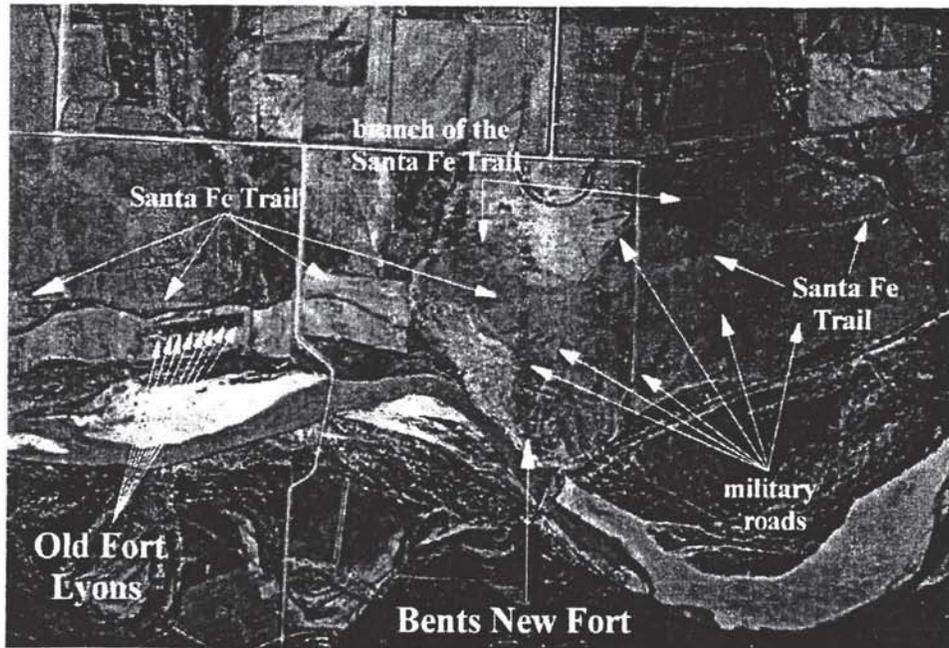


SAND CREEK MASSACRE SPECIAL STUDY
Analysis of Aerial Photography
from 1936-37, 1954, and 1975
Draft Report



by

Arthur K. Ireland
Technical Services Branch
Anthropology Projects
Santa Fe Support Office
National Park Service

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Cover Illustration: Close-up of the Fort Lyons/Bent's New Fort area from the 1936 aerial photography.

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COMMENTS ON THE ANALYSIS OF THE AERIAL PHOTOGRAPHY OF THE AREA ENCOMPASSED BY THE SAND CREEK MASSACRE SPECIAL STUDY

General Comments

The purpose of the interpretation of the aerial photographic record for the area around where the Sand Creek Massacre (Figure 1) was reported to have taken place was not to locate the actual massacre site, which is ephemeral at best, but rather to try to locate other features, such as aboriginal trails or wagon roads, that might have been related to the massacre or the Cheyenne and Arapaho village itself. Such trails are not unknown. The Chaco roads are one example. Another case in point was investigations done jointly by researchers at the University of North Dakota and the National Park Service's Southwest Cultural Resources Center and Midwest Archeological Center on the Bad Pass Trail on the west rim of Bighorn Canyon at Bighorn Canyon National Recreation Area on the Wyoming/Montana border. This trail has been suggested to have been a travois trail and grooves created by the horses' hooves and travois poles were still visible on the ground at the time the research was being done, which was 1971-1972. In the area around Fort Lyons and Bent's New Fort, west of Lamar, the Santa Fe Trail is clearly visible in the aerial photography.

The technique used to find and analyze resources visible in the photography is called photo-interpretation. Most commonly it is used on aerial photography. Lyons and Avery (1977:8) describe a photo-interpreter as, "one who successfully combines sound subject matter background with an above-average ability to observe, recognize, and draw meaningful inferences from various patterns and tones that are imaged on the photographs." Stanley (1981:x) further describes photo-interpreters as "usually cautious—stating positively only when incontrovertibly sure and otherwise loading on the caveats and disclaimers," and "the most common hedgebetters . . . are 'probable' and 'possible'."

It is possible to view and analyze photographs one at a time or monoscopically. However, viewing the photographs stereoscopically improves the effectiveness of the analysis dramatically. The reason for this is that the interpreter is viewing the photography three-dimensionally, the well-known "3-D" effect, rather than two-dimensionally. In order to achieve the 3-D effect, the area being examined must show up in two photographs at approximately the same scale. Such photographs are called stereo-pairs and contain an area of overlap, which produces the stereo-model, the three dimensional mental image that the interpreter sees. When aerial photography is being acquired for mapping or photo-interpretation, it is specified that each photograph on the line of flight will overlap the next one by 55% to 65% (forward overlap) and those on either side by 15% to 30% (sidelap). When viewing the resultant photographs with a stereoscope, the photo-interpreter has the same three-dimensional view that the photographer had when he took the photographs. However, the vertical dimension usually becomes exaggerated by a factor of three. It is this vertical exaggeration that aids in the photo-interpretation of cultural resources. Even a small, very low mound becomes quite obvious and a slight depression becomes a crater. However, not all cultural resources are discoverable through photo-interpretation. Locations with some type of structure will usually be visible. Other sites, e.g., prehistoric lithic or ceramics scatters, will not be. Historic dumps are occasionally visible.

Until sites can be positively identified, they are generally referred to as anomalies. One factor governing anomaly visibility in aerial photography is the scale of the photography--the larger the scale, the easier it is to recognize them. Another reason which may affect the visibility of the anomaly is the angle from which the stereo-pair was photographed. Since the overlap forming the stereo-pair is 60% (optimally), the preceding and succeeding stereo-models will contain 20% of the first stereo-model. The effect of this same factor is often more obvious in the sidelap areas. An anomaly located in the sidelap area may not be visible on the photographs on the same flight line but becomes visible when viewing stereo-pairs from adjoining flight lines.

It cannot be emphasized strongly enough that photo-interpretation is merely that--interpretation; it is what the interpreter thinks is there. Attributes that a photo-interpreter searching for cultural resources looks for are: mounds; depressions; apparent standing walls; vegetative, soils, and cover-type patterns that contrast with the surrounding area; and regularities--naturally occurring objects are less likely to have regular shapes than man-made ones. Stanley (1981:257) felt that shape was possibly the most important active factor in imagery analysis: "A surprising amount of intelligence could be deduced from some objects even when small scale, poor image quality, obscuring shadows degraded the photo until only general shapes when discernible."

Not every anomaly seen and recorded by the photo-interpreter is a site. It is advisable, therefore, for someone to visit the area at some time to field check the anomalies seen on the photographs, if possible. During the Sand Creek Special Study photo-interpretation project I did not record every anomaly I saw. To have done so would have doubled the number anomalies and my confidence that all were of cultural origins was insufficient to justify doing so. I did, however, record samples of each kind I saw. Lyons and Avery (1977:51) are very specific when emphasizing that photo-interpretation, and remote sensing in a larger sense, "is *not* [emphasis in the original] an alternative to archeological field work; it is an additive tool that can complement field examination and assist in making more efficient use of time spent on sites."

The Aerial Photography

The aerial photography analyzed was from four different years, covering a time span of nearly forty years. This long span allows us to see changes over time. These were remarkably few and were reflected by the increase in the number of homesteads and the amount of land under cultivation. Table 1 provides more detail on the aerial photography.

1936/1937 Aerial Photography

Even in the 1936/1937 aerial photography (Figure 2) the area along the Big Sandy Creek is criss-crossed by linear features. At a nominal scale of 1:20,000, it is sometimes difficult to determine what some of these are. Some are obviously fence lines and/or perhaps two-track roads or livestock paths that paralleled fence lines. Others are/were 20th century roads and railways and a few were canals coming off Big Sandy Creek.

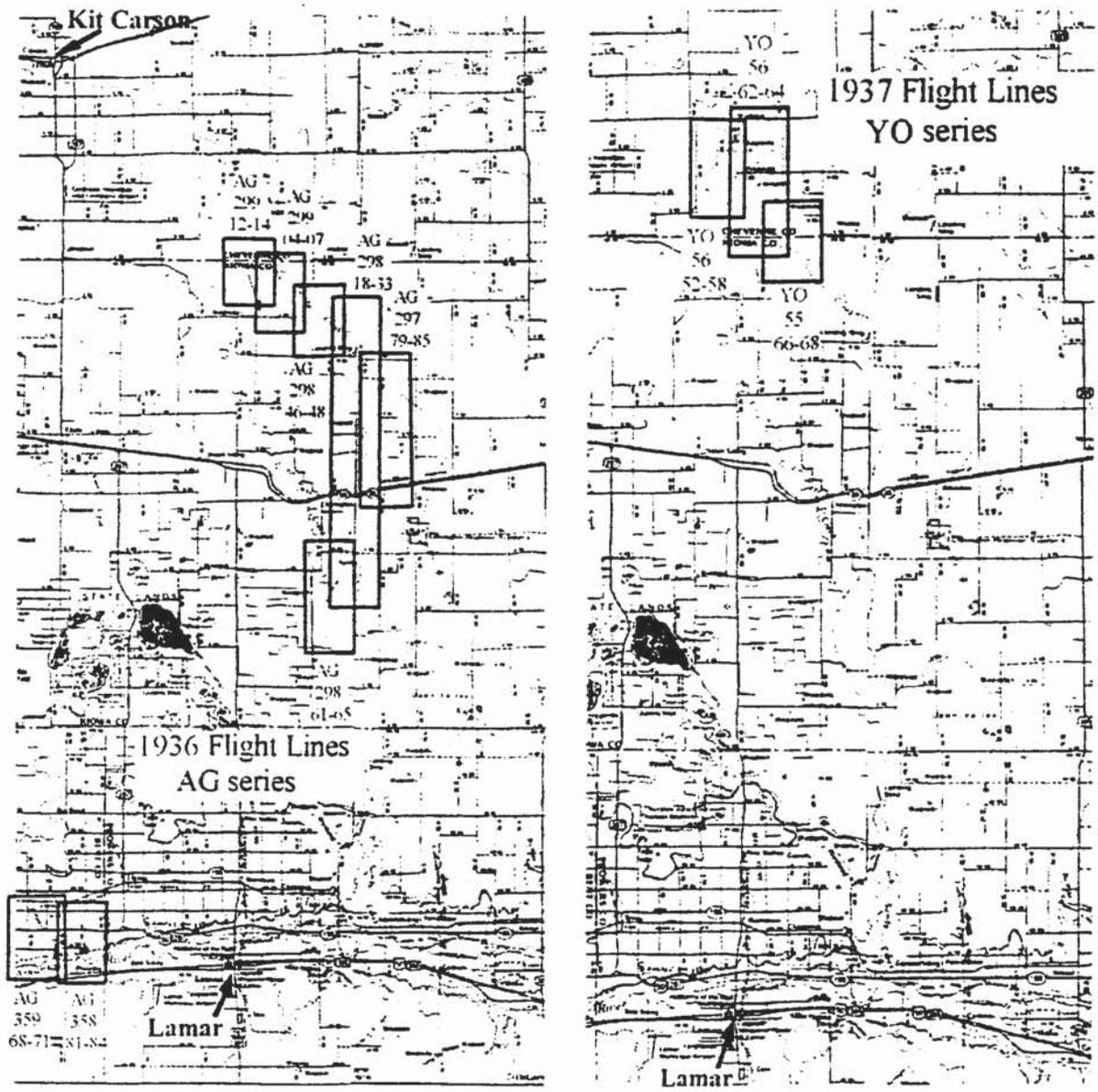


Figure 2. Flight index maps for the 1936 and 1937 aerial photography.

1954 Aerial Photography

The 1954 aerial photography (Figure 3), with its scale of 1:60,000, provided the benefit of being able to view a large area and to see more quickly the relationships of some of the anomalies. The downside of the extremely small scale was that it made distinguishing some of the anomalies noted in the 1936/1937 aerial photography difficult and, in some cases, impossible. It also meant it was even more difficult to make any conjectures as to what the anomalies viewed might be and those made very tenuous.

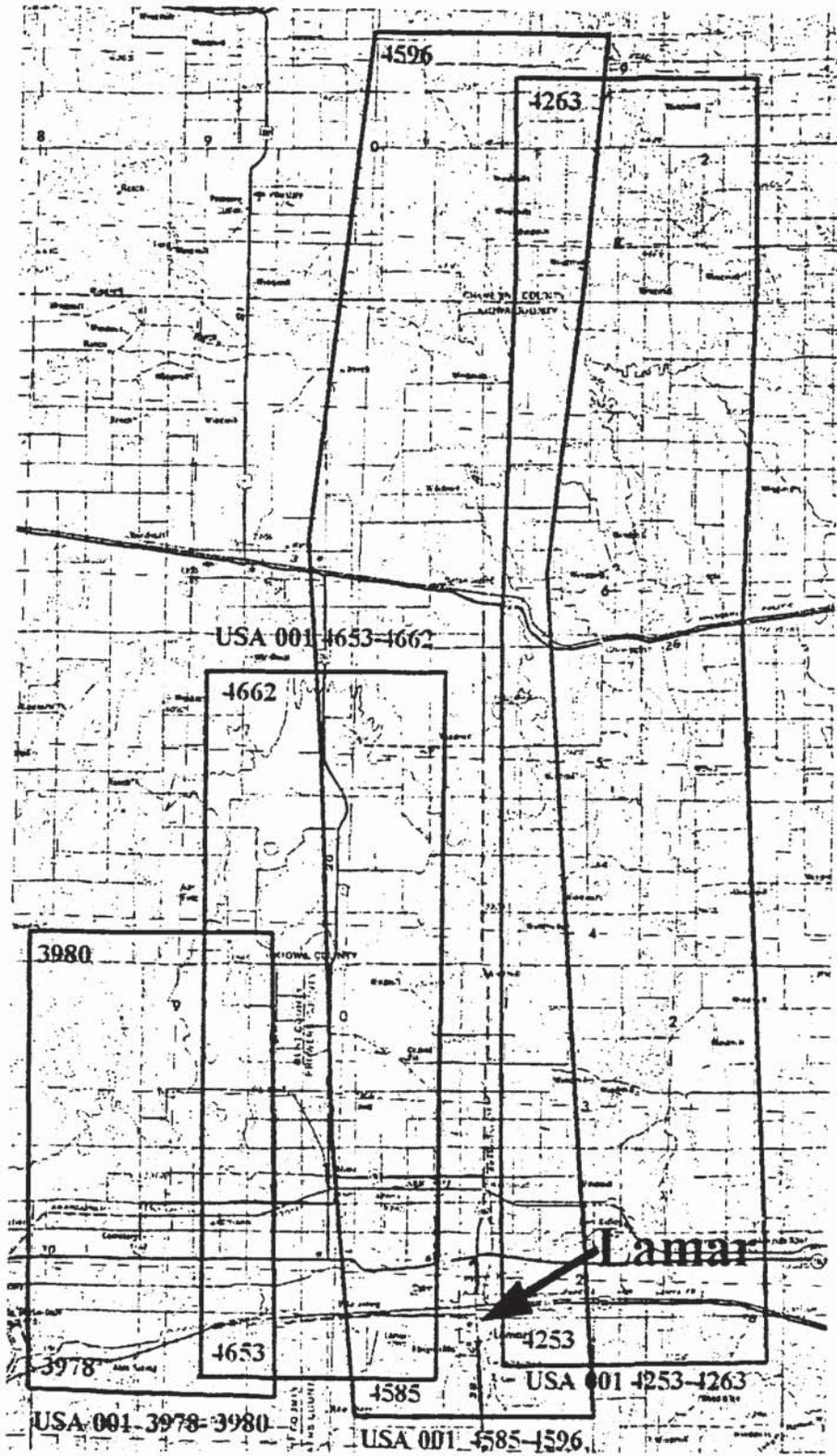


Figure 3. Flight index map for the 1954 aerial photography.

1975 Aerial Photography

This aerial photography (Figure 4) had nearly the same scale as the 1936/1937 photography—1:21,000. It covered the area of Dawson's Bend; the area around the spot known as the North Bend; and an area that I was unable to identify as to location. The major anomalies noted in the 1936/137 and 1954 aerial photography were also seen in these aerials as well, but some of the less important anomalies were not seen although other new ones were visible.

Table 1. Sand Creek Aerial Photography

<u>Year/Flight Line</u>	<u>Scale</u>	<u>Mission</u>	<u>Date</u>
	<u>Frames</u>		
1936 Aerial Photography		1:20,000	
Flight line 1	79-85	AG 297	17 Oct 1936
Flight line 2	18-33	AG 298	17 Oct 1936
Flight line 3	46-48	AG 298	17 Oct 1936
Flight line 4	61-65	AG 298	17 Oct 1936
Flight line 5	04-07	AG 299	17 Oct 1936
Flight line 6	12-14	AG 299	17 Oct 1936
Flight line 7	81-84	AG 358	15 Nov 1936
Flight line 8	68-71	AG 359	15 Nov 1936
1937 Aerial Photography		Scale 1:20,000	
Flight line 1	66-68	YO 55	27 Oct 1937
Flight line 2	52-58	YO 56	27 Oct 1937
Flight line 3	64-68	YO 56	27 Oct 1937
1954 Aerial Photography		Scale 1:60,000	
Flight line 1	USA 001 3978-3980	VV BE M 29 AMS	3 Sept 54 133
Flight line 2	USA 001 4658-4662	VV BE M 35 AMS	20 Sept 54 133
Flight line 3	USA 001 4585-4596	VV BE M 34 AMS	18 Sept 54 133
Flight line 4	USA 001 4253-4263	VV BE M 30 AMS	4 Sept 54 133
1975 Aerial Photography		Scale 1:21,199	
Flight line 1	2-17 to 2-19	GS-VDTJ	15 May 1975
Flight line 2	2-106 to 2-108	GS-VDTJ	15 May 1975
Flight line 3	2-142 to 2-143	GS-VDTJ	15 May 1975
Flight line 4	2-192 to 2-193	GS-VDTJ	15 May 1975

Methodology

The analytic equipment I used for viewing the imagery was a Richards roll film viewing light table with a Bausch & Lomb optical stereoscope equipped with variable power lenses. The usual power I used was 4 X. Although I received a compact disk containing all the images in digital

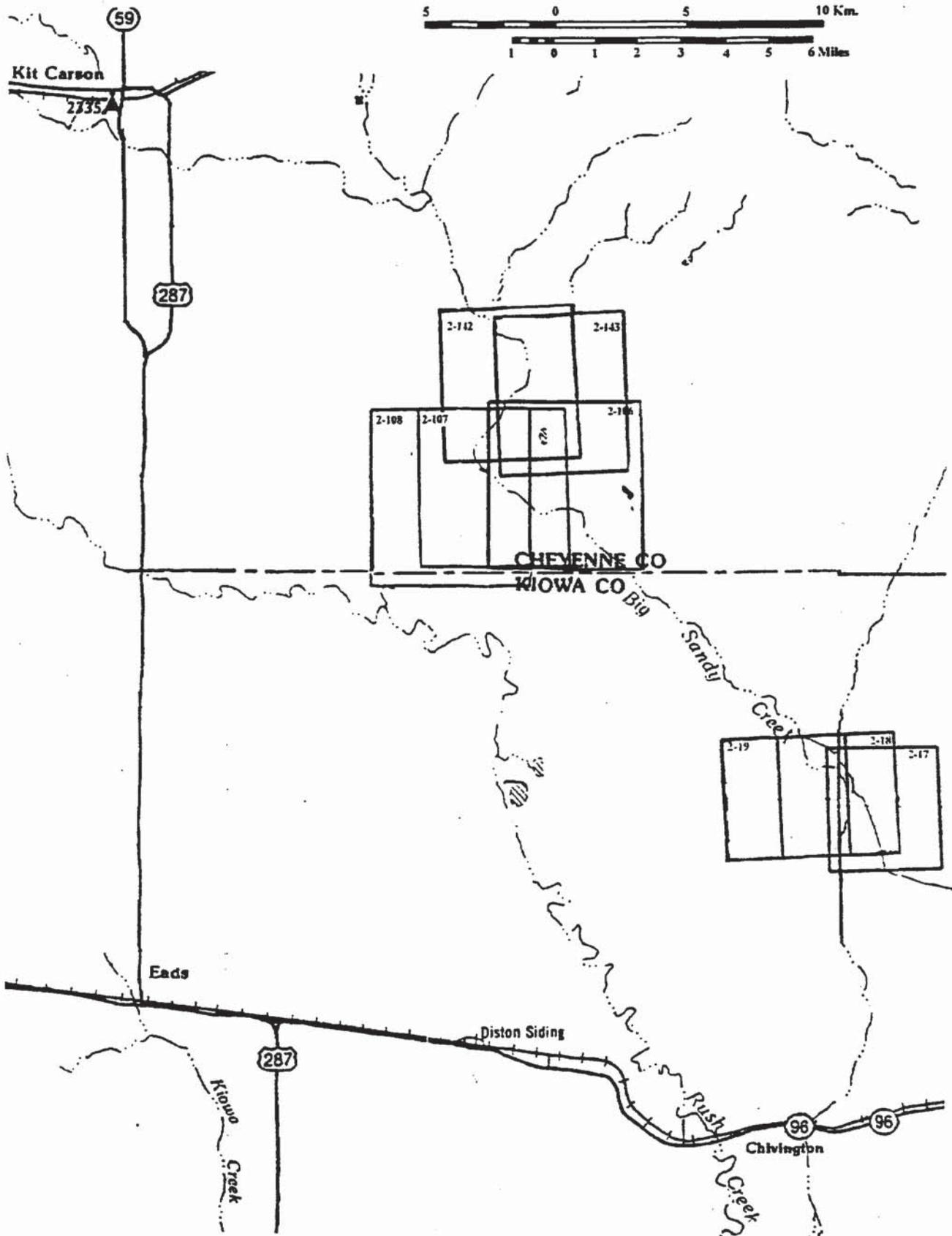


Figure 4. Flight index map for the 1975 aerial photography.

form after I had started the analysis, I had already scanned the diapositive imagery using a Hewlett Packard Scanjet IIc connected to a Dell 433L (486) computer which had been upgraded to the equivalency of a Pentium 90. Base maps were also scanned this way. I then manipulated the digital images used as illustrations using Corel Photo-Paint© on a Dell Optiplex Pentium II 450.

With only a few exceptions, which are noted in the descriptions of the anomalies in Appendices A-D, each photograph in a flight line was paired with the next one in the flight line and was viewed stereoscopically. Printed copies of the digital images of each of the photographs were marked to show the locations of the anomalies seen and then that information was used to annotate the digital images. Finally, the digital images were mosaicked together to show anomalies that could be traced across several photographs.

Some of the ways of eliminating certain of the more anomalous linear features were: 1) to see how far such a feature could be traced, 2) to see if the feature continued across natural features such as arroyos or the creek itself, and 3) to determine the origin and/or destination of the feature. One example is that the banks of the creek have numerous features leading down to the creek bottom but these do not cross the creek. Other examples are the features that lead to shallow lakes or stock tank or fence line corners. Why fence line corners? It is likely that there are gates near the fence line corners.

Results

Of the numerous anomalies were recorded on the 1936 aerial photographs, only seven are of major interest.

The series of photographs from missions 358 and 359 are of the Fort Lyons/Bents New Fort area on the Arkansas River, west of Lamar, Colorado. The location of this set of photographs had me puzzled for some time until I realized that Bents New Fort was fairly prominently displayed on Frames AG 359-82 and -83. Of course, without the report that Tom Baker published in 1998 on the Sand Creek Massacre, I wouldn't have known what I was seeing. His oblique aerial photograph on page 23 gave me the reference point I needed.

The Santa Fe Trail can be traced across AG 358-82 and AG 359-62 for more than five miles (Figure 5). Several probable fords at a large arroyo were also noted. It appears that the Santa Fe Trail may have forked at these fords and a possible parallel branch of the trail is visible about 1200 yards upslope from the main trail. At the west end of the Santa Fe Trail on Frame 359-62, there appears to be another trail heading south to the Arkansas River. If it indeed was a trail, there probably was a ford across the river at that point.

The Santa Fe Trail passes right by both Bents New Fort and the older section of Fort Lyons. Again, I am indebted to Tom Baker's earlier report in which he shows the locations of eight of the buildings at the old Fort Lyons (1998:28-29). These are also visible on Frames AG 358-82

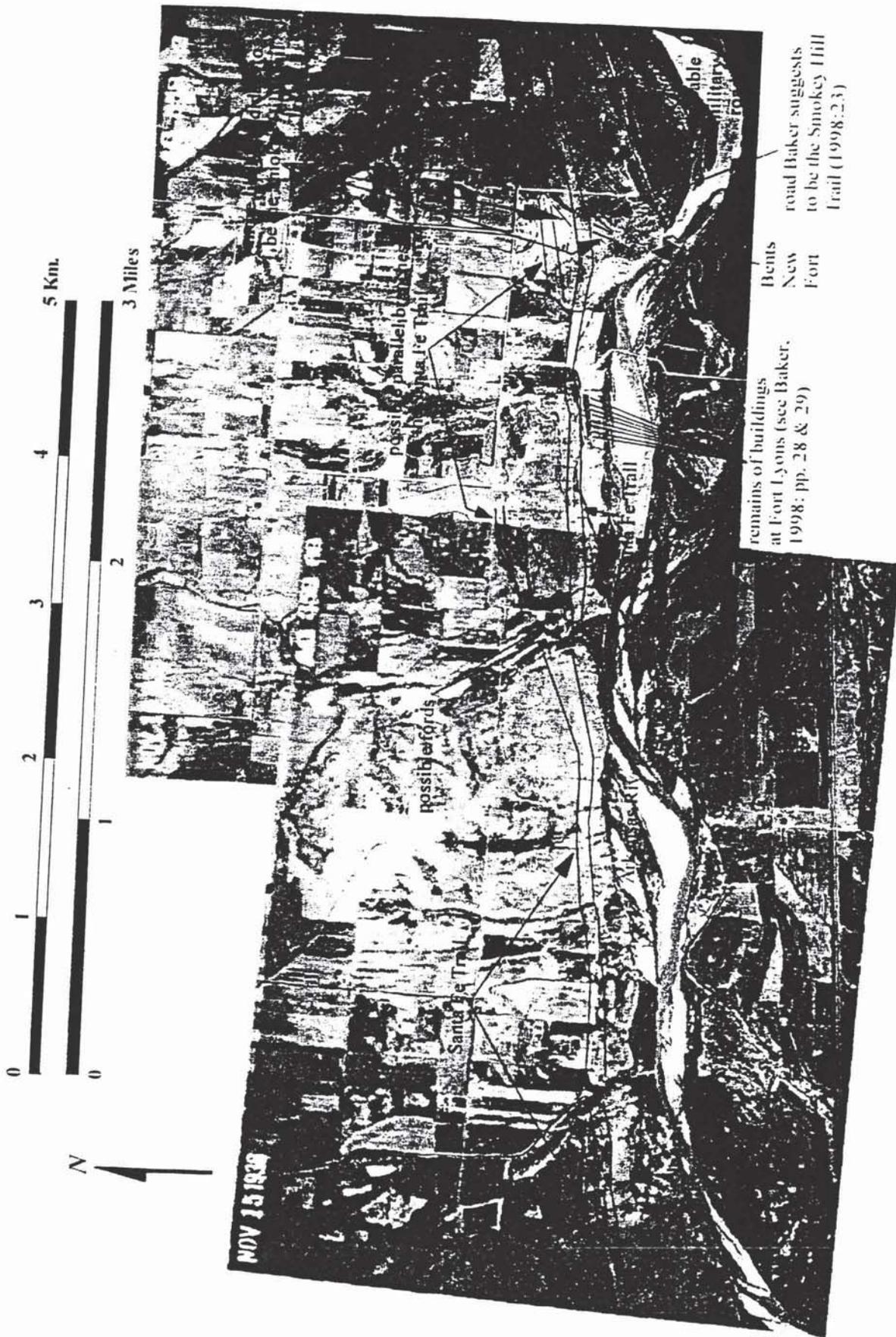


Figure 5. Fort Lyons, Bents New Fort, and the Santa Fe Trail along the Arkansas River, west of Lamar, Colorado.

and -83. Several roads are visible around Bents New Fort that probably were associated with its occupancy. One of these Baker (1998:23) suggests to possibly be the Smokey Hill Trail. However, further analysis reveals that this road merges with the Santa Fe Trail and then may have swung back south toward the river. A better candidate for the Smokey Hill trail is just to the west of the Baker's suggestion. For some reason it just barely shows up in Baker's oblique photograph. This road crosses the Santa Fe Trail and continues north-northeast before becoming invisible in cultivated fields.

All the other major anomalies occur in the photographs of the Sand Creek area itself (Figure 6). The first of these is a linear anomaly that was first seen coming southwest out of Dawson's Bend. Nine segments of this can be traced across seven photographs in the AG 298-18 to -33 series for 7.5 miles (Figure 7). In discussions with members of the Special Study Team it was discovered that some local landowners had mentioned an old wagon road running past their property. One segment of this anomaly passes this property.

Another linear anomaly was traced for $11\frac{3}{4}$ miles northwest along the north bank of Big Sandy Creek from just north of Dawson's Bend to north of the North Bend (Figure 8). This anomaly crosses five flight lines. Again, discussions with team members indicated the presence of an old wagon road on the north bank of Big Sandy Creek.

Segments of another linear anomaly come southwest out of the first large bend in Big Sandy Creek below the North Bend. This anomaly starts directly across the creek from numerous parallel anomalies. I saw these in the 1936 aerial photography and discounted them as likely being created by livestock going down to the creek. However, when reviewing the 1937 aerial photography which covers this area and further north, I realized that some of these anomalies could be traced for up to three miles, being interrupted here and there by cultivated fields. This indicated to me that these might not be stock trails. In fact, although some team members will disagree with me, I suspect that this may be the Three Forks area of the historical record.

Yet another linear anomaly starts on the west side of the North Bend, runs southeast for a little over a mile, then south-southwest for 2.2 miles, and then swings south-southeast for 1.4 miles before running out of the 1936 aerial coverage. Based on the directions this anomaly and the one running southwest out of large bend southeast of the North Bend were following when they ran out of the coverage, I assume they converged about a mile further south. Based on the map, I would further suggest they probably continued southeast along Rush Creek to its confluence with Big Sandy Creek.

As can be seen in Figure 2, the 1937 aerial photographic coverage was limited to the North Bend area. Virtually all the anomalies seen in this area on the 1936 photographs were also visible on the 1937 photographs. Because this coverage extends a little further north, one or two more segments of the wagon road on the north bank of Big Sandy Creek were noted and one other possible road was noted running more than 2 miles northeast from the first big bend north of North Bend before the coverage ended.

Photointerpretation of 1936 Aerials

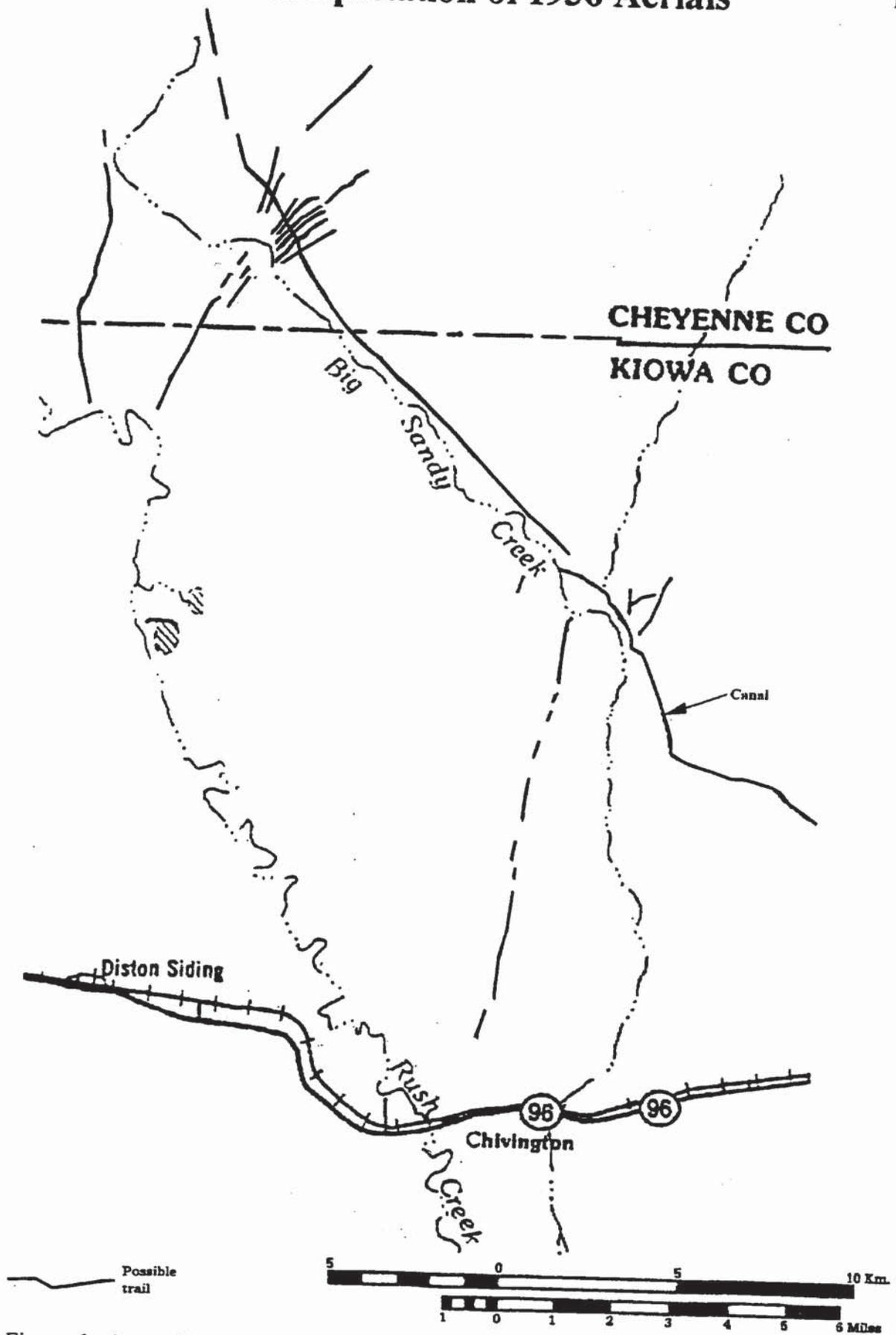


Figure 6. Anomalies seen in the 1936/1937 aerial photography of the Sand Creek area.



Figure 7. North-south wagon road from Dawson's Bend. 1936 aerial photography.

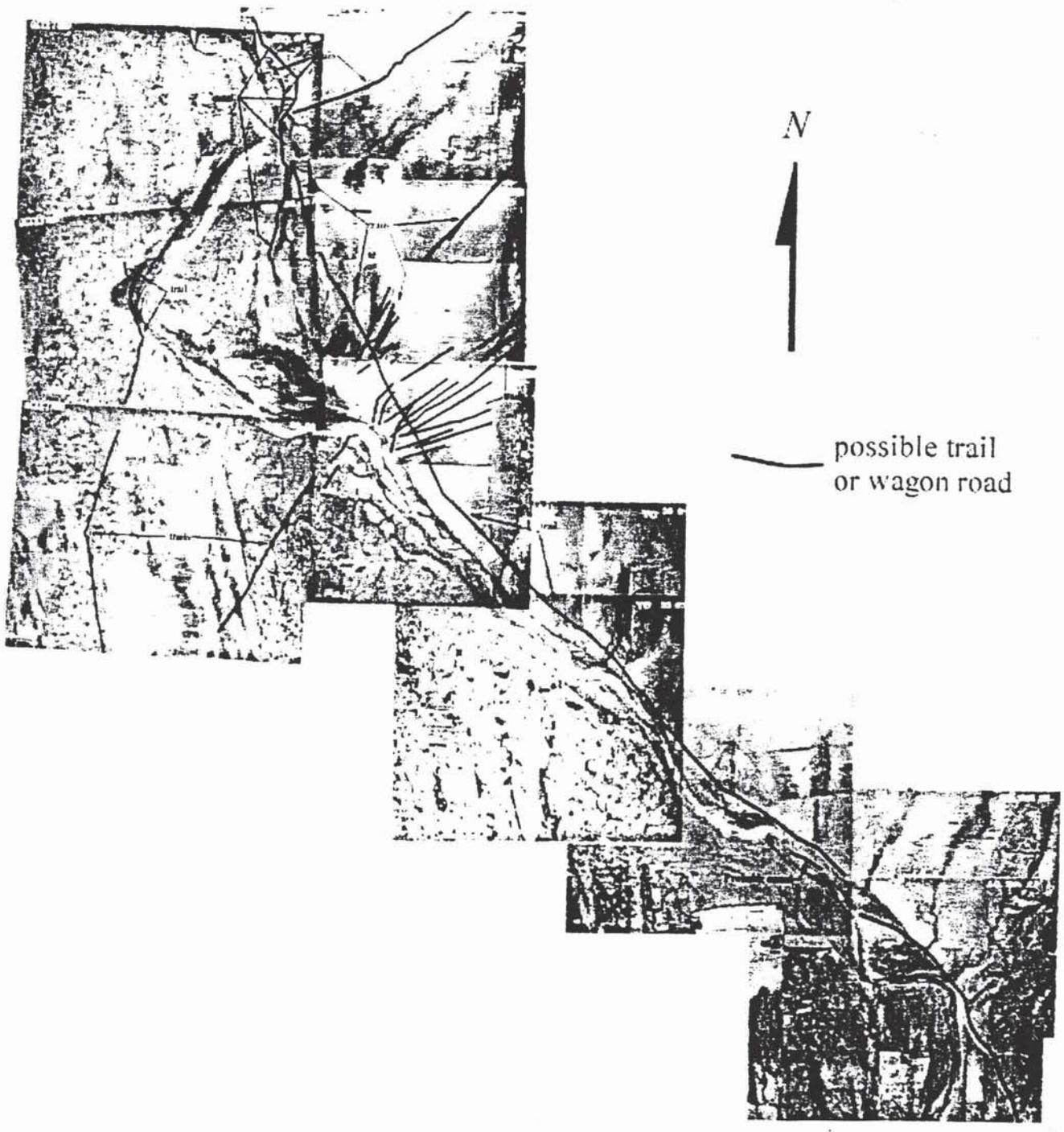
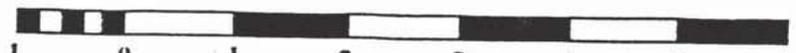
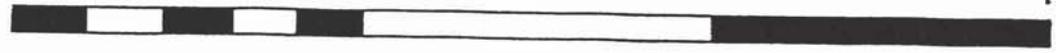


Figure 8. Anomalies possible representing a northwest wagon road, two trails, and what may be Three Forks, 1936 and 1937 aerial photography.

The analysis of the 1954 aerial photography, as previously mentioned, was extremely difficult due its extremely small scale. In fact, I had to use the 1936 aerial photographs to locate segments of the major anomalies seen in those photographs. Naturally, the Santa Fe Trail was still visible, Bent's New Fort was barely visible, and the remains of the building at old Fort Lyons were not visible. The westernmost segments of the Santa Fe Trail had to be viewed monoscopically because the stereoscopic coverage didn't extend far enough south. The westernmost three flight lines were viewed from north to south in order not to bias my choices as to which anomalies might be what we were looking for. As a result I noted 52 previously unrecorded anomalies on those three flight lines, some of which appeared to be associated with each other (Figure 9).

The northernmost frames in the third and fourth flight lines covered the same area as the 1936/1937 aerial photographs did. The possible wagon road on the north bank was still quite clear. However, I needed the earlier imagery to locate the anomaly coming out of the North Bend and the wagon road coming out of Dawson's Bend. Less of the wagon road was visible in the 1954 photographs and the anomaly coming out of the first big bend east of the North Bend was not visible at all. The anomalies I have suggested to be Three Forks were still visible but cultivated fields have obliterated many of them.

Some new anomalies were noted at the northern end of the fourth flight line but I suspect many to be associated with homesteads that were not there in the 1930s. Eighteen more anomalies were noted south of last segment of the north-south wagon road but the significance of these did not become apparent until I created a photo index (Figure 9). Only then did a pattern appear (Figure 10). A mile south of the last segment of the wagon seen on the 1936 photographs, it appears the road may have forked. One branch continued south for five more miles. This branch may have forked again after the first mile because parallel linear anomalies are visible. These merge again after 4.5 miles. The branch appears start trending to the southwest. Three and four miles southwest of the last segment of this part of the road, if indeed it is the road, two more parallel sets of linear anomalies are visible. The southeastern branch continues southwest for 5.5 miles, then there is a gap of slightly more than 2 miles, and another set of segments 5 miles long. Two miles to the northwest is the other branch. It runs southwest for 3.5 miles, then there is a gap of 4 miles, and another series of segments 3.5 miles long. The area in the gap contains many lakes, including Neeskah and King Reservoirs. At the southwest end of these two branches they are less than 0.3 miles apart and they have begun to trend more to the south-southwest. Only a slight change in direction to the south would take these branches into Fort Lyons/Bent's New Fort, 9 miles away.

What may be a third branch is located about 2 miles further southeast and appears to run 6.5 miles toward Lamar.

Four segments of a linear anomaly that passes to the southeast of Neegrunde Reservoir deserve brief mention. Although it is something of a stretch— $13\pm$ miles, these segments could connect with the western branch of the first fork noted on the north-south road from Dawson's Bend.

Sand Creek Massacre Project 1954 Aerial Photography

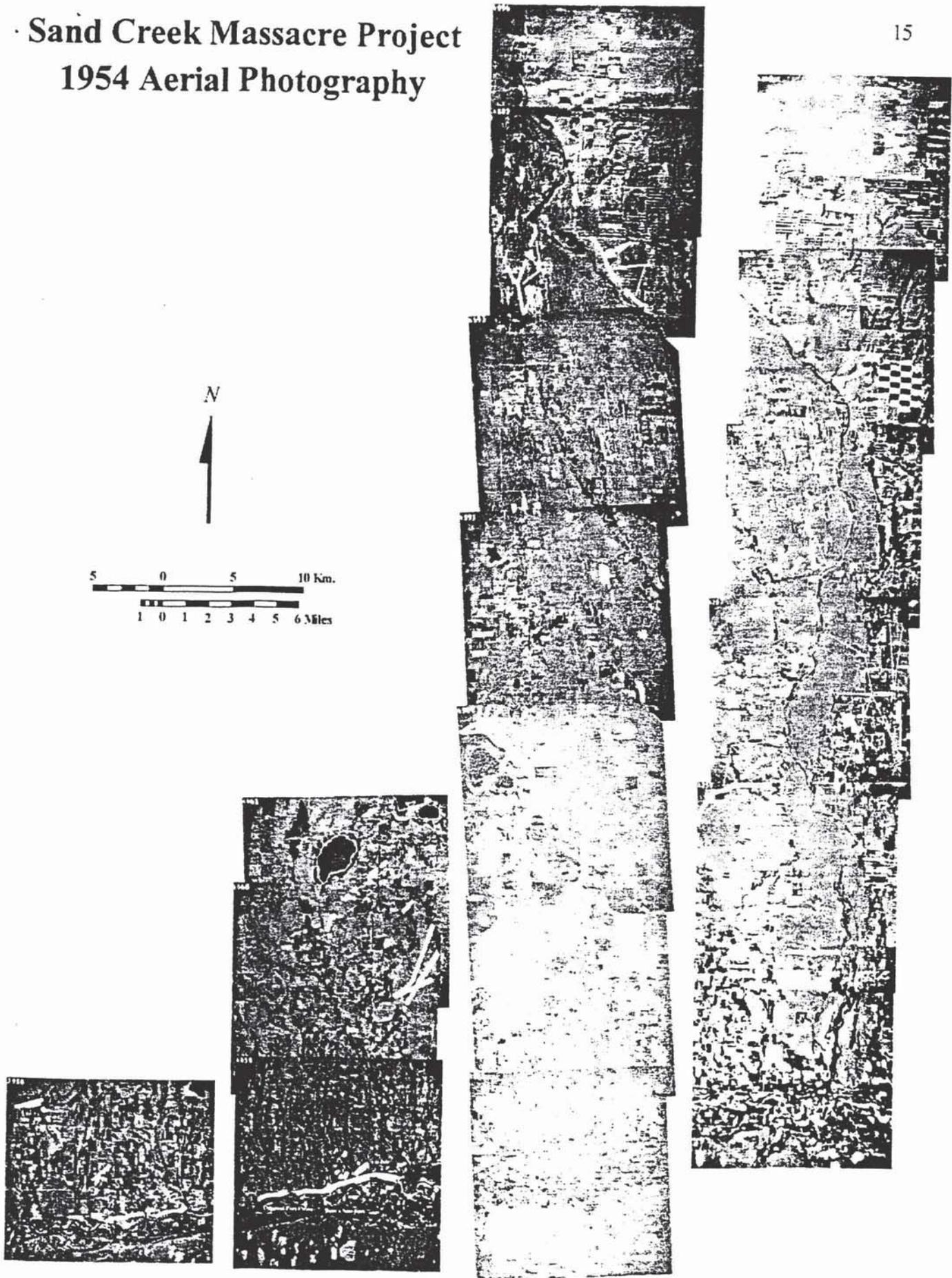


Figure 9. Photo-index for the 1954 aerial photography showing all the anomalies noted.

Photointerpretation of the 1954 Aerials

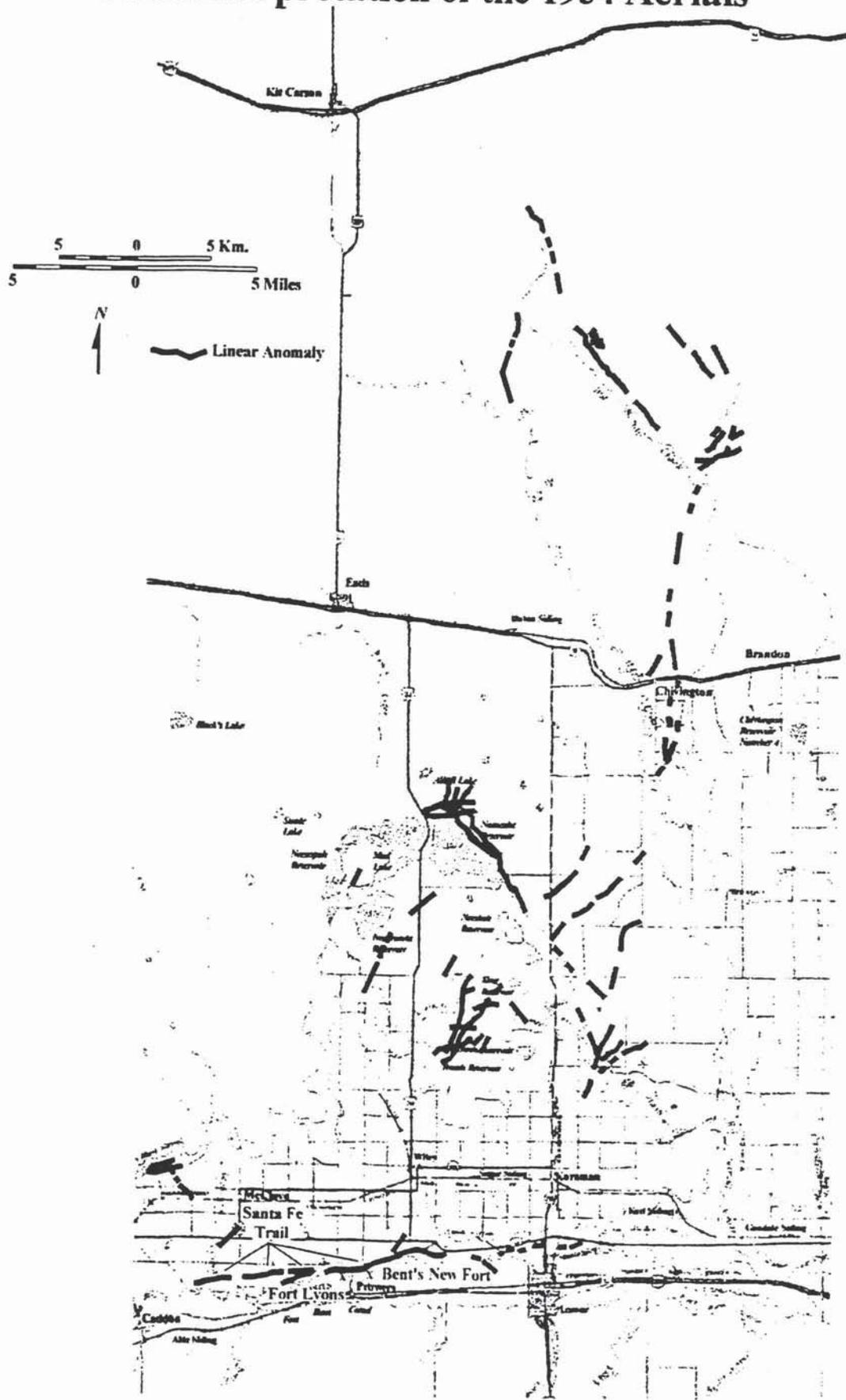


Figure 10. Anomalies seen in the 1954 aerial photography of the Sand Creek area.

Most of the linear anomalies north and east of Neenoshe Reservoir appear to be later, probably 20th Century.

The 1975 aerial photography consisted of four flight lines: one (2-17 to 2-19) covering Dawson's Bend; the second (2-106 to 2-108) and third (2-142- to 2-143) covering the North Bend; and one (2-192 to 2-193) whose location I was unable to determine.

The north-south wagon road coming out of Dawson's Bend was only slightly more visible in the 1975 aerial photography than it was in the 1954 aerial photography and no where near as visible as in the 1936 photographs (Figure 11). Two other linear anomalies that were visible in the 1936 aerials but not visible in the 1954 photographs were noted on the 1975 photographs. Of the five anomalies noted on Frame 2-17, four were noted visible on either the 1936 or 1954 aerials. The fifth anomaly was visible in the 1954 aerials but not the 1936 ones.

In the second and third flight lines, which cover the North Bend, the possible northwest wagon road, the anomaly running south-southwest from the North Bend, the anomaly running southwest from the first big bend east of the North Bend, and some of the anomalies I have suggested to be Three Forks are visible. The last have been severely impacted by the creation of the cultivated fields.

I didn't record anything on the fourth flight line.

Conclusions

More than 180 anomalies were recorded on the aerial photography from 1936 and 1937 (US Soil Conservation Service), 1954 (Army Mapping Service), and 1975 (US Geological Survey). Over 105 of these are segments of six major anomalies or known features: the Santa Fe Trail, the north-south Dawson's Bend wagon road, the north bank wagon road, what I'm suggesting to be Three Forks, the southwest trail from this Three Forks, and the North Bend south trail. What makes these six features important and lends credence to them actually being true features and possibly worthy of further research is the number of segments comprising them and the distances each can be traced (Table 2). To be able to trace these features for more than short distances suggests that their segments' association is more than coincidental.

Of the probably hundreds of other linear features that were visible, some perhaps should have also been included in the list recorded. A different photo-interpreter might well have chosen different features than I did. Generally there were solid reasons for not including them: too straight—more likely a current or former fence line or road or stock trail paralleling such a fence line; location—starting or ending at a fence corner or water source; or dimensions—too wide or too narrow. Sometimes the reasoning was a little less solid—just a gut-feeling, something just didn't seem right.

Table 2. Statistics of the Six Major Features

Feature	1936/1937 segments noted	1954 segments noted	1975 segments noted	Distance traced
Santa Fe Trail	14	6	0	5+ miles
Dawson's Bend north-south wagon road	9	23	4	32 miles
Big Sandy Creek north bank wagon road	3	6	2	12 miles
Three Forks 10 6 6	10	6	6	3 miles
Three Forks Bend southwest trail	5	0	2	2.4 miles
North Bend north-south trail	2	3	2	4.6 miles
total	35	52	16	59 miles

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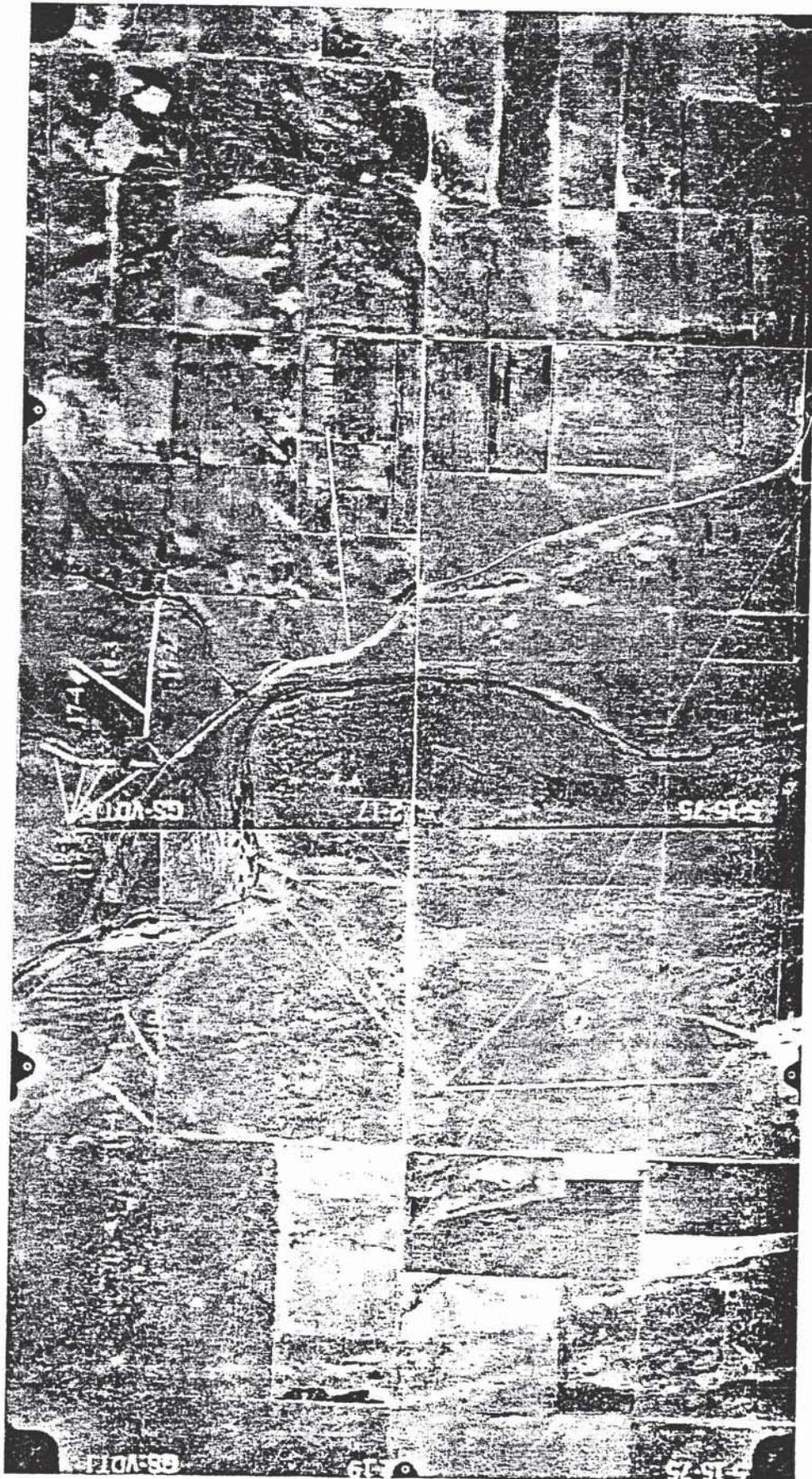
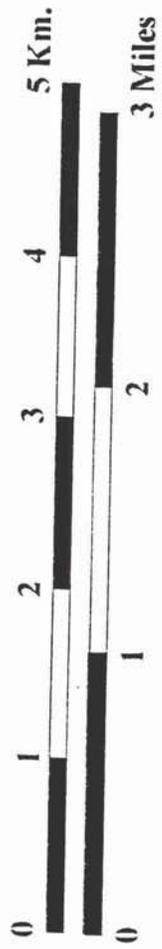


Figure 11. Dawson's Bend area: segments of the north-south wagon road are still visible in the 1975 aerial photography.

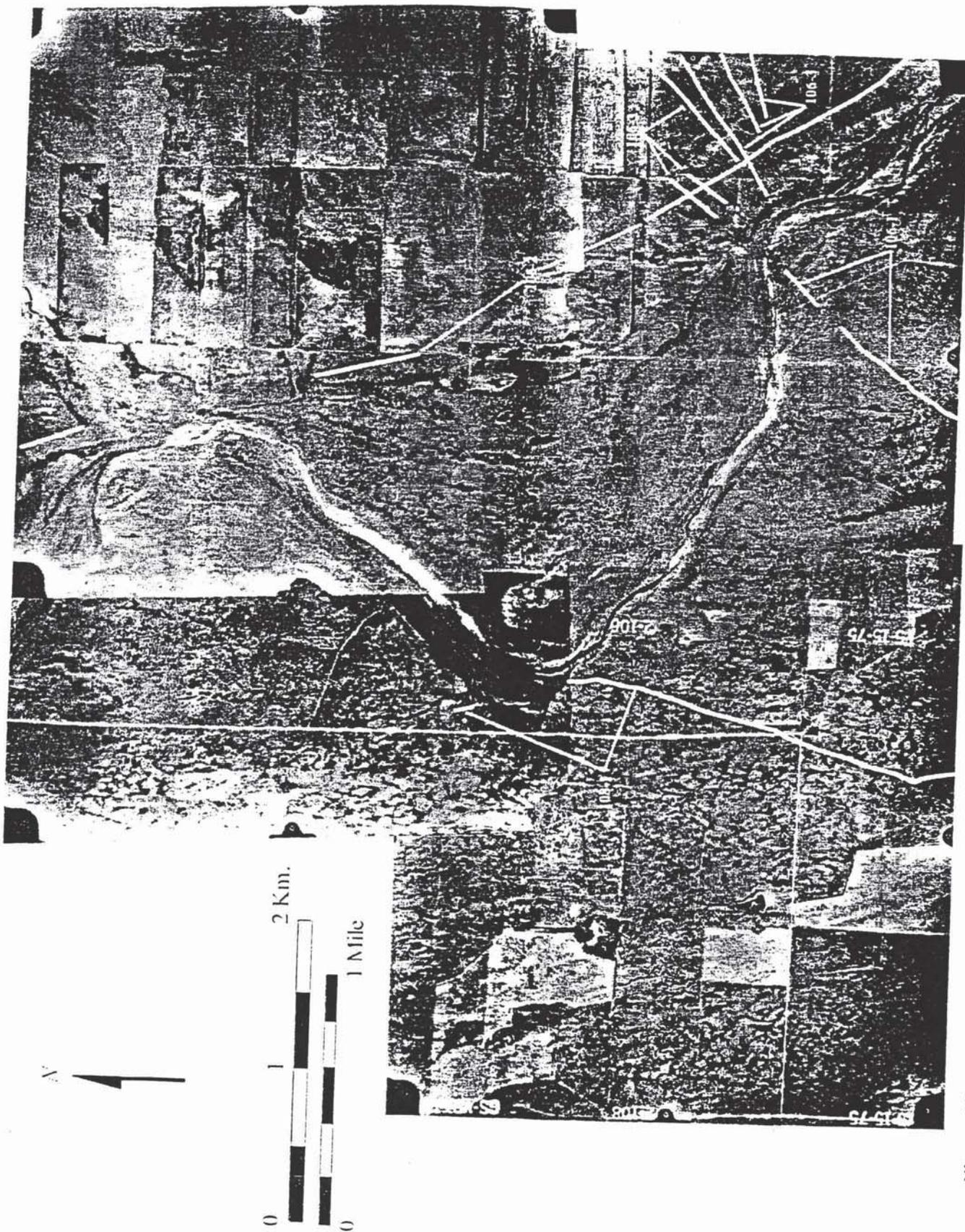


Figure 12. North Bend area, showing anomalies that may represent part of the possible northwest wagon road, two trails, and what may be Three Forks, 1975 aerial photography.

Appendix A
Descriptions of the anomalies noted
on the 1936 aerial photography

Sand Creek Massacre Special Study
Aerial Photography Interpretation

Year	Mission	Frames	Comments
1936	AG 297	79-85	no anomalies recorded
1936	AG 298	32	<p>1) Linear anomaly running SW from the S bank of Big Sandy Creek to a fence corner</p> <p>2) Linear anomaly running SSW from Dawson's Bend</p> <p>3) Linear anomaly starting at the canal SE of Dawson's Bend and running NE</p> <p>4) Linear anomalies: a. one runs from a bend in the canal E of Dawson's Bend NNE to a bend in the arroyo NE of Dawson's Bend, and b: the second forks off the first 2/3 of the way from the S end of the first and runs NE to possibly join #3</p> <p>A fifth linear anomaly is SE of #2 and runs over the bank from a fence line to the S down to a tree in the creek bottom, probably animal related</p>
1936	AG 298	30	1) Four more segments of 32-2
1936	AG 298	28	1) Four more segments of 32-2, the northernmost of which is the same as the southernmost of 30-1. This northernmost segment appears to fork but nothing further was visible on the east branch of the fork
1936	AG 298	26	1) Two more segments of 32-2, the northern part of the northernmost of which is the same as the southernmost of 28-1
1936	AG 298	24-18	Nothing recorded
1936	AG 298	62	several circular anomalies were noted on the last big oxbow bend on Rush Creek before it joins Big Sandy Creek
1936	AG 298	46	1) Linear anomaly runs NW along the N bank of Big Sandy Creek across the entire aerial
1936	AG 299	06	<p>1) This is a continuation of AG 298 46-1</p> <p>2) Short linear anomaly on the S side of Big Sandy Creek</p>

- | | | | |
|------|--------|-------|---|
| 1936 | AG 299 | 07 | 1) Linear anomaly runs NW along the N bank of Big Sandy Creek across the entire aerial, continuation of AG 298 46-1 |
| 1936 | AG 299 | 12 | 1) Linear anomaly runs NW along the N bank of Big Sandy Creek across the NE quadrant of the aerial, continuation of AG 298 46-1

2) Four segments of a linear anomaly that run SW from a large bend of Big Sandy Creek, east of the "North Bend". The northern three segments run parallel to each other and southern one appears to fork.

Although not recorded on this aerial, there are up to 20 linear anomalies on the N/E bank of the creek at the same bend form which #2 originates. It seems possible to me that this is the "Three Forks" area |
| 1936 | AG 299 | 13 | there is no #1

2) This is the same set of linear anomalies as #12-2 with one more segment further to the SW |
| 1936 | AG 358 | 81-84 | Bent's New Fort, the Santa Fe Trail, probable military roads, and remnants of Ft. Lyons are visible on 82-84 |
| 1936 | AG 359 | 69-70 | the Santa Fe Trail crosses these aerials from E to W, several possible fords were also noted. |

Appendix B
Descriptions of the anomalies noted
on the 1937 aerial photography

Sand Creek Massacre Special Study
Aerial Photography Interpretation

Year	Mission	Frames	Comments
1937	YO 56	54	<p>1) This is two segments of the same linear anomaly seen on the 1936 aerials as AG 298-46-1, AG 299-06-1, 07-01, and 12-1</p> <p>2) Linear anomalies that start at the bend on Big Sandy Creek, run NNE across #1, continue NNE across the rest of the aerial onto frame 52</p> <p>3) Linear anomalies that also start at the same bend but run ENE. These are the up to 20 anomalies noted on the 1936 aerials but not recorded and may represent "Three Forks"</p>
1937	YO 56	52	<p>1) Three more segments of the same linear anomaly seen on the 1936 aerials as AG 298-46-1, AG 299-06-1, 07-01, and 12-1; the southernmost is the same as the northernmost in #54-1</p> <p>2) This continues #54-2 a little further NE</p> <p>3) Linear anomaly that runs SW/NE across the top half of the aerial</p>
1937	YO 56	62	<p>1) Two segments of a linear anomaly that starts on the W bank of Big Sandy Creek N of the "North Bend", runs SE through the "North Bend", and then turns SW and runs across the rest of the aerial</p>
1937	YO 56	64	<p>1) This is the same linear anomaly as seen on the 1936 aerials as AG 299-12-2 and AG 299-13-2</p> <p>2) This is a continuation of #62-1. It runs SW across the N half of the aerial, then abruptly turns SE. It appears that this anomaly and #54-2/52-1 would eventually join.</p>
1937	YO 56	66	<p>1) One segment of the same linear anomaly seen on the 1936 aerials as AG 298-46-1, AG 299-06-1, 07-01, and 12-1; it is the same as the southernmost segment of 52-1</p>

- | | | | |
|------|-------|----|--|
| 1937 | YO 56 | 68 | <p>1) Four segments of the same linear anomaly seen on the 1936 aerials as AG 298-46-1, AG 299-06-1, 07-01, and 12-1; the three southernmost segments are the same as #52-1</p> <p>2) Linear anomaly that is the westernmost end of #52-3</p> <p>there is also a canal visible that empties into a shallow lake and two circular anomalies on the hill between the canal and Big Sandy Creek</p> |
| 1937 | YO 55 | 66 | <p>1) This is same linear anomaly seen on the 1936 aerials as AG 298-46-1, AG 299-06-1, 07-01, and 12-1 and the 1937 aerials as YO 56-52-1, 54-1, 66-1, and 68-1</p> |
| 1937 | YO 55 | 68 | <p>1) This is same linear anomaly seen on the 1936 aerials as AG 298-46-1, AG 299-06-1, 07-01, and 12-1 and the 1937 aerials as YO 56-52-1, 54-1, 66-1, and 68-1</p> |

Appendix C
Descriptions of the anomalies noted
on the 1954 aerial photography

Sand Creek Massacre Special Study
Aerial Photography Interpretation

Year	Mission	Frames	Comments
1954	USA 001 VV BE M 29 AMS	3978	there were a number of linear anomalies in this photo but most were either too straight or ended up at a water source
1954	USA 001 VV BE M 29 AMS	3980	#1: Santa Fe Trail viewed monoscopically #2: Linear anomaly running SW from the center of the photo across several fields into a shallow lake basin where it forks #3: Linear anomaly running NW across several fields before forking into three parallel lines. Just beyond the NW end are two parallel E-W trending linear depressions (wagon roads?)
1954	USA 001 VV BE M 35 AMS	4658	#1: Santa Fe Trail #2: NE trending road out of Bent's New Fort. This is the same as shows up in the 1936 photo. #3: Three pretty much parallel linear anomalies running NNE. The NW-most may be a continuation of #2. #4: Another linear anomaly running NE #5: Another linear anomaly running NE. It would be really stretching it to suggest that this too is a continuation of #2 & #3.

- 1954 USA 001 4660-
VV BE 4661
M 35
AMS
- Four interconnected linear anomalies: #1 runs NE, #2 runs ENE off from #3 and cuts across #1, #3 runs NNE past a stock tank, and a fourth appears to be an older two-track road coming off #3 and was not marked on the photo
- #4: Heavily eroded linear anomaly running NE
- #5: Five segments of what appears to be the same linear anomaly running NE through the center of the photo
- #6: Linear anomaly running NE between two shallow lakes
-
- 1954 USA 001 4585
VV BE
M 34
AMS
- Santa Fe Trail with possible segments on both the north and south banks of the Arkansas River
-
- 1954 USA 001 4587
VV BE
M 34
AMS
- #1, #2, & #3: these are the same as 4660-4661 #1, #2, & #3.
- #4-6: Not used
- #7: Linear anomaly running NE, more or less parallel with #1
- #8: Linear anomaly running NE, more or less parallel with #1
- #9: Linear anomaly running ENE and crosses #1
- #10: Linear anomaly running NW. Looks like it might cross #1 and #9 just south of a shallow lake.
- #11: Two segments of a linear anomaly running NW from near the right center of the photo
- #12: Linear anomaly running NNE, forks off from S end of #11
-
- 1954 USA 001 4589
VV BE
M 34
AMS
- #1: Linear anomaly running NW, passing NE of a shallow lake
- #2: Linear anomaly running NE from that shallow lake

			#3: Linear anomalies running NW, E-W, NEN, NE NNE, and N and intersecting each other. Most, if not all, appear to be fence line related.
1954	USA 001 VV BE M 34 AMS	4591	No anomalies recorded
1954	USA 001 VV BE M 34 AMS	4593	No anomalies recorded
1954	USA 001 VV BE M 34 AMS	4595	#1: Six segments of the suspected wagon road on the N bank of Big Sandy Creek seen in the 1936-1937 photos, one segment is newly seen #2: Three segments of the linear anomalies seen in the 1936-1937 photos in the area I think was Three Forks. Most of the segments seen in the earlier photos are not visible. #3: Three segments of the S trending linear anomaly seen in the 1936-1937 photos. The linear anomaly trending SW from the Three Forks area that was seen in the 1936-1937 photos was not visible.
1954	USA 001 VV BE M 30 AMS	4563	#1: Linear anomaly running SE in the upper right quadrant of the photo #2: Linear anomaly running NE from the center of the photo to intersect with #1 at its center #3: Linear anomaly running NW-SE at the left center of the photo
1954	USA 001 VV BE M 30 AMS	4561	#1: Linear anomaly running NNW in the upper left center of the photo. It ends at a homestead

- #2: Linear anomaly running NW in the upper left center of the photo a little west of #1. It also ends at a homestead
- #3: Two segments of a linear anomaly running NW-SE. This is the same wagon road seen in the 1936-1937 photos and as the two SE-most segments of #1 in photo 4595
- #4: Two parallel linear anomalies running NE near the center of the photo
- #5: Two segments of a linear anomaly that start on Big Sandy Creek just N of Dawson's Bend that join together and run ENE
- #6: Two segments of a linear anomaly that starts near the center of #5 and runs NNE
- #7: Three segments of the wagon road visible in the 1936 photos that started at Dawson's Bend and runs SSW
- 1954 USA 001 4259
VV BE
M 30
AMS
- #1: Three additional segments of the wagon road visible in the 1936 photos that started at Dawson's Bend and runs SSW
- #2: Linear anomaly running SW, possibly another segment of #1 but looks slightly different
- #3: Three segments of a linear anomaly running S, possibly a branch of #1 but looks slightly different
- 1954 USA 001 4257
VV BE
M 30
AMS
- #1: Four segments of a linear anomaly running S into the confluence of Big Sandy and Rush Creeks. The second segment from the S end forks and the third and fourth segments run parallel to each other and Big Sandy Creek
- #2: Three segments of a NE/SW trending linear anomaly, possibly a continuation of #1 and also a continuation of #2 on photo 4589
- Several canals are visible on the E side of Big Sandy Creek
- 1954 USA 001 4255
VV BE
M 30
AMS
- #1: Three segments of a linear anomaly running first NNE, then ENE in the upper center of the photo

#2: This is the same as #2 in photo 4257 & #2 in photo 4589

#3: This is the same as #11 in photo 4587

#4: This is the same as #12 in photo 4587

#5: This linear anomaly begins just E of the S end of #12 in photo 4587 and runs first NE, then E

#6: Four segments of a linear anomaly starting just E of the beginnings of #5 and #12 in Photo 4587 and running pretty much parallel to #5

1954	USA 001	4253	No anomalies recorded
	VV BE		
	M 30		
	AMS		

Appendix D
Descriptions of the anomalies noted
on the 1975 aerial photography

Sand Creek Massacre Special Study
Aerial Photography Interpretation

Year	Mission	Frames	Comments
1975	GS-VDTJ	2-17	<p>1) Linear anomaly running N/S, could be an old fence line but doesn't line up with current one</p> <p>2) Linear anomaly starting in an arroyo and running E and then slightly SE to a homestead, probably 20th century</p> <p>3) Linear anomaly starts from #2 E of the arroyo and runs NE</p> <p>4) Faint traces of a fork NW of the NE end of #3, may be the same as was seen on the 1936 aerials</p> <p>5) Two segments of a linear anomaly running N from the bank above Big Sandy Creek and W of the arroyo</p>
1975	GS-VDTJ	2-19	<p>1) The same as #17-5 but with two more segments bending more to the NE</p> <p>2) Four segments of the linear anomaly identified as the wagon road running SSW from Dawson's Bend that was seen in the 1936 & 1954 aerials</p> <p>3) Linear anomaly NW of Dawson's Bend, runs NE over the bank and down to a tree in the creek bottom, probably animal related</p> <p>4) Linear anomaly NW of #3, same as seen in the 1936 aerials</p>
1975	GS-VDTJ	2-106	<p>1) Two segments of the anomaly at the large creek bend (Three Forks?) running SW, was seen in the 1936 & 1937 aerials</p> <p>2) Two segments of the linear anomaly (wagon road?) on the N bank of Big Sandy Creek, seen in the 1936, 1937, and 1954 aerials</p> <p>3) Six more or less parallel linear anomalies, same as were seen in the 1936 and 1954 aerials—what I think is Three Forks</p>

1975	GS- VDTJ	2-108	1) Linear anomaly running SSW, then SE, from the North Bend, the same as was seen in the 1937 and 1954 aerials
1975	GS- VDTJ	2-143	1) Linear anomaly, probably the continuation of #106-2, seen in the 1936 & 1954 aerials