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GEOLOGICAL REPORT

on

COYOTE CREEK DAM SITE,

UINTA COUNTY, WYOMING

By

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GEOLOGICAL REPORT ON THE COYOTE CREEK DAM SITE, UINTA COUNTY

Location: The area described in this report is located approximately ten miles west-southwest of Evanston, Uinta County, Wyoming. The dam site is in the NE¼, SW¼, Sec. 26, T. 14 N., R. 121 W.

Topography and drainage: The dam site is located on Coyote Creek (sometimes called Needles Creek) approximately ½ mile from its junction with Yellow Creek, which in turn is a tributary of Bear River and enters it north of the town of Evanston. In the vicinity of the dam site Coyote Creek flows east to west and Yellow Creek flows south to north.

On the north side of the dam site there is a precipitous ridge of conglomerate, trending north-south, which has been so distinctly carved by erosion that it is locally called "The Needles". A continuation of this ridge is on the south side but is not so precipitous because nearly the entire thickness of resistant conglomerates has been faulted out. The exposures of bed rock on the south side of the dam site are poor owing to the presence of considerable scrub vegetation and detrital material which covers the slopes. Due to the resistant character of the conglomerate, the valley of Coyote Creek is very narrow where the stream has cut through the ridge. This narrow cut is the site of the proposed dam. The ridge on either side rises 700 feet or more above the stream level. East of the dam site the drainage system of Coyote Creek is established entirely in the soft, non-resistant shales and sandstones of the Knight formation. The gradient of Coyote Creek is extremely low and it meanders across a fairly broad flood plain. On either side there are several long, flat-bottomed tributary valleys. Below the dam site the stream gradient is not materially increased. The twisted and faulted beds on the west side of the ridge are not very resistant so the topography slopes fairly steeply down to Yellow Creek, and flattens abruptly in a wide, flat-bottomed flood plain.

Coyote Creek is an intermittent stream, along which there are numerous seeps and small springs. Yellow Creek, the only other major stream course in the vicinity, is a flowing stream, at present carrying about 1/10 sec. feet of water

Field Work: The field work, upon which this report is based, was done under the auspices of the Geological Survey of Wyoming. The preliminary survey work was done from July 25 to 30, 1934 and the detailed survey with plane table and alidade from August 11 to 19, 1934. The primary elevation used in the topographic work was taken from an engineers bench mark which in turn had been taken from a United States Geological Survey bench mark a mile to the west of the dam site. The geological and topographic work was checked in the field by Dr. S. H. Knight, State Geologist and Director of the Survey.

Geology

Beckwith Formation: The group of sandstones, shales and limestones comprising the Beckwith formation are the oldest rocks exposed in the region. As the various beds have been highly folded and faulted their normal relationships are not apparent. The base of the Beckwith has been faulted away and the top is either covered with Tertiary or Quaternary sediments or has been removed by faulting. In general, the formation consists of an alternating sequence of conglomerates, red shales, red shaly sandstones, and gray, rather hard massive to thin-laminated sandstones. There are a few thin purple and white limestone beds containing quantities of chert but no fossils. The conglomerates are distinctive and easily recognized. One conglomerate consists of blue limestone pebbles somewhat rounded and cemented together with a limy and glauconitic matrix. The most conspicuous conglomerate is composed mainly of hard angular brown fragments of chert, marble sized, embedded in a finer limy and cherty matrix. The upper three hundred feet or more of the formation as exposed in this region consists of a coarsely bedded fine-grained red sandstone.

No fossils were found in the Beckwith formation in this region and it was correlated with the Beckwith described by Veatch (Veatch, A.C., P.P. 56, U.S. Geol.

Surv., 1907) strictly on the basis of lithology and geographic position of the exposures. On the basis of fossils from other localities, Veatch has established the age of the Beckwith as being equivalent to Upper Jurassic and Lower Cretaceous.

For convenience is mapping the structure and determining the relative amount of displacement along fault lines in the Beckwith formation, five conspicuous beds, which were well exposed and distinctive enough to be easily recognized, were selected and designated on the maps as Kb "a", "b", "c", "d", and "e".

Kb "a" consists of hard thinly laminated gray to greenish fine sandstone resting on a siliceous red shale. On the thinly laminated sandstone is a massive gray to buff member which contains and is overlain by fine cherty conglomerate lenses. It also contains fragments of buff and greenish shale and sandstone. This is overlain by a red siliceous shale. The total thickness of the member is approximately 100 feet.

Kb "b" is a massive gray to buff coarse sandstone containing numerous fine conglomerate lenses. The roundstones are marble size. This member is so resistant that its outcrop takes the topographic expression of a ridge. It is about 50 feet thick.

Kb "c" is a massive gray sandstone containing some conglomerate lenses. It greatly resembles "b" but is more resistant and forms a higher ridge. It is about 60 feet thick.

Kb "d" is a massive to thinly laminated gray to buff sandstone which is somewhat conglomeratic and cross-laminated. This member is the most conspicuous of all, for it is more resistant and forms the highest ridge. It is between 75 and 100 feet thick.

Members "b", "c", and "d" are separated by red shaly sandstones and red siliceous shales.

Kb "e" is a coarsely bedded dark red sandstone several hundred feet thick. It is unfossiliferous and has no distinctive features other than its color, thickness and resistance to erosion. Its outcrop always forms a conspicuous ridge. This member is the uppermost part of the Beckwith formation exposed in this area..

Almy Formation: The Almy formation in this area consists of massive conglomerates,

comglomeratic cross-laminated to massive sandstones, and siliceous variegated shales. The thickness of the Almy is unknown because the basal part has been faulted out and the upper part is covered by the variegated shales and sandstones of the Knight formation.

No fossils were found in the Almy in this area so it was correlated with the Almy described by Veatch (Veatch, A. C., P.P. 56, U.S. Geol. Surv., 1907) strictly on the basis of lithology and geographic position of the outcrops. The age of the Almy is not definitely known. It has been called "Eocene" by Veatch on the evidence supplied by a few fossils, and because of its stratigraphic position. The Almy has been assigned to the lower part of the Wasatch Group of Hayden, but in the light of present evidence may be tentatively correlated with the Basal Eocene beds in southeastern Wyoming.

For convenience in mapping the structure and determining the relative amount of displacement along fault lines in the Almy formation, conspicuous beds which were well exposed and distinctive enough to be easily recognized were selected and designated an the maps as Ta "a", "x", "b", and "c".

Ta "a" consists of a strongly cross-bedded gray sandstone containing lenses of conglomerate, the roundstones of which are marble size. The member is fairly resistant and forms a low ridge. It is about 30 feet thick and is underlain and overlain by variegated red and white siliceous shales containing many siliceous concretions.

Ta "x" consists of 100 feet or more of massive to cross-bedded,white to very ferrugnious brown sandstones containing numerous irregular fine conglomerate lenses. The ferruginous band is very distinctive and is most easily traced. Numerous joints and shear zones and silicification have destroyed the bedding planes in many places.

Ta "b" consists of about 20 feet of hard ferruginous brown cross-laminated sandstone and conglomerate, the roundstones of which are seldom over an inch in diameter. This member is so resistant that it can easily be traced. It is underlain by sandstones and conglomerates and overlain by about 50 feet of pale salmon-colored

siliceous shale.

Ta "c" is the most conspicuous and easily recognized member in the entire area. It consists almost entirely of massive conglomerates containing a few gray sandstone lenses. The high ridge to the north and south of the dam site is formed by this member because of its extremely resistant character. The Needles are formed from this conglomerate and the greater part of the dam is to have its foundation on this member.

The roundstones in the conglomerate vary in size up to slightly more than a foot in diameter, although the average is about four inches. They are embedded in a matrix of fine to coarse sand and small pebbles and the whole is tightly cemented together with siliceous material. In some places the interstitial space between the roundstones has not been filled, but this condition is not common. The roundstones are composed mainly of extremely hard quartzite and quartzitic cobbles, although there are a few scattered chert and sandstone fragments. This member lies directly against the fault line and has been subjected to such great stress that many minor faults and shear zones have developed. The quartzite roundstones are locally crushed and sheared. In many places silicification and re-cementing has taken place subsequent to shearing and crushing. All these factors combine to make this member extremely irregular in texture and hardness. The entire thickness exposed in this area is approximately 200 feet.

Knight Formation: The Knight formation in this area consists of variegated red, white and greenish shales, often very siliceous, and massive and resistant to soft and thinly laminated gray sandstones, which often contain fine conglomeratic lenses. The variegated shales can not be differentiated from those in the Almy either by color or texture, but the maximum dip in the Knight is 5°. The angle of unconformity between the Knight and the Almy is approximately 25°.

No fossils were found in the Knight in this region so it was correlated with the Knight as described by Hayden and Veatch on the basis of lithology and stratigraphic position.

Quaternary Alluvium: The valley of Coyote Creek above the reservoir site and the food plain of Yellow Creek are covered with alluvium to an unknown depth. It consist mainly of boulders and gravel derived from the Beckwith, Almy and Knight conglomerates, sands and shales derived from the same formations, over which the streams flow. The depth of the alluvium at the dam site is not definitely known, but it exceeds 25 feet.

Structure

The area described in this report is located on two major fault planes, the eastern one designated as the southern extension of the Medicine Butte faiut, and the western one the southern extension of the Acocks fault ~~by~~ of Veatch (Veatch, A. C., P.P. 56, U.S. Geol. Surv., 1907). He also described the structure at the Needles as being the southern part of the Rock Creek-Needles anticline.

As the Acocks fault has little bearing on this problem, further discussion of it will be omitted.

The Medicine Butte fault is a high-angle thrust fault with its axis dipping steeply to the west in this area, and trending approximately north-south. Sediments of Upper Jurassic and Lower Cretaceous age have been thrust up against and on sediments of Basal Eocene age. Between the top of the Beckwith formation and the base of the Almy there are, in the normal succession, between fifteen thousand and twenty-two thousand feet of Upper Cretaceous sediments. The Beckwith sediments here represent part of the lower 2500 feet of the formation. The Almy conglomerate "c" represents the basal part of the Almy formation. The strike of the Beckwith and Almy beds is usually nearly at right angles and the dip near the fault zone is never less than 50°. The fault plane is not vertical but dips to the west at approximately 70°. After a consideration of these factors it seems safe to say that the displacement along the Medicine Butte fault here has not been less than 20,000 feet.

This great amount of displacement has caused considerable shearing, crushing and general brecciation in the Almy formation as well as in the Beckwith formation.

In addition to the two major faults in this area there are at least seven minor

faults at oblique angles to the major ones. The relative amount of displacement is small and they are probably contemporaneous in age with the major faults. As nearly as could be determined there has been little vertical displacement. These fault planes are almost vertical. These oblique faults are of importance, not only in working out the general structure, but because their zones of brecciation are at right angles to the axis of the proposed dam, and are a possible source for leakage.

The recommended site for the dam (see accompanying map) is located almost entirely on the Almy conglomerate "c", and entirely on the Almy formation, except for the southwestern edge of the fill. At this location all the dam except the southwestern edge will be east of the major fault plane, and will cross only one oblique fault. This fault cuts off the Almy conglomerate "c" and in its place are siliceous red and green shales and buff to gray sandstones.

At the dam site the bed of Almy conglomerate "c" has been broken by the fault and has been turned clockwise back on itself at an angle of 180°. The mechanics of deformation which brought about the formation of this distinctive pothook are not understood. Just south of the south end of the dam site the Almy conglomerate "c" appears again striking north-south, the same as it does north of the pothook. The intervening space is filled with a block of Almy variegated shales and buff to gray sandstones which belong between "a" and "x". The sudden sharp bend in "c" has added to the shearing, crushing and general brecciation caused by its proximity to the major fault zone. Beds "a", "b", and "x" bend around conformably with "c" until cut off by the oblique fault just south of Coyote Creek.

IMPORTANT GEOLOGICAL CONSIDERATIONS PERTINENT TO THE PROPOSED DAM SITE

As was previously mentioned the northern ¾ of the dam will be built on the Almy conglomerate "c". The base of the dam on the upstream side, on the north side of Coyote Creek, will be on hard, massive quartzite conglomerate dipping 50° to the southeast and striking northeast. Here the conglomerate is very hard, and contains few joints, fractures and shear and crushed zones. There is little chance of water,

even under pressure, seeping through this part of the conglomerate. Under the middle of the dam on the north side of Coyote Creek the conglomerate strikes east-west and dips 50° to the south. There are some shear and crush zones and joints at this locality and these factors, combined with the strike of the beds may result in more seepage. Below the dam site on the north side of Coyote Creek the massive conglomerate is badly jointed and crushed and there are many shear zones.

The rock upon which the central part of the dam will be built is covered by at least 25 feet of alluvium. A test pit sunk 22 feet into this alluvium encountered no bed rock, and a bar sunk three feet more struck nothing solid. It is probable that the alluvium does not extend below a depth of 30 to 35 feet. The bed rock is probably the Almy conglomerate "c".

On the south side of Coyote Creek the massive conglomerate and some conglomeratic sandstone lenses are exposed in place. They are badly weathered and brecciated from their proximity to the oblique fault to the south and to the main fault zone to the west. There is some possibility of seepage under pressure along the fault zone.

The foundation rocks south of the oblique fault are covered by wash, fault breccia and vegetation so their true character and relationships are rather uncertain. They consist mainly of siliceous variegated shales and buff to gray sandstones, striking northeast-southwest and standing nearly vertically. Their stratigraphic position is somewhere between "a" and "x". The shales are so siliceous that they should be fairly impervious.

The extreme southwestern part of the dam may rest on Beckwith red shales but they are so siliceous that little trouble is anticipated.

It is desirable to place the dam where it will have to cross the fewest number of faults and shear zones. At the recommended location the dam will be built across one oblique fault. This fault should in no way impair the safety of the structure.

CONCLUSIONS: From a geological standpoint it is entirely feasible to build a safe and permanent dam at the recommended site.

COMMENTS AND SUGGESTIONS RELATIVE TO CONSTRUCTION:

1. Subsurface exploration by drilling should precede construction. Drill cores should be taken at frequent intervals along the entire dam site. Additional drill cores should be taken along the creek bottom to determine the depth of alluvium and character of the rock underneath. Especial care should be taken to get enough drill cores in the vicinity of the oblique fault to determine the extent and character of the brecciation, and its relation to the dam site.

2. Conglomerate "c" is so resistant that the weathered zone is shallow. A trench not more than five feet deep should reach solid rock in any part of "c" which has not been crushed and brecciated.

3. It should not be necessary to sink the puddle core more than 5 feet into bed rock.

4. It may be necessary to put a concrete apron across the area of the oblique fault to prevent seepage. This will depend partly upon the findings from the drill cores along the fault.

5. The specifications previously drawn up call for an outlet tunnel through solid rock on the north side of the dam. As this rock is composed of cemented quartzite cobble it is suggested that allowance be made for its resistant character with the alternative possibility of placing the outlet tunnel along the bottom of the dam as it was done at the dam in Echo Canyon, Utah.

David Love

Garvin Hurwitz

Inspected and approved by:

S. H. Knight, State Geologist

GEOLOGIC AND TOPOGRAPHIC MAP OF THE COYOTE CREEK DAM SITE

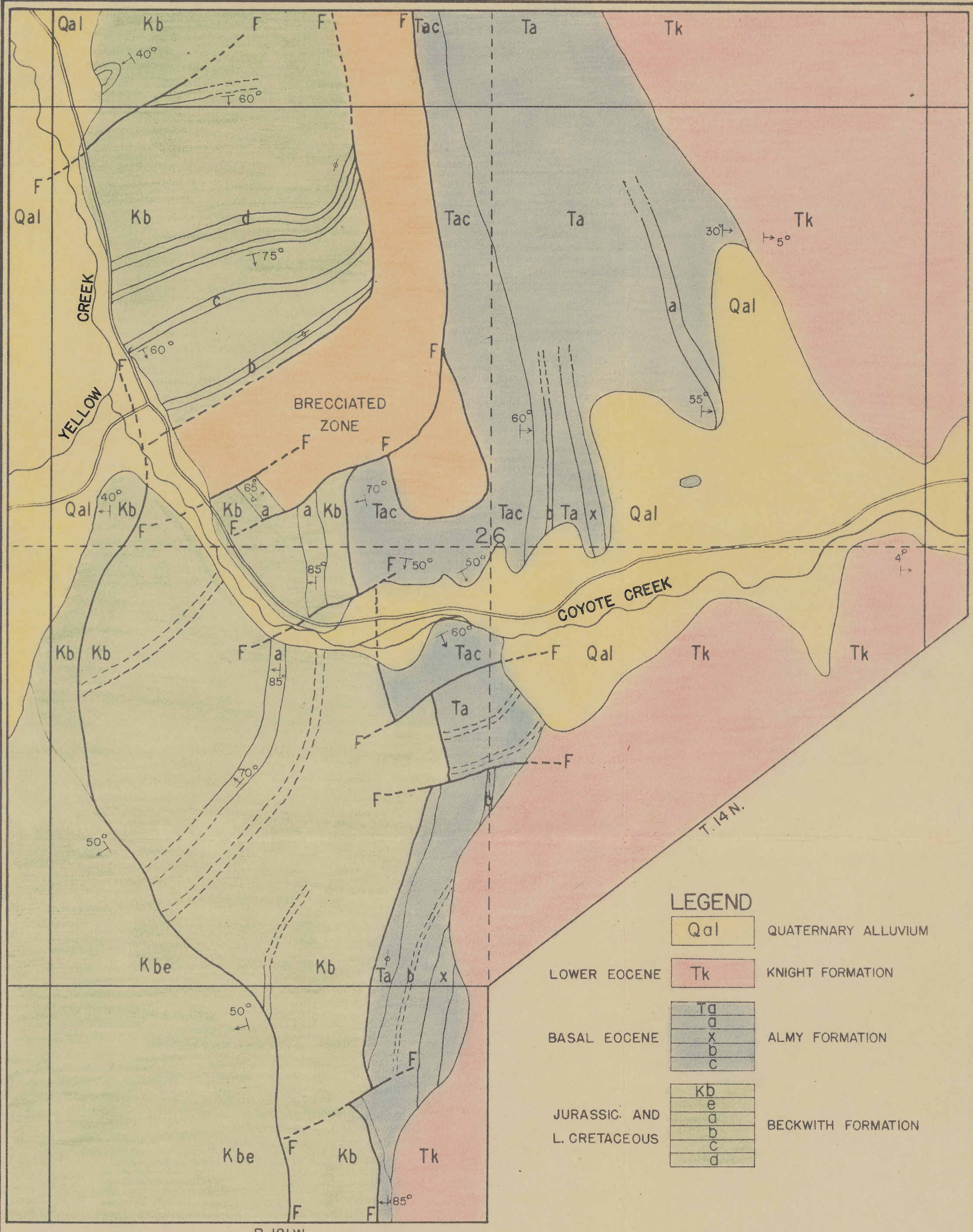
Enlarged Section of the Accompanying Map

SCALE

0 250 500 750 FEET

CONTOUR INTERVAL = 20 FEET

Qal	QUATERNARY ALLUVIUM
Tk	KNIGHT FORMATION
Ta, a, x, b, c	ALMY FORMATION
Kb, a, b	BECKWITH FORMATION



GEOLOGIC MAP OF THE

COYOTE CREEK DAM SITE

THE GEOLOGICAL SURVEY OF WYOMING.

GEOLOGY BY D. LOVE & G. HURWITZ
CHECKED IN FIELD AND APPROVED
BY S. H. KNIGHT, STATE GEOLOGIST.
1934