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Wyoming's Response to the US and Tribes, Volume VII, Appendix B, Part 2

Attorney General, State of Wyoming

WYOMING'S RESPONSE TO THE UNITED STATES' AND TRIBES' PROPOSED FINDINGS OF FACT, CONCLUSIONS OF LAW, INTERLOCUTORY DECREE AND SUPPORTING BRIEFS

VOLUME VII

Appendix B

(Part 2)

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Margaret V. Hampton CLERK

DEPUTY

IN THE DISTRICT COURT OF THE
FIFTH JUDICIAL DISTRICT
STATE OF WYOMING

IN RE: THE GENERAL ADJUDICATION)
OF ALL RIGHTS TO USE WATER IN)
THE BIG HORN RIVER SYSTEM AND) CIVIL NO. 4993
ALL OTHER SOURCES, STATE OF)
WYOMING

VOLUME 7

APPENDIX B

(PART 2)

This Part 2 of Appendix B responds to the Tribes' proposed Findings of Fact 98 through 161. Each Proposed Finding to which Wyoming responds is reproduced verbatim on a single page with Wyoming's response thereto on the page or pages immediately following.

N.B. Wyoming has not responded to every finding of fact proposed by the Tribes but the lack of a response to a finding should not be construed as an admission of the relevance or accuracy of such finding.

Tribes' Proposed Finding of Fact:

1. Unadjudicated In-Use Lands

99. Ronald E. Billstein testified for the United States on unadjudicated trust lands currently in irrigation. Mr. Billstein, a civil engineer specializing in water resource studies, earned both a Bachelors and a Masters degree in Engineering. He had ten years of work experience relating to the study of water resources (Tr. V. 18, pp. 1894-96). Throughout his testimony, Mr. Billstein demonstrated expertise in the analysis of current irrigation. He also exhibited knowledge of the irrigation systems and patterns of water use on the Wind River Indian Reservation (e.g., Tr. V. 33, pp. 2874-76). I find that Mr. Billstein is a well-qualified water resource planner.

Wyoming's Response:

99. The unadjudicated in-use lands study involved several other people at HKM, none of whom testified in support of the United States' claim. Messrs. Waples, Saunders and Johnston performed the majority of the study and made numerous interpretations in the field. Tr. 1899, 1928 (Billstein). Mr. Waples did testify concerning Type VII and Type VIII lands but not unadjudicated in-use lands. Tr. 3285 et seq., 3698 (Waples). Neither Mr. Saunders nor Mr. Johnston ever testified before the Master and were never qualified as experts. Mr. Billstein actually spent only three days in the field reviewing the claimed lands, primarily from a helicopter. Tr. 1986, 2125 (Billstein).

Tribes' Proposed Finding of Fact:

100. The study of trust lands currently in irrigation was undertaken for the United States under the direction and control of Mr. Billstein, by HKM Associates.

Wyoming's Response:

100. The most important element to consider regarding the unadjudicated in-use study is that the analysis is based on those lands alleged to be actually "receiving water" in 1980. This must be kept in mind when reviewing the HKM study since it is the touchstone of both the United States' and State of Wyoming's analyses. Mr. Billstein stated unequivocally that his conclusions only concern lands in-use in 1980. Tr. 2047 (Billstein).

Tribes' Proposed Finding of Fact:

101. Under Mr. Billstein's direction, existing information, including State, BIA, and SCS records, was reviewed to develop knowledge of the existing and historic irrigation on the Reservation and to establish the land base to be studied (Tr. V. 19, pp. 1898-901; U.S. Ex. C-138, pp. 2-4).

Wyoming's Response:

101. The Bureau of Indian Affairs and Soil Conservation Service Records are outdated and cannot help determine irrigation water use in 1980. See Wyoming's Response to Tribes' Proposed Finding of Fact 102.

Tribes' Proposed Finding of Fact:

102. The United States consultants used aerial photography in their study of historic lands, including lands currently in irrigation. The most recent set of aerial photographs of the Reservation available -- taken in 1979 and 1980 -- was extensively used (Tr. V. 13, pp. 1901-04). These were black and white photographs, in a scale of 1" = 1,000' (U.S. Exs. C-56 through C-136; C-138, p. 3).

Wyoming's Response:

102. The Court must not be misled by the subtle inferences of Tribes' Proposed Finding of Fact 102. While it is true that the 1979-1980 aerial photography covered the entire area of claimed unadjudicated in-use lands, this photography was only used to review those unadjudicated in-use lands lying outside the FIPs.

Additionally, Mr. Billstein's conclusions that lands are in-use purport to relate only to the 1980 season. Tr. 2047 (Billstein). Yet the photography used to identify irrigation in 1980 includes aerial photography flown on October 3, 1979. Approximately 50% or 17,312 acres of the total land claimed to have received water in 1980 was identified from the 1979 photography. U.S. Exhs. WRIR C-56 through C-136.

Finally, the outdated nature of the Bureau of Indian Affairs (BIA) and Soil Conservation Service (SCS) materials relied on to determine which lands were in-use in 1980 must be noted. The BIA study was based on 1954 data and the SCS study was based on data from 1954 through 1960. See Wyoming's Response to United States' Proposed Findings of Fact 5 and 11.

Tribes' Proposed Finding of Fact:

103. The historic lands study base was mapped by EKM on aerial photographs (U.S. Ex. C-138, pp. 2-5).

Wyoming's Response:

103. HKM's extensive reliance on aerial photographs was misplaced primarily because the head of HKM's study, Mr. Billstein, assumed the photographs to be of a higher degree of accuracy than they were. HKM's heavy reliance on less accurate photography renders their unadjudicated in-use lands study and the resulting conclusions suspect.

Tribes' Proposed Finding of Fact:

104. In analyzing the aerial photographs, HKM used a stereoscope. This device gives a three-dimensional effect to aerial photographs, enabling the viewer to see, for example, the contour of ditches. The steroscope used also enlarged the image three times. Under Mr. Billstein's direction, the aerial photographs covering the historic study areas, outside of the Federal Irrigation Projects, were stereoscopically analyzed by Mr. Ralph Saunders of HKM, an experienced user of stereoscopes (Tr. V. 18, pp. 1907-12). The stereoscope was used to help identify lands in current and historical use, and the source of water for each tract (Tr. V. 33, pp. 2896-902). The use of the stereoscope is "a major improvement over just pure pictorial analysis" (Tr. V. 12, p. 1913).

Wyoming's Response:

104. The evidence depicting the location and extent of current use of unadjudicated lands, as claimed by the United States, is not reliable. Its unreliability is due to the use of outdated information within the FIP lands and a questionable stereoscopic analysis of those lands outside the FIPs.

The evidence of inaccurate photo-interpretation from stereoscopic viewing and lack of ground truthing can be seen on Wyo. Exh. WRIR HSO-19 (hand-held photographs mounted on foam board) where features of varying heights contrast sharply in elevation with the ground through stereoscope. It is baffling that these features were included within these tracts even after Mr. Billstein made his field trip to visit each tract outside the FIPs. Tr. 1912, 1937, 2900-2902 (Billstein). Tract 22-9, shown in the third hand-held photo in second row, has 13 acres of brush cover that could not be presently irrigated or fit the category of Type II land. In tract 13-5, shown in the first and second photo in row 4, the entire 4 acres of Type II land lie within the fenced highway right-of-way on the north side of Hwy. U.S. 26. there are 2.2 acres with paved parking, picnic shelters and toilet areas, all of which would greatly contrast with the ground elevation.

In Tract 22-5, shown in the fifth photo in row 2, there are areas of rocky ground and sage brush within Type IV lands. Tract 22-27, shown in the fifth, sixth and seventh hand-held photos in row 3, has a fenced roadway, housing and brush included in the Type IV acres. Had a stereoscopic analysis been made of the FIP lands, it would have been apparent that Tracts 1-133 and 1-134 were dry, covered with sage brush, lie above the ditch and should not have been classified as Type V land. Wyo. Exh. WRIR HSO-17 (aerial photo "15" 179-23, first photo, first row).

Evidence shows that tracts which appear light grey on the hydrographic photos are not necessarily just recently harvested and thus irrigated in 1980 or 1979. An example of a field which changes tone from a dark grey with a crop to a light grey upon harvesting is located on photo "16" 379-108 in the NW1/4 NE1/4 of Section 36, T2N, R1E. This field does not compare to other light-toned or light grey tracts nearby with no evidence of irrigation. Tr. 13123 (Sostrom).

Additional evidence of land claimed to be irrigated in 1980 which in fact was not irrigated in 1980 is found in portions of Tracts 2-98 and 2-102 of photo "17" 279-67. Tr. 13012-13029 (Sostrom). By first comparing Tracts 2-98 and 2-102 to the example in photo "16" 279-108 above, it is apparent that the light grey

areas are not as fine-textured or uniform in tone. This would cause a photo interpreter to think there is a dissimilarity and possibly not a harvested crop. The light grey in the tracts 2-98 and 2-102 contains a mottled pattern of darker greys which is similar to the mottling on idle land tracts 2-10x of photo "15" 179-25, and 2-26x and 2-27x of photo "16" 379-110 which could be patterns from weeds and other vegetation common to previously-irrigated land. Tr. 12995 (Sostrom). A further observation of tracts 2-98 and 2-102 can be made on the right-hand (east) edge of overlap on photo "16" 379-112 which provides an image of the ground with light reflecting from a different angle during the same day of 1980. This technique serves the same purpose as a second photo to assist with interpretation. Tr. 1914 (Billstein). The color infrared photograph reveals dark purple on these tracts which indicates a nonvigorous growth of crops or weeds as compared to the brilliant red of a well-irrigated, healthy crop. The color infrared photo, dated 1974, when compared to the 1980 black and white photos for the adjacent tracts, shows irrigation use is declining over time. The adjacent tracts show vivid red on the color infrared photo but a dark grey on the 1980 photo. Tr. 13014, 13077, 13061 (Sostrom).

The conclusion to be drawn from this photointerpretation exercise is that there is overwhelming evidence that portions of these tracts are not irrigated and/or received no irrigation water during 1980. Therefore, the acreage in U.S. Exh. WRIR C-137A is unreliable.

Wyo. Exhs. WRIR HSO-2A, HSO-3 and Appendices 8 and 11 to Wyoming's Proposed Findings of Fact contain reliable evidence of unadjudicated in-use lands irrigated in 1980.

Tribes' Proposed Finding of Fact:

105. Aerial photographs from 1936, 1939, 1948, 1954, and 1969 were also reviewed by HKM to supplement the analysis of the more recent photos (U.S. Ex. C-138, pp. 5-6).

Wyoming's Response:

105. There is no evidence in the Record that indicates how the earlier photography was specifically incorporated into the identification of land currently in use in 1980. It is unclear as to how historic use can provide much assistance in making accurate determinations of use in a single year. The aerial photographs taken in 1936, 1939, 1948, 1954 and 1969 were never entered into evidence. There is no indication regarding the extent of their coverage of the Reservation. It is unlikely that the earliest years covered all of the tributary drainages and outlying areas in which the stereoscopic analysis was used. There is also no indication of the season in which the photographs were taken nor the quality of those photographs.

Tribes' Proposed Finding of Fact:

106. Lands identified on the aerial photographs as being currently or historically irrigated were assigned a land type defined as follows:

Type I: Intensively Irrigated Cropland

Usually have an adequate or nearly adequate water supply. Generally devoted to raising row crops or crops in rotation. Irrigation systems are generally well developed and maintained.

Type II: Irrigated Cropland With An Adequate Water Supply. Generally devoted to raising hay crops or hay, small grains, and pasture. Irrigation systems may not be as well developed and maintained as Type I.

Type III: Meadow Irrigation

Usually have an adequate early season water supply and may have an adequate year round supply. Usually located at higher elevations and are devoted to raising native or improved grass-legume hay. Irrigation systems are generally poorly developed and continuous irrigation is common.

Type IV: Occasionally Irrigated -- Partial Service

Lands irrigated sporadically or irregularly by water spreading systems or by conventional systems. Water supply may be limited. Native hay and pasture are the usual land uses.

Tribes' Proposed Finding of Fact:

Type V: Subirrigated or "Seeped" Lands

Are not intentionally irrigated but receive sufficient water from adjacent irrigated lands, canals, and/or from streams to provide beneficial use.

Type VI: Irregularly Irrigated Lands

Lands are irrigated sporadically or irregularly by conventional systems. They are poor quality, and require a higher level of irrigation management. Water supply is adequate. Native hay and pasture are the usual land uses.

Type VII: Idle Lands -- Historic

Lands not now being irrigated but having a history of irrigation.

Type VIII: Idle Lands -- Undeveloped

Undeveloped arable lands within the Wind River Federal Indian (Irrigation) Project. (State's Ex. HB-8; Tr. V. 19, pp. 2040-41).

Wyoming's Response:

106. This finding adds confusion to the Tribes' analysis of unadjudicated in-use land. It appears that some reliance was placed on land types. Furthermore, the use of land types to designate the degree or type of current water use is in direct conflict with Mr. Stetson's analysis that all land types should receive a full duty of water. It is inconsistent to identify land types which are "irrigated sporadically or irregularly" (Type IV and VI), limited in water supply (Type IV), and unintentionally irrigated (Type V) and later assign a full water requirement. U.S. Exhs. HS-3, HS-4 and HS-5.

The inclusion of Type VII and Type VIII lands is immaterial to a finding regarding unadjudicated in-use land. In fact, Mr. Billstein specifically excludes Types VII and VIII on the cited transcript pages. Tr. 2040-2041 (Billstein).

Tribes' Proposed Finding of Fact:

107. The results of the office analysis by EKM were recorded on the aerial photographs. Then the lands identified were screened for trust ownership, based on BIA data (Tr. V. 39, pp. 3224-25).

Wyoming's Response:

107. There is no evidence in the Record concerning the information that Mr. Billstein actually used to screen for trust ownership. Instead, the United States introduced U.S. Exh. C-317 for its determination of ownership. A careful perusal of these BIA Indices reveals that tracts 8-7, 8-8, 8-9, 8-10, 1-34, 1-53, 4-7, 5-58, 6-1 and 23-17 are not currently held in trust by the United States for the Tribes or individual Indians. These tracts comprise 111.8 acres with a diversion requirement of 425.6 acre-feet and a net irrigation requirement of 212.8 acre-feet. See Wyoming's Proposed Findings of Fact 28-1 et seq.

Tribes' Proposed Finding of Fact:

108. Consultants for the United States visited in the field each tract identified by stereoscopic analysis as being historically irrigated (Tr. V. 18, pp. 1923-24). These field inspections were undertaken by qualified land typing experts (Tr. V. 19, pp. 2076-77). Along with the stereoscopic work, this field review comprised about three man-months of work (id., p. 2109). In the field, the United States consultants examined the condition of irrigation facilities, and mapped on aerial photographs the boundaries of the areas of trust land in use (id., pp. 2072-73; U.S. Ex. C-138, pp. 8-9). "Any significant obstacle" such as a road or farmstead was eliminated (Tr. V. 29, p. 2587).

Wyoming's Response:

108. There is no evidence in the Record that each tract was visited in the field. This proposed finding is an attempt to combine the methods used on lands outside the FIP with lands within the FIP. This tends to increase the appearance of study intensity.

The field review by Billstein in February, 1980, was only on lands outside the FIP boundaries. Tr. 1937 (Billstein). Field investigations were conducted on the FIP lands in 1978. Tr. 1988 (Billstein); United States' Proposed Finding of Fact 6. No field investigations were conducted for FIP lands in 1980, the year of interest.

On cross-examination, Mr. Billstein acknowledged that the lands he had classified as unadjudicated in-use included some obstacles such as trees and brush. Tr. 2628 (Billstein). HKM apparently attempted to exclude some obvious obstacles such as major and secondary roads and major farmsteads. Tr. 2587 (Billstein). However, examination and review of the aerial photographs admitted as exhibits C-56 through C-136 reveal numerous obstacles that remain within the delineated boundaries of unadjudicated in-use lands. The obstacles include haystacks and stockyards, drain ditches and canals, buildings and farmyards, roads and dikes,

draws and ravines, and stockponds and reservoirs. Tr. 2599, 2600, 2628 (Billstein). Examination of the infrared aerial photography referred to during Mr. Billstein's cross-examination reveals that he also failed to exclude several high, dry, alkali parcels. Tr. 2208, 2609, 2647 (Billstein). This last category of lands contains very little moisture or vegetation cover and therefore lacks any red color on the infrared photography. Tr. 2208 (Billstein).

Tribes' Proposed Finding of Fact:

109. After the field program, HKM personnel interviewed many Indian farmers to confirm the extent of unadjudicated trust lands in irrigation (Tr. V. 18, pp. 1933-35). BIA personnel and ditchriders were also consulted (id., pp. 1935-36). The results of the field program were further reviewed and verified by Mr. Billstein, who checked those findings against the assessment records of the irrigation districts, Soil Conservation Service data and color infrared photographs (id., pp. 1936-37; Tr. V. 28, pp. 2587-88). In addition, Mr. Billstein undertook a field review of all tracts, and the source of water for those tracts, outside of the Federal Irrigation Projects, as well as those in the LeClair Irrigation District (Tr. V. 19, p. 1986; V. 33, pp. 2900-04; 2907-09).

Wyoming's Response:

109. The evidence shows that less than half of the land owners outside the FIP lands were interviewed. Furthermore, only Mr. Twitchell and Mr. Crook were interviewed regarding lands irrigated within the FIP lands. Tr. 1926, 1932-1935, 2079 (Billstein). Since only 28% of the land occurs outside of the FIPs, interviews were only conducted with landowners for about 14% of the total land claimed. See U.S. Exh. C-137A; Wyoming's Response to United States' Proposed Finding of Fact 3.

There is no evidence in the Record that the assessments were in fact made or that the assessments were actually paid. The assessment record maps are kept on old aerial photographs, dated about 1954, which are of questionable value in identifing 1980 irrigation use. Mr. Twitchell's personal knowledge was relied upon for the review of the 1978 mapping by Mr. Waples. Since Mr. Twitchell did not testify, his background, qualifications and recollection of irrigation use are unknown. Tr. 1936, 1988, 2034, 2150 (Billstein); Wyo. Exh. WRIR HB-56; U.S. Exh. WRIR C-138.

Color infrared photos obtained by the United States' experts are dated 1972 to 1978. Tr. 1937 (Billstein). The 1968-1970 SCS irrigated lands inventory

utilized black and white aerial photography dated September and October of 1954, 1955, and 1960. Tr. 1937, 2337, 2867 (Billstein); Wyo. Exhs. HB-53 and HB-59. These photos depicting irrigation in past points of time add little to the analysis of lands in-use in 1980.

The field review by Billstein in February, 1980, was performed only on lands outside the FIP boundaries. Tr. 1937 (Billstein). Field investigations were conducted on the FIP lands in 1978. Tr. 1988 (Billstein); United States' Proposed Finding of Fact 6.

Tribes' Proposed Finding of Fact:

110. Mr. Billstein concluded that 34,427 acres of unadjudicated trust lands (51 acres thereof are in the off-Reservation part of Arapahoe Ranch) were in use (Tr. V. 33, p. 2941a; U.S. Exs. C-140, C-141). The location of each tract and its water source is found on U.S. Exs. C-56 through C-136.

Wyoming's Response:

110. There are numerous factual deficiencies in the United States' claim for unadjudicated in-use acreage. The deficiencies and alternative evaluation by the State of Wyoming are discussed in detail in Wyoming's Proposed Findings of Fact 24-1 et seq. and support therefor. In summary, these deficiencies and alternatives are:

1. Inclusion of land outside of the stipulated Reservation boundaries. See Wyoming's Proposed Finding of Fact 24-15 and support therefor.

2. Inclusion of miscellaneous nonarable and nonirrigable obstacles such as buildings, rocks, reservoirs, trees and brush. See Wyoming's Proposed Finding of Fact 24-16 and support therefor.

3. Inaccuracies in the aerial photography and therefore, acreage measurements. See Wyoming's Proposed Finding of Fact 24-17 and support therefor.

4. Inclusion of nonarable land. See Wyoming's Proposed Finding of Fact 24-18 and support therefor.

5. Inclusion of land not irrigated in 1980. See Wyoming's Proposed Findings of Fact 24-20 and 24-21 and support therefor.

The State of Wyoming's more reliable investigation shows that 17,724.1 irrigable acres were irrigated in 1980. See Wyoming Amended proposed Finding of Fact 24-11 and support therefor.

Tribes' Proposed Finding of Fact:

111. Henry Sostrum testified for the State on unadjudicated trust lands currently in irrigation. Mr. Sostrum has worked primarily as a highway engineer (State's Ex. HSO-1; Tr. V. 133, pp. 12567-76). In that capacity, he had occasion to use aerial photography to locate gravel deposits, and lands under irrigation (id., pp. 12570, 12572-74). I find nothing in Mr. Sostrum's education, experience, or testimony which reflects a detailed understanding of the methods of analyzing current irrigation on the scale involved in this case.

Wyoming's Response:

111. Mr. Sostrom has extensive experience in engineering, particularly in the area on and around the Wind River Indian Reservation. Wyo. Exh. HSO-1. He is presently employed by Banner Associates, Inc. as project manager for the Big Horn Adjudication. Mr. Sostrom's other duties at Banner include design of miscellaneous civil engineering projects in water resources development, site grading and transportation plans, writing of project specifications for construction projects, as well as construction and contract management of large-scale projects.

Prior to joining Banner in 1975, Mr. Sostrom gained several years of experience at the Wyoming Highway Department, where his highway location work involved the evaluation of irrigated lands. Since highways commonly cross irrigation projects and act as a dike and a nuisance to a rancher or irrigator, Mr. Sostrom's duties with the Highway Department required the determination of adjudicated lands; lands actually receiving water; and how, despite the highway, to continue the supply water to those lands with the least interruption or infringement. This type of work requires extensive research of the State Engineer's and the Board of Control's files, detailed land

surveying, personal contact with irrigators regarding their system operation, estimating construction costs, and a great deal of photographic interpretation. Tr. 12572-12574 (Sostrom). There are many similarities between the work involved with the Highway Department and the work involved in reviewing the United States' claim for historically irrigated lands. Mr. Sostrom is eminently qualified to render opinions on presently irrigated lands.

In addition to his experience and training as an engineer and photographic interpreter, Mr. Sostrom is intimately familiar with the Wind River Indian Reservation, having lived in the area all of his life. Tr. 12568 (Sostrom).

Tribes' Proposed Finding of Fact:

112. Mr. Sostrum's conclusions on unadjudicated in-use lands were based on the interpretation of a single set of black and white aerial photographs, viewed by five persons under his direction. (Tr. V. 142, p. 13067; V. 141, pp. 12951-52).

Wyoming's Response:

112. The study of unadjudicated in-use lands was conducted primarily under the auspices of Mr. Henry Sostrom. The study consisted of three parts: (1) a color infrared aerial photography study, followed by (2) a black and white aerial photography study, and finally (3) a tract-by-tract analysis of the United States' claim. Tr. 12615 (Sostrom).

The purpose of the color infrared aerial photography study was to preliminarily evaluate the historically irrigated lands on the Wind River Indian Reservation. Tr. 12621 (Sostrom). The primary tool for this initial study was color-infrared aerial photography (CIR) flown between 1974 and 1979 that provided full coverage of the Wind River Indian Reservation. Tr. 12623 (Sostrom). Mr. Sostrom also utilized USGS topographic contour maps, USGS orthophoto quads, SCS-State irrigated lands study photos, BIA land status maps, and the Water Division No. 3 Adjudication Record (commonly referred to as the "Blue Book"). Tr. 12621 (Sostrom).

Mr. Sostrom conducted a very intense photo interpretation analysis on the CIR for physical evidence of presently or historically irrigated fields. Historically irrigated fields whose outline or ditches

were barely discernable from long periods of idleness were outlined and included within the total acres of the identified historically irrigated lands. Tr. 12624 (Sostrom)

The boundaries between the trust and fee lands were plotted onto the acetate overlays of the CIR on which the identified historically irrigated fields were outlined. The boundaries were established from a 1969 BIA land status map. There was no attempt at this stage to distinguish lands with adjudicated water rights from unadjudicated in-use lands, as the interest was in determining all acres on which irrigation actually has been and is being conducted.

The outlined areas were measured with a planimeter and summarized by fee and trust for each stream. The acreage total of historically irrigated trust acres, which include present and past unadjudicated and adjudicated lands, is 35,860 acres. Tr. 12621 (Sostrom). The black and white aerial photo study was conducted during October 1979 through mid-January 1980.

The black and white photos (scale: 1" = +/- 1000') were flown in October 1979 and June and July 1980. The same data and photographs used in the color infrared study were utilized to assist with the interpretation of the black and white photos which showed more detail than the infrared photos. Tr. 12622 (Sostrom).

The historically irrigated areas identified from the photos were outlined on acetate overlays on the black and white photos and categorized as "Presently Irrigated," "Subirrigated," "Previously Irrigated," or "Possibly Previously Irrigated." "Presently Irrigated" are lands identified as having had water applied during the season the photography was taken as well as lands appearing to be idle but estimated to have been irrigated within the most recent decade. "Previously Irrigated" lands are those identified to be idle with irrigation systems readily visible. These lands may have a light cover of sagebrush apparent. "Possibly Previously Irrigated" are lands for which it is difficult to conclude whether or not they were irrigated regularly in the past. The area is often overgrown in sagebrush, small trees, or willows. It is now similar in appearance to the surrounding range land. The outline of the previously irrigated land is generally identifiable on the photo. Tr. 12624 (Sostrom).

The fee-trust ownership boundaries were tranferred to the acetate overlays from a 1976 BIA land ownership map, from Tribes' Exh. M-1 and data from the county clerks of Fremont and Hot Springs County.

The acres for each tract were determined with a planimeter and summarized by "trust only" and "trust plus fee" for each stream. This summary appears in Exhibit HSO-H:

	Unadjudicated	Adjudicated	
Presently In-Use	26,100	5,000	31,100
Previously Irrigated	4,500	2,800	7,300
Possibly Previously Irrigated	2,100	1,100	3,200
	32,700	8,900 =	41,600

Tr. 12623 (Sostrom). Although Mr. Sostrom misspoke himself and stated that there were only 24,700 unadjudicated presently in-use lands, the State acknowledges and the Record reflects that the correct acreage is 26,100. This is substantiated in the record by the total acreage of unadjudicated plus adjudicated presently in-use lands shown on Wyo. Exh. HSO-H to be approximately 31,100. Tr. 13632 (Sostrom)

The final stage of the State's analysis was the tract-by-tract evaluation of the United States' claims. The purpose of the tract-by-tract analysis differs from the color infrared and the black and white studies. The purpose of this final stage of the State's analysis was to

determine which lands actually received water during the season the photos were flown, regardless of the land type or condition of the tract. Tr. 12747, 13026 (Sostrom).

This analysis was conducted under Mr. Sostrom's supervision by comparing the photo of each tract on the Billstein hydrographics to the State's black and white photos, to the color infrared photos, and to hand-held photographs taken by Mr. Sostrom while visiting the reservation by automobile and helicopter. Tr. 12696 (Sostrom).

Mr. Sostrom's conclusion as to the number of unadjudicated in-use acres on the reservation is set forth in Wyo. Exh. HSO-3A, which shows approximately 17,800 acres with an annual diversion requirement of approximately 54,000 acre-feet.

Tribes' Proposed Finding of Fact:

113. Mr. Sostrum relied on copies of the same aerial photographs primarily used by HKM (Tr. V. 137, pp. 12615, 12666; V. 141, p. 12997). The State presented evidence by two witnesses, a photogrammetry expert and a surveyor, seeking to discredit the accuracy of the photographs (Tr. V. 128, pp. 11653-55, V. 129, p. 11777). Neither witness testified as to the effect, if any, the alleged inaccuracies might have on the acreage claims of the United States. No photographs were offered by the State as being more accurate than those used by HKM. I find that the aerial photographs relied on by HKM (and Mr. Sostrum) were sufficiently accurate for the purposes used.

Wyoming's Response:

113. HKM's first step toward determining the number of unadjudicated in-use acres on the Wind River Reservation was to obtain a set of recent aerial photographs of the Reservation. Tr. 1901 (Billstein). Once obtained, these photographs were used throughout HKM's analysis. They also used the aerial photographs to determine study areas, analyze present use, perform a stereoscopic analysis and determine the acreage included in each parcel through the use of a planimeter. Tr. 1904, 1917, 2000 (Billstein). The aerial photographs used by HKM were taken in the fall of 1979 and the early summer of 1980 by the firm of Horizon, Inc. Tr. 1901 (Billstein).

Mr. Billstein testified that it was his impression that the aerial photographs received from Horizon, Inc., were individually scale rectified. He testified that the photographs were reviewed by Horizon for tilt and that a quadrangle rectification process or a linear rectification process was performed. Tr. 2000 (Billstein).

In an effort to clarify the nature and characteristics of the aerial photographs relied upon so heavily by the United States, the State called Mr. Jack Dozzi. Mr. Dozzi is the Vice-President of Operations for

Horizon, Inc. of Rapid City, South Dakota, the firm from which HKM ordered the aerial photographs that were eventually admitted as Exhibits C-56 through C-136. Tr. 11624. Mr. Dozzi was the principal in charge of filling the order requested by HKM on behalf of the United States. Tr. 11639-11640 (Dozzi)

Mr. Dozzi is a highly qualified and certified aerial photogrammetrist, having received much of his early training from Mark Hurd Aerial Surveys, a pioneer firm in the field of aerial photography. Tr. 11628. As Vice-President of Operations, Mr. Dozzi deals with over 300 aerial photography projects per year. Since 1965 Mr. Dozzi has been involved in county-wide type photography projects and the development of products for county coverage in approximately 50 counties in the mid-West and the West. Tr. 11631. Through his extensive training and expertise, Mr. Dozzi is a highly qualified expert in the field of aerial photogrammetry and was, accordingly, accepted by the Court as an expert. Exhibit DP-1, Tr. 11639 (Dozzi).

The testimony of Mr. Dozzi clearly indicates that Mr. Billstein's conclusions regarding the accuracy of the aerial photographs were incorrect. Rather than being scale rectified photos as testified to by Mr. Billstein, they were merely scale ratioed. Tr. 11645-11646, 11655,

11667 (Dozzi). The photographs are therefore correspondingly less accurate than Mr. Billstin believed them to be.

Although the difference in accuracy between a scale rectified versus a scale ratioed photograph is essentially one of degree, it is a significant difference. Tr. 11639-11708, passim (Dozzi). The primary difference between the two types is that a scale rectified photo is corrected for tilt while a scale ratioed photo is not. Scale rectification of a photograph involves using a greater number of control points or cross distances than is generally used when a photo is merely scale ratioed. Tr. 11654, 11655.

The conclusion stemming from Mr. Dozzi's testimony is that the photographs relied upon extensively by HKM throughout all phases of their analysis, including boundary designation, stereoscopic analysis, land use determinations and planimetering were less accurate than HKM and Mr. Billstein believed them to be. Tr. 11671 (Dozzi). Therefore, the factor of reliability and accuracy attributable to the aerial photographs and the acreages derived from them must be reduced accordingly.

In addition to the testimony of Mr. Dozzi, the State also presented the testimony of Mr. Dave McRobbie. Mr. McRobbie was accepted by the Master as an expert in

land surveying. Tr. 11744 (McRobbie). Mr. McRobbie performed a ground verification study of a portion of the aerial photographs, checking corners, section lines, and scales generally. Tr. 11744. Due to limitations of time and access to Reservation lands, Mr. McRobbie could only review a few of the aerial photos. Tr. 11737 et seq., 11827 (McRobbie).

Based upon his admittedly limited review, Mr. McRobbie found errors in locations and distances indicated on the aerial photos of up to 17%. Tr. 11777 (McRobbie). Consequently, he concluded that planimetering these photographs would not provide accurate information of acreages. Tr. 11779 (McRobbie).

In short, the unrefuted testimony of Messrs. Dozzi and McRobbie establishes that the aerial photographs upon which the United States relied so heavily were less accurate and reliable than represented by Mr. Billstein to the Court.

Tribes' Proposed Finding of Fact:

114. Mr. Sostrum stated that a stereoscope would be "helpful, but not necessary in determining irrigated lands" (Tr. V. 137, p. 12587). No reason was given by Mr. Sostrum for the failure of those under his direction to use a stereoscope.

Wyoming's Response:

114. A stereoscopic analysis is not necessary, thus no direction was given to do this type of analysis. The evidence provided by the United States Exhibits WRIR C-56 through C-136 was "photocoverage" and not stereo pairs, therefor, an analysis by stereoscope is not possible. See Wyoming's Response to the Tribes' Finding of Fact No. 104.

Tribes' Proposed Finding of Fact:

115. No field work was relied on by Mr. Sostrum in reaching his conclusions, although Mr. Sostrum was in the field many times (Tr. V. 137, p. 12588; V. 142, p. 13067). I find this lack of field verification to be a major factor casting doubt on the accuracy of Mr. Sostrum's findings.

Wyoming's Response:

115. The United States failed to consider all the available information, especially information and classifications developed in the field by its own experts. The United States merely viewed the land and the aerial photos. What they did not consider was the field land classification work performed by their fellow experts. In view of the State's limited access to the Reservation to do its own field study, HKM's land classification work is the most probative information available regarding the physical or chemical nature of the land, that is, its arability. This is not to say that the State fully supports HKM's study in its entirety or that there are not problems with the study. The State relied on HKM's study only because it had no alternative and lacked the time and opportunity to perform its own study. The State considered this data in its analysis but the United States, for some unarticulated reason, chose not to do so. See Wyoming Amended Proposed Finding of Fact 24-18 and support therefor.

Third, Mr. Sostrom is much more familiar with the area, having grown up on the Reservation and obtained much of his engineering and photointerpretation experience and training there. This familiarity with an area is very

important in areas such as the Wind River Indian Reservation because of the complexity of factors involved. See Wyoming Amended Proposed Finding of Fact 24-19 and support therefor.

Additionally, Mr. Sostrom personally supervised virtually all of the State's analysis and performed much of it himself. This is in contrast to the United States' analysis testified to by Mr. Billstein. Mr. Billstein did virtually none of the original field work personally. His only personal observations were made from a helicopter during a three-day whirlwind tour of the study lands. Most of his testimony was not the result of his own work or analysis. Rather, most of Mr. Billstein's testimony was based on his conversations with others, such as Messrs. Waples, Saunders, Johnston and Twitchell, even though he was unable to recall the substance of those conversations on cross examination.

Tribes' Proposed Finding of Fact:

116. Mr. Sostrum did not evaluate all lands claimed by the United States to be in irrigation. Certain lands were eliminated by Mr. Sostrum irrespective of current use, because of soils problems (Tr. V. 139, pp. 12717-26; V. 137, p. 12668-69; State's Ex. SS-1000). However, the record shows that many lands on the Reservation which do not meet land classification standards for arability are in fact being successfully irrigated (Tr. V. 32, pp. 2816-17; V. 151, pp. 13630-36, 13729-30). This was confirmed by Mr. Sostrum's own work, which showed that his own reviewers found certain Type V lands to be in use in 1990. Despite this actual use, Mr. Sostrum deleted these lands (Tr. V. 151, pp. 12717-26).

Wyoming's Response:

116. The Record clearly contradicts the statement that "Mr. Sostrom did not evaluate all lands to be in irrigation." He excluded some lands which were nonarable regardless of whether they receive water. Nonarable lands cannot be irrigable, land must be arable to be practicably irrigable acreage. U.S. Exh. WRIR C-226 (p. 41). This is clearly a full examination of all lands claimed by the United States.

There is no evidence in the Record that lands which do not meet arability standards "are in fact being successfully irrigated." Type V lands are not intentionally irrigated. Wyo. Exh. WRIR HB-8. Whether these lands receive water or not is no indication that nonarable lands are successfully irrigated or irrigable.

The final stage of the State's analysis was the tract-by-tract evaluation. The purpose of the tract-by-tract analysis of the United States' claims differs from the color infrared and the black and white studies. The purpose of this stage of the State's analysis was to determine which lands actually received water during the season the photos were flown, regardless of the land type or condition of the tract. Tr. 12747, 13026 (Sostrom). See Wyoming Amended Proposed Finding of Fact 24-20 and support therefor.

This analysis was conducted under Mr. Sostrom's supervision by comparing the photo of each tract on the Billstein hydrographics to the State's black and white photos, to the color infrared photos, and to hand-held photographs taken by Mr. Sostrom while visiting the reservation by automobile and helicopter. Tr. 12696 (Sostrom). See Wyoming's Response to Tribes' proposed Finding of Fact 104

Tribes' Proposed Finding of Fact:

119. I find that there are 34,427 acres (including 51 acres off-Reservation) of unadjudicated trust lands currently in irrigation.

Wyoming's Response:

119. See Wyoming's Response to Tribes' proposed Finding of Fact 110.

Tribes' Proposed Finding of Fact:

121. Mr. Stetson is a water resources consultant with over 30 years experience in water-related matters. He testified as an expert witness in the original trial in Arizona v. California. He has served as District Engineer for various rivers and water districts in California (Tr. V. 33, pp. 5208-16). I find that Mr. Stetson is a well-qualified water resources engineer.

Wyoming's Response:

121. Mr. Stetson was admitted as an expert in engineering, although previous to this case, he had no experience in determining water requirements for irrigation in Wyoming. Tr. 5208, 5220-5221, 5255 (Stetson).

Tribes' Proposed Finding of Fact:

122. For unadjudicated in-use lands within the Wind River Federal Irrigation Project, the LeClair Irrigation District and the Midvale Irrigation District -- known as the "project lands" -- Mr. Stetson reviewed historic records of actual water use within each project area. For each project, Mr. Stetson adopted the average annual diversion per acre for the period of record as the diversion requirement for the unadjudicated in-use lands (Tr. V. 58, pp. 5224-26, 5228-30, 5234-36).

Wyoming's Response:

122. The historic water diversions testified to by Mr. Stetson in the Upper Wind Unit are not actual diversion requirements. Tr. 5358, 5362 (Stetson); 13794 (Bishop). Evidence presented by Wyoming shows overall efficiencies of 50% can be achieved for historic irrigation systems. Tr. 12168, 13693-13694, 13725 (Bishop); Tr. 7277-7283, 7303-7304 (Billstein). Improvements in overall efficiencies in the Upper Wind Unit must be accomplished. There should be no reason to condone past inefficiency by quantifying reserved rights on the basis of overall historic diversion averages when higher efficiencies are achievable. See Wyoming's Amended proposed Finding of Fact 24-10 and support therefor.

Tribes' Proposed Finding of Fact:

123. For unadjudicated in-use trust lands within the projects Mr. Stetson testified that the diversion requirements were as follows (Tr. V. 58, pp. 5234-35):

Project Area	Acres	Annual Diversion Requirement (Acre-Feet Per Acre)	Total Annual Diversion Requirement
Ray	7,732	5.32	41,400
Coolidge	6,357	4.95	31,467
Subagency	2,962	5.25	15,530
Upper Wind A Canal	1,019	12.06	12,289
Dinwoody Bench	4,611	12.06	55,609
Johnstown	465	6.94	3,227
Lefthand	1,541	6.9	10,633
Midvale	569	5.58	3,175
LeClair	1,271	5.43	6,965
TOTAL	26,577		130,345

Wyoming's General Response to Tribes' proposed Findings of Fact 123 through 126:

Tribes' Proposed Findings of Fact 123 through 126, regarding unadjudicated in-use lands, are incomplete and erroneous. As a result, these proposed Findings are virtually useless to the Court. The deficiencies, errors and alternative acreage with water requirements are summarized below. There are nine major deficiencies and errors in the United States Proposed Findings of Fact with respect to adjudicated in-use lands. These are that:

1. Not all of the claimed lands are currently held in trust by the United States. See Wyoming's Amended proposed Findings of Fact 28-1 et seq and support therefor.

2. The climatic data upon which net irrigation requirement is based is too general. See Wyoming's Amended Proposed Findings of Fact 18-17, 18-18 and support therefor.

3. Different land types have water requirements commensurate with the current availability and use of water. See Wyoming's Amended proposed Findings of Fact 24-10, 23-11 and support therefor.

4. The historic and estimated conveyance and application efficiencies are too low. See Wyoming's Amended Proposed Findings of Fact 24-10 and 24-11 and support therefor.

5. Since the United States' evaluation of net irrigation requirements, land types and efficiencies is deficient, the resulting diversion requirements are unreasonably high. See Wyoming's Amended Proposed Findings of Fact 24-10, and 24-11 and support therefor.

6. Furthermore, the net irrigation requirement. a necessary component in quantifying reserved water rights, is not provided in the proposed findings. Compare, Wyoming's Amended Proposed Decree (Appendix 1); cf., Arizona v. California, (Supplemental Decree) 439 U.S. 419, 422 (1979); Wyo. Stat. § 41-3-104; Basin Electric Power v. State Board of Control, 578 P.2d 557 (Wyo. 1978).

7. Even if these studies are not required in detail, the acres to which the detail is applied are overestimated. Nonarable land; therefore nonirrigable land, in included in the acreage. See Wyoming's Amended Proposed Findings of Fact 24-11 and 24-18 and support therefor.

8. There is no evidence in the Record to show that these lands are practicably irrigable because no arability, engineering, economic, or water availability analyses were performed. See Wyoming's Amended Proposed Findings of Fact 24-5, 24-7, 24-12 and 24-13 and support therefor.

9. Land which was not irrigated in 1980 is erroneously included in the acreage. See Wyoming's Amended Proposed Findings of Fact 24-16 and 24-20 and support therefor.

In view of these numerous errors and inconsistencies, the State of Wyoming submitted evidence regarding acreage and water requirements summarized in the following table. See's Wyoming Amended Proposed Finding of Fact 24-1, et seq., and support therefor. The specific line items responding to a particular United States' Proposed Findings of Fact are shown in the following summary table.

UNALLOCATED IN-USE TRUST LANDS
ACREAGE AND WATER REQUIREMENTS
STATE EVALUATION

Project or Stream Number	Description	Acres	Diversion Requirement Acre-Feet	Net Irrigation Requirement Acre-Feet
	PROJECT LANDS			
	WIND RIVER FEDERAL IRRIGATION PROJECT			
	LITTLE WIND UNIT			
1	Ray Unit	3,500.2	10,299.6	5,149.9
2	Coolidge Unit	2,788.0	8,744.2	4,172.3
3	SubAgency Unit	1,526.0	6,011.0	3,005.5
	UPPER WIND UNIT			
4	Wind River 'A' Canal	514.0	1,279.2	639.7
5	Dinwoody Bench Area	2,896.0	10,970.2	5,479.3
6	JOHNSTOWN UNIT	200.0	691.6	345.8
7	LEFTHAND UNIT	418.0	1,381.4	690.7
8	RIDVALE IRRIGATION DISTRICT - TRUST LANDS	457.8	1,285.9	641.0
9	LECLAIR IRRIGATION DISTRICT - TRUST LANDS	825.0	2,758.1	1,379.1
	Total Project Lands	13,125.0	43,421.2	21,705.3
	NON-PROJECT LANDS			
	WIND RIVER BASIN			
10	East Fork Wind River	7.0	7.6	1.8
11	Dinwoody Creek	103.0	134.0	67.0
12	Dry Creek (12-5N-4W)	62.0	201.0	100.5
13	Bull Lake Creek	11.0	17.8	8.9
14	Meadow Creek	154.0	322.6	161.3
15	Dry (Pasup) Creek	38.0	66.8	33.4
16	Crow Creek	28.0	45.6	22.8
17	Willow Creek	0.0	0.0	0.0
18	Sand Draw	0.0	0.0	0.0
19	Wind River - Main Stem	383.0	1,136.1	568.2
	Subtotal	786.0	1,931.5	965.9

UNADJUDICATED IN-USE

Project on Stream Number	Description	Acres	Diversion Requirement Acre-Feet	Net Irrigation Requirement Acre-Feet
	BIG HORN RIVER BASIN			
10	Main Stem - Big Horn River	0.0	0.0	0.0
18	Cottonwood Creek	135.0	83.0	41.5
20	Buddy Creek	572.3	582.5	291.4
21	Five Mile Creek	25.0	14.4	7.2
	Subtotal	732.3	679.9	340.1
	LITTLE WIND RIVER BASIN			
22	North Fork Little Wind River	1,241.0	3,918.0	1,959.1
23	South Fork Little Wind River	611.0	1,365.8	682.9
24	Main Stem - Little Wind River	332.8	804.4	402.3
25	Sage Creek	323.0	292.9	146.5
26	Crooked Creek	45.0	118.4	59.2
27	Trout Creek	194.0	512.6	256.4
28	Spring Creek	73.0	258.4	129.2
29	Big Horn Draw	8.0	4.4	2.2
17	Hill Creek	0.0	0.0	0.0
	Subtotal	2,827.8	7,274.9	3,617.8
	POPO AGIE RIVER BASIN			
31	South Fork Popo Agie River	77.0	238.8	119.4
32	Main Stem - Popo Agie River	19.0	29.6	14.8
	Subtotal	96.0	268.4	134.2
	OWL CREEK BASIN			
34	Main Stem - Owl Creek	0.0	0.0	0.0
33	South Fork Owl Creek and Tributaries	28.0	48.4	24.2
35	Red Creek	129.0	172.4	86.2
36	Red Creek	0.0	0.0	0.0
	Subtotal	157.0	220.8	110.4
	Total: Non-Project Lands	4,599.1	10,375.5	5,188.4
	GRAND TOTAL	17,724.1	53,796.7	26,891.7

Tribes' Proposed Finding of Fact:

128. The State's witnesses had no disagreement with Mr. Stetson as to the climate zones, cropping patterns, and formula for determining consumptive use (Jenson-Haise) utilized for unadjudicated in-use lands outside the project areas (Tr. V. 148, pp. 13692, 13715, 13720).

Wyoming's Response:

128. See Wyoming's General Response to Tribes' Proposed Findings of Fact 23 through 26.

Tribes' Proposed Finding of Fact:

129. Mr. Bishop testified that he used a 50% overall irrigation efficiency for his analysis of the historic lands including the unadjudicated in-use lands (id., pp. 13819-21). However, Mr. Bishop could not cite a single example of lands in the Big Horn Basin currently achieving a 50% efficiency. He agreed with Mr. Stetson's testimony concerning current efficiencies on the Reservation (id., pp. 13718-19).

Wyoming's Response:

129. Mr. Bishop did cite two examples of large irrigation projects in Wyoming which achieve a 50% or better efficiency. These are the Goshen Irrigation District with 52,232 acres and the Kendrick Project with 23,234 acres. Tr. 13819-13821 (Bishop). Although Mr. Bishop agreed that efficiencies are less than 50% on and adjacent to the Reservation, he stated that water management is not very good. Tr. 13811 (Bishop).

Mr. Billstein and Mr. Bliesner both testified that efficiencies within the Reservation could be easily increased anywhere from 10 to 15% above the efficiencies used to quantify the United States' and Tribes' claims. Both testified that efficiencies of 50% were achievable. Tr. 7277-7283, 7303-7304 (Billstein; Tr. 8543-8545 (Bliesner). Efficiencies of 50% are not only achievable, but should be a minimum requirement in this age of critical water shortage and the necessity to conserve in any way possible.

Tribes' Proposed Finding of Fact:

132. Mr. Bishop testified that for Type IV and Type VI lands, he assigned a "net irrigation requirement" of .3 of the full service net irrigation requirements (Tr. V. 148, pp. 13693-94). These "net irrigation requirements" ranged from .59 to .70 acre-feet per acre. By his own definition, Mr. Bishop acknowledged that this was not enough water to grow crops.

Wyoming's Response:

132. Mr. Toedter, an expert for the United States, and Mr. Bishop, an expert for the State of Wyoming, agree that Type IV and VI lands should be given a net irrigation requirement of 30% of the full net irrigation requirement. Tr. 6938-6939 (Toedter), Tr. 13693-13694 (Bishop). Since only 30% of the land receives irrigation water at any one time, that portion receives enough water to grow crops. Overall, this is enough water to irrigate that 30% of the land. Tr. 13761 (Bishop).

Tribes' Proposed Finding of Fact:

133. Mr. Bishop's 70% reduction in net irrigation requirement for Type IV and Type VI lands was based on the assumption that only 30% of the Type IV lands are irrigated in a given year (Tr. V. 149, pp. 13737, 13761). Mr. Bishop testified that he had not investigated these lands or otherwise attempted to verify this assumption (id., p. 13807). The evidence did not support the assumption (Tr. V. 29, pp. 2638-41). Mr. Bishop stated that he "was not trying to determine the [diversion] requirement for a specific tract" (Tr. V. 144, p. 13738). But he did, in fact, present water requirements on a tract-by-tract basis (e.g., State's Exs. HFB-1a, 1b, 2 and 3). Mr. Bishop conceded that "for a specific tract, it [his conclusions on diversion requirements] may reflect an inadequate amount of water" (Tr. V. 149, p. 13761).

Wyoming's Response:

133. See Wyoming's Response to Tribes' Proposed Finding of Fact 132.

Tribes' Proposed Finding of Fact:

134. Mr. Bishop did not type any lands. Nor did any other State consultant (Tr. V. 149, p. 13775; V. 140, p. 12955). Mr. Billstein, the United States witness under whose direction the lands were typed, testified that certain lands were Type IV because they generally receive a good supply of water for only a limited season (Tr. V. 24, p. 2337). Some Type IV lands simply had a temporary deficiency in the ditch system, which did not allow full service at that time (Tr. V. 19, pp. 2044-45). Type IV lands do provide beneficial use (Tr. V. 21, pp. 2141-42).

Mr. Bishop recognized that lands could be Type IV for a variety of reasons (Tr. V. 149, p. 13775). He further testified that a small number of Type IV tracts were in water short drainages (id., p. 13761). His use of 30% of the full service irrigation requirement for these lands would not permit full service to be restored to lands which had a correctable physical ditch system problem in 1980. Nor could full service be provided in typically water short drainages in years of abundance.

Wyoming's Response:

134. See Wyoming's Response to Tribes' Proposed Finding of Fact 132.

Tribes' Proposed Finding of Fact:

135. Mr. Bishop testified that for Type V lands, he assigned a water requirement of zero (Tr. V. 148, p. 13694). He based this on the view that "diversions were not necessary for those lands" (id.). In describing Type V lands, Mr. Billstein testified that each tract was viewed in the field, and that in each case "[t]here was actual beneficial use the people were taking advantage of in terms of a grass or pasture" (Tr. V. 30, pp. 2694-95). Mr. Bishop did not dispute this and did not testify as to the beneficial use of Type V lands which would be lost if no water was provided.

Wyoming's Response:

135. The United States and State of Wyoming agreed that Type V lands do not require diversions since they receive water from seepage due to diversions for other lands. Tr. 6938-6939 (Toedter), Tr. 13694 (Bishop). The degree of beneficial use is questionable since many Type V lands were classified nonarable by the United States experts. U.S. Exh. WRIR SS-1000. In fact, Mr. Bishop stated that some Type V lands would actually benefit by receiving less water since they are adversely affected by receiving too much at present. Tr. 13729 (Bishop).

Tribes' Proposed Finding of Fact:

136. The State's witnesses testified that for water short drainages, they assumed an irrigation season from May 1 to July 15, with no water thereafter. Mr. Sostrum testified that he made the determination that this abbreviated irrigation season was appropriate for these lands (Tr. V. 140, p. 12892). Mr. Bishop stated that an irrigator with a State-awarded water right for lands in these water short streams would be entitled to irrigate after July 15, up to the amount of his right, so long as there was a sufficient supply of water (Tr. V. 149, pp. 13744-45).

Wyoming's Response:

136. It must be re-emphasized that state water rights differ from reserved water rights in many respects. Reserved water rights determined through a quantification of practiably irrigable acreage must have a reliable source of water. See Wyoming Amended Proposed Findings of Fact 15-24 et seq. and support therefor. A state water right is adjudicated without reference to available water supply. See Wyoming Amended Proposed Finding of Fact 26-4 and support therefor.

Tribes' Proposed Finding of Fact:

137. Mr. Bishop testified that for Type IV lands in water short drainages he reduced the water requirement once by 70%, based on its being Type IV, and again by applying the abbreviated irrigation season. This resulted in providing far less water than is required to grow crops on these tracts (Tr. V. 149, pp. 13759-66).

Wyoming's Response:

137. This simplistic proposed finding fails to recognize that in reality these Type IV tracts, by the United States own admission, receive very little water at present. It is not a matter of what is provided, it is a matter of what water is available and how it is currently used on these tracts. See Wyoming's Response to Tribes' Proposed Findings of Fact 132 and 136. The Tribes' themselves note Mr. Billstein's testimony that Type IV lands receive water for only a limited season. See Tribes' Proposed Finding 134. In addition the United States, in their Proposed Finding of Fact 439, discuss at length water short drainages.

> The results of Mr. Billstein's study showed that the agricultural demands were generally met in May and June, thereafter the flows receded with only a portion of the agricultural water requirements being met in July. Tr. 7371-7373. This streamflow pattern was confirmed by Mr. Henry Sostrom, a consultant for the State of Wyoming. Tr. 12891. It was concluded that when runoff was occurring in the early irrigation season water was available for the government claims.

Tr. 7372-7373.

Tribes' Proposed Finding of Fact:

138. Mr. Sostrum preliminarily determined that 7.45 acre-feet per acre was the average diversion requirement for the historic lands (State's Ex. HSO-H; Tr. V. 149, pp. 13798-800). Mr. Bishop's final conclusion was 3.03 acre-feet per acre (Tr. V. 149, p. 13793). Historically, diversions on the Reservation have been "significantly greater than that" (Tr. V. 144, p. 13744). Under the State's water law, irrigation to the full amount over the irrigation season on the Reservation would result in diversions in excess of 4 acre-feet per acre (id., p. 13797).

Wyoming's Response:

138. The net irrigation requirements for lands designated to receive a full water supply do not differ substantially from the United States. Tr. 13693 (Bishop). The primary difference is in diversion requirements due to the higher efficiency used by Mr. Bishop. All parties agree that 50% efficiencies are achievable. Historic diversions on and adjacent to the Reservation have included waste resulting from poor water management. See Wyoming's Response to Tribes' Proposed Finding of Fact 129. Although state water law allows annual diversions slightly in excess of four acre-feet per acre, few, if any water users divert at the maximum rate throughout the irrigation season. Tr. 13797 (Bishop).

Tribes' Proposed Finding of Fact:

139. Testimony by non-Indian irrigators confirmed that the reduced diversion requirements suggested by Mr. Bishop would be insufficient to support crops on the lands of the Reservation. Mr. Jack Long, manager of the Midvale Irrigation District, stated that in Midvale, where diversions are "reasonable" and where penalties are charged for excess water use, diversions in 1978 were 4.77 acre-feet per year (Tr. V. 152, pp. 13735, 13751-52, 13755). Gideon Davison, a Commissioner of the Riverton Valley Irrigation District and farmer, cowman, and sheepherder, testified that with water cut off in July his farming operation "would be a total washout; there wouldn't be any crop" (id., p. 13764). This was repeated time and again by other witnesses (Tr. V. 151, p. 13484; V. 152, p. 13805; V. 153, pp. 13863, 14029-29). Farmers testified that the 1 c.f.s. per 70 acres allowed under state law is insufficient to irrigate crops. Many purchase additional water to meet their needs (e.g., Tr. V. 153, p. 14047; V. 159, pp. 14154, 14160). Over a five-month growing season, 1 c.f.s. per 70 acres equals 4.24 acre-feet per acre annually.

Wyoming's Response:

139. Past inefficiencies are no reason to condone future inefficiencies. Higher efficiencies are achievable on the Reservation. See Wyoming's Response to Tribes' Proposed Finding of Fact 129. In fact, the Tribes' proposed future project on Big Horn Flats has a diversion requirement of less than 2.5 acre-feet per acre. Many unadjudicated in-use lands are served from short ditches, very unlike the approximately 70 miles of main canal in the Midvale Irrigation District. The reference to Gideon Davis and other irrigators on major streams is in no way analagous to the few, unique water short drainages to which the mid-July date was used to estimate water requirements. There is no evidence in the Record that Riverton Valley Irrigation District, diverting from the Wind River, is in any way similar to water short drainages like Owl Creek.

Tribes' Proposed Finding of Fact:

140. I find that the diversion requirements suggested by the State for unadjudicated in-use lands are insufficient to grow crops on those lands. The diversion requirements testified to by Mr. Stetson are more realistic and reasonable. I find that the diversion requirements for the 34,427 acres (including 51 acres off-Reservation) of unadjudicated in-use trust lands are a total of 222,915 acre-feet per year (including 277 for off-Reservation acreage) as set forth in Findings 123-26 supra.

Wyoming's Response:

140. See Wyoming's General Response to Tribes' Proposed Findings of Fact 123 through 126.

Tribes' Proposed Finding of Fact:

3. Historic Soils (Type VII and Type VIII Lands)

141. HKM personnel, under the direction of Ross Waples, who was qualified as an expert in land classification and soils science (see Finding 7 supra), perfcrmed a land classification of idle lands of the Wind River Reservation. These idle lands are those trust lands which are not now receiving irrigation and which either (1) have a history of irrigation (hereinafter "Type VII lands") (Tr. V. 58, p. 5254) or (2) are undeveloped arable lands within the Wind River Federal Indian Irrigation Project (hereinafter "Type VIII lands") (Tr. V. 63, p. 5582; U.S. Ex. C-226, p. 1).

Wyoming's Response:

141. U.S. Exh. C-226 (p. 1) makes no specific reference to the definition of Type VIII lands.

Tribes' Proposed Finding of Fact:

145. As with HKM's future lands studies, the idle lands work involved evaluation of previous soils and lands investigation, and field work on the historic project lands did not substantially differ from that on the future lands (U.S. Ex. C-226, p. 2). Land classification standards used on the historic project lands areas were identical to those used on the future lands within the North Crowheart, South Crowheart, Big Horn Flats, Owl Creek and Arapahoe study areas (id.), and the land classification definitions for historic project areas and future lands were the same (id., p. 3; see Finding 11 supra). The procedures used to classify future lands, as described in Finding 12 supra, were utilized on the historic project areas and, for the most part, on the idle nonproject areas, except as noted in Finding 147 infra (U.S. Ex. C-226; pp. 10-11).

Wyoming's Response:

145. The HKM project historic land standards are identical to those finally adopted by HKM for the future lands study. Thus, the project historic land standards are deficient in the same aspects. The deficiencies of the future lands standards are discussed at length in Wyoming's Response to Tribes' Proposed Findings of Fact 4 and 12; U.S. Exhs. WRIR C-226 (pp. 5, 6 and 7), C-36A; Tr. 10797 (Sommers); and Wyoming's Amended Proposed Finding of Fact 18-3 through 18-8 and support therefor.

As with the future land study, the historic land drainage standards vary considerably from the Bureau of Reclamation standards. To explain the differences, Mr. Waples contends that HKM's premise and end point are different; thus, different standards. He further explains that the HKM historic study deals with large scale farm development rather than individual units. However, he later refutes this by stating that the HKM historic lands are small individual tracts and that the Bureau of Reclamation study deals with large-scale projects. Tr. 3488, 3516 (Waples).

The land class definitions used in the historic land classification program, being the same as those used in the future land classification program, are deficient for the same reasons. See Wyoming's Response to Tribes' proposed Finding of Fact 11.

Tribes' Proposed Finding of Fact:

147. The standards used by Mr. Waples in classifying the idle nonproject lands were virtually the same as those utilized on the future lands and on the historic project lands. There were two exceptions, based on HKM's findings in the field that many lands were being successfully irrigated which would not meet the project classification standards (U.S. Ex. C-226, p. 14). The first exception was that some lands that were too gravelly or too cobbly to meet project standards were classified as arable, since experience indicated that these conditions were not always serious limitations. (Id.). The second was that drainage was considered the responsibility of the operator of the individual tracts (id.). Since these were small, isolated tracts, the rigorous drainage standard required for large projects was not applicable. (Id., p. 14.)

Wyoming's Response:

147. There is no evidence in the Record that any lands which would not meet the project standards are being "successfully" irrigated. There is also no record of any "experience" to indicate that gravel and cobble are not serious limitations. In addition, Mr. Sommers felt it was improper to exclude the drainage requirement and depth of good free-working soil in non-project lands and standards. Tr. 11138-11139 (Sommers). One example of an errant result for relaxing the non-project standards was observed on Mr. Enos' farm where he stated that he had no intention of ever irrigating a portion of his Type VII land because it was "too rocky." Tr. 11139 (Sommers). The Tribes have attempted to imply that currently irrigated land is arable land which it indeed may not be. Even by HKM's definition, irrigated land is not necessarily irrigable land or arable land. It must be kept in mind that Type VII lands are those which have gone out of production for some reason and are now idle.

Tribes' Proposed Finding of Fact:

148. Also as in the case of the future soils, the State of Wyoming presented Mr. Fowkes and Mr. Sommers, whose criticism of the HKM idle lands study was along the same lines as their criticism of the future lands study (see Finding 17 supra). Mr. Sommers concluded that he would have identified fewer arable acres in the Types VII and VIII lands. In State's Ex. SS-7 (Revised), as modified further by his subsequent testimony (Tr. V. 122, pp. 11093, 11150), he gave his opinion that there were only 4,650.4 acres of arable Type VII lands on the Reservation. In State's Ex. SS-8 (Revised), he gave his opinion that there were only 841.5 acres of arable Type VIII lands.

Wyoming's Response:

148. As posted in Wyo. Exh. SS-8, 1019.0 rather than 841.5 acres were determined to be arable by Mr. Sommers.

Tribes' Proposed Finding of Fact:

149. Mr. Waples, through his and HKM's work, however, reached his conclusions as to the total arable Type VII and Type VIII lands, by an intensive and long investigation, conducted parcel-by-parcel. Under the circumstances and for the purpose of this case, I find that his study was reasonably complete and accurate.

Wyoming's Response:

149. The HKM study suffers from innumerable deficiencies and therefore cannot be reasonably complete and accurate. See Wyoming's Amended proposed Findings of Fact 20-2 (Type VIII land) and 23-7 (Type VII land) and support therefor.

Tribes' Proposed Finding of Fact:

5. Type VII Lands -- Economics

156. Mr. Dornbusch used the same basic method in analyz-
ing the Type VII lands as he did for the future lands, with cer-
tain exceptions. First, benefits and costs were calculated on a
parcel-by-parcel basis for Type VII lands (Tr. V. 65, p. 5721).
In addition, cropping patterns and yields were somewhat differen
for Type VII lands than for future lands. Corn was excluded,
because the Type VII parcels may not have been large enough to
support the special equipment needed for growing corn (id., pp.
5741, 5753). Separate cropping patterns were developed for type
VII lands which were designated as Class 4 by HKM, or which were
determined by HKM to be in water short drainages (id., pp. 5741-
42). This was necessary because no Class 4 or water short lands
were included in the future projects. Appropriate yields for
these Class 4 and water short lands were determined. According
to Mr. Dornbusch's calculations, the net returns from these Clas
4 and water short Type VII lands were substantially less than th
returns from other Type VII lands (U.S. Ex. C-278, pp. 36-37).

Additional costs were added to certain Type VII
lands for soil amendments for reclamation purposes (Tr. V. 65,
pp. 5756-57). For all Type VII lands, outside the PIDs, addi-
tional costs were added to account for moving equipment to the
scattered Type VII parcels (U.S. Ex. C-278, p. 20; Tr. V. 65, pp
5744-45).

Tribes' Proposed Finding of Fact:

With these modifications -- each of which tended to diminish the economic feasibility of Type VII lands -- Mr. Dornbusch analyzed costs and benefits for the Type VII lands. Mr. Dornbusch concluded that it would be economically feasible to irrigate 7,946 acres (including 87 acres on the off-Reservation part of Arapahoe Ranch) of arable Type VII land (Tr. V. 65, p. 5759).

Wyoming's Response:

156. The State of Wyoming's objections to Mr. Dornbusch's analysis are detailed in its own Findings, its Response to the United States' Findings of Fact, and its Response to the Tribes' Findings of Fact with regard to future projects and will not be repeated here. Mr. Dornbusch did use the same basic methods in analyzing Type VII lands as he did for future lands, and the State of Wyoming's Reservations about his methods are thus applicable.

Tribes' Proposed Finding of Fact:

159. For the Type VII lands, Mr. Jacobs testified that full labor costs were included in his analysis. This was because Type VII lands are small, scattered tracts, which would be irrigated by existing irrigators, not the unemployed (Tr. V. 159, p. 14759). Yet, in considering costs, Mr. Jacobs assumed that each Type VII tract, even though worked by existing farmers, would require all new equipment (id., p. 14852).

Wyoming's Response:

159. This finding is a disguised attempt to indirectly criticize in a different way Dr. Jacobs' assumption of a 320-acre farm size for his analysis. The State of Wyoming's Response in justification of this assumption is fully detailed in its Response to Tribes' Proposed Finding of Fact 87 and its Response to United States' Proposed Findings of Fact 306 and 307.

Tribes' Proposed Finding of Fact:

161. I find that Mr. Dornbusch's testimony is more credible and persuasive than Mr. Jacobs'. Therefore I find that it is economically feasible to irrigate 7,946 acres of Type VII lands (including the 87 acres off-Reservation).

Wyoming's Response:

161. The Court should instead conclude that Dr. Jacobs' analysis is far more persuasive than Mr. Dornbusch's, based upon the evidence supplied by the State of Wyoming in Response to the Tribes' Proposed Findings of Fact regarding the future projects.