COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
JOHN W. ROLD, DIRECTOR

Surficial-Geologic and Landslide Map of Vega Reservoir and Vicinity, Mesa County, Colorado

by James M. Soule

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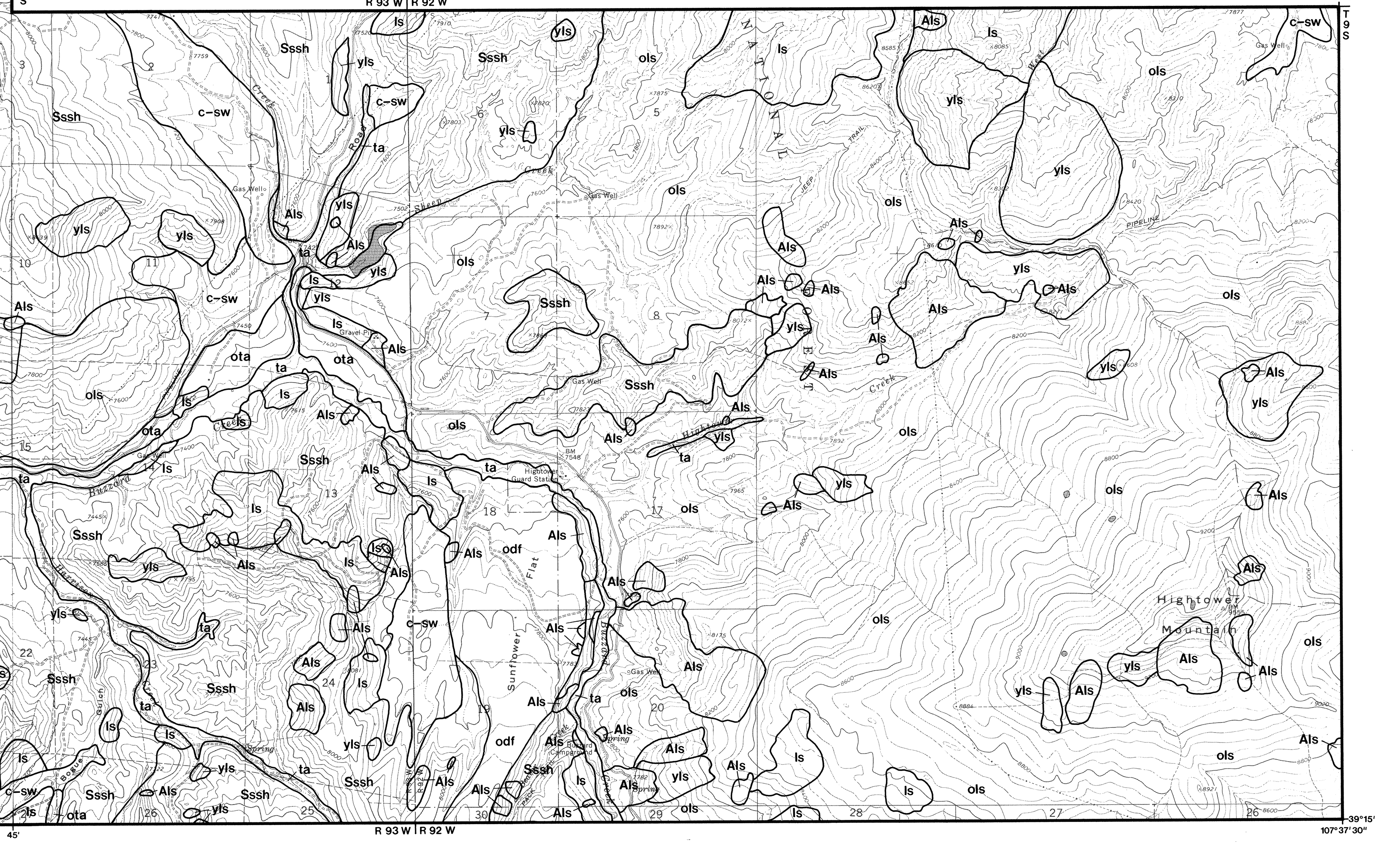

Base from U.S.G.S. 7 1/2 minute topographic quadrangles

Prepared in cooperation with U.S.G.S. under Cooperative Agreement No. 14-08-0001-A0420

EXPLANATION

DISCUSSION

This map, at a scale of 1:24,000, based on 7.5 minute topographic quadrangles (Hightower Mountain, Porter Mountain, South Mann Peak, Vega Reservoir, Hawkshurst Creek, Collbran), is a combination of surficial-deposits mapping and an evaluation of the state of landsliding and landsliding potential in an area where both surficial deposits and bedrock are, or have been in the recent geologic past, very prone to mass slope movements. With few exceptions, all bedrock outcrops in the area consist of sandstones, shales, and marlstones (oil shale) of the Tertiary Wasatch and Green River Formations. The remnants of a younger, formerly more extensive, extrusive basalt sheet are found on the summits of Battlement and Grand Mesas. Exposures of in-place bedrock in the area are uncommon, owing to widespread ancient and modern landslides and landsliding of various scales. Rapid and large scale degradation of Battlement and Grand Mesas by large-scale debris flows has formed many of the colluvial deposits covering bedrock. Oil shales in the younger Green River Formation are more resistant than Wasatch rocks and hold up most of the cliffs and higher summits in the area.

The major drainages in the area are competent, capable of carrying large sediment loads, and choked with sediment owing to the rapid degradation of hillslopes and have associated ancient and modern terraces and modern floodplains. The relationships between stream erosion and landsliding are problematical in many places. In most instances streams are not rapidly downcutting, probably due to their relatively large sediment loads. However, in very few places was it observed that stream banks were failing on any large scale into streams. Initially this condition seemed paradoxical as the area in general is so landslide prone. However, field observations give some indications as to why this is the case. Most of the modern landslides seen in the Vega Reservoir area are relatively thin considering their aerial extent. Additionally, the majority of them appear to move only during the late spring and early summer months when ground moisture is seasonally high and most of the sediment that they produce is fine-grained. As discussed below, an assignment to the author at the outset of this project was to determine the potential, if possible, of major catastrophic landsliding that might result in the impoundment of streams and flood surges after breaching of landslide dams.

This quadrangle-scale mapping follows mostly the same format as the detailed map made of the Vega Reservoir access road (Soule, 1986). For this road and along the important transportation routes and settled parts of the area, new (1985) aerial photography was made specifically for this project. However, for the remainder of the area these newer photographs were not made. Therefore, we used two series of older and smaller scale aerial photographs made by the U.S. Bureau of Land Management in 1977 (CO-77-F) and 1980 (CO-80-BC). Because of the smaller scale and differing ages of these older photographs and the fact that most of the modern landslides in the area have occurred or increased in size or activity considerably since these older photographs were made, absolute consistency in accuracy of landslide mapping for the entire area was not possible. Fortunately, all the areas where the older photographs were used are away from places where landslides could cause serious problems for human activities.

Because the principal objective of this work was to assess landslide potential, active landsliding, and after effects of ancient landslides and landslide episodes, we concentrated on accurate mapping of landslides and landslide deposits.

Virtually all of the bedrock exposures in the area, which are composed of immature friable and soft sandstones and shale of the Tertiary bedrock units, have been or are involved in landslides. Because of this and in order to make a meaningful distinction for hazards assessment, we divided landslides into four types: ancient, old, young, and modern.

These types were chosen as each represents a different problem of slope instability for human activities. Active landslides are those that are moving naturally and whose movements typically have either accelerated or were initiated coincident with increased precipitation and resultant ground moisture during the nineteen-eighties. Young landslides are those whose form is clearly unmodified by subsequent erosion, but where currently the state of landslide activity (movement) is indeterminate or uncertain. Because many of these same areas are probably subject to episodic slope movements, it should be assumed that all areas so mapped are serious potential slope-instability-hazard areas. The other types of landslides present in the area are mapped as old and ancient. These are the eroded remains of landslide features that formed when climatic and soil moisture conditions were probably much different from what they are today. Many of these older landslides appear to have involved far larger amounts of material than most of the presently active ones. This is evident in some areas as extensive eroded and dissected remains of large landslides, such as the one that makes up the southwest flanks of Cambell Mountain. Here an entire mountainside apparently moved into the valley of ancestral Plateau Creek. This event possibly formed a landslide dam of the creek resulting in natural inundation of the area now occupied approximately by modern Vega Reservoir. Such large landslide features are seen no place in the area today suggesting that the mechanisms by which they formed are not currently operable.

In addition to the landslides themselves, there are no other seriously hazardous geologic conditions present in the Vega Reservoir area. All major streams are subject to heavy flooding during spring runoff periods and the problems associated with this can be complicated by undercutting of stream banks by flood water coincident with the season of highest ground-moisture content and consequently landsliding potential. The usual case is that by mid-June landslide activity appears to nearly cease for the season regardless of how severe or extensive activity was in the previous two or three months.

LANDSLIDES AND LANDSLIDE DEPOSITS

Als Modern Landslides — These features are simple to complex slope failures, usually no more than a few tens of feet thick which are undoubtedly active at the present time. Movement of these varies seasonally and can range from feet per day to nil depending on local and seasonal moisture conditions and changes, oversteepening of slopes by erosion or other means, seasonal weather changes, and variation in bedrock type(s) beneath them. Virtually all landslides in the area are composed of materials derived from sandstones and shales of the Wasatch Formation.

yls Young Landslides — These features have all the attributes of modern landslides except present movement is unlikely or uncertain. In most instances they are in a state of metastable equilibrium and would likely move if ground moisture were to increase or slopes became oversteepened. In many places young landslides are contained within old landslides or ancient landslides suggesting that a continuous process occurs whereby one type grades to another.

ls Old Landslides — These are areas where surficial deposits are composed of landslide material that retains most of its landslide form and where recent or modern movement is clearly not taking place. These areas usually are composites of several individual landslides of different age. Evidence is primarily related to location of drainage(s), landforms of landslide origin, and steepness and composition of slopes.

ols Ancient Landslides — These are areas where the landsliding process took place long enough ago that erosion and other surficial processes have considerably modified the form of the deposit. This implies that a major landslide event took place and ended thousands if not tens of thousands of years ago and that the area affected has been in static equilibrium since.

SURFICIAL DEPOSITS OTHER THAN LANDSLIDES

ta Stream Alluvium of Terraces and Floodplains — These are modern and young alluvial deposits of the larger streams in the area. Mostly these deposits consist of erosional remains of sandstone and shale bedrock and make up a fine grained alluvium. In many places basalt boulders derived from old debris-flow deposits are also found in stream alluviums and terraces.

c–sw Colluvium and Slopewash — Deposits usually on gentle slopes consisting of fine grained alluvium and colluvium derived from nearby sandstone and shale supported hillslopes. These areas are usually coincident with places that are streetflood-prone and as such can be hazardous.

odf Old Debris-flow Deposits — These deposits are the remains of formerly extensive landforms produced by massive large-scale debris flows that originated from the summits of Grand and Battlement Mesas, presumably during the Pleistocene or possibly late Neogene. The predominant constituents of these deposits are weathered basalt boulders supported by a matrix of clayey fines. The surface of these deposits is usually strewn with basalt boulders which either are the remains of dissected and eroded debris-flow deposits or residual lag deposits of larger materials left after the finer materials originally containing them have eroded away.

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bog Bog and Peat Deposits — Soft organic-rich deposits in poorly drained areas. Shown only for larger areas on Grand and Battlement Mesas.

t–bs Boulder Streams and Fields — Coarse, angular and blocky unconsolidated basalt boulders derived from disintegration and mass wasting of basalt flows.

BEDROCK

Bedrock at the surface in an undisturbed, in place condition is rare in this area. This situation exists because virtually all of the sedimentary and volcanic rocks that underlie the area have been involved in slope failures, either in the past or at present. Bedrock consists essentially of only sedimentary and volcanic rocks and only four lithologic types: sandstone, shale, marlstone (oil shale), and basalt.

Sssh Sandstone, Shale, and Marlstone — Interbedded sandstone and shale of the Wasatch Formation overlain by the Green River Formation which is composed of sandstones, shales, and marlstones (oil shale).

V Basalt — Volcanic and intrusive igneous rocks, undifferentiated.

MAN-MADE DEPOSITS

af Fill of Vega Dam. Other fills in the area are not mapped and have been placed primarily for roads and canals.

SUGGESTIONS TO USERS OF THIS MAP

This map shows a combination of landslides mapped according to relative age and surficial deposits mapped according to origin. Bedrock is shown as undifferentiated Tertiary sedimentary or volcanic rocks. At lower elevations the predominant bedrock types are sandstones and shales which, even where exposed, are highly prone to fail by landsliding. The Wasatch Formation is typically so poorly indurated that in many places it is nearly as incompetent and prone to mass movements as the surficial deposits that overlie it.

Because the map shows the distribution of four different ages of landslides, the obvious tendency of most users will be to equate relative age with landslide activity and degree of hazard. This should be done with considerable caution however, as after my field observation of many active landslides they can occur, apparently, with nearly unpredictable equivalent frequency in any of the older landslide units or in in-place bedrock. Additionally, areas affected by active landsliding are known in advance and planning for or coping with their potential effects can be done routinely. Areas known to be, or to have been subject to landsliding in the past are more problematical as prediction of specific landslide effects is practically impossible without highly detailed site-specific investigations.

REFERENCES

Donnell, John R., et al., 1985, Preliminary geologic map of the Collbran Quadrangle, Mesa County, Colorado: U.S. Geological Survey Map MF-1825.

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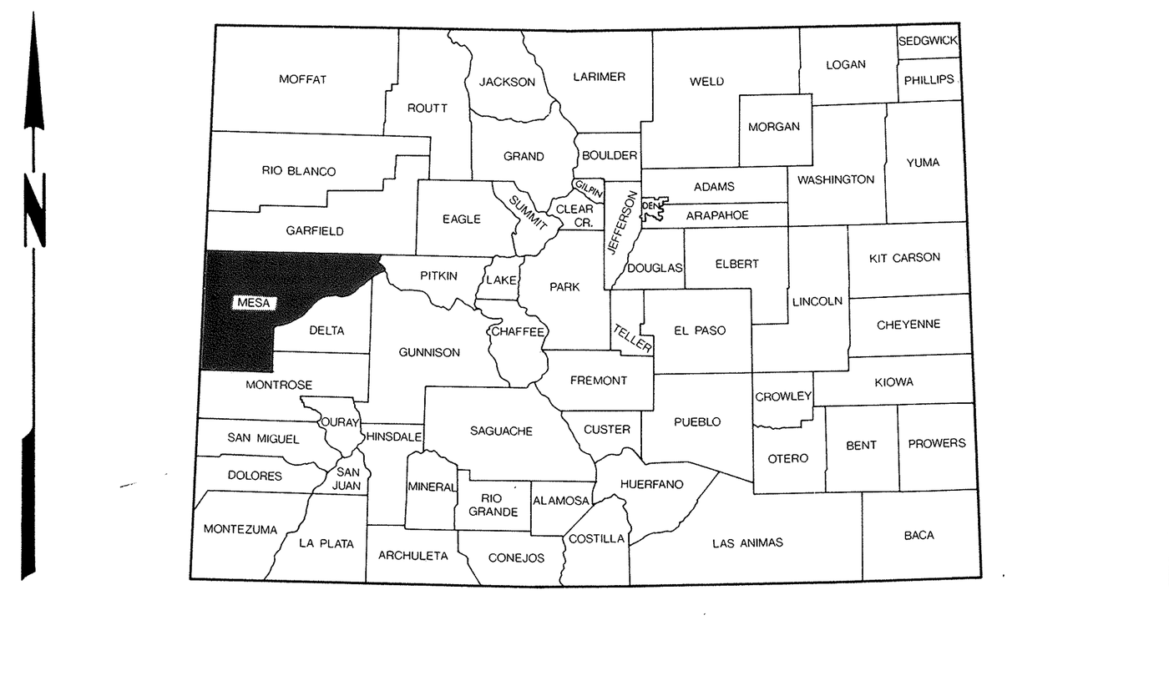
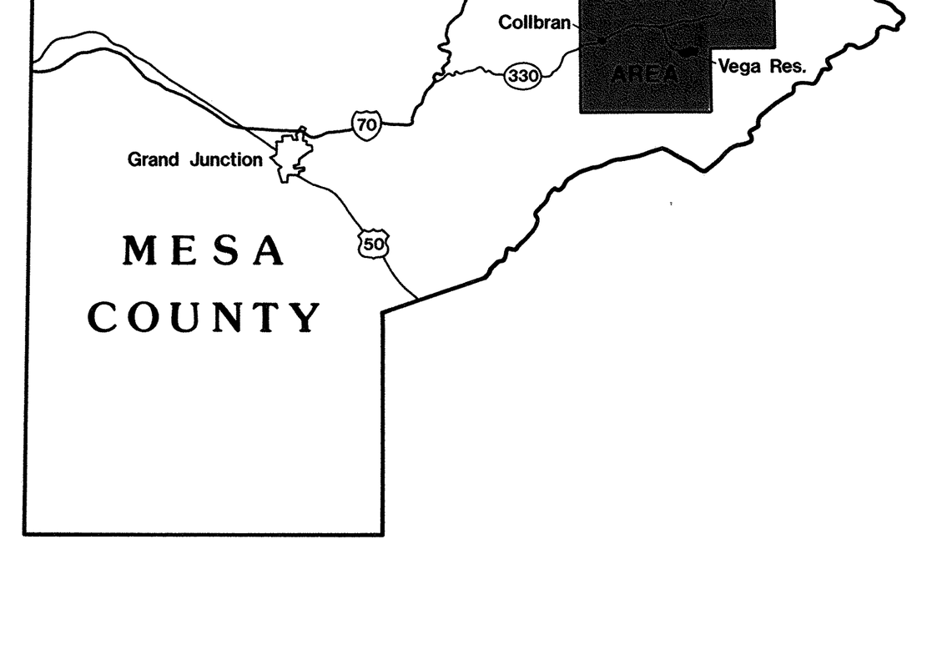
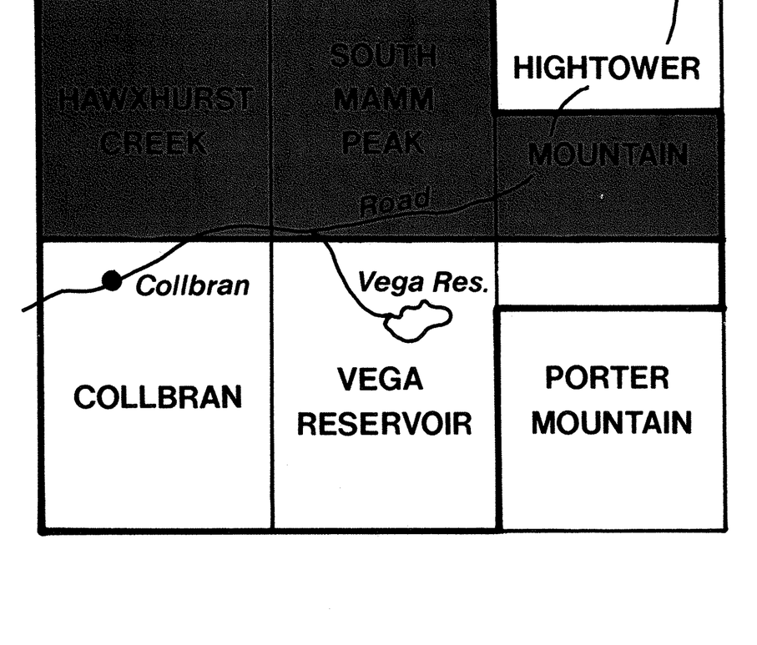
COUNTY INDEX



STUDY AREA INDEX



7 1/2′ QUADRANGLE INDEX



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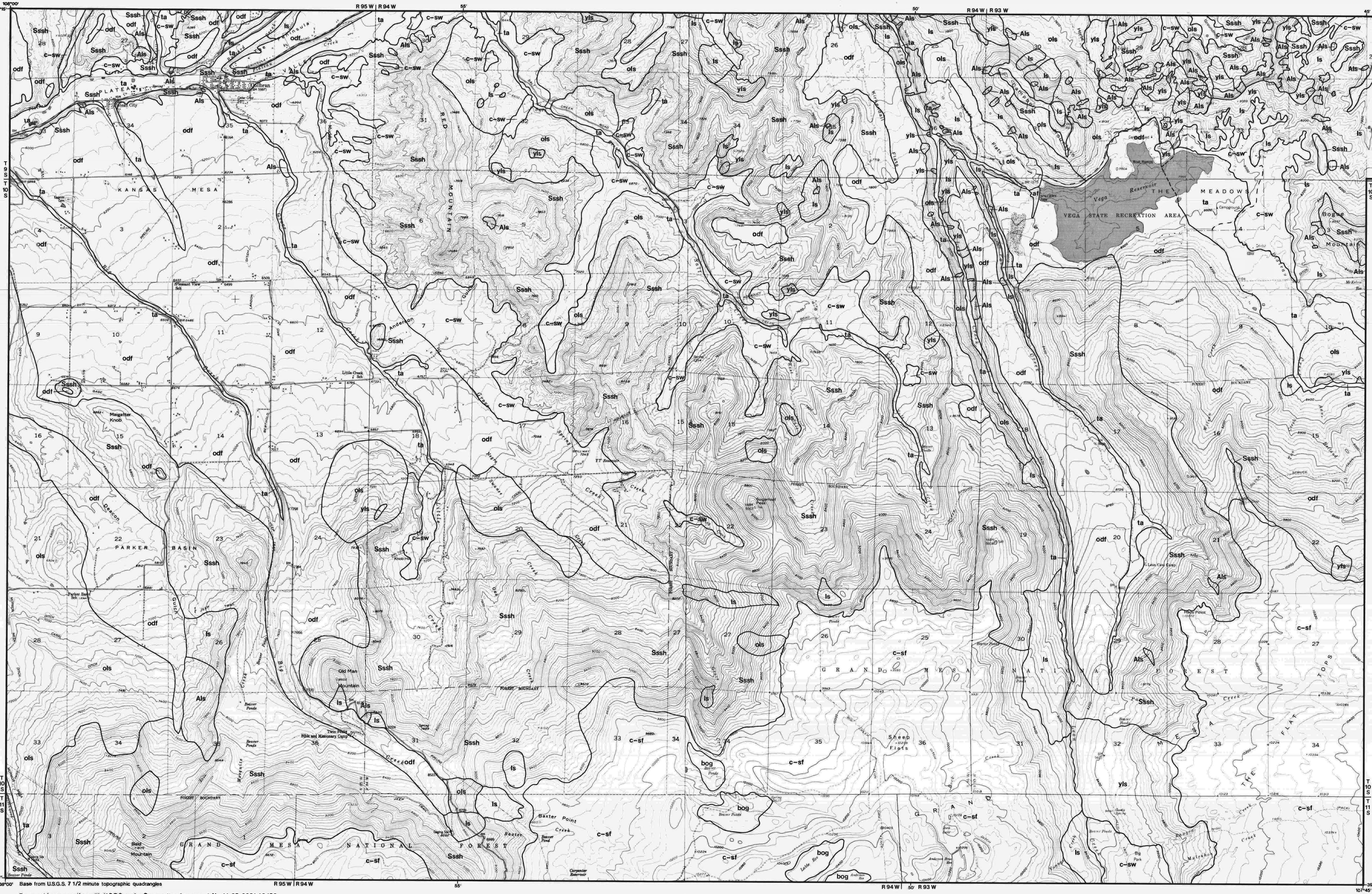

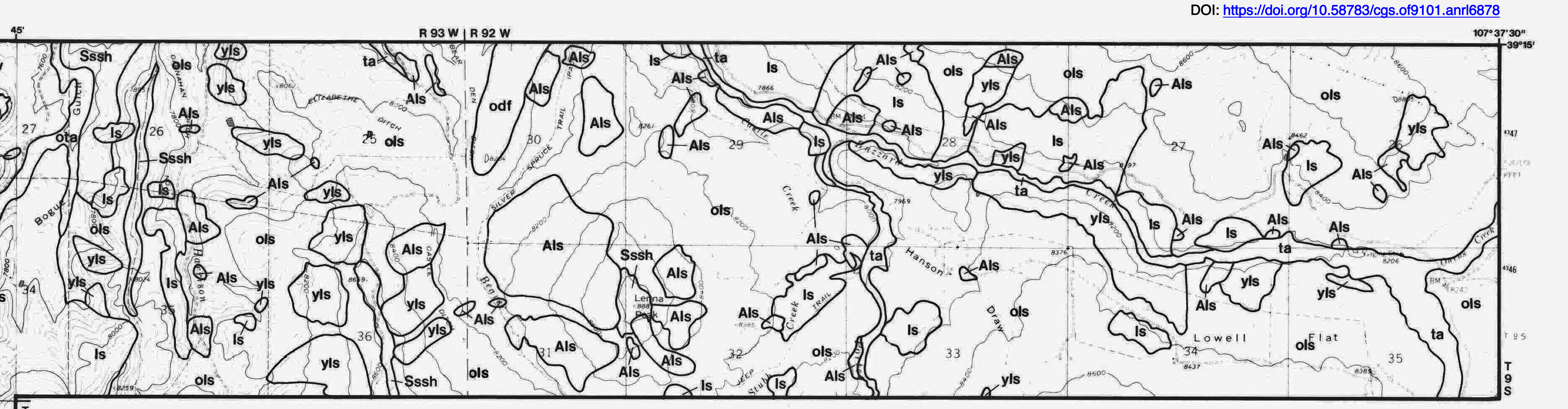

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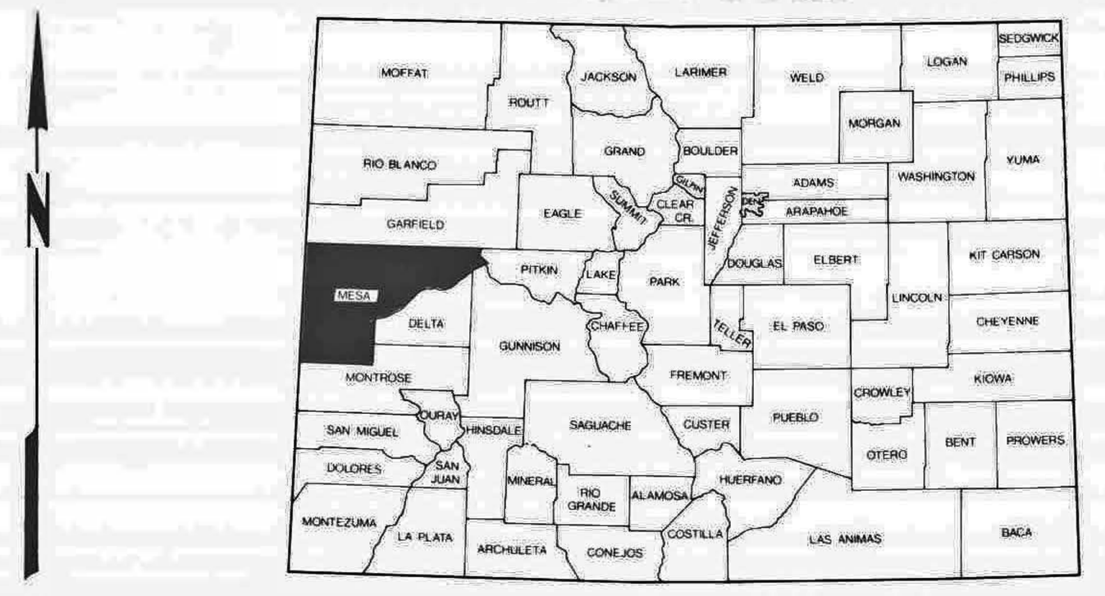

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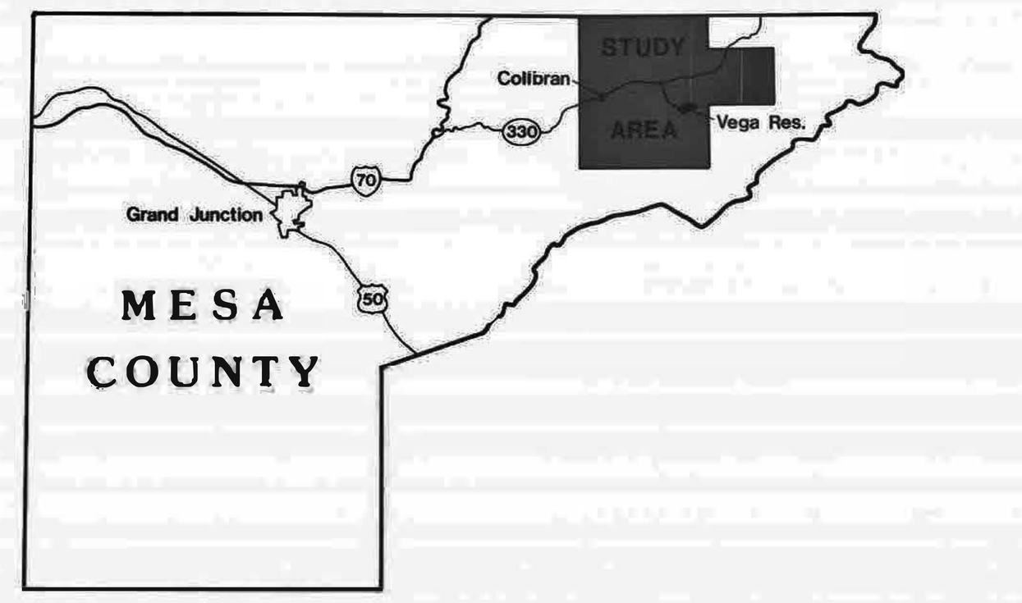

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