STATE OF WASHINGTON
DEPARTMENT OF NATURAL RESOURCES
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DIVISION OF GEOLOGY AND EARTH RESOURCES
Raymond Lasmanis, State Geologist

COMPILATION GEOLOGIC MAP OF THE GREEN RIVER COAL DISTRICT, KING COUNTY, WASHINGTON

by

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Open File Report 84-4

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This report consists of a compilation geologic map (Plate 1), a table of radiometric age determinations (Table 1), a tabulation of available subsurface data (Table 2), and graphic columns from 14 drill holes (Plates 2 and 3). Table 1 and all the references cited in this report are contained in Plate 1.

The report was produced in order to supply a single-sheet geologic map of one of the most productive of Washington's coal mining districts. Because of its position on the join of four 1:24,000-scale U. S. Geological Survey topographic maps, the Green River area has not been mapped as a unit since 1945 (Warren and others, 1945).

In addition, this report summarizes the available (nonpropietary) subsurface data of the district. Since publication of the last major studies of the area (Mullineaux, 1965, 1970; Vine, 1969), a large amount of subsurface information has been collected, mostly as a result of oil, gas, and coal exploration. The drill holes illustrate very well the complex structure and abrupt facies changes present within the coal-bearing Eocene Puget Group. Understanding of the Puget Group on a regional, as well as a local basis, is a requirement for future extraction of energy resources.

TABLE 2 – SUBSURFACE DATA

Map No.	Total Depth (ft)	Date	Information Available	Comments	Source
K-3	1,403	1911	Driller's logs, well cuttings, gas analysis	Cable tools. Gas showings 900-1000 ft. Salt water below 1000 ft.	1
K-6	2,362	1928	Driller's log	Cable tools. Bottom of glacial drift at 256 ft. Good gas showing.	1
K-11	3,440	1937	Driller's log, ditch samples, gas analysis, E log.	Base of glacial drift at 294 ft. Good oil and gas showing.	1
K-12	5,047	1938	Driller's log, E log.	Cable tools. Slight gas and oil showing.	1
K-14	5,770	1942	Driller's log, core analysis, E log.	Traces of oil and gas	1
K-15	4,016	1944	Driller's log, core description, core analysis, ditch samples, E log.	Traces of oil and gas	1
K-16	4,319	1947	Core description, well history, sidewall core description, E log, ditch sample descriptions.	Several small gas showings, one small oil show at 3,210 ft.	1
K-17	3,509	1948	Core description, well history, sidewall core description, E log, ditch sample description.	Bottom of glacial drift at 660 ft. Cove from 900 ft. has oil odor.	1
125	6,023	1957	Driller's log, microlog, baroid log, E log, dipmeter survey.	Several gas showings	1
128	4,326	1957	Driller's log, microlog, baroid log, E log, core description, core analysis.	Gas and oil showings	1
151	3,944	1961	Sample description, E log, mud log, ditch samples.	Dry hole	1
158	3,411	1961	Sample descriptions, E log.	Dry hole	1
353	7,270	1983	–	Data available 3-85	2

TABLE 2 — Continued

Map No.	Total Depth (ft)	Date	Information Available	Comments	Source
374	1,736	1984	—	Data available 10-85	2
378	1,517	1984	—	Data available 10-85	2
Getty	2,150	1983	Graphic column constructed from downhole geophysical logs.	Base of glacial drift at 560 ft. Numerous coal beds encountered.	3
Muckleshoot	2,465	1983	Sample descriptions, ditch samples	Base of glacial drift at 400 ft. Penetrated volcanic and/or igneous intrusive rocks interbedded with coal-bearing sediments. Gas showing.	4
PCC-1	1,153	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated Big Dirty through Franklin No. 9 coal beds.	5
PCC-2	1,289	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated McKay through Franklin No. 9 coal beds.	5
PCC-3	683	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated Franklin No. 12 and 11 coal beds.	5
PCC-4	1,022	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated Big Dirty through Franklin No. 9 coal beds.	5
PCC-5	1,150	1960	Graphic column constructed from drill core logs.	Core hole. Penetrated thick andesite sill and fault zones.	5
GEO-3	2,000	1981	Temperature, density, and porosity logs.	Geothermal test hole (abandoned)	6
GEO-4	2,423	1982	Temperature, density, and porosity logs.	Geothermal test hole (adandoned)	6
GEO-5	2,006	1981	Temperature, E-log, with density logs.	Geothermal test hole (abandoned)	6

TABLE 2 — Continued

Map No.	Total Depth (ft)	Date	Information Available	Comments	Source
81-1	420	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-2	700	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-3	200	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-4	553	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-5c	320	1981	Graphic column, sample description and coal analysis	Coal reserve drilling for proposed John Henry coal mine.	7
81-6c	400	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-7c	400	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
82-1	310	1982	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
82-3c	420	1982	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
MW-5	687	1980	Ditch sample descriptions and graphic column.	Groundwater monitor well for Cedar River Watershed. Bedrock encountered at 660 ft.	8

Sources of data:

1. McFarland, 1983
2. Carl McFarland, Division of Geology and Earth Resources, personal communication, 1984.
3. Jon Lindberg; Getty Mining Company, personal communication, 1983
4. Shawn Muller, Council of Energy Resource Tribes, personal communication, 1983
5. Glaeser, 1960, 1961.
6. Division of Geology and Earth Resources geothermal well files.
7. Pacific Coast Coal Company, 1983.
8. Seattle Water Department, 1980.

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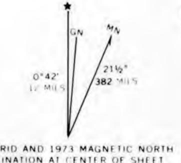
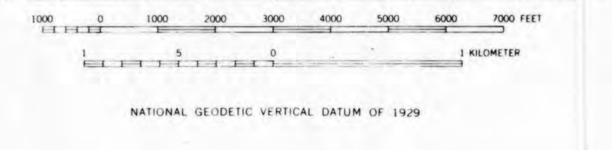
OPEN FILE OF 84-4

Topographic base map from portions of the following U.S. Geological Survey 7.5-minute quadrangles: Black Diamond (1973); Buckley (1973); Cumberland (1973); Eagle Gorge (1968); Enumclaw (1973); Hobart (1973); Maple Valley (1973); North Bend (1968)



UTM GRID AND 1973 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000



NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

EXPLANATION

QUATERNARY — Recent

Qal — Alluvium. Along Cedar and Green Rivers consists mostly of well-sorted pebble-to-cobble gravel and sand. Includes some terrace deposits along Green River. Along smaller streams consists of thin deposits of gravel and sand

Qp — Peat and swamp (inorganic) deposits. Thickness highly variable. Most deposits formed from late glacial time to present

Qls — Landslides and colluvium; also alluvium from small streams in northeast portions of map area. Thickness highly variable. Large landslide north of Green River in S.1 (21-7) involves failure of competent, ridge-capping Tertiary lava flows (Tvf) underlain by volcanic-derived sediments (Tvs)

Qom — Osceola Mudflow. Unsorted, unstratified mixture of granule-to-cobble-size rock fragments in clay, silt and sand matrix. Thickness 0 to 20 feet in map area. (Mullineaux, 1965). Derived from northeast side of Mt. Rainier, possibly as a result of volcanic eruption, earthquake-induced slope failure, or slope failure after oversteepening by glacier erosion. Radiocarbon dating indicates age of about 5000 years. (Mullineaux, 1970)

QUATERNARY — Pleistocene

Qvs — Vashon stratified drift deposits. Mostly well-sorted unconsolidated pebble-and-cobble gravel deposited by streams along and behind retreating front of Puget glacial lobe (Mullineaux, 1965). Includes outwash plain and valley train deposits of Mullineaux (1965, 1970); recessional outwash and lacustrine deposits of Luzier (1969); terrace gravel and stratified drift deposits of Vine (1969); and recessional outwash, and lacustrine deposits of Rosengreen (1965). Thickness of these deposits is highly variable, ranging less than 10 feet to over 50 feet. In S.11 (21-7), includes terrace deposits of Green River of probable post-Vashon age

Qvic — Ice-contact deposits. Unconsolidated gravel and sand deposited on or against glacial ice of Puget lobe. Includes kame and kame field deposits characterized by abrupt vertical and horizontal changes in grain size, by boulders, and by inclusions of till; also silty clayey sand deposited in ice-dammed ponds (Mullineaux, 1965). Thickness highly variable but generally less than 100 feet

Qvt — Vashon till deposits. Compact, unsorted mixture of sand, silt, clay, and gravel deposited by Puget glacier lobe. In map area, generally forms drumlinized, southeast-trending hills underlain by bedrock. Highly variable in thickness but generally less than 40-50 feet

Qvu — Vashon deposits, undivided. Includes advance outwash deposits along Cedar and Green Rivers (Luzier, 1969; Rosengreen, 1965) and mixed till and outwash deposits elswhere

Qos — Older (pre-Vashon) Pleistocene sediments. Includes Salmon Springs and Orting Drift in S. 28-29 (21-6) (Mullineaux, 1965). There deposits consist of iron-stained, generally well-sorted sand and gravel derived from British Columbia and northern and central Cascade Range. Along the Cedar River 2 till layers separated by sand and sandy pebble-gravel are exposed. These deposits underlie Vashon sediments and are about 200 feet thick. Also exposed northwest of Landsburg are about 110 feet of strongly oxidized, well-sorted sands, and gravels assigned a pre-Vashon age by Rosengreen (1965)

unconformity

TERTIARY — Miocene

Th — Hammer Bluff Formation. Cohesive and compact clay-rich quartzose sediments overlain by volcanic sand and gravel with thin kaolinitic clay beds, woody lignites, and volcanic ash beds. Formation is at least 100 feet thick where exposed along Green River in S. 28-21 (21-6). A late Miocene age is assigned to the Hammer Bluff Formation on the basis of fossil leaves. Probably deposited by streams draining arkosic Puget Group rocks and late Oligocene-Miocene volcanic rocks of the ancestral Cascades. (Mullineax, 1965, 1970)

Tyv — Younger volcanic rocks. Previously unrecognized in area. Two isolated, but very prominent outcrops in S. 5-6 (20-7) of unaltered, glassy to holocrystalline, columnar-jointed basalt flows. Cooling columns are inclined suggesting that the units have been either folded and/or faulted, or that the exposures are erosional remnants of valley flows. Presence of groundmass glass and unaltered mafic minerals contrast sharply with pervasively altered nature of older intrusive and volcanic rocks of the map area. Whole-rock K-Ar dating at Veazey Quarry indicates a middle Miocene (16.5 +/- 4.1) age for the units (Table 1)

unconformity

TERTIARY — Oligocene

Ti — Intrusive igneous rocks, chiefly basaltic to andesitic composition dikes and sills intruding Puget Group sediments. Typically porphyritic with phenocrysts of augite and plagioclase. Groundmass generally composed of plagioclase laths, pyroxene, chlorite, clay minerals, and magnetite, (Vine, 1969). Alteration of augite to calcite, quartz, and zeolites is common. Many dikes and sills have been bleached a reddish-gray color; a few have been completely altered to "white-cake," i.e. a mass of kaolinite, quartz, limonite, calcite and dawsonite (Vine, 1969). An example is the altered sill in the Elk clay pit in SW/4, SE/4, S. 34 (22-7). Outcrop patterns of intrusive rocks suggest that they were emplaced before folding and faulting of the Puget Group sediments. K-Ar age dating (Table 1) indicates that the intrusive rocks are upper Oligocene and perhaps cogenetic with some of the volcanic rocks overlying the Puget Group. Very complex contact relations and poor exposure conditions precluded mapping intrusives in the volcanic highlands of the eastern side of the map area. The map unit Tv probably contains many small intrusive bodies

Tv, Tvs, Tvf — Unnamed volcanic rocks, stratigraphically above and graditional with arkosic sediments of the Puget Group. Tv indicates areas where volcanic sediments and flow rocks were not distinguished during mapping. Tvs denotes volcanic-derived sediments, chiefly volcanic sandstone, conglomerate, impure coals, and water-worked tuffs. Tvs includes sediments mapped by Hammond (1963) as Tukwila Formation and Mt. Catherine tuff. Interstratified with the volcanic sediments are andesitic lava flows, signified Tvf. These flows correspond in large part to the Enumclaw Formation of Hammond (1963). The flows are principally platy to blocky, ridge-forming porphyritic pyroxene andesites. Alteration of groundmass to quartz and carbonate is common. About 5000 feet (Vine, 1969) of volcanic rocks overlie the Puget Group in the map area. Radiometric dating (Table 1) and fossil leaves (Wolfe, 1968) indicate a lower Oligocene (35-33 m.y.a.) age for the approximate base of the volcanic rocks

TERTIARY — Eocene

Tp, Tpv — Puget Group undivided (Tp) and volcanic rocks contained in lower portions of Puget Group (Tpv). Feldspathic, micaceous sandstone, siltstone, shale, carbonaceous shale, claystone, and coal make up the undivided Puget Group (Vine, 1969). North of the map area, a thick volcanic unit (Tukwila Formation) permits division of the Puget Group into 3 formations (Tiger Mountain, Tukwila, and Renton Formations); this division is not possible in the map area. Coal beds, which have been extensively mined, serve as locally useful stratigraphic markers. The most regionally extensive coal bed, the McKay, and it's approximate correlatives, are indicated on the map.

Stratigraphic control based upon structure, coal beds, and fossil leaves is adequate to define a volcanic unit in the basal Puget Group. In SW/4 S. 19 (22-7), the unit consists of a matrix-supported conglomerate with clasts of dark-colored volcanic rock and white altered pumice fragments. In NE/4 S. 23 (22-6), a sequence of volcanic sandstones and siltstones is exposed. The volcanic unit is stratigraphically below the Franklin coal series and therefore cannot be correlated with the Tukwila Formation. These volcanic nonmarine strata are tentatively correlated with marine volcanic siltstones, sandstones, and conglomerates of the Raging River Formation exposed north of the map area in T. 23 N., R. 7 E. (Vine, 1969).

The Puget Group is at least 6,200 feet thick in the map area. Fossil leaves (Wolfe, 1968) indicate an early Eocene to early Oligocene age for the Green River area Puget Group section. However, radiometric dating of ash partings (Turner and others, 1983) suggests a much shorter age range (41.2 +/- 1.8 to 45.0 +/- 2.1 m.y.) for this section

TABLE 1

Radiometric Age Determinations

Sample	Map Unit	Method	Dated Material	Age (Million years +/- 2 σ)	Source
1	Ti	K-Ar whole rock	altered basalt intruding Puget Group.	29.1 +/- 1.8	Turner and others, (1983)
2	Tv	K-Ar whole rock	altered andesite intruding volcanic rocks overlying Puget Group.	32.5 +/- 2.0	Turner and others, (1983)
3	Tv	K-Ar whole rock	andesite intrusive in volcanic rocks overlying Puget Group.	27.9 +/- 1.6	Turner and others, (1983)
4	Tv	K-Ar whole rock	porphyritic andesite flow breccia in volcanic rocks overlying Puget Group.	35.2 +/- 2.2	Turner and others, (1983)
5	Tv	K-Ar whole rock	andesite flow in Enumclaw Formation of Hammond, 1963	33.1 +/- 1.7	Courtesy, Dan Vice, Meridian Land and Minerals, Inc.
6	Tyv	K-Ar whole rock	fresh, columnar basalt flow at Veazey Quarry	16.5 +/- 4.1	Courtesy, Steve Pappajohn, AMOCO Production Inc.

Anticline, showing trace of axial plane and direction of plunge. Dashed where approximately located; dotted where concealed; dashed and dotted where identified from aerial photographs (not field checked)

Syncline, showing trace of axial plane and direction of plunge. Dashed where approximately located; dotted where concealed; dashed and dotted where identified from aerial photographs (not field checked)

Contact, dashed where approximately located; dotted where concealed; queried where inferred

U/D — Fault, showing upthrown (U) and downthrown (D) sides. Dashed where approximately located; dotted where concealed; queried where inferred

Fault, showing relative movement. Dashed where approximately located; dotted where concealed; queried where inferred

Thrust fault, with sawteeth on upper plate. Dashed where approximately located; dotted where concealed

Coal bed. Dashed where approximately located; dotted where concealed. Coal bed names are after Vine (1969). Only the widely-mined McKay coal bed and it's approximate correlations are shown

Dry hole

Dry hole with show of oil and gas

Dry hole with show of gas

Coal exploration hole

Coal exploration hole with show of gas

60 — Strike and dip of overturned beds

40 — Strike and dip of beds

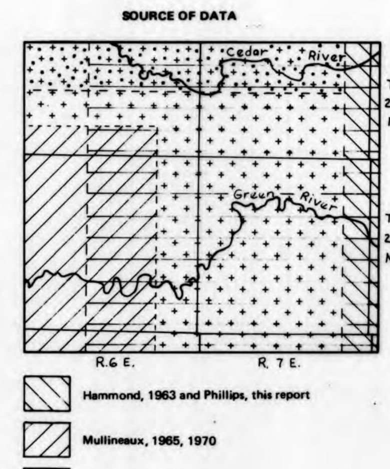
32 — Strike and dip of partings in volcanic rocks

90 — Strike of vertical beds

22 — Strike and dip of coal beds in Puget Group. Data from underground mine workings

3 — Radiometric age determination. See Table 1 for descriptions

SOURCE OF DATA



Hammond, 1963 and Phillips, this report

Mullineaux, 1965, 1970

Rosengreen, 1965 [surficial geology]

Vine, 1969 [bedrock geology]

Warren and others, 1945 [bedrock geology]

Luzier, 1969 [surficial geology, entire map area]

Schasse and others, 1983 [underground coal mine data]

ACKNOWLEDGEMENTS

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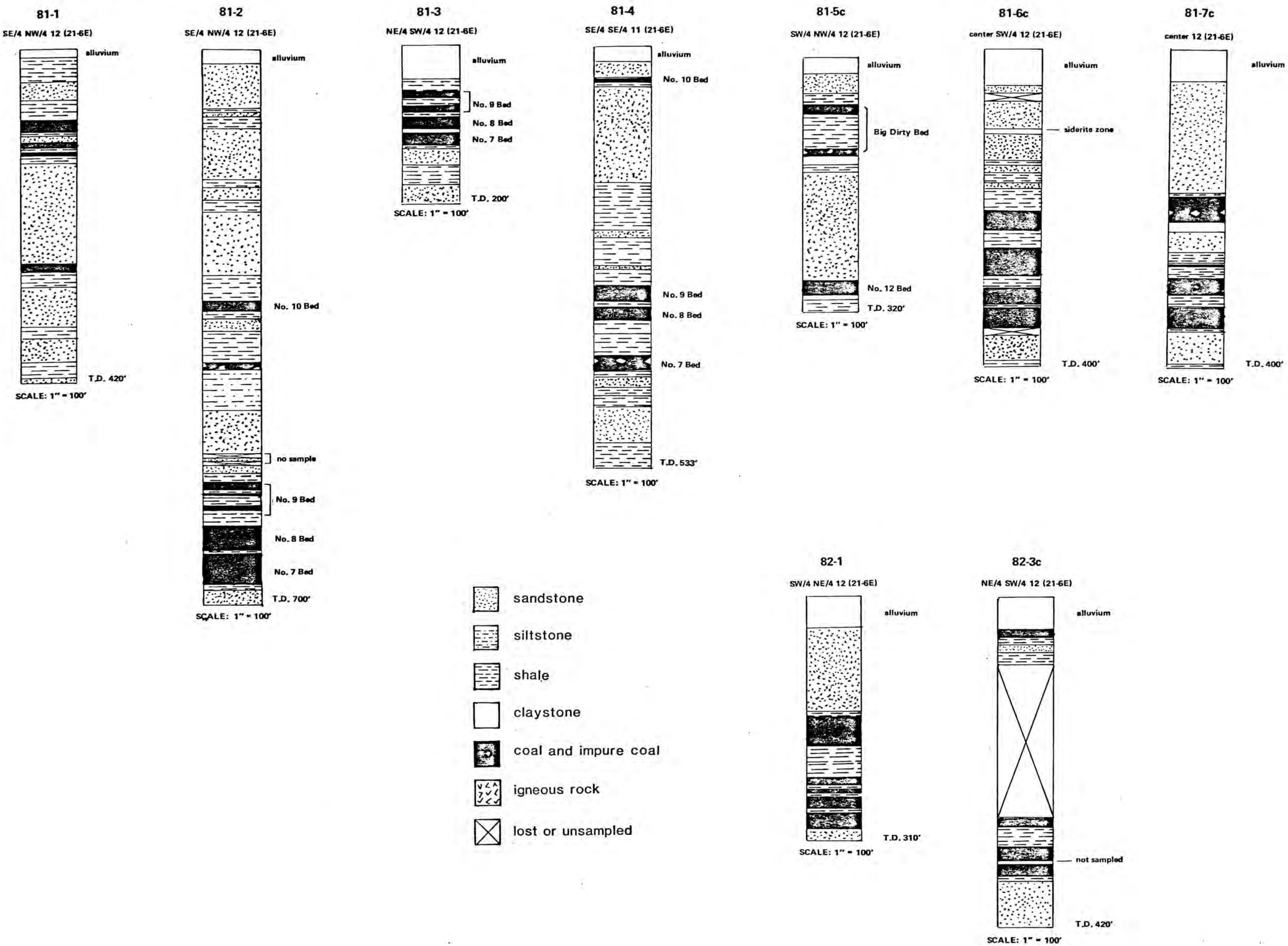
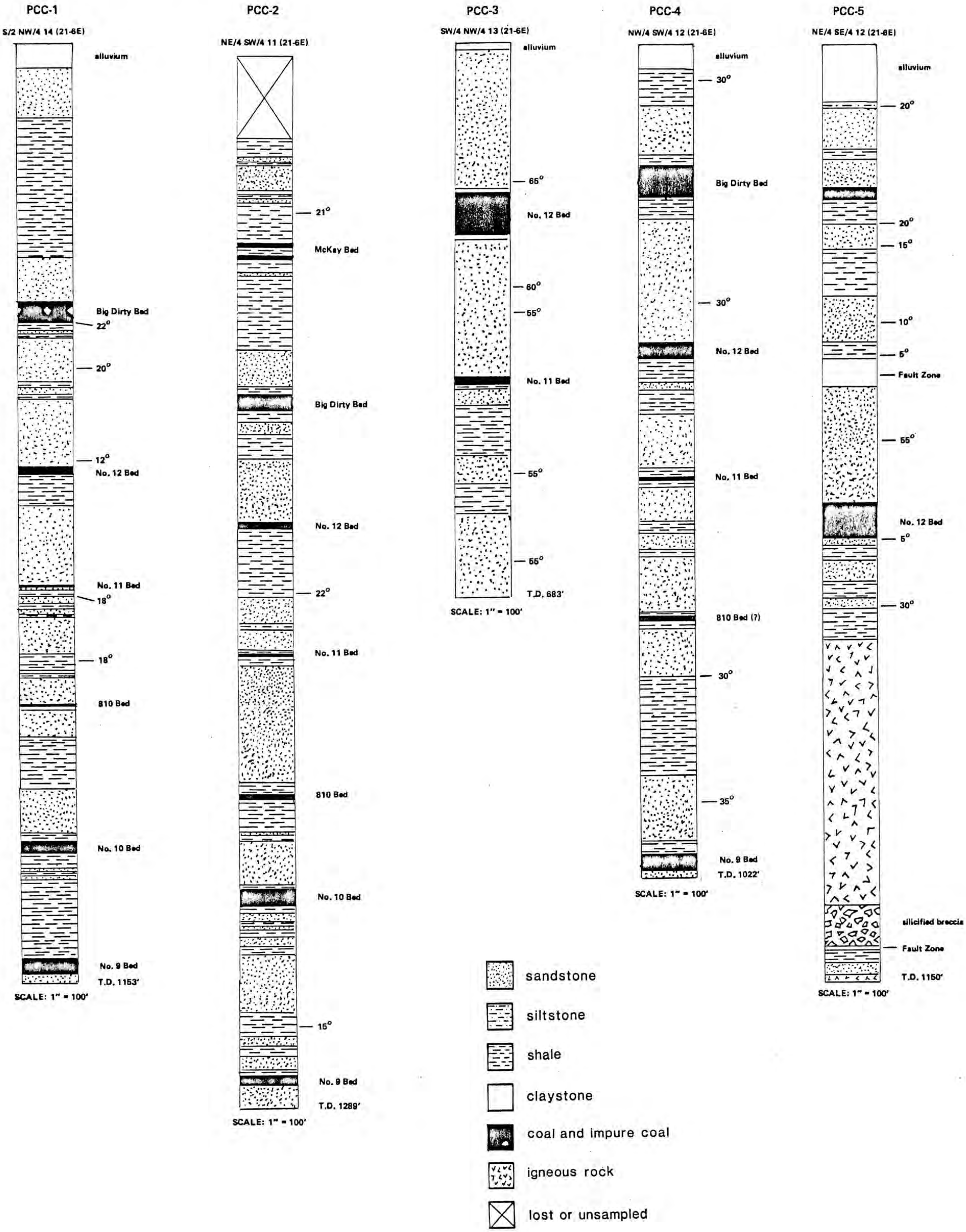
COMPILATION GEOLOGIC MAP OF THE GREEN RIVER COAL DISTRICT, KING COUNTY, WASHINGTON

BY
WILLIAM M. PHILLIPS

1984


81-1
SE/4 NW/4 12 (21-6E)
alluvium
T.D. 420'
SCALE: 1" = 100'
81-2
SE/4 NW/4 12 (21-6E)
alluvium
No. 10 Bed
no sample
No. 9 Bed
No. 8 Bed
No. 7 Bed
T.D. 700'
SCALE: 1" = 100'
81-3
NE/4 SW/4 12 (21-6E)
alluvium
No. 9 Bed
No. 8 Bed
No. 7 Bed
T.D. 200'
SCALE: 1" = 100'
81-4
SE/4 SE/4 11 (21-6E)
alluvium
No. 10 Bed
No. 9 Bed
No. 8 Bed
No. 7 Bed
T.D. 533'
SCALE: 1" = 100'
81-5c
SW/4 NW/4 12 (21-6E)
alluvium
Big Dirty Bed
No. 12 Bed
T.D. 320'
SCALE: 1" = 100'
81-6c
center SW/4 12 (21-6E)
alluvium
siderite zone
T.D. 400'
SCALE: 1" = 100'
81-7c
center 12 (21-6E)
alluvium
T.D. 400'
SCALE: 1" = 100'
sandstone
siltstone
shale
claystone
coal and impure coal
igneous rock
lost or unsampled
82-1
SW/4 NE/4 12 (21-6E)
alluvium
T.D. 310'
SCALE: 1" = 100'
82-3c
NE/4 SW/4 12 (21-6E)
alluvium
not sampled
T.D. 420'
SCALE: 1" = 100'


PCC-1
S/2 NW/4 14 (21-6E)
alluvium
Big Dirty Bed
22°
20°
12°
No. 12 Bed
No. 11 Bed
18°
18°
810 Bed
No. 10 Bed
No. 9 Bed
T.D. 1153'
SCALE: 1" = 100'
PCC-2
NE/4 SW/4 11 (21-6E)
21°
McKay Bed
Big Dirty Bed
No. 12 Bed
22°
No. 11 Bed
810 Bed
No. 10 Bed
15°
No. 9 Bed
T.D. 1289'
SCALE: 1" = 100'
PCC-3
SW/4 NW/4 13 (21-6E)
alluvium
65°
No. 12 Bed
60°
55°
No. 11 Bed
55°
55°
T.D. 683'
SCALE: 1" = 100'
PCC-4
NW/4 SW/4 12 (21-6E)
alluvium
30°
Big Dirty Bed
30°
No. 12 Bed
No. 11 Bed
810 Bed (?)
30°
35°
No. 9 Bed
T.D. 1022'
SCALE: 1" = 100'
PCC-5
NE/4 SE/4 12 (21-6E)
alluvium
20°
20°
15°
10°
5°
Fault Zone
55°
No. 12 Bed
5°
30°
silicified breccia
Fault Zone
T.D. 1150'
SCALE: 1" = 100'
sandstone
siltstone
shale
claystone
coal and impure coal
igneous rock
lost or unsampled