet of overburden above Zone E for entire G.L.O. section. (Applies only to sections indicated.)
<50	Less than 50 feet		

MAP VII

SURFACE GEOLOGY AND OVERBURDEN MAP P.R. SPRING TAR SAND DEPOSIT, UINTAH AND GRAND COUNTIES, UTAH

1980

Geology compiled by: J. N. Dahm