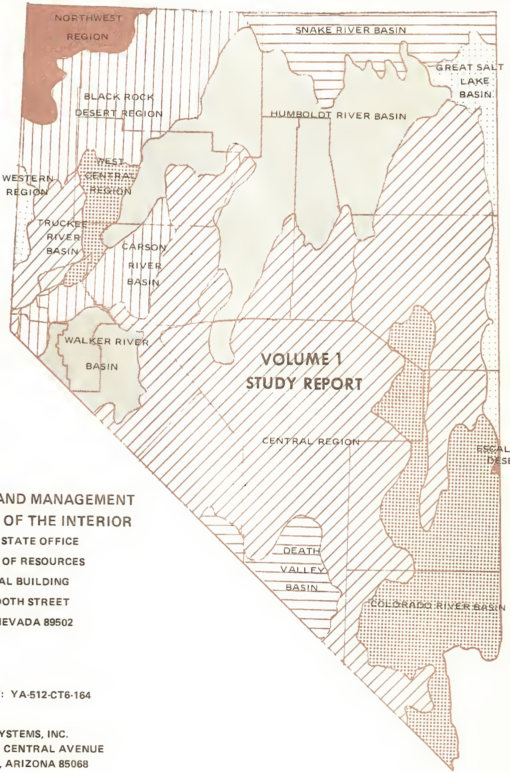
AGRICULTURAL POTENTIAL OF NATIONAL RESOURCE LANDS IN THE STATE OF NEVADA



BUREAU OF LAND MANAGEMENT
DEPARTMENT OF THE INTERIOR
NEVADA STATE OFFICE
DIVISION OF RESOURCES
FEDERAL BUILDING
3008 BOOTH STREET
RENO, NEVADA 89502

CONTRACT: YA-512-CT6-164

BRI SYSTEMS, INC.
8900 NORTH CENTRAL AVENUE
PHOENIX, ARIZONA 85068

SEPTEMBER 30, 1976

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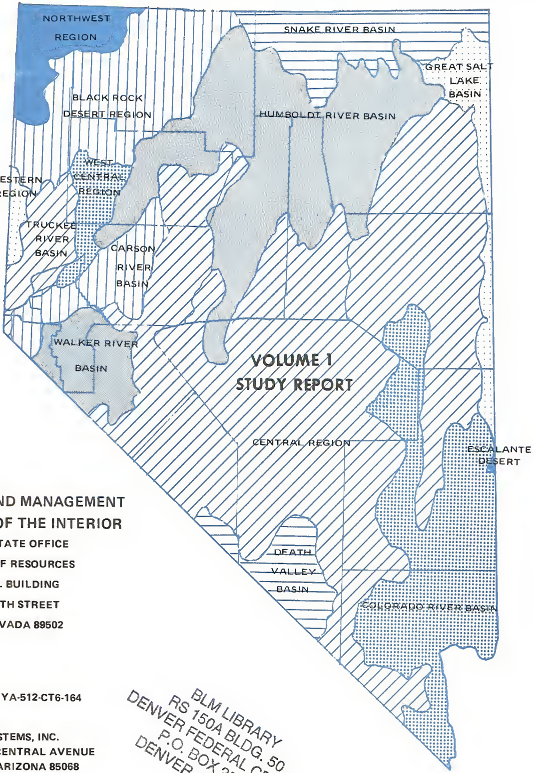

VOLUME 1
STUDY REPORT

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FOREWORD

Nevada has many distinctions. Over the past three decades, economic growth in the state has increased at a rapid rate. The population of the state has quadrupled; this growth trend is still continuing.

Nevada is ranked second in the Nation in population growth and third in education with regard to the percent of a state's population that has attained a high school or higher education. In agriculture, Nevada boasts the second largest average farm size in the U.S. The state also has the second largest percentage of Federally administered lands in our Nation. Only Alaska surpasses it. These lands are used for purposes that include national forests, wildlife refuges, atomic testing, and multiple use national resource lands.

The economic expansions in Nevada have placed many demands and pressures upon the national resource lands. The natural resources are not inexhaustible. The Bureau of Land Management (BLM), Department of the Interior, is responsible for administration of these lands. BLM is aware of the growing and varied public interests and concerns surrounding the resources present on these lands. As a part of its planning, BLM is engaged in evaluating the potentials of the lands. BRI Systems, Inc., performed this study for BLM to present a current picture of the agricultural potential of these lands. The report summarizes the potentials that exist. It has been developed in a format to provide reference for future use.

The study report consists of two volumes. Volume 1 presents the study background, setting, and findings. The referenced appendices are included in the supplementary study report, Volume 2.

ACKNOWLEDGEMENTS

BRI Systems graciously acknowledges the contribution and cooperation of numerous individuals and organizations who assisted the research efforts in preparing this report.

Special acknowledgement is made to Messrs. James Perkins, Jack Cardinalli, and Victor Hill, State Engineer's Office, Department of Conservation and Natural Resources, State of Nevada, and members of the Water Resources Division for their valuable assistance in providing information and allowing BRI access to the Division's files.

Acknowledgement is also made to members of the Department of Agriculture, Carson City and Reno, Nevada, for providing additional resource and economic data. The assistance received from the Bureau of Reclamation, Carson City, and the access to the Bureau's reports at the Engineering and Research Center, Denver, Colorado, is also highly appreciated.

BRI also acknowledges the efforts of Mr. William Lewis and the staff at the Environmental Protection Agency, San Francisco, Region IX Office, for providing the most recent STORET data for use in the study.

Appreciation is given to the U.S. Geological Survey, Carson City, and staff members of the Max C. Fleischman College of Agriculture and Bureau of Mines, University of Nevada, Reno, for providing information and recommendations with respect to the subject matters evaluated in the study.

Appreciation is given to Mr. Dick Morrison, Bureau of Land Management, who managed the study for the Department of Interior, for his valuable assistance.

Mr. Ted Adamczyk of BRI Systems directed the study efforts. Acknowledgement is given to members of the staff who contributed to the study. Special appreciation is given to Mrs. Sharon Klingner for her efforts in producing this report.

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GLOSSARY OF TERMS
REFERENCED IN THE REPORT

ACRE-FOOT - A unit of volume of water equal to the volume of a prism one foot high with a base one acre in area. It is the volume of water that will cover one acre of land to a depth of one foot and is approximately equal to 325,900 gallons.

ACTIVE STORAGE CAPACITY - The total amount of usable reservoir capacity available for seasonal or cyclic water storage. It is the gross reservoir capacity minus inactive storage capacity.

AGRICULTURAL PRODUCTION - Assumes crop production as referenced in this report.

ALKALI - Poorly drained soil consisting of large amounts of mineral salts.

ALLUVIAL FAN - A land form resulting from water borne sediment deposition.

ALLUVIUM - Water borne sediment.

ANNUAL - Accumulated over a consecutive 12 month period of time for which the beginning date is identified.

APPROPRIATION - To take possession of; the term is used in the report for water resources. To appropriate a water source is to request that the state set apart certain waters to be assigned specifically for one's use. Such an assignment could subsequently lead to the issuance of a Certificate (License) specifying the amount of water to be used, the periods of time governing water use and conditions regulating water use, as applicable.

AVERAGE ANNUAL - Average value of annual data measurements when determined over a period of time longer than one year.

AQUIFER - A permeable geologic formation which stores and transmits water.

ARID - A term applied to a climate or region where precipitation is so deficient in quantity, or occurs so infrequently, that agriculture is impractical without irrigation.

AVAILABLE WATER HOLDING CAPACITY - Water retained by the soil that can be used by plants.

AVERAGE ANNUAL BENEFIT - Average yearly value of benefits that will accrue over the length of the evaluation period.

AVERAGE ANNUAL COST - Average yearly cost derived from amortization of a project's costs over the evaluation period.

GLOSSARY OF TERMS
(Continued)

BASE PERIOD - A period of time specified for the selection of data for analysis.

BENEFICIAL EFFECT - A favorable change generated by an alternative plan.

BENEFICIAL USE OF WATER - The use of water for any purpose from which benefits are derived, such as domestic, irrigation, industrial supply, power development or recreation; beneficial use is the basis of Nevada Water Law...it is the framework, the measure, and the limit of the right to the use of water in the state.

CHANCE SUPPLY - A statistical term used to represent the probability of some event occurring within a specified time.

CHECKERBOARD OWNERSHIP PATTERN - The land ownership pattern that is similar in appearance to a checkerboard, generally the result of the government's land grants to railroads during the mid-1800's; seen in northern Nevada.

CHISELING OR CHISEL - Loosening the soil to break up layers of soil below the normal plow depth that inhibits water movement or root development. The soil is not turned over as in plowing and there is a minimum of surface soil mixing.

CLOSED BASIN - A basin is considered closed with respect to surface flow if its topography prevents the occurrence of surface outflow; It is closed hydrologically if neither surface nor underground outflow can occur; it is closed (designated) legally if no further water appropriations may be made; see Designated Basin.

CONFINED AQUIFER - An aquifer which is bounded above and below by formations of impermeable or relatively impermeable material.

CONJUNCTIVE USE - The joining together of two sources of irrigation water, such as ground water and surface water, to serve a particular land area.

CONSUMPTIVE USE (WATER) - The quantity of water that is discharged to the atmosphere or incorporated in the process products of vegetative growth, processing, or other uses.

CROPLAND - Lands presently used for the production of either irrigated or non-irrigated crops and pasture.

CFS - Cubic Foot per Second; rate of fluid flow at which 1 cubic foot of fluid passes a measuring point in 1 second.

DECREED WATER RIGHTS - Water rights determined as a result of a court decree.

GLOSSARY OF TERMS
(Continued)

DEPLETION - Withdrawal of water from a ground source at a rate greater than its rate of recharge, usually over an extended period of several years.

DESIGNATED BASIN - A basin where permitted ground water rights approach or exceed the estimated average annual recharge; The Nevada State Engineer may designate underground water basins which are being depleted and declare preferred uses in these basins; no wells, outside of limited domestic use exceptions, can be drilled in a designated basin until a permit is granted by the state.

DISCOUNT RATE - The interest rate charged for loans or capital advances.

DISCOUNTED CASH FLOW - Method of reducing estimated future net cash flow to a single present-value figure (present-value analysis) based upon finding the present value of investment that is discounted at a specified interest rate.

DISSOLVED OXYGEN - The amount of free oxygen in water; expressed in milligrams per liter.

DISSOLVED SOLIDS - Chemicals in solution.

DIVERSIONS - Structures used to divert water away from eroding areas.

DIVERTIBLE WATER SUPPLY - Includes that amount of water consumptively used and that water which returns to the stream system. Since return flow becomes available for subsequent diversion and reuse, the total divertible supply is greater than the depletable supply.

DOMESTIC USE - Water used normally for residential purposes, including household use, personal hygiene, and drinking, and outside uses such as car washing, swimming pools, and for lawns, gardens, and shrubs.

DRAINAGE - The processes of the discharge of water from a soil area by sheet or streamflow (surface drainage) and the removal of excess water from within the soil by the downward flow of water through the soil (internal drainage); also the means for effecting the removal of water from the surface of soil and from within the soil.

DRYLAND (FARMING) - Non-irrigated cropland.

ECONOMIC BASE - The economic characteristics (e.g., quantities of resources, demand for products, supply of goods, production relationships, stage of development) that contribute to income.

EROSION - The process by which earth or rock materials are dissolved or separated and removed from any part of the earth's surface. It includes weathering, solution, corrosion, and transportation.

EVAPOTRANSPIRATION - The process by which water is transpired by plants and evaporated from the plant and surrounding surfaces.

GEOTHERMAL - Terrestrial heat, usually associated with water as hot springs.

GRAZING LAND - All lands presently being grazed by livestock within grass, brush, and forest cover types, excluding irrigated pasture.

GROSS WATER YIELD - The available water runoff, both surface and subsurface, prior to use by man's activities, phreatophytes or evaporation from free water surfaces.

GROUND WATER - Underground water that is in a zone of saturation.

GROUND WATER BASIN - A ground water reservoir, including all the overlying land surface and the underlying aquifers, that contribute water to the reservoir. In some cases, the boundaries of successively deeper aquifers may differ in a way that creates difficulty in defining the limits of the basin.

GROUND WATER RECHARGE - Inflow to a ground water reservoir.

GROUND WATER RESERVOIR - An aquifer or aquifer system in which ground water is stored. The water may be placed in the aquifer by artificial or natural means.

GROUND WATER STORAGE CAPACITY - The reservoir space contained in a given volume of deposits.

GROWING SEASON - The average number of days exceeding 32°F in a given year (28°F in this study).

HYDROGRAPHIC - Term is used to represent the unique features of geography, topography, precipitation, and drainage of a basin. The State of Nevada is divided into 14 hydrographic basins which are further subdivided into 255 individual hydrographic subbasins.

HYDROGRAPHIC STUDY AREA - An area of hydrological and climatological similarity subdivided for study purposes.

IMPOUNDMENT - An artificial storage area for water.

INDUSTRIAL WATER - Water used for manufacturing or processing activities by an industrial establishment.

GLOSSARY OF TERMS
(Continued)

INFILTRATION - The process whereby water passes through an interface, such as from air to soil or between two soil horizons.

IRRIGABLE LANDS - Lands capable of being irrigated by any method. Arable land for which a water supply is available and which is provided with, or planned to be provided with, irrigation, drainage, flood protection, and other facilities as necessary for sustained irrigation utilization.

IRRIGATED CROPLAND - All lands being supplied water by artificial means that are being used for the production of orchard, field or grain crops, and pasture.

IRRIGATION EFFICIENCY - The ratio of consumptive use of applied irrigation water to the total amount of water applied, expressed as a percentage of the applied water.

IRRIGATION REQUIREMENT - The quantity of water, exclusive of effective precipitation, that is required for production of a specific crop.

IRRIGATION RETURN FLOW - Applied water which is not consumptively used and returns to the surface of the ground water supply. See Return Flow.

IRRIGATION WATER REQUIREMENT - See Irrigation Requirement.

LAND RESOURCE AREAS - Broad, geographic areas having similar soils, climatic, geologic, vegetative, and topographic features which are grouped into a land resource region.

MEAN ANNUAL PRECIPITATION - The average of all annual precipitation values known, or an estimated equivalent value derived by such methods as regional indexes or isohyetal maps.

MEAN ANNUAL RUNOFF - The average value of all annual water runoff amounts, usually estimated from a period of record or during a specified base period in a specified area.

MILLIGRAMS PER LITER - mg/l; the weight in milligrams of any substance contained in one liter of liquid; nearly the same as parts per million.

MUNICIPAL AND INDUSTRIAL WATER - Water supplied to a central municipal distribution system, for rural domestic use, stock water, steam electric powerplants, and water used in industry and commerce.

NATIONAL RESOURCE LANDS - Public domain lands administered by BLM.

GLOSSARY OF TERMS
(Continued)

NATURAL FLOW - The rate of water movement past a specified point on a natural stream from a drainage area for which there have been no effects caused by stream diversion, storage, import, export, return flow, or consumptive use changes caused by man-controlled modifications to land use.

NET WATER YIELD - The available water runoff at a given location, both surface and subsurface, after upstream uses by man's activities, phreatophytes, and evaporation from upstream free water surfaces.

NEVADA RESOURCE LANDS - Term used to represent National Resource Lands in Nevada; see National Resource Lands.

OVERDRAFT - The amount by which the net pumping of water draft exceeds the perennial yield.

PERENNIAL YIELD (GROUND WATER) - The amount of usable water of a ground water reservoir that can be withdrawn and consumed economically each year for an indefinite period of time. It cannot exceed the natural recharge to that ground water reservoir and ultimately is limited by the maximum amount of discharge that can be utilized for beneficial use.

pH (HYDROGEN ION CONCENTRATION) - Measure of acidity or alkalinity of water. Distilled water, which is neutral, has a pH value of 7; values above 7 indicate the presence of alkalies, while those below 7 indicate acids.

PERCOLATING WATERS - Ground waters which seep through the soil and do not have a defined channel.

PHREATOPHYTE - A plant that obtains its water supply from the zone of saturation, either directly or through the capillary fringe.

OPERATION AND MAINTENANCE COSTS - The value of goods and services needed to operate a project and make repairs and replacements necessary to maintain the project in sound operating condition during its economic life.

PARTS PER MILLION (PPM) - Parts in weight, per million units of water.

PLAYA - A dry lake.

RECLAIMED WATER - Waste water treated for reuse or brackish water demineralized for use.

RECONNAISSANCE INVESTIGATION - A preliminary study and evaluation of existing data supplemented by a minimum amount of specifically collective data when it is not possible to determine the merits of further, more detailed investigations. It normally includes all facets of more detailed investigations, but the studies are generalized.

GLOSSARY OF TERMS
(Continued)

RETURN FLOW - That part of a diverted flow which is not consumptively used and which returns to a surface supply.

REUSE WATER - Water used repeatedly.

RUNOFF - That portion of the precipitation in a drainage area that is discharged from the area in stream channels. It may include surface runoff, ground water runoff, or seepage.

SALINE WATER - Water in which the concentration of dissolved solids exceeds 1,000 ppm.

SALT BALANCE - A condition whereby the total dissolved solids that are removed from a drainage equals the comparable dissolved solids added to the drainage (from all sources) during a specified period of time.

SALVAGED WATER - The part of a particular stream, or another water supply source, that is saved from loss, with respect to quantity and quality, and is retained and made available for use.

SEDIMENTATION - The accumulation or depositing of fragments of material that settle from water to air. This material normally results from the erosion process.

SEMIARID - Applied to regions or climates where moisture is normally greater than under arid conditions but still definitely limits the growth of most crops. The upper limit of average annual precipitation in the cool semiarid regions is as low as 15 inches; whereas in tropical regions it is as high as 45 or 50 inches.

STREAMFLOW - The rate of flow of water past a specified point in a stream channel. Streamflow can originate from either a natural or a modified environment.

SUSPENDED SEDIMENT - Sediment particles suspended in a liquid.

SUSPENDED SOLIDS - Solids which are not in true solution and which can be removed by filtration.

TOTAL DISSOLVED SOLIDS (TDS) - A measure of the mineral constituents in a liquid, usually expressed in mg/l.

TOXICITY - The state or degree of being poisonous.

TRANSPIRATION - The process whereby free water in a plant is released as a vapor into the air through the leaves or bark.

SUBBASIN - Hydrographic area; Refer to Hydrographic and Chapter 2.0.

GLOSSARY OF TERMS
(Continued)

VALLEY FILL - Alluvium or other material occupying areas below mountain slopes.

VESTED (WATER) RIGHT - Water rights initiated by applied water to beneficial use prior to March 1, 1905, and which have been continuously used.

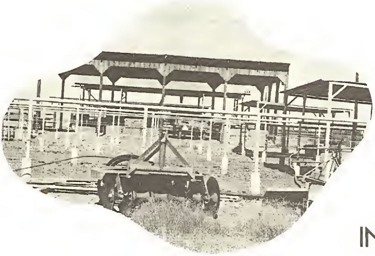
WATER QUALITY - A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

WATER REQUIREMENT (AGRICULTURAL) - The total quantity of water, regardless of its source, required for production of crops at their normal growth. It includes applied water, subsurface irrigation, and precipitation needed by the crops.

WATER TABLE - The upper surface of a zone of saturation, except where that surface is confined by an impermeable body.

YIELD - The return from cultivation practices specified in terms of tons per acre, bushels per acre, or hundred weights (cwt) per acre.

CHAPTER 1.0



INTRODUCTION

AGRICULTURAL POTENTIAL OF
NATIONAL RESOURCE LANDS
IN THE STATE OF NEVADA

1.0 INTRODUCTION

During the period July 1,1950 to June 4, 1964, a total of 7,152 agricultural applications were filed in the State of Nevada(1). On June 4, 1964 the Secretary of Interior suspended the acceptance of all agricultural applications in the state "unless the lands described...had first been classified...and open...to such". Appendix A (Number A-2) provides a transcript of the notice which appeared in the Federal Register on this date for reference.

Prior to and following the Secretary's action, the Bureau of Land Management (BLM) has worked closely with the Nevada Department of Conservation and Natural Resources and other agencies to identify and evaluate areas of the state which may offer potentials for agricultural development.

PRIOR STUDIES

BLM conducted a study in 1963 to evaluate the effectiveness and significance of the agricultural land laws(2). A total of 9,300 applications, permits and entries were evaluated in 11 states(3).

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(1) Chandler, R.E., Agricultural Potential Of Public Lands In The State Of Nevada, Bureau of Land Management, Department of Interior, July, 1972.

(2) Bureau of Land Management, Agricultural Land Law Effectiveness Study, Department of Interior, Reno, Nevada, August, 1963.

(3) Pittman applications and permits, Homestead application and entries, Desert Land applications and entries, and patented entries were reviewed and evaluated.

This was followed by a BLM study in the State of Nevada in 1972 (4). The study identified the existing potential of the national resource lands for agricultural development in each subbasin of the state.

CURRENT STUDY PURPOSE

Since 1972, the State of Nevada has completed its efforts leading to the published State Water Plan(5). The State and the U.S. Geological Survey have also completed additional basin reconnaissance studies. The studies conducted by these organizations, as well as others referenced in the Bibliography which were performed by institutions of the region over the past 10 years, made it necessary to reevaluate the earlier findings, in light of the additional information which had been developed. The economics of agricultural development have also changed considerably over the past years. Increased energy, fertilizer and machinery prices are typical of these changes.

This report summarizes the study that was initiated to update the earlier findings. The purpose of the study and this report is to present a current picture of the agricultural potential of the national resource lands in Nevada.

1.1 REPORT DESIGN

The study that was performed is documented in 7 Chapters as shown in Figure 1-1.

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(4) Refer to Footnote No. (1) source.

(5) Entitled Water For Nevada, available at Division of Water Resources, Department of Conservation and Natural Resources, Carson City, Nevada.

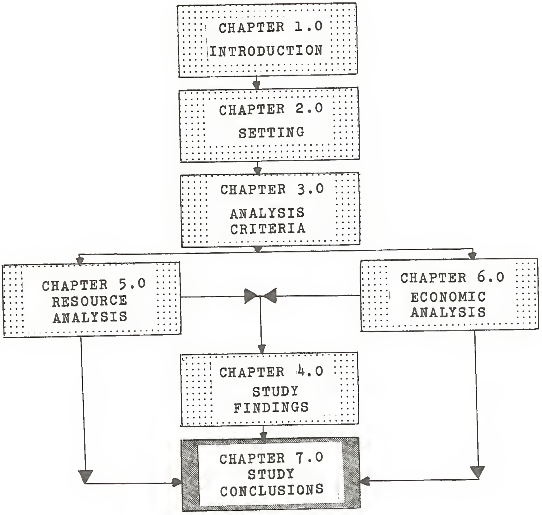


FIGURE 1-1
REPORT DESIGN PROFILE
SOURCE: BRI SYSTEMS, INC.

Chapter 2.0 presents the setting for the study. It discusses the characteristics of the regions of Nevada which influence agricultural development on the national resource lands. Physical resource features such as climate, soils and water resources are summarized. A description of the available national resource lands is also provided for reference. Important economic characteristics and trends of the state are shown to set the framework for the following discussions. The following chapters specify the research methods that were used and the findings that were identified.

STUDY CRITERIA

Chapter 3.0 discusses the criteria that were used for evaluation of the Nevada resource lands in the study. The physical resource feasibility criteria are discussed in Chapter 3.1. This is followed by a presentation of the economic feasibility criteria in Chapter 3.2.

The study was performed in two steps:

A. The physical resource potentials of the national resource lands were evaluated (Chapter 3.1), and
B. The economics of agricultural production on the lands found suitable for development were analyzed (Chapter 3.2).

The economic analysis also consisted of 2 steps, the preliminary analysis (Phase I) and the final analysis (Phase II) as shown in Figure 1-1.

Chapter 3.1 discusses the assumptions and criteria of the physical resource analysis that was performed. The Federal Government administers over 86 percent of the lands in Nevada as shown in Table I-1. The Bureau of Land Management is responsible for administration of nearly 80 percent of these Federal lands; this represents a management responsibility for over 68 percent of all the lands in the State of Nevada. The physical characteristics of these lands were evaluated.

TABLE I-1
NEVADA LAND STATISTICS *

TOTAL STATISTICS	ACRES	SQUARE MILES
Land Area	70,328,960	109,889
Water Area	416,640	651
TOTALS	70,745,600	110,540
BLM ADMINISTERED LANDS		
Natural Resource Lands	48,375,664	75,586.9
State(%)	68.4	68.4

* As of June 30, 1975; Based Upon Bureau Of Land Management Statistics.

SOURCE: U.S. Department of Interior, Bureau of Land Management, BLM Land Statistics, 1975, Bureau of Land Management, Reno, Nevada, 1976.

Chapter 3.2 discusses the economic criteria and assumptions that were used in the study. Precise economic analysis is handicapped by gaps in the information that is available. Specific combinations of labor and capital, for example, yield different results in different natural (physical) environments. This factor accounts in large measure for the regional differences that arise in agriculture, geographic population densities and industry dispersion. In seeking a maximum return for one's effort on the Nevada resource lands, a great deal of attention must be placed upon the available natural resources (i.e., depth to water, soil reclamation programs, irrigation leaching requirements, etc.) which all influence the economic analysis.

The variability in production and price which occurs also influences labor and capital. Over the intermediate period, lending institutions tend to give land a prior rather than a residual claim on agricultural income. This is observed when there is a crop failure and the land has produced nothing, yet the costs must be met. In such a situation, this cost can only be met from the available return of labor and capital, a reduction in the standard of living and/or neglect of the maintenance and replacement of capital items.

These factors cannot be neglected in future decisions. It is realized that any individual's economic vulnerability is a function of the liability-to-income ratio and that the lower this ratio is, the easier it is to withstand economic storms. The assumptions made in the economic analysis are fully discussed in Chapter 3.2.

STUDY FINDINGS PRESENTATION

Chapter 4.0 summarizes the findings of the study. It identifies the national resource lands which met the natural resource criteria, presented in Chapter 5.0, and the preliminary economic analysis findings, documented in Chapter 6.0.

Chapter 7.0 summarizes the overall study findings and conclusions.

The Appendix to this report consists of 4 sections:

A. General Reference Information.
B. Physical Resource Feasibility Analysis Reference Data.
C. Economic Feasiblity Analysis Reference Data.
D. Bibliography.

1.2 STUDY SCOPE

The reference data used in the conduct of the study are identified in the Appendix (D) to this report. Many factors are involved in an analysis of the potential of the national resource lands for agricultural development. Many assumptions must also be made.

FACTORS INFLUENCING STUDY

It is recognized that the demands upon an arid state as Nevada which supports an expanding population have outstripped the natural water supply available to serve it in many regions. Tomorrow's needs will place further demands upon these resources. Such demands were given consideration along with other physical resource factors influencing potential agricultural development of the Nevada lands. Typical national resource lands in largely undeveloped areas which were investigated are shown in Figures 1-2 and 1-3. The lands of such valleys as Tikapoo and the Rhodes area were evaluated along with those in areas where development has occurred such as in Jakes Valley, Figure 1-4, and the Diamond Valley area, Figure 1-5.

APPROACH

The state was divided into 12 portions for the analysis. Each portion is referred to as a Quadrant (Quad) in the report and the feasibility of the national resource lands in each Quadrant is separately discussed. Figure 1-6 shows the divisions used and specifies the areas contained within each Quadrant. The detailed Quadrant maps are located in Chapter 5.0. The region within each Quadrant is the area contained within the Township and Range values specified in Table I-2.

FIGURE 1-2
TIKAPOO VALLEY NATIONAL RESOURCE LANDS
SOURCE: BRI SYSTEMS, INC.

FIGURE 1-3
NATIONAL RESOURCE LANDS, RHODES SALT FLAT SUBBASIN
SOURCE: BRI SYSTEMS, INC.

FIGURE 1-4
NATIONAL RESOURCE LANDS SURROUNDING CURRENT AGRICULTURAL DEVELOPMENT IN JAKES VALLEY
SOURCE: BRI SYSTEMS, INC.

FIGURE 1-5
DIAMOND VALLEY AREA
SOURCE: BRI SYSTEMS, INC.

TABLE I-2
STUDY QUADRANT (QUAD) IDENTIFICATION

REFERENCED QUADRANT NUMBER	NEVADA QUADRANT REGION(a) DESIGNATION	NEVADA TOWNSHIP LOCATIONS	NEVADA RANGE LOCATIONS
1	Northwest	27N. - 47N.	18E. - 29E.
2	North Central I	27N. - 47N.	29E. - 43E.
3	North Central II	27N. - 47N.	44E. - 55E.
4	Northeast	27N. - 47N.	56E. - 70E.
5	Central West	6N. - 26N.	18E. - 30E.
6	Central I	6N. - 26N.	30E. - 43E.
7	Central II	6N. - 26N.	44E. - 55E.
8	Central East	6N. - 26N.	56E. - 70E.
9	Southwest	11S. - 5N.	24E. - 43E.
10	South Central	16S. - 5N.	44E. - 55E.
11	Southeast	16S. - 5N.	56E. - 71E.
12	South	33S. - 17S.	49E. - 71E.

(a) It is noted that because of the similarities that exist, a number of Regions are combined in the Chapter 2.0 discussion.

SOURCE: BRI SYSTEMS, INC.

The Nevada valley lands which were found to have potentials for agricultural development, based upon their physical resource suitability, were further investigated for their economic feasibility. Chapter 3.2 discusses the requirements set to represent economic feasibility and viability which may be expressed as the number of production acres required for a producer to maintain a standard of living from crop production on the lands.

The study findings for each of the Nevada lands which met the physical resource and economic feasibility criteria are presented in Chapter 4.0. These findings led to the study conclusions discussed in Chapter 7.0.

1.3 GOALS AND OBJECTIVES

The objective of this study has been to identify the production

FIGURE 1-6
REFERENCE STUDY QUADRANTS OF NEVADA
SOURCE: BRI SYSTEMS, INC.

acres required for a producer to maintain a livelihood of a set standard on the national resource lands. In fulfilling this objective, the report may hopefully serve the goal of providing a basis for evaluating future actions concerning the disposition of some of these lands for future agricultural development purposes.

1.4 GENERAL FINDINGS

One of the benefits of agricultural land development to man includes the products of the resource development which will add to the individual's quality of living. Many factors, both monetary and nonmonetary, influence one's desire to own and develop land. Individual economic and social goals are among the factors which highly influence such decisions. Of importance to the decision making process, one should not proceed with the resource development unless a gross benefit can be realized which equals or exceeds the projected costs of labor and material in developing the land resource. Emphasis is placed upon the term "gross benefits". In this study, it was assumed that natural (land and water) resources that will yield products whose economic value was greater and above the costs for the necessary labor and capital that must be employed have development potential and that such lands offer agricultural production opportunities. Such opportunities were identified to exist if the total gross income projected to be received from the labors of production were equal to or greater than the total estimated (amortized) fixed investment cost, the costs of production and a (desired) income that would provide an average standard of living for the producer.

PRODUCTION ACREAGE REQUIREMENTS ON NEVADA RESOURCE LANDS

The combination of resources that will provide the desired income is difficult to ascertain, particularly in a resource development analysis with as many variables as are present in this study. It is far easier, for example, to determine what will improve productivity to increase income than it is to determine the level of conditions that will provide the desired income in each Nevada valley. Emphasis is placed upon specifying "the direction to go rather than indicating the distance to travel". There are many uncertainties that affect the distance or the absolute number of production acres in each valley; whereas one can establish reasonable bounds upon the direction of travel or the magnitude of production acres required to attain an income level.

Considering the increasing prices for water development, machinery and other factors such as energy sources, for example, fuel and power, the analysis showed that a minimum of one section of land (640 acres) is needed to attain the desired income for a family of 4.

Under the best of conditions, it was found that about 400-500 acres were required in production. On the other hand, many solutions specified that about 750 acres were needed. If one were to take the average between these two values, one obtains about 625 acres, or almost one section of land.

Of all Nevada national resource lands which were investigated in this study, only the lands of 18 Nevada valleys met the joint physical resource and economic feasibility criteria. A review of the 18 valley areas shows that:

A. If the producer invests appropriately for all equipment needed for tillage, planting, harvest and hauling to obtain the maximum yields possible in the area of production and drills a well that will adequately provide for his full supply of ground irrigation waters, under the best of conditions he could attain the average standard of living by producing crops on not less than:

- 400 acres in 1 valley or,
- 500 acres in 5 valleys or,
- 600 acres in 13 valleys, or
- 700 acres in 14 valleys of the 18 valleys which met all study criteria.

B. Surface waters are generally not available to the producer on the national resource lands; they have been appropriated by other users in most valleys having agricultural potential. The producer will be required to invest in well development to provide for his irrigation water supply.

C. Allowing for the many contingencies that exist, the producer specified in (A) above has a better opportunity to succeed if he produces crops on not less than:

- 500 acres of 1 valley or,
- 700 acres in 4 valleys or,
- 800 acres in 7 valleys, or
- 900 acres in 13 valleys of the 18 which met the study criteria.

D. The producer must be able to withstand a negative cash flow in the early years of production. If one considers the desired income to be received by the producer as part of the total fixed costs of the operation (i.e., salary to the producer) and amortizes the other fixed investment expenses, a producer dependent upon only income received from crops will not attain a positive cash flow position until approximately the fifth year of operation and will pay off his total investment in a period of:

- o 17-19 years for an operation of 400 acres, or
- o 8-9 years for an operation of 600 acres.

E. The larger the operation size is, the better opportunity the producer will have to more rapidly reduce his liability-to-income ratio; on the other hand, the producer will require increased capital and will increase his potential risks to withstand economic storms (i.e., low market prices, poor crop yields, etc.) with the larger operation sizes.

F. The lowest risk situation for the producer is the profile that consists of utilizing surface waters, with ground waters as a supplement, on national resource lands that are near market areas also offering custom harvest services. Unfortunately, these conditions are not generally available.

G. There are other valleys present in the state which would offer greater opportunity for agricultural development if they had additional water resources than many of those identified. These valleys are discussed in Chapter 5.0. A potential for additional waters exists in some of these valleys in the future, based upon state water resource preliminary project plans. Such potentials are at least 10 years away and in most cases, about 20-25 years in the future.

H. The average operation production break-even point has been determined to be:

- o 310 acres (average value) and
- o 290 acres (weighted average value)

based upon evaluating 15 of the 18 areas that offer the best potential. On an annual basis, considering total amortized fixed costs and total variable production costs, it is seen that the total revenue from marketing the products of production is equal to the total costs for a production operation of a size of about 300 acres. This assumes the production yields specified in Appendix C of Volume 2 (Tables C-28 through C-31). It also assumes the fixed cost profile discussed in Chapter 3.0. Factors which highly influence the economic analysis include necessary equipment costs, water development costs, related transportation costs (spacial distances of operation to market(s)), and the yield productivity losses that the operation must absorb in the first years of crop production in reclaiming the lands.

FACTORS TO BE CONSIDERED IN INTERPRETING STUDY FINDINGS

Water availability of suitable quality is an important factor in determining the potential for agricultural development upon the national resource lands. Two elements of this factor which must be recognized in the study findings are summarized:

A. Preliminary Nature Of Water Reconnaissance Data

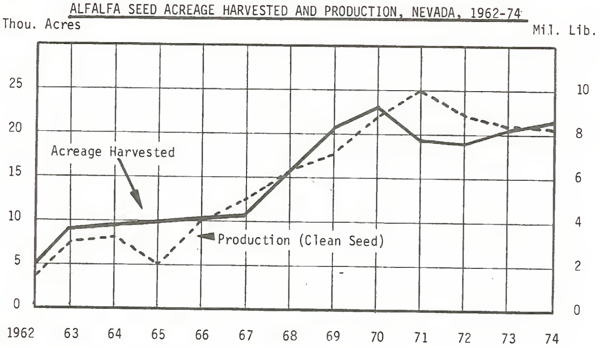
The preliminary nature of the water availability data requires that this information serve primarily as guidance in determining the "safe" perennial pumping yields of the valleys containing arable national resource lands. When current water appropriations did not allow for additional water resource use, based upon the estimated salvageable perennial yield in a respective valley containing arable national resource lands, the lands were given lower priority, proportional to water availability, in the analysis (Chapter 3.1). The lands offering suitable potentials which are confronted with water availability limitations are discussed in Chapter 5.0.

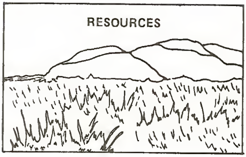
B. Water Appropriations And Water Use

All permits to appropriate water do not result in the granting of a certificate by the State Engineer. For example, many appropriators will not file the necessary proof of commencement, proof of completion, and proof of beneficial water use. Forfeiture, the loss of a water right caused by the failure of the appropriator to perform required acts, or abandonment, the intent to abandon a right by nonuse, must be shown and proven, respectively.

It is not possible to evaluate these issues in a study of this scope. The State Engineer will allow appropriations in excess of salvageable perennial yield, when on-site comprehensive investigations result in demonstrating that water resource development is far below water rights permitted and future developments will not affect prior water rights.

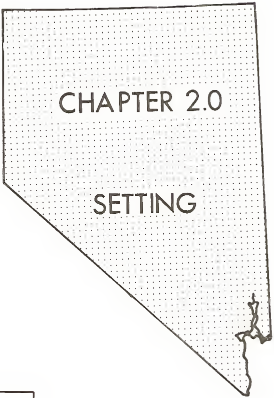
The eighteen valleys identified in Chapter 4.0 and Chapter 7.0 fully meet all study physical resource and economic criteria. Potential also exists at other Nevada valleys. The issues and problems surrounding agricultural feasibility on the national resource lands in these valleys are separately discussed in Chapter 5.0. Comprehensive investigation is required to fully address the issues associated with each.


ALFALFA SEED ACREAGE HARVESTED AND PRODUCTION, NEVADA, 1962-74
Thou. Acres
Mil. Lib.
25
20
15
10
5
0
10
8
6
4
2
0
Acreage Harvested
Production (Clean Seed)
1962
63
64
65
66
67
68
69
70
71
72
73
74



CHAPTER 2.0

SETTING



NW NE

REGIONAL

CHARACTERISTICS

SW SE

2.0 STUDY AREA SETTING

Nevada is the seventh largest state in the U.S. encompassing an area of 100,540 square miles. Over 99.4 percent of the state's area consists of land resources; natural and man-made surface water resources account for only a very small portion of the state's overall resources(1).

TOPOGRAPHY CHARACTERISTICS

Nevada is referred to as the Great Basin since it is a subdivision of the large western basin where drainage flows into enclosed basins rather than being discharged into waterways which eventually lead into the ocean. The mountain ranges that surround the valleys or subbasins of Nevada generally trend in a north or northeast direction and, on the average, rise to elevations between 8,000 and 10,000 feet above sea level. Individual ranges extend up to 80 miles in length and average between 5 and 15 miles in width.

A wide variation of elevations are found in Nevada, ranging from 470 feet along the Colorado River to the 13,143 foot-high Boundary Peak. The mean elevation for the state is 5,500 feet(2). Figures 2-1 and 2-2 illustrate the rugged terrain which borders the many valleys of the state.

Figure 2-3 shows the major basins of Nevada which are discussed on the following pages. A description of the basins in the state along with the other factors that influence the study such as climate, economy, land ownership, water resources and water use is presented in the following discussion.

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(1) U.S. Department of Commerce, Statistical Abstract of the U.S., 1975, Washington, D.C., Table #229, page 176.

(2) Ibid., Table #302, page 178.

FIGURE 2-1
MUDDY SPRINGS RIVER AREA
SOURCE: BRI SYSTEMS, INC.

FIGURE 2-2
SOUTHWESTERN NEVADA TOPOGRAPHY
SOURCE: BRI SYSTEMS, INC.

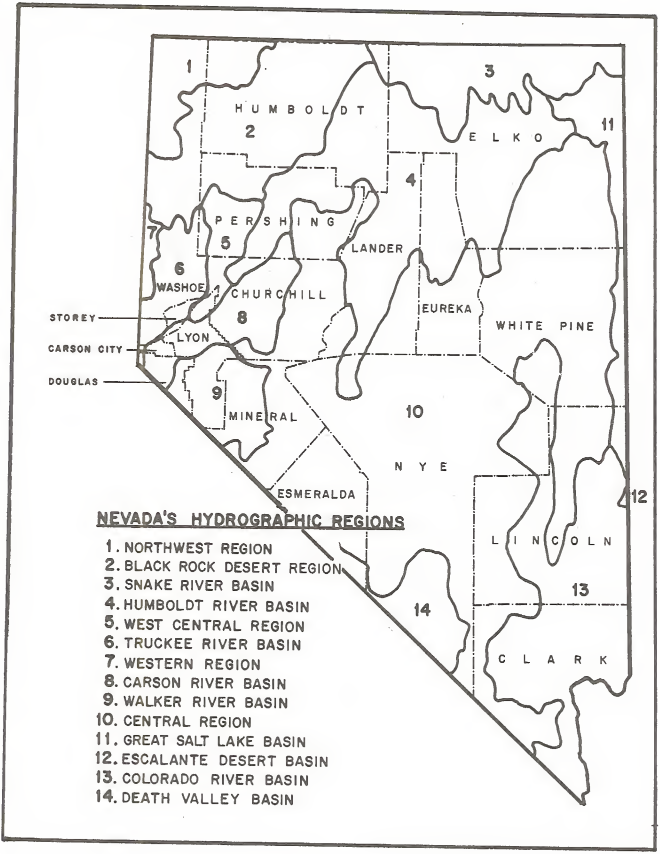

FIGURE 2-3
NEVADA BASINS
SOURCE: DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, CARSON CITY, NEVADA

2.1 NEVADA'S BASINS

The topography of Nevada includes many basins from which there is no surface water outflow. The state is divided into major hydrologic units or basins as were shown in Figure 2-3. A summary of the characteristics of these regions is provided for reference.

NORTHWEST REGION

In the northwest part of the state lie the Northwest, Black Rock Desert and Humboldt River Basins as shown in Figure 2-4. This area includes about 28,500 square miles, 18.3 million acres, and is characterized by large playas, small lakes and many intermittent streams. The principal stream of the area is the Humboldt River. The Humboldt River meanders from Wells, in eastern Nevada, over 300 miles in a westerly direction before it enters the Humboldt Sink(3).

All drainage waters of the Humboldt Basin are contained within it and there exists no outlet to the sea. In the Northwest Basin, small streams flow from Nevada to California and Oregon, except for Smoke Creek which flows into the state from California. The Quinn River is the major stream of the Black Rock Desert region. The river begins in Oregon and flows into Nevada.

The region is mostly unpopulated. Agriculture and mining, to an extent, are the predominant industries in this arid region which contains many valleys.

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(3) In years of extremely high water runoff, the river will flow into the Carson Sink which lies below the Humboldt Sink.

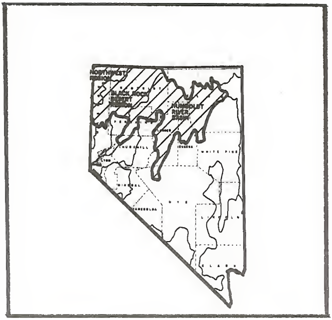

FIGURE 2-4
NORTHWEST, BLACK ROCK DESERT AND HUMBOLDT BASINS LOCATIONS
SOURCE: BRI SYSTEMS, INC.

NORTHEAST REGION

The Snake River Basin shown in Figure 2-5 is the major basin of the northeast region. The area consists of 5,230 square miles, 3.3 million acres, and is one of the few major basins in Nevada, along with the Colorado Basin, where water originating in the state flows out of the state. The Snake River is a part of the Columbia River system which extends into Idaho, Utah and Oregon(4). All drainages that contribute to the Snake River system and in turn, the Columbia River, eventually enter the Pacific Ocean.

The topography of the region varies widely. In the east, Little Owyhee Valley, a flat valley is surrounded by deep canyons with vertical cliffs. The Bruneau Valley may be characterized by a flat flood plain surrounded by hills in its southern portions and steep mountains to the north.

(4) Nevada segment represents about 2 percent of the entire system.

Salmon Falls Creek Valley has a similar topography. A topography from table lands to vertical-sided canyons is found within this region.

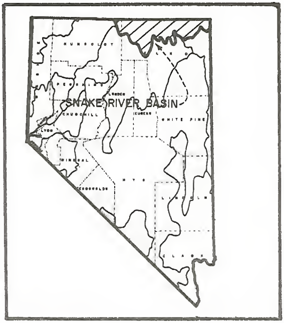

FIGURE 2-5
SNAKE RIVER BASIN LOCATION
SOURCE: BRI SYSTEMS, INC.

WESTERN REGION

The western region consists of the West Central, Truckee River, Western Nevada, Carson River and Walker River Basins which were shown in Figure 2-3. Principal streams include the Truckee River and Carson River which both originate from the Sierra Nevada region in California. The Truckee River originates at Lake Tahoe and flows into Pyramid Lake in Nevada. The Carson River flow is somewhat parallel to the Truckee River, about 25 miles to the south of it. The Walker River Basin also receives most of its water supply from the Sierra Nevada.

Medium to large reservoirs are located in this region.

Typical examples include Pyramid Lake, Walker Lake, Lahontan Reservoir, Boca Reservoir, Topaz Lake and Weber Reservoir. The region may be characterized as consisting of both, primary agricultural areas such as exist in the Carson Valley, Mason Valley, Smith Valley, Fernley and Fallon areas, and the arid valleys seen predominantly in many reaches of this region. The Sparks-Reno-Carson City area within this region is the second largest metropolitan area in the state.

CENTRAL REGION

The central region of the state includes the Central, Great Salt Lake and Death Valley Basins as seen in Figure 2-6.

FIGURE 2-6
CENTRAL REGION OF NEVADA BASINS LOCATION
SOURCE: BRI SYSTEMS, INC.

This region consists of 53,000 square miles, 34 million acres, and encompasses about 48 percent of the land area of Nevada. There are no major river systems or large bodies of water within the region.

The region may be characterized by elevations between 2,500 feet in the Death Valley drainage area extending to over 13,000 feet in the eastern and western portions. Long narrow valleys and small intermittent streams are predominant. The area has a sparse population with Ely, consisting of about 10,000 inhabitants, being the largest population center. A large portion of the region is used for the Nevada Test Site and military bombing and gunnery range purposes.

SOUTHEAST REGION

The southeast region consists of the Colorado River and Escalante Desert Basins which were shown in Figure 2-3. The region consists of 12,000 square miles, 7.9 million acres, and borders Arizona and Utah.

The Colorado River, White River, Muddy River, Virgin River and Meadow Valley Wash are the principal surface waters in the region. Hoover Dam, shown in Figure 2-7, is located about 35 road miles from Las Vegas, the principal metropolitan area in the state. There are about 30 reservoirs and ponds located in this region, many having a small capacity. The largest reservoirs, outside of Lake Mead or Lake Mohave, are Mathews Canyon and Pine Canyon Reservoirs located in the Clover Valley, Lincoln County. Figure 2-8 shows the features of Coyote Spring Valley located within the region which is typical of the many areas which are not under irrigation. Phreatophytes such as rabbit brush, greasewood, saltgrass and meadowgrass are present and abundant in areas supported by spring discharge, similar to many of the other regions of the state.

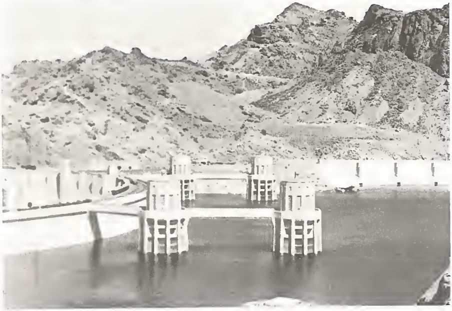

FIGURE 2-7
HOOVER DAM AND LAKE MEAD AREA
SOURCE: BRI SYSTEMS, INC.

FIGURE 2-8
COYOTE SPRING VALLEY AREA
SOURCE: BRI SYSTEMS, INC.

2.2 NEVADA'S CLIMATE

Temperatures in northern and central Nevada are typical of the middle latitudes, while the southern portion of the state is subtropical. Elevation reinforces temperature effects. The valley elevations average 2,000 to 3,000 feet higher in the northern portion of the state than in the south. Therefore, in parts of northern Nevada, frost may occur any month of the year, whereas southern Nevada rarely experiences freezing weather except during the winter period.

CLIMATE PROFILE

Nevada lies within the mid-latitude belt of the prevailing westerly winds. These winds are responsible for frequent changes of weather experienced especially during the fall-to-spring months. The state experiences its greatest precipitation during this period. To the south of the mid-latitude westerly lies a zone of high pressure in the subtropical latitudes, with its center over the Pacific Ocean. In the summer this high-pressure shifts northward resulting in clear and generally dry conditions, with scattered thundershowers. Figure 2-9 portrays the patterns experienced in the state.

Figure 2-10 illustrates the climate profile within the state. In the northern part of Nevada, the valleys experience cold winters and a short growing season which in turn limits the variety of irrigated crops that can be grown. In southern Nevada the valleys are below 3,000 feet. They experience mild winters and long hot summers.

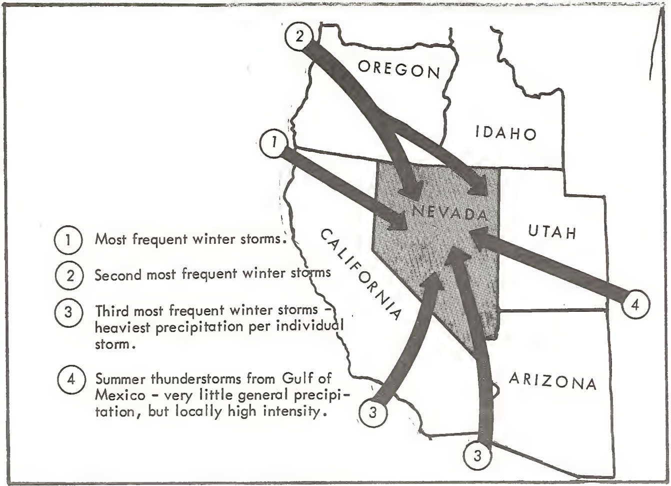

FIGURE 2-9
STORM PATTERN OF NEVADA
SOURCE: U.S. WEATHER BUREAU AND UNIVERSITY OF NEVADA, RENO, NEVADA

PRECIPITATION

Above the walley floors, most of Nevada's mountain ranges rise abruptly several thousand feet. This has an affect upon the state's climate. Temperature decreases with height, thus sub-freezing weather prevails on the highest peaks most of the year. Precipitation increases with elevation; the higher elevation's precipitation contrasts strikingly as compared to the deserts and semi-arid areas of the valleys below them. The benefits of the mountain climates include heavy winter snow and slightly greater precipitation during other periods of the year.

Nevada's precipitation averages about 9 inches annually with

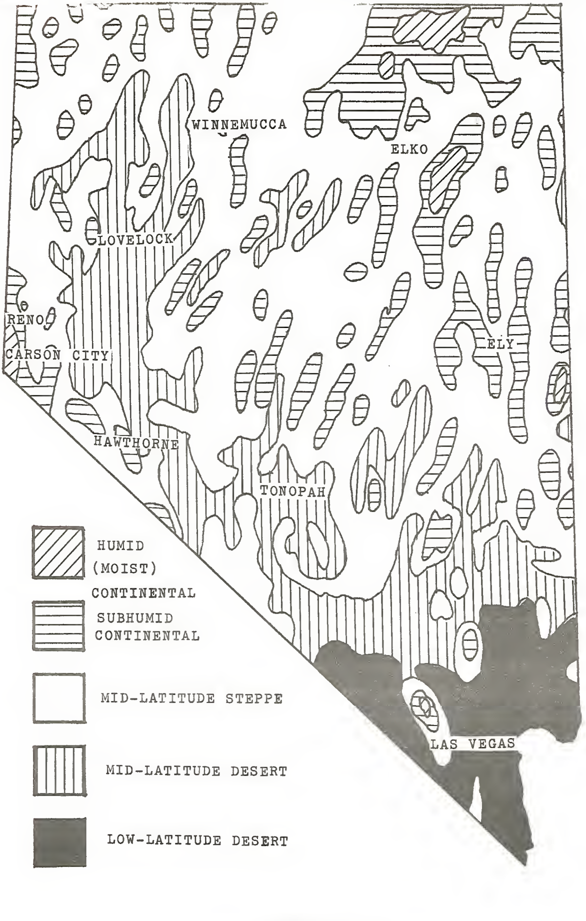

FIGURE 2-10
NEVADA CLIMATE PROFILE
SOURCE: HOUGHTON, J.G., et al, NEVADA'S WEATHER AND CLIMATE, UNIVERSITY OF NEVADA, 1975

a range of 3 inches in the more arid regions up to 40 inches in the higher mountain ranges. This is equivalent to about 54 million acre-feet of water annually(5). The state's water economy is essentially a deficit economy because of its climate. Nevada eventually loses nearly all of the water it receives from precipitation by evapotranspiration(6). Figure 2-11 illustrates the distribution of the evapotranspiration profile throughout the state and shows the differences that arise between the regions.

2.3 NEVADA'S SOILS

The soils of Nevada are typical of arid and semi-arid regions and include materials of the alluvial and immature consolidated upland classes.

LIGHT COLORED SOILS

Light colored soils of the arid regions are found between 125-8,000 feet elevation. They support low-to-moderate grazing practices. Associations of Red Desert and Alluvial are found in the lower elevations of the southern part of the state. Mixed alluvium and coluvium is found along eastern areas of the state between 1,000-5,000 feet. The central and south-central regions of the state also include alluvium from shale and sandstone, loess, residuum and volcanic ash materials between elevations of 4,000-7,500 feet. Other typical higher elevation arid soil associations include materials from shale, siltstone and sandstone along the terraces, mountain slopes

(5) State Engineer's Office, Water For Nevada: The Future Role Of Desalting In Nevada, Carson City, Nevada, April, 1973.

(6) University of Nevada, Mineral and Water Resources of Nevada, Prepared by U.S. Geological Survey and Nevada Bureau of Mines, Bulletin 65, 1964.

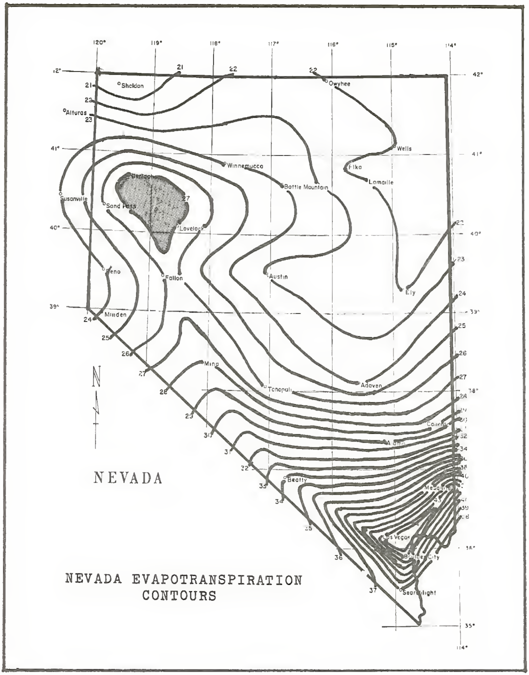

FIGURE 2-11
EVAPOTRANSPIRATION CONTOUR MAP OF NEVADA
SOURCE: BEHNKE, J.E., et al, EMPIRICAL METHOD FOR ESTIMATING MONTHLY POTENTIAL EVAPOTRANSPIRATION IN NEVADA

and alluvial fans such as are present in northeast Nevada(7).

DARK COLORED SOILS

The moderately dark and dark-colored soils of semi-arid regions support moderate grazing and agricultural irrigated farming.

ALLUVIAL SOILS

Alluvial soils occupy the fans and floodplains of the streams and enclosed mountain basins. These soils support irrigated croplands and low quantity grazing when there are only limited waters present.

OTHER ASSOCIATIONS PRESENT

Immature (shallow) soils on consolidated upland materials are located along a wide range of elevations in the eastern, southern and northwestern regions of the state. The soil associations are found along foothills and mountain slopes throughout these regions(8).

SOIL BENEFITS

Organic matter, available phosphorus and nitrogen range from low to medium levels in most of Nevada's irrigated soils. Potassium, on the other hand, has been generally found to range between medium and high levels within the state(9).

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(7) Washington State University, Soils of the Western U.S., Joint Regional Publication, Sept., 1964.

(8) Ibid.

(9) Dunn, L.E., Fertility Levels of Nevada Soils, College of Agriculture, University of Nevada, August, 1967.

2.4 NEVADA'S ECONOMY

NON-AGRICULTURAL SECTOR

Services and trade are the principal industries of Nevada as shown in Table II-1(10). Mining, finance and the manufacturing industries employ the least people within the state(11). This is in sharp contrast to the combination of mining and ranching which were responsible for the important early settlements and transportation routes in the state. Later, railroads were built, many which have since been dismantled. Present-day reminders of the past occupations are abandoned railroad grades and stations, abandoned mines, and several ghost towns.

TABLE II-1
NEVADA EMPLOYMENT PROFILE
NONAGRICULTURE: 1974

INDUSTRY	NO. OF PERSONS
Services(a)	105,000
Trade	50,000
Government	43,000
Construction	17,000
Transportation and Utilities	17,000
Manufacturing	12,000
Finance	11,000
Mining	4,000
TOTAL	259,000

(a) Includes gaming.

SOURCE: U.S. Department of Commerce, Statistical Abstract of the U.S., 1975, Washington, D.C., 1975.

(10) Includes wholesale and retail trade and gaming.

(11) U.S. Department of Commerce, Statistical Abstract of the U.S., 1975, Washington, D.C., 1975.

Nevada ranks eight in per capita personal income in the U.S.(12). The total personal income in Nevada in 1974 was over $3.5 billion; the per capita income was $6,073. Over 97 percent of this income was derived from non-farm sources(13).

AGRICULTURAL SECTOR

Table II-2 shows the farm and ranch profile in the state between 1960-1975. The number of farms has decreased and the size of the average farm has grown to about 4,500 acres; it has increased in size about 27 percent over the 15 year period.

Agriculture in the state is oriented towards livestock production and related industries. Total farm income in 1973 was $147 million; a major portion of this was derived from the sale of cattle, hay, milk and potatoes. This represented a 37 percent increase over the 1972 period(14).

2.5 NEVADA'S POPULATION

GROWTH AND PROJECTIONS

In 1930 the population of Nevada was 91,000(15) as compared to a total of 3.5 million persons in the entire southwest(16).

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(12) Ibid.

(13) Ibid.

(14) Ibid.

(15) U.S. Department of Commerce, Statistical Abstract of the U.S., 1975, Washington, D.C., pg. 14-15, 1975.

(16) U.S. Department of Interior, Pacific Southwest Water Plan, Bureau of Reclamation, Jan., 1964.

TABLE II-2

NUMBER OF FARMS AND RANCHES

NEVADA AND UNITED STATES 1960-1975

	NEVADA			UNITED STATES		
YEAR	NUMBER OF FARMS	AVERAGE SIZE OF FARMS (ACRES)	LAND IN FARMS (1,000 ACRES)	NUMBER OF FARMS (THOUSANDS)	AVERAGE SIZE OF FARMS (ACRES)	LAND IN FARMS (1,000 ACRES)
1960	2,600	3,540	9,200	3,962	297	1,176,946
1961	2,500	3,680	9,200	3,821	306	1,169,899
1962	2,400	3,620	8,700	3,685	315	1,161,383
1963	2,300	3,870	8,900	3,561	324	1,153,072
1964	2,300	3,830	8,800	3,442	333	1,146,806
1965	2,200	4,000	8,800	3,340	342	1,141,536
1966	2,200	4,000	8,800	3,239	351	1,137,161
1967	2,200	4,000	8,800	3,146	360	1,131,982
1968	2,100	4,190	8,800	3,054	369	1,127,567
1969	2,100	4,286	9,000	2,971	378	1,123,984
1970	2,100	4,286	9,000	2,924	383	1,120,725
1971	2,000	4,500	9,000	2,876	389	1,117,835
1972	2,000	4,500	9,000	2,870	381	1,093,017
1973	2,000	4,500	9,000	2,844	383	1,089,530
1974	2,000	4,500	9,000	2,830	384	1,087,788
1975(a)	2,000	4,500	9,000	2,819	385	1,086,375

(a) Estimated preliminary value.

SOURCE: U.S. Department of Agriculture, Nevada Agriculture Statistics, 1970, (1960-1970); 1974, (1971-75).

In 1960, the population of Nevada increased to 285,000 or about 213 percent, which was slightly greater than the growth trend for the entire southwest. Ten years later, in 1970, the population of the state grew to 489,000 and is currently 573,000(17). Figure 2-12 indicates the expected growth trends in Nevada to the year 2020 as compared to the other southwest states.

POPULATION DISTRIBUTION CHARACTERISTICS

About 50 percent of the state's residents are concentrated in the Las Vegas Valley in southern Nevada and 35 percent of the population lives in the western Nevada valleys of the Truckee, Carson and Walker Rivers. The balance of the population, except for a small concentration in the Humboldt River Basin, is distributed throughout the state. The current population of 573,000 results in a density of 5.2 persons per square mile within the state.

2.6 LAND OWNERSHIP

The Federal Government owns 86.6 percent of the lands in Nevada. This totals over 60.8 million acres. Private ownership patterns vary considerably in the state. The Northwest and Western Regions discussed in Chapter 2.1 include a larger percentage of private lands than found in the other regions. For example, only 4 percent of the Central Region's lands are in private ownership (1.26 million acres) and 5 percent of the Southeastern Region's lands are in private ownership (410,000 acres)(18).

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(17) Reference footnote No. (15).

(18) Reference Alternative Plans For Water Resource Use, Division of Water Resources, Department of Conservation and Natural Resources.

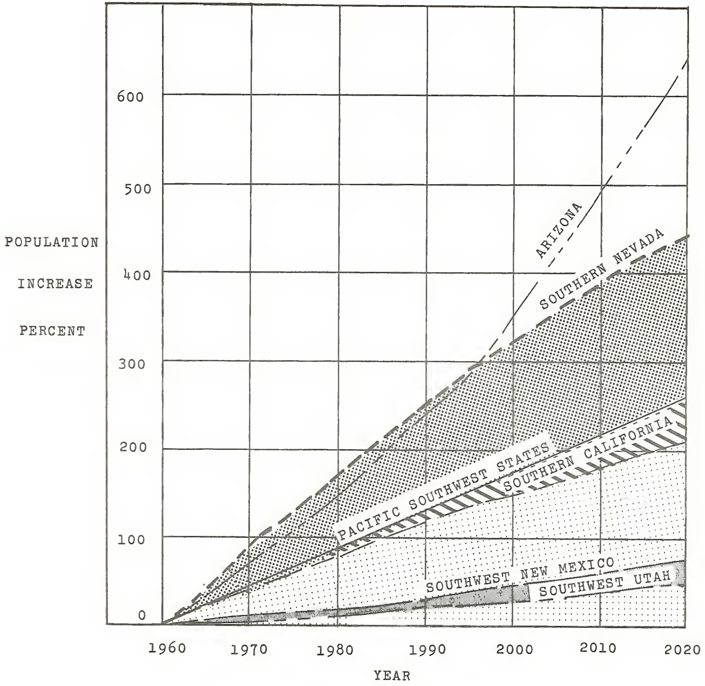


FIGURE 2-12

PROJECTED POPULATION GROWTH OF NEVADA AS COMPARED TO SOUTHWEST STATES

SOURCE: U.S. BUREAU OF RECLAMATION, PACIFIC SOUTHWEST WATER PLAN, 1964.

Table II-3 shows the lands that are managed by BLM in each county of the state. A profile of the lands administered by BLM, based upon use, is shown in Table II-4. Table II-5 compares the use of the national resource lands in Nevada to the adjoining states of Arizona and California.

2.7 WATER RESOURCES

Most of the streams draining the mountains surrounding Nevada's mountain ranges are supplied by snowmelt and storm runoff. The average annual surface runoff from the mountains is estimated at 3.2 million acre-feet annually(19). The remaining precipitation is lost by evaporation and transpiration (evapotranspiration).

Streams in all but two areas of Nevada drain into closed basins. The Colorado River and Snake River systems located in the southeastern and northeastern regions of the state, respectively, are the only outlets that transport water to the sea.

WATER AVAILABILITY

Major surface water sources in Nevada include the Humboldt, Carson, Truckee and Walker Rivers. The principal tributaries include such streams as the Bruneau, Owyhee, Salmon Falls and Virgin Rivers. Most of the water that is stored in Nevada is ground water(20). The average annual ground water recharge is estimated at about 2.2 million acre-feet(21). Each basin has

(19) Department of Conservation and Natural Resources, Division of Water Resources, unpublished data.

(20) "Storage" is used here to include all waters in the cycle from precipitation to evapotranspiration.

(21) Reference footnote No. (19).

TABLE II-3
ACRES MANAGED BY BUREAU OF LAND MANAGEMENT IN NEVADA: COUNTY PROFILE

COUNTY	TOTAL ACRES IN COUNTY	PERCENT OF ACRES IN STATE	ACRES MANAGED BY BLM	PERCENT OF BLM ACRES MANAGED IN COUNTY	PERCENT OF BLM ACRES MANAGED IN STATE
Carson City	97,920	0.1	42,801	43.7	(1)
Churchill	3,144,320	4.4	2,295,389	73.0	3.2
Clark	5,173,760	7.3	2,690,133	52.0	3.8
Douglas	480,640	0.7	184,850	38.5	0.3
Elko	10,995,840	15.5	6,780,334	61.7	9.6
Esmeralda	2,284,800	3.2	2,120,597	92.8	3.0
Eureka	2,676,480	3.8	2,026,449	75.7	2.9
Humboldt	6,210,560	8.8	4,319,357	69.5	6.1
Lander	3,597,440	5.2	3,022,186	84.0	4.3
Lincoln	6,816,000	9.6	5,667,994	83.2	8.0
Lyon	1,295,360	1.8	714,346	55.1	1.0
Mineral	2,455,680	3.6	1,729,685	70.4	2.4
Nye	11,560,960	16.3	6,850,661	59.3	9.7
Pershing	3,859,840	5.5	2,910,424	75.4	4.1
Storey	167,680	0.2	17,313	10.3	(1)
Washoe	4,229,120	5.9	2,637,987	62.4	3.7
White Pine	5,699,200	8.1	4,365,158	76.6	6.2
TOTALS	70,745,600	100.0	48,375,664	68.4	68.4

(1)Less than 1 percent.

Source: U.S. Department of Interior, Bureau of Land Management, Statistics 1975, NSO Pub. #5; U.S. Department of Interior, Bureau of Land Management, BLM Land Statistics, 1975, U.S. Government Printing Office, 1976.

TABLE II-4

PROFILE OF LANDS ADMINISTERED BY BUREAU OF LAND MANAGEMENT IN NEVADA(1)

	PERCENT OF TOTAL LANDS ADMINISTERED BY BLM
Lands Outside Grazing Districts	8.1
Lands Within Grazing Districts	89.8
Subtotal	97.9
Reserved Lands	
Land Utilization Project	(2)
Other Uses	2.1
Unperfected Entries Pending	(2)
Total Percent	100.0

(1)1974 Statistical Base;
(2)Less than 1 percent.

Source: U.S. Department of Interior, Bureau of Land Management, BLM Land Statistics, 1975, U.S. Government Printing Office, 1976.

TABLE II-5

COMPARISON OF AUTHORIZED USE OF BLM GRAZING DISTRICT LANDS IN NEVADA (1973) TO ARIZONA AND CALIFORNIA(1)

STATE	NEVADA	ARIZONA	CALIFORNIA
No. of Operators	838	293	508
No. of Livestock	706,054	158,413	88,088
Animal Units	432,939	70,644	86,008

(1)Does not include nonuse or exchange-of-use lands.

Source: U.S. Department of Interior, Bureau of Land Management, BLM Land Statistics, 1975, U.S. Government Printing Office, 1976.

unique ground water characteristics. They are addressed in Chapter 5.0. Total ground water pumpage in the state is estimated at about 330,000 acre-feet annually(21).

IRRIGATION PROFILE

Table II-6 lists the irrigated lands in the principal valleys of Nevada. The county irrigation use profile of the state, is shown in Table II-7. As shown in the referenced tables, irrigation dependent upon surface flows is heavily influenced by the availability of water in a given year and the number of acres in production will vary accordingly.

WATER LAWS

Nevada has laws regarding water and its development. In Nevada, ground water and surface water, is considered the property of the state(22). An application to appropriate the public waters of the State of Nevada is required by statute to be made to the Division of Water Resources. If there is no interference to existing water rights at the source, the State Engineer will issue a permit. Full use and development of the water may then be made under the terms of the permit. A certificate will then be granted under the permit for the quantity of water actually placed to a beneficial use which is the limit and extent of the water right.

The Nevada State Engineer has established a duty of water to be applied to a beneficial use when issuing permits and certificates for irrigation purposes. The courts determine the

(21) State Engineer's Office, Water For Nevada: Forecasts For The Future-Agriculture, Jan., 1974, page 177.

(22) Exceptions are present as in the case of Federal projects.

quantity or duty of water to be applied to a beneficial use in any adjudication of water rights.

TABLE II-6

IRRIGATED LANDS PROFILE: PRINCIPAL VALLEYS OF NEVADA

(1000 ACRES)

HYDROGRAPHIC AREA	WATER YEAR PROFILE LIMITED WATER	AMPLE WATER
Amargosa Desert(1)	6.0	6.0
Diamond Valley(1)	29.5	32.7
Fallon-Fernley Area	87.9	98.0
Hualapai Flats - Gerlach Area(2)	13.8	15.2
Upper Humboldt River Drainage(3)	120.5	155.5
Middle Humboldt River Drainage(4)	62.1	99.8
Lower Humboldt River Drainage(5)	30.7	40.1
Kings River Drainage(2)	30.0	43.2
Lund Area	8.4	11.0
Minden-Gardnerville Area	32.0	46.4
Muddy River Drainage	6.8	7.6
Owyhee River Drainage	78.6	90.6
Pahranagat Valley	6.1	6.7
Pahrump Valley Area(1)	12.7	12.7
Little Humboldt Riv. Drain. (Paradise Valley)	59.6	73.9
Quinn River Drainage(2)	60.0	75.8
Reese River Drainage(2)	22.4	28.5
Reno-Truckee Area	24.2	31.2
Ruby-Clover Valley Area	16.0	22.9
Smith Valley	22.6	25.5
Smokey Valley(2)	10.3	15.8
Yerington Area	38.0	72.9
All Other Areas	170.4	300.0
TOTAL	948.6	1312.0

(1) Irrigated primarily by pumped ground water.
(2) Irrigated mainly by pumped ground water-some surface water used.
(3) Above Palisades.
(4) Between Palisades and Rye Patch Reservoir, excluding Paradise Valley.
(5) All Humboldt drainage below Rye Patch Reservoir.

Source: Bourns, C.T., Irrigated Lands Of Nevada, University of Nevada, Oct., 1966.

TABLE II-7

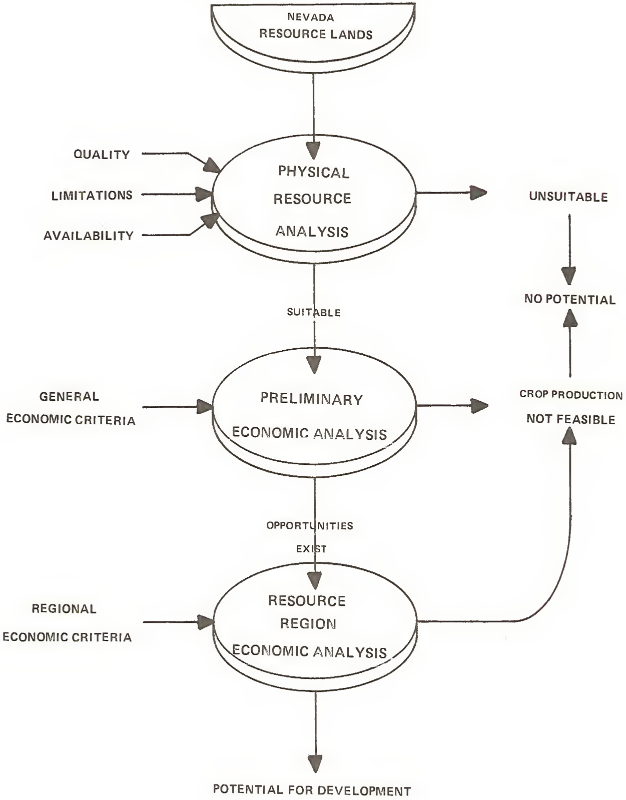
IRRIGATED LANDS OF NEVADA: COUNTY PROFILE
(1000 Acres)

COUNTY	WATER YEAR PROFILE: LIMITED WATER AVAILABILITY	WATER YEAR PROFILE: AMPLE WATER AVAILABILITY
Churchill	87.9	95.0
Clark	12.5	13.5
Douglas	32.0	46.7
Elko	229.9	329.8
Esmeralda	6.8	7.7
Eureka	56.5	79.9
Humboldt	227.6	312.4
Lander	39.5	52.1
Lincoln	18.5	32.1
Lyon	60.6	78.8
Mineral	5.3	6.2
Nye	43.1	54.6
Ormsby	4.0	4.7
Pershing	42.6	64.3
Storey	1.5	1.7
Washoe	49.2	77.1
White Pine	31.1	55.4
TOTAL	948.6	1312.0

Source: Bourns, C.T., Irrigated Lands of Nevada, University of Nevada, Oct., 1966.

CHAPTER 3.0

ANALYSIS CRITERIA



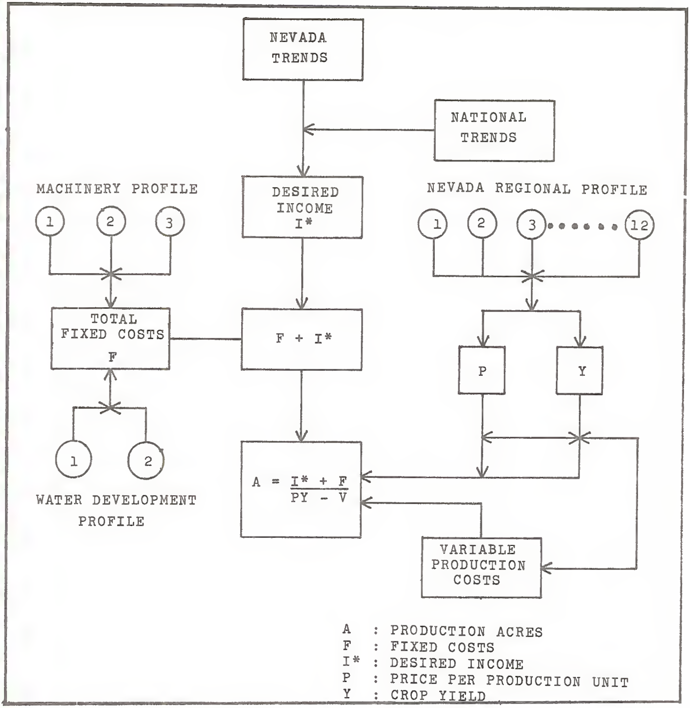


FIGURE 3-1
NEVADA NATIONAL RESOURCE LANDS FEASIBILITY ANALYSIS PROFILE
SOURCE: BRI SYSTEMS, INC.

3.0 FEASIBILITY ANALYSIS CRITERIA, ASSUMPTIONS AND MEASUREMENT BACKGROUND

Two primary characteristics of the national resource lands were evaluated in the analysis:

A. Determination of the physical resource potential of the lands for agricultural development and
B. Evaluation of the economic potential for agricultural operations on those lands which met the physical resource criteria.

Evaluation of the two characteristics, the physical resource and economic feasibility, involved the development of a number of assumptions and the assessment of many variables. The criteria that was used in the evaluation process and the assumptions that were made are outlined in the following paragraphs.

3.1 PHYSICAL RESOURCE FEASIBILITY CRITERIA

FACTORS EVALUATED

The physical resource factors investigated and evaluated included national resource land availability, land quality (for example, topography, soils and growing season), natural limitations that might be a deterrent to agricultural development on the Nevada resource lands, man-made limitations, water availability and water quality. Each of these factors is separately addressed. It should be noted that lands which were identified to meet the physical resource criteria do not necessarily offer excellent agricultural production potentials. They must be investigated on a local basis and further evaluated. The intent of the resource feasibility analysis has been to identify those Nevada resource lands where the potentials appear greater for investigation.

Chapter 5.0 discusses the potentials of the Nevada national resource lands and the identified limitations that may be a deterrent to agricultural production on them. All Nevada national resource lands which were found to meet the physical resource criteria are discussed. The lands identified to offer above-marginal to good physical resource potentials were further evaluated in the economic feasibility analysis which is summarized in Chapters 4.0 and 6.0.

PHYSICAL RESOURCE FACTOR MEASUREMENT

Each physical resource factor was evaluated and assigned a numerical value based upon the evaluation which indicated how well the national resource lands of each Nevada valley met the criteria for the factor. A method was used to combine these factors to obtain a total numerical value or Figure-of-Merit (FOM) for each valley. The factor numerical FOM's are presented in Appendix B to this report.

It was shown in Chapter 1.0 that the total area of the state was divided into 12 study Quadrants. Each Quadrant includes a portion of the state, about 9,159 square miles, more or less, and was separately evaluated. The study Quadrants were further segmented into smaller divisions for analysis. These divisions correspond to the Townships of the state.

Each physical factor addressed is documented in an Array, divided into Townships, that corresponds to one of the study Quadrants. The arrays are listed in Appendix B; they correspond to the study Quadrant maps which are presented in Chapter 5.0 where the potentials of the Nevada national resource lands are discussed. Each study Quadrant has arrays to represent physical resource criteria such as land availability, land quality, water availability and water quality among the other factors evaluated. Figure 3-2 shows the relationship between the study Quadrant maps of Chapter 5.0 and the physical resource factor arrays which are discussed in this chapter and located in the Appendix. The criteria discussed for each of the physical resource factors in the following paragraphs references the array in Appendix B that specifies how well each Nevada resource land area met the criteria for the factor.

LAND QUANTITY ASSESSMENT CRITERIA

LAND QUANTITY BACKGROUND

Land quantity is a measure of the availability of national source lands. The array titled Array 1 for each study Quadrant specifies this value. The number shown in Array 1 indicates a measure of the amount of Nevada resource lands that are available for potential development in each Quadrant. The Land Status Map of Nevada, (1972), was used as the reference for determining the amount of lands (acreages) to be given consideration in the analysis. Lands which were not given further consideration included:

A. Private lands.

B. Federal managed & administered lands such as:
   - a) National Forests,
   - b) Bureau of Reclamation land withdrawals,
   - c) Federal wildlife areas,
   - d) National recreation areas,
   - e) Atomic Energy Commission and Department of Defense lands.

C. American Indian lands consisting of:
   - a) Trust lands,
   - b) Reservation lands.

D. State of Nevada lands.

E. Other lands such as:
   - a) Stock driveways and
   - b) Patented mineral lands.

APPENDIX B

PHYSICAL RESOURCE ARRAYS

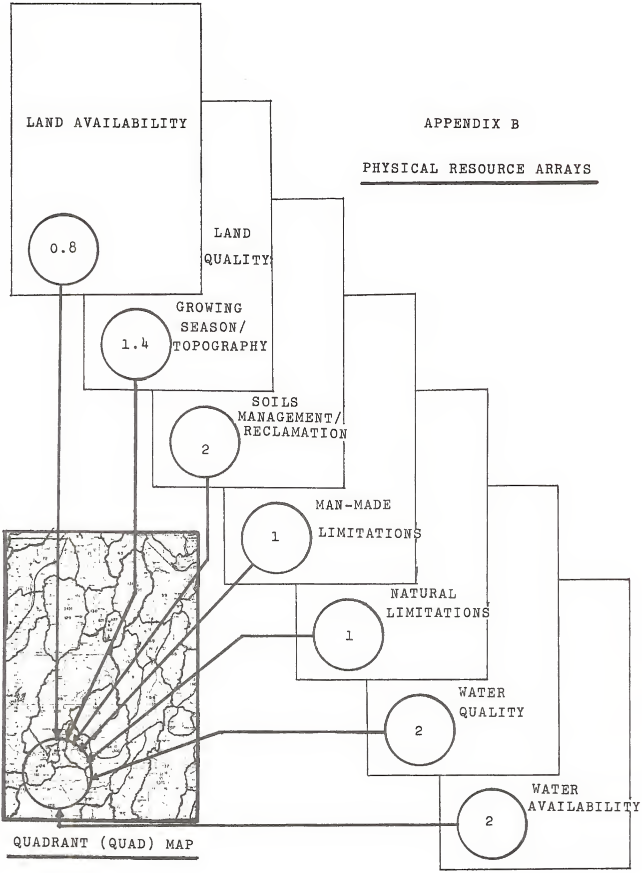


FIGURE 3-2
STUDY QUADRANT MAP AND FACTOR ARRAY RELATIONSHIPS
SOURCE: BRI SYSTEMS, INC.

LAND QUANTITY MEASUREMENT AND EVALUATION

Each Quadrant in Array 1 of Appendix B specifies a value which is a measure of the availability of the national resource lands contained within it. A value of 0, indicates that none of the Quadrant lands were to be further considered in the analysis. The lands in each Quadrant fall into one of the categories mentioned above. A value of 0.75 or 1.4, on the other hand, indicates that approximately 27 Sections (17,280 acres) or 50.4 Sections (32,256 acres) of national resource lands are available in the Quadrant respectively. The latter value of 1.4 represents a situation where Township overlaps occur; such overlaps have been used when necessary for consistency in the analysis.

NATURAL LIMITATIONS I ASSESSMENT CRITERIA

GROWING SEASON BACKGROUND

Array 2 for each study Quadrant specifies a factor value based upon the growing season of each area. The number of days between the last spring freeze and the first autumn freeze is used to provide a measure of the length of the growing season. A freeze is defined in the analysis as the occurrence of a selected minimum temperature in each Nevada valley. Although the freeze temperature generally referred to is 32°F, one may see from Table III-1 that for agricultural purposes a freeze-free season based upon a temperature of 28°F is more representative for this analysis, since frost may or may not accompany a freeze.

The length of the growing season depends highly on local surface features. Large water bodies for example, will modify the temperature extremes, thereby lengthening the growing season.

TABLE III-1

TEMPERATURES (°F) HARMFUL TO SELECT CROPS

CROP	GROWTH STAGE		
	GERMINATION	FLOWERING	FRUITING
Alfalfa	25	28	-
Beans	30	31	-
Cabbage	20	-	-
Corn	27	30	28
Cotton	32	32	28
Melons	32	32	30
Oats	20	28	28
Potatoes	28	30	30
Sorghum	30	30	28
Spring Wheat	18	27	28
Tomatoes	32	32	32

SOURCE: Condensed from Nevada's Weather and Climate, 1975.

The Lahontan Reservoir west of Fallon is typical of this. Another influencial variable is topography, especially as it affects temperature inversions in the valleys. While mean temperature decreases with high elevation, the night-time minimum is usually less at the bottom of a valley than it is near the surrounding mountains or at slightly higher elevations. These valley areas have a longer growing season; in some areas of Nevada they are planted into crops which might otherwise suffer frost damage on the valley floor. The length of the growing season is also variable from year to year, reflecting a random occurrence of first and last frosts. On the average, one might expect that in 4 years out of 5 the growing season will be within plus or minus 27 days of a mean determined length. Table III-2 shows an example of the variations that can occur in the growing season length for the communities of Alamo and Caliente.

TABLE III-2
NUMBER OF DAYS BETWEEN FREEZE TEMPERATURES

YEAR	32°F (OR BELOW) ALAMO	32°F (OR BELOW) CALIENTE	28°F (OR BELOW) ALAMO	28°F (OR BELOW) CALIENTE	24°F (OR BELOW) ALAMO	24°F (OR BELOW) CALIENTE
1952	177	183	212	208	227	227
1953	117	122	150	144	208	191
1954	219	151	230	206	257	210
1955	141	137	178	178	208	186
1956	134	151	183	-	202	204
1957	163	138	169	162	238	227
1958	173	134	176	152	222	191
1959	151	135	184	150	228	200
1960	144	141	164	189	198	205
1961	129	136	156	179	188	183
AVERAGE	154	142	180	174	217	202

SOURCE: Division of Water Resources, Reconnaissance Report No. 16, Department of Conservation and Natural Resources, Carson City, Nevada.

GROWING SEASON ASSUMPTIONS

Variations will arise in determination of the freeze-free period based upon the period of data collection. Table III-3 shows the freeze-free period for select Nevada communities published by the Cooperative Extension Service. A comparison of the community of Caliente's freeze-free season shown in Table III-2 and Table III-3 provides an example of these variations. It is seen that this value is only a good approximation.

TABLE III-3
FREEZE-FREE PERIOD FOR SELECT NEVADA COMMUNITIES

LOCATION	ELEVATION FEET	FREEZE-FREE PERIOD 32 F DAYS	24 F DAYS
1. Austin	6,600	109	168
2. Beatty	3,300	198	254
3. Caliente	4,400	150	211
4. Ely	6,300	80	141
5. Fallon	4,000	132	192
6. Las Vegas	2,200	248	302
7. Lovelock	4,000	129	178
8. Mina	4,600	155	213
9. Overton	1,200	231	291
10. Pahrump	2,800	201	257
11. Reno	4,400	103	171

SOURCE: Cooperative Extension Service, Selecting An Alfalfa Variety, University of Nevada, Reno, June, 1972.

Table III-4 summarizes the general characteristics of the climate in Nevada for the various elevations present within the state. Figure 3-3 illustrates the characteristics which are shown in Table III-4. Such characteristics are a part of the assumptions made.

The assumptions were based upon Nevada's principal crops and included:

A. Hardy varities of alfalfa hay require between 70-120 freeze-free growing days,
B. Moderate hardy varities of alfalfa hay require between 120-200 freeze-free growing days,
C. Non-hardy varieties of alfalfa hay require a freeze-free growing season greater than 200 days, and
D. Alfalfa seed production requires a minimum of 100 freeze-free days.

TABLE III-4

CHARACTERISTICS OF CLIMATIC TYPES IN NEVADA

	MEAN TEMPERATURE (°F) WINTER	MEAN TEMPERATURE (°F) SUMMER	ANNUAL PRECIPITATION (INCHES) TOTAL	DOMINANT VEGETATION
Tundra	0-15°	40-50°	15-45"	Alpine Meadow
Humid continental	10-30°	50-70°	25-45"	Pine-fir forest
Subhumid continental	10-30°	50-70°	12-25"	Pine or scrub woodland
Mid-latitude steppe	20-40°	65-80°	6-15"	Sagebrush, grass, scrub
Mid-latitude desert	20-40°	65-80°	3- 8"	Greasewood, shadscale
Low-latitude desert	40-50°	80-90°	2-10"	Creosote bush

SOURCE: Condensed from Nevada's Weather and Climate, 1975.

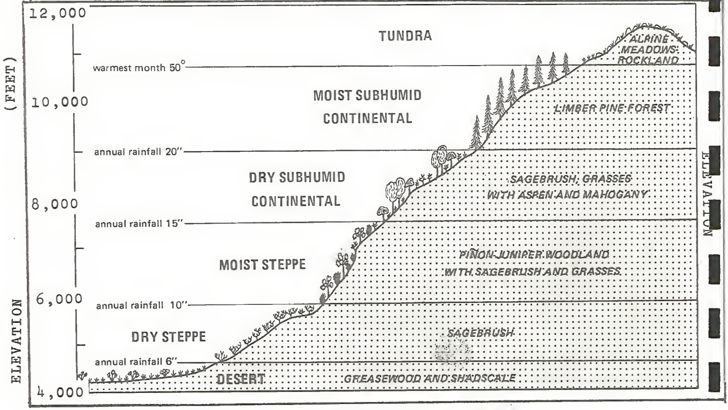


FIGURE 3-3

EFFECT OF ELEVATION ON CLIMATE AND VEGETATION

SOURCE: NEVADA'S WEATHER AND CLIMATE, UNIVERSITY OF NEVADA, 1975

A minimum of 100 freeze-free days of 28°F was used as the basis for defining the required growing season in this analysis.

ASSESSMENT CRITERIA DEVELOPMENT

The growing season value used in the analysis was obtained by research of the references specified in the Bibliography; it represents an average growing season value in the respective valleys of the study region. In situations where discrepancies arose between the source data, other valleys having similar characteristics were used as a further reference in determining an average value. The informational resources included, but were not limited to:

A. Freeze-Free (32°F) Seasons of the Major Basins and Plateaus of Nevada, University of Nevada, Reno, 1973.
B. Reconnaissance Reports, U.S. Geological Survey and Department of Conservation and Natural Resources, Carson City, Nevada.
C. Soil Survey Reports and related studies, Department of Agriculture, Carson City and Reno, Nevada.
D. Unpublished and preliminary water resource reports and basin characteristics, Division of Water Resources, Carson City, Nevada/U.S. Geological Survey, and
E. Supplementary information sources denoted in the Appendix Bibliography.

The values shown in Array 2 for each study Quadrant indicate the average growing season FOM value which was developed based upon the resources used. If the growing season for lands under consideration was less than 100 days, it was specified as 0 and was not given further consideration in the analysis. Other values shown in Array 2 such as 1.2 and

1.9 indicate an estimated average growing season of 120 days and 190 days for the valleys, respectively.

LAND QUALITY: MANAGEMENT AND RECLAMATION ASSESSMENT CRITERIA

BACKGROUND

Important characteristics of land quality include topography and soils or viewed from another framework, the management and reclamation practices that must be performed to develop the natural resource lands for cropping purposes. The quality of Nevada resource lands is dependent upon their physiography and soils as well as the potential effects upon such lands from local problems that may be created by irrigation water solutes such as salinity and alkalinity.

LAND QUALITY ASSUMPTIONS

If the soils and water quality characteristics were "perfectly known", one would be able to predict the affect of irrigation water upon the soils. Neither factor is perfectly known in most of the study area; thus one must project the potential interactive effects that will take place based upon the information that is available.

The physical factors that influence soils and in turn the reclamation and management practices that must be carried out are shown in Figure 3-4. One must also acknowledge that there are different types or degrees of efficiency in land preparation. The land operator must make some choices as to the degree to be performed when he undertakes land preparation. Many factors, including available farm equipment, will influence this choice. Because of differences in soils, slopes,

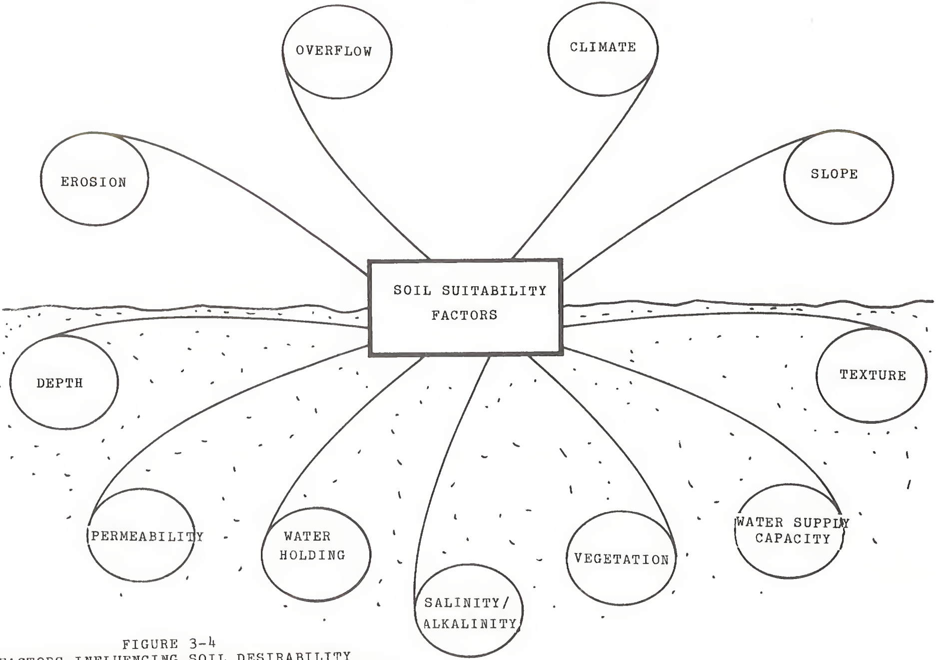


FIGURE 3-4

FACTORS INFLUENCING SOIL DESIRABILITY

SOURCE: DEPARTMENT OF AGRICULTURE, RENO, NEVADA

TABLE III-6
MANAGEMENT AND RECLAMATION
ARRAY 3 FOM VALUE DEFINITIONS

ASSIGNED VALUE	DEFINITION
0	Extensive reclamation needed for areas of poor or very marginal soils with associated poor water quality characteristics.
2	Moderate-to-extensive reclamation and management practices; also includes areas where further investigations are required to address soil suitability for cropping because of uncertainties in the available information.
3	Moderate reclamation and management practices needed for good soils on suitable topography with limitations.
4	Lessor degree of reclamation and management practices needed for good soils, suitable topography and associated good water source quality characteristics.

SOURCE: BRI SYSTEMS, INC.

MAN-MADE LIMITATIONS ASSESSMENT CRITERIA

BACKGROUND

The reference data in Appendix B entitled Array 4 specifies the man-made limitations in the study area. Two types of limitations which could influence agricultural development on the lands were given consideration:

A. Surface water limitations and

B. Ground water limitations.

In an arid state as Nevada, water is scarce; therefore it is strictly controlled and regulated by the Division of Water Resources (Division of Water Resources is used synonymously with the Office of the State Engineer as the State Engineer is the executive head of the Division). The water policy and philosophy of the State of Nevada has been developed over a period of 100 years (beginning about 1849) and is now contained in the Nevada Water Law, Nevada Revised Statutes of 1957 (NRS), as amended. NRS Chapters 533 through 544 contain the state water policy, procedure for acquiring a right to use water by adjudication and by appropriation, and provides for the administration for the conservation, regulation and distribution of the public waters of the state above and below the surface of the ground.

ASSUMPTIONS AND CRITERIA DEVELOPMENT

Water in the adjudicated stream systems of Nevada is distributed in accordance with civil, state or federal decrees which are defined as follows:

A. Civil decrees result from court decisions in disputes between water users.

B. State decrees represent the decisions in adjudication procedures set by the statutes.

C. Federal decrees are the result of cases brought in Federal court because waters of more than one state were involved.

The surface water decrees of the state are listed in Table A-1 of the Appendix of this report.

The State Engineer may also designate underground water basins which are being depleted and declare preferred uses in such designated basins. No well can be drilled in designated areas until a permit is granted. Wells for domestic purposes are an exception and may be drilled without a permit; but they must meet the requirements of all wells drilled in Nevada. However, the State Engineer may prohibit the drilling of wells for domestic use in areas within designated basins where water can be furnished by an entity such as a water district or municipality presently engaged in furnishing water.

Chapter 5.0 summarizes the water appropriations that have been filed with the state in each valley given consideration in the analysis and also specifies the waters that are available for further agricultural development(1). In most situations, water unavailability is the biggest deterrent to development upon the national resource lands.

Table III-7 lists the ground water basins which are designated or restricted in the state. The FOM value assigned to each area in Array 4 of Appendix B is either a 0 or 1. Since most surface waters have generally been appropriated, emphasis is accorded ground water availability. A value of 0 indicates that the study area lies within a closed or restricted basin. No water is available for further development. If no restrictions were identified for an area, a value of 1 was assigned for this factor.

NATURAL LIMITATIONS II ASSESSMENT CRITERIA

BACKGROUND

Array 5 designates an FOM factor for other natural limitations that were identified in each study area. These limitations which could be a deterrent to agricultural production are generally due to mineral potentials and corresponding claims.

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(1) This only includes the valleys containing national resource lands which have met the physical resource criteria.

TABLE III-7

MAN-MADE LIMITATIONS
NEVADA DESIGNATED AND RESTRICTED BASINS

HYDROGRAPHIC REGION NO.	DESIGNATION DESCRIPTION
24	Permits Not Being Issued
29A	Restricted
30	Permits Not Being Issued
31	Designated
32	Designated
33	Designated
57	Designated
58	Designated
66	Designated
69	Designated
70	Designated
71	Designated
73	Designated
85	Designated
92	Designated
103	Designated
104	Designated
107	Designated
153	Designated
162	Designated
212	Designated
219	Designated

Refer to Study Supplement, Volume 2, for hydrographic region designations.

Source: State Engineer's Office, Verbal Communications, Carson City, Nevada, June, 1974.

Emphasis was upon the number of claims in each study area as they may affect adjoining national resource land developments. It should be noted that many claims are located in areas where the topography is not generally condusive for agricultural cropping purposes; thus, in most situations, this factor has only minimal affect upon the findings.

ASSUMPTIONS AND CRITERIA DEVELOPMENT

An FOM value was developed by assessing the number of mineral claims or identified mineral veins within each study area. A small numerical value in Array 5 indicates that many mineral claims are present and/or that a mineral vein of significance was identified. The FOM value in Array 5 is based upon a percentage approximation that designates the percent of lands in each area that should be given further consideration for agricultural production; these lands do not have any natural limitations such as mineral or geothermal resources on, upon or near them. The information is based upon the Bureau of Mine's information sources specified in the Bibliography.

WATER QUALITY ASSESSMENT CRITERIA

BACKGROUND

The water quality FOM value (Array 6) specifies the general water quality characteristics of the water sources available to the study lands. As indicated in the prior paragraphs, agricultural developments upon the Nevada resource lands will be highly dependent upon the ground waters available since much, if not all, of the surface waters in many areas have been previously appropriated.

Many variables are involved in assessing ground water quality characteristics. For example, as ground water moves from areas of recharge to areas of discharge, the quality of the water may change in response to changing conditions in its environment. The dissolved-solids content of water is generally low in areas of natural recharge, near mountains, and increases as water moves toward areas of natural discharge in valley lowlands. In areas of natural discharge, the dissolved-solids content usually increases as water moves upward towards the surface.

The FOM value shown in Array 6 for each study area is the product of two important water quality parameters that must be considered for national resource land development: (1) the sodium-alkali hazard and (2) toxicity.

SALINITY-ALKALINITY INFLUENCE

The sodium-alkali hazard was determined from the computation of the sodium-absorption-ratio (SAR) and specific conductance. When SAR information was available, it was used directly. In other situations SAR was computed from available sodium, magnesium and calcium data. The SAR values for each area were then averaged to obtain a representative average for use in the physical resource analysis.

Dissolved-solids content, as it is related to the suitability of water for agricultural use, commonly is referred to as salinity hazard. The salinity hazard usually is defined in terms of specific conductance, which is a measure of the ease with which an electric current will pass through the water. The U.S. Department of Agriculture defines salinity hazard and its relation to specific conductance as follows:

TABLE III-8
SALINITY HAZARD MEASUREMENT

SALINITY HAZARD	SPECIFIC CONDUCTANCE (MICROMHOS PER CENTIMETER AT 25°C)
Low	0 to 250
Medium	251 to 750
High	751 to 2,250
Very High	greater than 2,250

SOURCE: U.S. Department of Agriculture.

Prior studies in Nevada have indicated that the growth of barley was not appreciably influenced by SAR levels of waters and that alfalfa yields were about the same for low, medium and medium-high SAR levels. Yields were shown to be generally lower when high SAR levels were present(2).

Figure 3-5 shows the relationship between alkalinity (sodium hazard) and the salinity hazard used in the analysis. The corresponding numerical value in each segment of the figure (i.e., 0-9) specifies the FOM value assigned to the waters available to the study area which represented the sodium-alkali hazard.

TOXICITY INFLUENCE

The toxicity value was developed by using Figure 3-6, based upon the boron and chloride quality assumptions shown in Table III-9 and Table III-10. Prior studies of boron's impact upon crop yields of barley and alfalfa showed that there were some significant changes in yield, but they did not follow a consistent pattern. With the exception of alfalfa on Sonoma soil, boron caused some spotting or

(2) Dunn, L.E., et al, Quality Standards of Irrigation Waters for Nevada Soils, University of Nevada, Reno, 1970.

SALINITY MEASURE

(SAR vs Conductance)

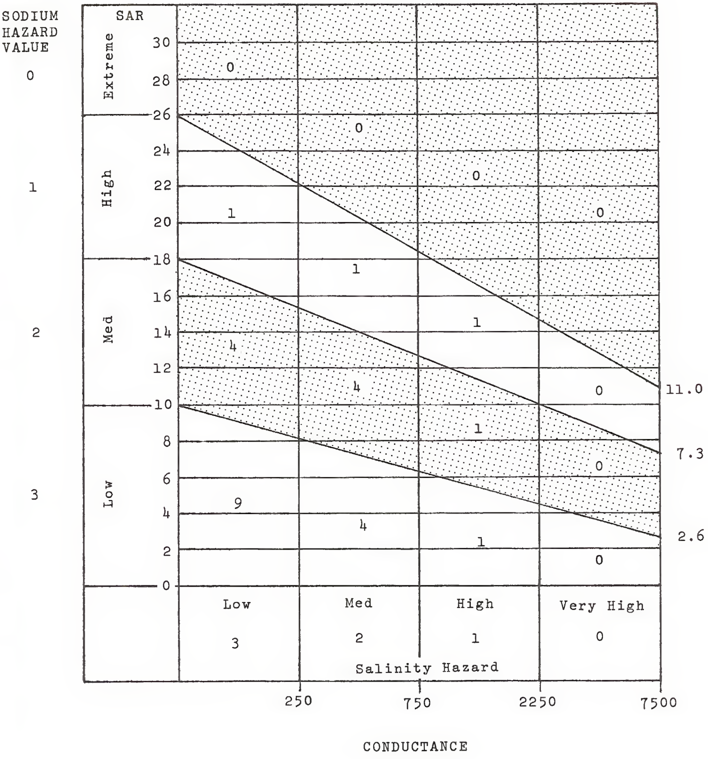

FIGURE 3-5
SALINITY-ALKALINITY HAZARD FOM
SOURCE: WATER QUALITY CRITERIA, REFERENCE TABLE III-9.

FIGURE 3-6

WATER QUALITY
TOXICITY DETERMINATION

CHLORIDE (ppm)	CHLORIDE (MEQ/Liter)	BORON (ppm) 0 – 1.0	1.0 – 2.0	2.0 – 3.0	3.0 – 3.75	3.75 –
350	8	0	0	0	0	0
250	4	.50	.50	.50	.25	0
175	2	.75	.75	.50	.25	0
0	0	1	.75	.50	.25	0

FIGURE 3-6
TOXICITY: BORON-CHLORIDE HAZARDS FOM
SOURCE: WATER QUALITY CRITERIA, REFERENCE TABLE III-9.

TABLE III-9

BORON QUALITY FOM FOR ALFALFA

BORON QUANTITY (ppm)	COMMENTS	ASSIGNED FOM VALUE
0-1.00	Essential To Plant Nutrition	3
1.00-2.00	Good-To-Permissible	2
2.00-3.00	Permissible	1
3.00-3.75	Doubtful	0
3.75	Unsuitable	0

SOURCE: Based upon recommendations of the National Technical Advisory Committee, Water Quality Criteria, Federal Water Pollution Control Administration, 1968.

TABLE III-10

CHLORIDE QUALITY FOM

CHLORIDE QUANTITY ppm	CHLORIDE QUANTITY Meq/Liter	COMMENTS	ASSIGNED FOM VALUE
175	2	Excellent	3
175-250	2-4	Good Or Not Known	2
250-350	4-8	Permissible	1
350	8	Unsuitable	0

SOURCE: Ibid.

chlorosis of leaves when present at high concentrations. Boron toxicity was more prominent on coarser-textured soils. On such soils, high levels of boron decreased alfalfa yields through the loss of leaves(3).

ASSESSMENT CRITERIA DEVELOPMENT

The FOM value shown in Array 6 represents the product of the sodium-alkali FOM value of Figure 3-5 and toxicity FOM value shown in Figure 3-6 for each study area. The value determined offers a basis for physical resource assessment and should not be considered beyond this scope. In any given area selected for development, the specific water quality characteristics should be investigated. The value developed in this analysis includes the averaging of many values in certain valley areas and the extrapolation of water quality properties in other valley areas when information was not available. It is based upon sources listed in the Biliography which included:

A. The Environmental Protection Agency STORET data listing for Nevada,
B. Reconnaissance surveys by Federal, State and educational institutions,
C. Special area reports listing respective water quality characteristics.

OTHER WATER QUALITY FACTORS

The residual sodium carbonate (RSC) is another factor that affects the chemical suitability of irrigation water. This parameter was not given consideration in the analysis because only very limited data was available on its elements

(3) Ibid.

within the entire study reach(4). It is generally believed that an RSC value larger than 2.5 milliequivalents per liter is unsuitable for irrigation.

Other factors such as hardness, shown in Table III-11 only affect domestic and (certain) industrial water suitability. They were not given consideration in the study.

TABLE III-11
WATER HARDNESS CLASSIFICATION

HARDNESS RANGE (ppm)	CLASSIFICATION
0-60	Soft
61-120	Moderately Hard
121-180	Hard
Greater than 180	Very Hard

SOURCE: U.S. Geological Survey, Carson City, Nevada.

WATER QUANTITY ASSESSMENT CRITERIA

BACKGROUND

Array 7 in Appendix B specifies the water quantity FOM value for each study area. It is based upon the availability of ground waters to the individual study areas.

ASSUMPTIONS

The consumptive use of water represents the water used by

(4) Residual sodium carbonate = $(CO^{--} + HCO_3^{-}) - (Ca^{++} + Mg^{++})$.

plants plus the water evaporated from the soil in which a crop is growing. The water requirement for a crop as alfalfa depends on the age and vigor of the plants, availability of nutrients, soil depth and texture, topography, infiltration rate, method used to apply the water, moisture stress, rainfall, temperature, daylight hours,wind movement, wind velocity, length of growing season, presence of salt in the irrigation profile, and the rate of intake of water.

It may be seen that many factors influence the water requirements. Irrigation waters also carry variable amounts of salt. Consequently, salt tends to concentrate within the soils. It is recognized that if an irrigation project is to be permanently successful, it must be designed and operated so that the drainage leaving the area of irrigation carries off the accumulating soluble salts. Ideally, the amount of soluble mineral matter that should be removed is equivalent to the amount of water entering the area in the irrigation water supply as well as the matter from other local sources. This is the principle of the salt balance in the operation.

Salt concentrations should be maintained at levels below those at which crop growth is impaired. To bring about and maintain a tolerable salt content within the soil profile, a percentage of the total applied irrigation water must be drained or leached below the root zone, carrying away the excess salts. This water percentage, termed a leaching requirement, is not consumptively used since it drains through the soil profile. Figure 3-7 shows the relationship developed to determine the amount of water needed for leaching. The value is based upon both the available irrigation water and the crop produced; both of these variables are far from being definitive in the study and relate to localized situations.

$$LP = \frac{E_{ciw}}{2\ E_c \times 100}$$

Where:

LP = Leaching percentage requirement,

E_{ciw} = Specific conductance of irrigation water,

E_c = Specific conductance of saturated-soil-paste extract associated with 50 percent decrement of crop yield.

FIGURE 3-7
LEACHING WATER REQUIREMENT
SOURCE: U.S. Geological Survey, Carson City, Nevada.

Consumptive use of water can vary considerably for crops such as alfalfa. Prior calculated consumptive use in Nevada varied between 14 to 56 inches in various parts of the state(5).

ASSESSMENT CRITERIA DEVELOPMENT AND MEASUREMENT

The intent of this analysis was to establish the water requirements needed for each study area, based upon the availability of ground waters with suitable water quality characteristics. The FOM value developed for each study area depicts the general availability of waters required for the production of alfalfa on the Nevada resource lands, based upon the water requirements in each respective area (i.e., water duty). After the candidate national resource areas were identified, further assessment was made as is discussed in Chapter 5.0.

The FOM value was set at 0 if the water availability (i.e.,

(5) U.S. Department of Agriculture, Agriculture Year Book, 1955.

less estimated current usage) for a given study area was less than 130 percent (allowing for irrigation recycling) of the available perennial yield to irrigate at least 160 acres. A value of 1 was used to indicate areas of limited water availability for future development, whereas an FOM value of 2 in Array 7 specifies a region that has ground water, or a combination of ground and unappropriated surface waters, available for additional agricultural development. Caution must be noted in referencing this factor by itself. For example, the value of 2 specifies water availability, but it does not specify that the water can be obtained economically. The amount of usable ground water in storage, for example, which is available on an economic basis will depend upon the distribution of the water yielding deposits, the distribution (range) of the water's chemical parameter concentration and the number and distribution of current wells in the study area.

The information used as a basis in assessing this factor consisted of computed water duties (i.e., acre-feet per acre requirements for alfalfa in each study area) and the perennial yields of each subbasin. This information was obtained from the Department of Conservation and Natural Resources. The approach used also assumed a 5 percent applied water leaching requirement(6).

STUDY AREA TOTAL FOM DETERMINATION

A total FOM value was developed for each study area based upon the individual factor FOM values. This total FOM value

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(6) Based upon Fuller's (1965) requirement stated by Rush, F.E., et al, Water Resources Bulletin No. 41, assuming 25 percent decrement of crop yield for irrigation water specific conductance of 500 micromhos/cm^2.

offered a framework for evaluating the national resource lands of one valley against another for the purpose of further investigation. Areas which did not meet the primary criteria set forth because of unsuitable conditions are identified in Appendix B by a value of 0. The FOM values of the other areas were then compared to determine the relative merit of lands in one valley versus another.

It was assumed that the physical resource value (FOM) or feasibility of each Quadrant of land area in the study was equivalent to:

$$(3\text{-}1) \quad \begin{bmatrix} \text{LAND} \\ \text{VALUE} \\ \text{FOM} \end{bmatrix} = \prod_{i=1}^{7} W_i W_i^* V_i$$

Where:

V_i = Qualitative or quantitative value of physical factor being evaluated.
W_i = Weighting factor for establishing an analysis quantitative value.
W_i^* = Weighting factor representing the significance of V in the assessment.
i = 7 principal factors.

The variable relationship value $W_i V_i$ is presented as the physical factor FOM in the respective arrays as discussed on the prior pages. A value W_i^* was then developed, based upon the significance of the individual factors, to combine them.

The relationship shown in Figure 3-8 was developed to combine the respective physical resource factor FOM's. It is important to note that the total numerical FOM absolute value computed for each study area is not as important as the relative difference between respective area FOM's. Study areas having a small FOM value offer limited development opportunities. On the other hand, those valleys consisting of national resource lands having higher FOM values offer some basis for development from a physical resource framework.

FIGURE 3-8
PHYSICAL RESOURCE FEASIBILITY TOTAL FOM DETERMINATION

Study Area FOM = [Land Availability FOM*36]
*[Natural Limitations I FOM]
*[Land Quality FOM]
*[Man-Made Limitations FOM]
*[Natural Limitations II FOM]
*[Water Quality FOM/4]
*[Water Quantity FOM]

SOURCE: BRI Systems, Inc.

The approach allowed the Nevada resource lands which have a larger continguous area of good soils, available water of suitable quality and few limitations to be given higher emphasis. Similarly, an area having soil and water characteristics of like quality to another valley, but which had a longer growing season was further accentuated; whereas more severe natural or man-made limitations reduced the value accordingly. The total FOM ranking of study lands allowed a profile of hydrographic areas which offer potential to be developed for further analysis.

The total FOM's were tabulated for each valley. A listing of FOM values is shown in Chapter 5.0. It identifies the FOM's for each individual valley which met the physical resource criteria(7).

(7) Final valley FOM shown in Chapter 5.0 indicates the computed valley FOM scaled by 100.

3.2 ECONOMIC FEASIBILITY ANALYSIS CRITERIA

INTRODUCTION TO THE ECONOMIC ANALYSIS

Areas which were found to satisfy the physical resource feasibility criteria for agricultural development were further investigated for their economic feasibility to provide a minimum desired income to the potential operator. The economics of operation are dependent upon operation size; thus, emphasis was accorded determination of the minimum number of acres required for the potential operator to attain a livelihood farming the Nevada resource lands. This section describes the model that was used to investigate this economic feasibility and the assumptions governing the analysis.

REVENUE, COSTS AND INCOME

The model used in the analysis is based upon the relationships shown in Figure 3-9. For a given agricultural investment, a fixed cost is present. The total cost for an operation consists of both the fixed cost and the variable costs of production as shown in the referenced figure.

The difference between the Total Revenue (TR) received by the operator and the Total Costs (TC) for the operation is the Income (I) that will be earned. One may express this relationship as

$$(3\text{-}2) \qquad I = TR - TC.$$

Equation (3-2) may also be rewritten to express Total Revenue (TR) in the form

$$(3\text{-}3) \qquad TR = I + TC.$$

In our analysis we are interested in having the producer or operator attain an income of a sufficient level which will allow him to sustain a livelihood from the operation. Thus

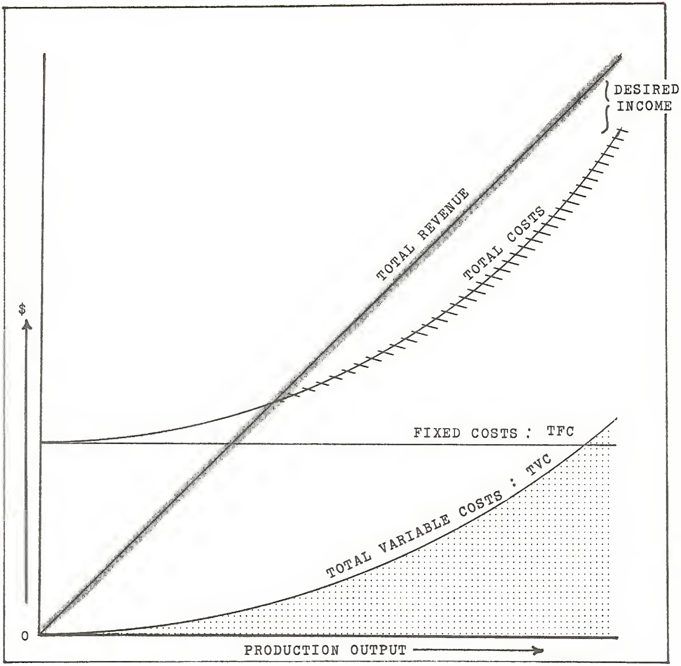

FIGURE 3-9
AGRICULTURAL PRODUCTION ECONOMICS
SOURCE: BLM, Reno, Nevada

it is of interest to have the producer attain a desired income (I*). Equation (3-3) may be further rewritten to express this as

(3-4) $TR = I^* + TC.$

COMMENTS ON THE ECONOMIC MODEL

The economic model shown in Figure 3-9 is representative of the classic agricultural production function. Total Fixed Costs (TFC) are identical for all output production levels. Fixed costs do not change in magnitude as the amount of production output changes; furthermore, these costs are incurred even when production is not undertaken.

The Total Variable Costs (TVC) shown in Figure 3-9 are the product of the variable production acres and the variable costs per acre.

The average fixed cost can be computed by dividing total fixed costs by the amount of production output. Similarly, the average variable cost may be determined by dividing the total variable costs by the amount of production output.

The total revenue minus the total costs is equivalent to the operation's profit. In our model, this is equivalent to the desired income. Thus, the desired income is equivalent to net returns or net revenue in the classic production function.

The law of diminishing returns is applicable for this production function. This relationship states that "if increasing amounts of an input variable are added to the production process, while all other inputs are held constant, the amount of production output gained per unit of variable input will eventually decrease."

THE TOTAL REVENUE RELATIONSHIPS

The Total Revenue recieved by the producer is based upon three criteria(8):

A. The price received for his crops (P),

B. The crop yield per acre (y) and

C. The number of acres in production (A).

This may be expressed as

$$(3\text{-}5) \qquad TR = PyA.$$

Equations (3-4) and (3-5) both express relationships for TR; therefore they may be equated as shown in Equation (3-6)

$$(3\text{-}6) \qquad PyA = I^* + TC.$$

THE TOTAL COST RELATIONSHIPS

The Total Cost (TC) for an operation consists of fixed and variable production costs. Fixed costs (F) include the investment expenses for such items as water development, machinery and improvements. Variable costs are the costs associated with production and they may be expressed in terms of dollars per acre (V) multiplied by the acres in production (A) as shown in Equation (3-7)

$$(3\text{-}7) \qquad \text{Variable Costs} = VA.$$

Equation (3-6) may be rewritten in terms of the fixed and variable costs resulting in

$$(3\text{-}8) \qquad PyA = I^* + (F + VA).$$

PRODUCTION ACRES DETERMINATION

The size of an operation to provide a desired income level may be determined from Equation (3-8) by rewriting it in the form shown on the following page

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8) Assumes that the operator will obtain his total income from crop production.

(3-8)

$$A = \frac{I^* + F}{Py - V} .$$

Equation (3-8) provides a basis for estimating the number of acres (A) that are required to provide a desired income (I*) to the producer based upon his fixed costs (F), variable costs (V), product market price received (P) and product yields(y). There are many factors that must be given consideration in determining (A), among which include:

A. Fixed and variable costs can vary considerably in each area of the state,

B. The water development and machinery profiles can highly influence the operation's economic characteristics, i.e., the depth to water, method of irrigation, method of harvesting such as the use of custom services among other factors that can be stated,

C. Market variables influencing the prices received for crops are highly unpredictable and beyond the control of the producer,

D. Climate and available surface waters, when required, will affect crop yields in any given year, and

E. The variable costs of production can be influenced by national, regional and local factors, i.e., increased energy and fertilizer prices are typical of such factors.

The assumptions made in the analysis for each of the variables of Equation (3-8) and the criteria that was used in the determination of each variable are summarized in the following paragraphs. Figure 3-10 illustrates the economic analysis procedure that was developed to estimate the production acreages. The steps of the procedure are discussed in the following paragraphs.

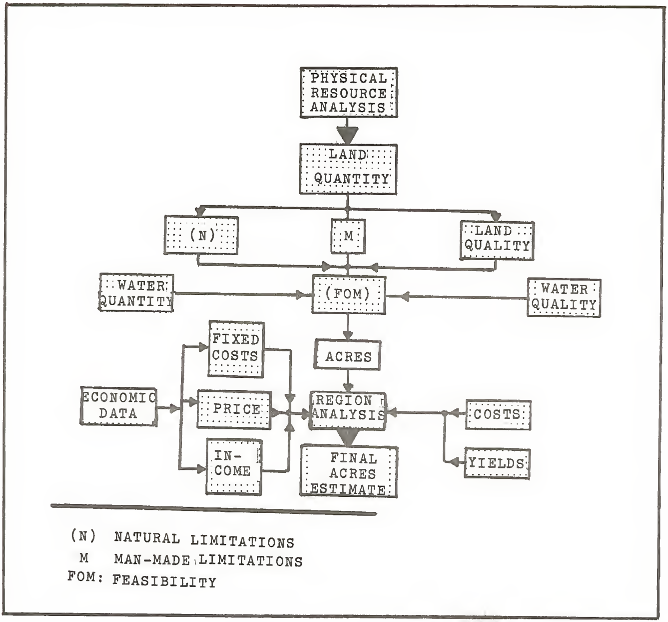

FIGURE 3-10
SCHEMATIC FLOW OF ECONOMIC ANALYSIS PROCEDURE
SOURCE: BLM, Reno, Nevada

PERIOD OF INVESTMENT ANALYSIS CRITERIA

Several criteria influence selection of the period for the investment analysis. Initially, characteristics of a specific subbasin such as climate, soils, and water availability can influence crop productivity in a given year and in turn affect the annual returns on investment to the producer. Second, investments by inexperienced producers may tend to exhibit a slow buildup of returns and cash flow. This is due to the growing productivity of the individual's agricultural management capabilities in the first few years of operation, Third, the individual's financial position influences the timing of production practices with regard to the land, farm equipment purchases, improvements and financing. An experienced operator with increased cash resources, for example, is more likely to have improved opportunities for obtaining needed financing for agricultural developments. Last, many economic alternatives exist that may further influence the timing of the cash flow required for agricultural development. Investment alternatives can influence the timing of when lands will be developed, wells will be drilled and the type of crops that will be grown.

Consideration must also be allowed for specific needs such as improving the soils for the primary crops during the analysis period. It is recommended, for example, to grow small grains or other annual crops for a minimum of one to two years prior to establishing a crop as alfalfa(9). Such practices will highly improve the soil conditions on the national resource lands reclaimed.

Numerous factors influence agricultural development on the

(9) Guenthner, H.R., et al, Establishment And Management Of Alfalfa, Max C. Fleischmann College of Agriculture, University of Nevada, Reno, Jan., 1973.

Nevada resource lands. Although there are many uncertainties present, a framework may be established for determination of the period of analysis based upon past trends and the principles of economics.

INVESTMENT PAYBACK PERIOD ASSUMPTIONS

The investment analysis payback period is determined by the relationship

$$\text{(3-9)} \quad \text{Payback Period} = \frac{\text{Investment Capital}}{\text{Projected Cash Flow Per Period}}$$

The trends of the past may be used to provide guidance for the investment and in turn, the period for economic analysis. Rather than biasing the investment payback period by referencing past homestead and desert land entry statistics(10), the period of analysis is based upon a profile developed for the purchase and operation of the "average" Nevada farm unit.

The total value of the average Nevada farm(11) in 1969 was estimated at $271,000 as is shown in Table III-12. This farm consisted of over 5,000 acres and was engaged in the production of livestock and crops(12). This average farm, as determined by the Department of Commerce, was found to be about 780 acres larger than what the Department of Agriculture's statistical sources indicated(13); although in 1969, it can be assumed that the average farm size was somewhere between 4,300-5,100

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(10) The Pittman Act, for example, operable in Nevada, was almost a complete failure. Out of 1,700 applications, 172 were allowed and only two (2) went to patent through 1962. Only a few remained uncancelled. Agricultural Land Law Effectiveness Study, Bureau of Land Management, August, 1963.

(11) Includes farms and ranches.

(12) U.S. Department of Commerce, County and City Data Yearbook, 1972, U.S. Government Printing Office, Washington, D.C., 1972.

(13) U.S. Department of Agriculture, Nevada Agricultural Statistics, 1974, Reno, Nevada, 1975.

acres. The year 1969 is used in determination of the period of investment analysis because multiple cross-reference sources are available for this year and the trends between this year and the current period can also be reviewed.

TABLE III-12

FARM VALUATIONS

COUNTY	NO. OF FARMS (1969)	AVE. VALUE PER FARM(1)	AVE. VALUE PER ACRE(2)	AVE. NO. OF ACRES PER FARM(2)
Carson City	17	$ 146,000	$ 122	1,176
Churchill	423	121,000	158	764
Clark	159	146,000	247	591
Douglas	99	306,000	188	1,626
Elko	234	475,000	37	12,838
Esmeralda(3)	19	19,200	19	980
Eureka	49	304,000	52	5,857
Humboldt	140	257,000	41	6,321
Lander(3)	66	72,300	24	2,924
Lincoln	86	100,000	222	453
Lyon	260	194,000	181	1,073
Mineral	21	600,000	38	15,714
Nye	126	272,000	81	3,349
Pershing	102	440,000	63	6,961
Storey (4)	(4)	(4)	(4)	(4)
Washoe	203	374,000	87	4,291
White Pine	102	132,000	74	1,557
Averages (5) and Totals	2,112	271,000	53	5,070

(1)Includes land, buildings and other improvements;

(2)Information taken from County Data Book except when noted;

(3)Inconsistencies arise in Department of Commerce data; data shown is based upon estimates developed from State Water Plan (data column 4), Commerce data (data columns 1,3), and averages (data column 2);

(4)Data not available for publication; less than 10 farm operations reporting;

(5)Data columns 2-4 represent averages.

Source: Reference Above.

The average realized net income of all farms in the U.S. totals about 34.4 percent of their average gross income(14). If one assumes a comparable ratio will be representative for Nevada farm units, the average Nevada farm would have expected a realized net income return of $17,115 in 1969(15). The realized net income has varied appreciably in the past(16). The annual cash flow for Equation (3-9) may be estimated to be equal to the average net realized income and average annual depreciation for the average farm operation, ignoring the other variable costs of production.

INVESTMENT PAYBACK PERIOD DETERMINATION

The average annual depreciation for our farm unit was computed to be $4,568(17). Utilizing the investment capital of $271,000

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(14) U.S. Department of Commerce, Statistical Abstract Of The U.S., 1975, Farms, Farm Income and Expenses, Table 1050, Government Printing Office, Washington, D.C., 1975, See Footnote (16) For Nevada.

(15) The average value of farm products sold in Nevada in 1969 was $49,753. This figure is representative of all farms in the state that had annual sales of $2,500 or greater based upon statistics of U.S. Department of Commerce, County and City Data Yearbook, 1972, U.S. Government Printing Office, Washington, D.C., 1972; average Nevada farm realized net income in 1969 is assumed to equal 34.4 percent of $49,753 gross sales; does not account for off-farm revenues or income.

(16) The average total gross farm income, average realized net income per farm and percent of realized net-to-total gross for the past years are: 1974--$75,550; $16,159; 21.3%; 1973--$80,000, $25,208; 31.5%; 1972--$61,500; $17,359; 28.2%; a three year average of 27% is seen based upon the source identified in footnote (13).

(17) Machinery, equipment and related assets consist of about 17 percent of total farm real estate values; (refer to footnote (14) source: Balance Sheet of the Farming Sector, 1950-1975); An estimate of the average real estate value of our average farm is $268,710. Assuming a similar 17 percent asset realtionship, approximately $45,681 of the total farm's value consists of machinery and improvements that are depreciable. Assuming a ten-year life, on the average, for depreciated assets (Davidson, Sidney, Editor-In-Chief, Handbook Of Modern Accounting, McGraw-Hill Book Co., New York, Page 18-6, 1970) the annual depreciation is estimated at $4,568.

and a cash flow of $21,683 in Equation (3-9), the payback period is estimated at 12.5 years. The range of the investment payback period in our example, based upon the differences that may arise in the assumptions made, will be between 10-15 years.

Assuming that alfalfa will be one of the principal crops grown on the natural resource lands reclaimed(18), a total production cycle is seen to require a period of 10 years, if one considers the profile:

A. Grain introduction and production during the first 3 years of operation to improve the soil conditions of the Nevada resource lands, followed by
B. Seven (7) years of alfalfa production.

A 10 year payback period on the investment was selected because:

A. It corresponds directly to the alfalfa production cycle length,
B. It requires a greater annualized fixed investment cost(19) and represents a conservative payback period,
C. It is compatible with standard accounting practices,
D. It is typical of an operation profile which will obtain an average annual return-on-investment of between 6-8 percent(20), and
E. It covers a time period for which projections can be made with a better degree of confidence.

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(18) This is further discussed in the sections on crop selection in this chapter.

(19) The total fixed investment cost (water, equipment, etc.) when annualized over the period of the investment.

(20) Assumes annual gross income of about $61,500 and a cash flow amounting to 54 percent of the annual operation expenses.

The individual assumptions made for the 10 year period are discussed in the section of this Chapter which they are pertinent to. It is recognized that many things change with time. Figures 3-11 and 3-12 demonstrate this. The 10 year period for which the assumptions are made most likely will also see changes, but many of the changes are of a more predictable nature as compared to a 20, 25 or 50 year projection and analysis period.

GUIDELINES GOVERNING THE ECONOMIC ANALYSIS

The primary guidelines which governed the economic analysis include:

A. The period of investment analysis was selected to be 10 years as determined in the prior paragraphs,
B. The base reference year was established as 1976,
C. The production acreages were computed for all 12 study Quadrants,
D. A multi-pass economic feasibility analysis approach was used; the computed production acres for each study Quadrant were initially compared (Phase I) to Nevada national resource land acreages determined to offer above marginal-to-good potentials (Chapter 6.0); those valleys found meeting the preliminary criteria were then further evaluated (Phase II) in more detail (Chapter 4.0), and
E. An average annualized value was computed for each economic variable to allow for evaluation and comparison of the production acreages in Equation (3-8).

The preliminary (Phase I) economic feasibility analysis consisted of evaluating the Nevada resource lands discussed in Chapter 5.0 which met the physical resource criteria of Chapter

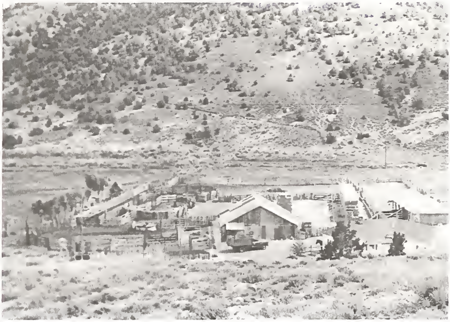

FIGURE 3-11
RANCH OPERATION LOCATED IN CENTRAL NEVADA VALLEY, 1975
SOURCE: BRI SYSTEMS, INC.

FIGURE 3-12
RANCH HOUSE LOCATED IN NYE COUNTY, 1927
SOURCE: NEVADA HISTORICAL SOCIETY, RENO, NEVADA

3.1. An economic profile was developed to account for the many variables in the broad region being evaluated. The Nevada valleys were evaluated with regard to their potential in meeting the profile criteria. The criteria are presented on the following pages of this Chapter. Those lands which met the economic criteria were further evaluated for their economic potentials in greater detail. A summary of this (Phase II) evaluation is presented in Chapter 4.0.

DESIRED INCOME

The major goal of the economic analysis was to determine the minimum acres required for crop production on the national resource lands which would provide the producer a sufficient standard of living. A sufficient standard of living or livelihood is defined in the analysis as the attainment of an average income for a Nevada farm family of 4.

The objective of defining a desired income which would meet the standard of living was addressed by considering the inflationary impacts on such a standard over the 10 year period of the analysis. Price pressures have been steadily moving upward in the U.S.; it was assumed that the desired income in any given year would have to compensate for this trend.

Differences arose in the value of such an income based upon the sources referenced. It was decided to use the more conservative values identified for the Phase I preliminary economic analysis because of the uncertainty of the many other variables present. This value was updated in the final analysis as discussed.

PHASE I ECONOMIC ANALYSIS DESIRED INCOME

The desired income for a Nevada farm family of 4 in 1976 was computed to be $18,420(21). An income multiplier was developed and an average annual income of $23,169 was determined for the 10 year period(22). The average annual desired income of $23,169 is equivalent to the average of the desired income values for the period 1976-85, initiating with an income of $18,420 and assuming a 5 percent annual income escalation requirement.

PHASE II ECONOMIC ANALYSIS DESIRED INCOME

Nevada ranked fourth in the Nation in 1972 in per capita income, behind the States of Alaska, New Jersey and Connecticut (23). In the period 1972-74, per capita income growth slightly decreased in the state relative to increases seen in other states. This resulted in a drop in overall national ranking to seventh place(24).

In 1969, the median income in the state was $10,687 as compared to a median farm family income of $8,921(25). Using the median farm family income as a base for projection, allowing for average consumer total price increases since

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(21) Reference Table C-15, Appendix C to this report.

(22) Refer to Table C-14, Appendix C to this report.

(23) Per Capita Income in 1972 was $4,390; Statistical Abstract of the U.S., 1975, Government Printing Office, Washington, D.C., 1975.

(24) U.S. Department of Commerce, USA Statistics In Brief, 1975, Bureau of the Census, Government Printing Office, Washington, D.C., 1976.

(25) U.S. Department of Commerce, County and City Data Yearbook, 1972, Government Printing Office, Washington, D.C., 1972.

this period to 1974(26), mean family farm incomes of $12,291 and $13,639 were estimated for the years 1974 and 1976, respectively. Utilizing the annual income multiplier discussed in the Phase I analysis(27), an average annual desired income of $17,155 was computed. It is projected that the average annual desired income should fall somewhere inbetween the $23,169 value developed in the Phase I analysis and the $17,155 income computed. The desired income value for the Phase II economic analysis consisted of the average of these values or $20,162.

FIXED COSTS

The fixed costs include the producer's investment for farm machinery and water development. It was assumed that surface waters would not be available to the producer(28) and that ground waters would have to be used for irrigation on the natural resource lands.

Many assumptions were made in developing the fixed costs. These costs are generally determined once a production site has been defined. Water pumping costs, for example, are dependent upon such variables as the number of acres irrigated, crops grown, diversity of crop production, growing season length and temperature range. A choice of the power unit to drive the pump is also made based upon the availability and cost of power (i.e., electric motors versus internal-combustion engines).

(26) Consumer price increase (all items): 1970: 5.5 percent; 1971-74: 6.9 percent per year average; Statistical Abstract of the U.S., 1975.

(27) Refer to Table C-14 of Appendix C.

(28) Refer to Chapter 3.1, Water Quantity.

ECONOMIC ANALYSIS FIXED COST PROFILES

A combination of 3 machinery profiles and 2 water development profiles were developed to represent the fixed costs in the analysis as shown in Figure 3-13.

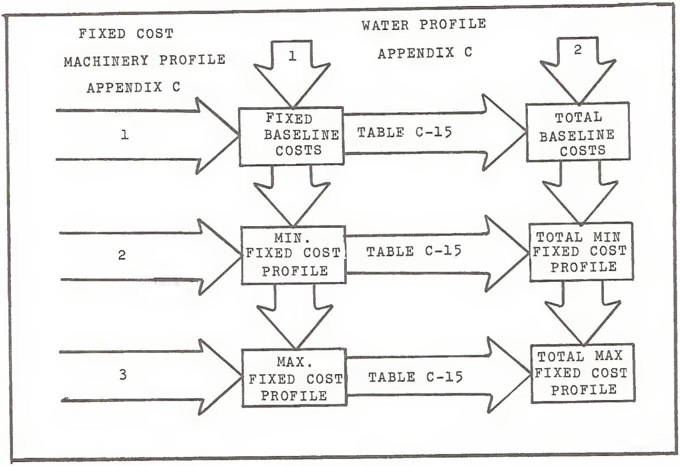

FIGURE 3-13
FIXED COSTS PROFILES GIVEN CONSIDERATION IN PRELIMINARY ECONOMIC ANALYSIS
SOURCE: BRI SYSTEMS, INC.

The 2 water profiles used for the Phase I economic analysis assumed water lifts of 300 feet and 500 feet, and drilling depths of 600 feet and 1,000 feet, respectively. A linear extrapolation of this cost was then made and used in the Phase II economic analysis for the water depths identified in the valleys meeting the preliminary criteria. The assumptions made for the equipment (i.e., casing, pump assembly, bowls, etc.) and investment criteria (i.e., depreciation, salvage value, interest rate, etc.) are defined in Table C-12 of Appendix C.

The 3 machinery profiles developed included a base equipment profile (i.e., equipment necessary for tillage, planting, harvest and hauling)(29), a similar profile that assumed the use of custom harvesting services(30) and a third profile that included larger power equipment and additional tillage and harvest equipment which would result in increased fixed costs but greater operation productivity (i.e., decreased variable costs) as defined in Table C-13 of Appendix C.

The average annual total fixed costs ranged from a low of $15,437 for the machinery profile without harvest equipment (water profile 1) to $38,333 for the machinery profile with the additional equipment (water profile 2)(31).

VARIABLE COSTS

The primary reference used for the variable cost data was the joint Department of Agriculture-University of Nevada-University of Arizona study entitled "Cost of Producing Crops In The Irrigated Southwest-Nevada(32)" published in 1975. The variable costs for the regions of Nevada(33) were obtained for

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(29) Refer to Table C-13, Appendix C.

(30) Ibid.

(31) Refer to Table C-11, Appendix C.

(32) Available from either participant of the study team.

(33) Referenced study is divided into 3 principal regions: northeast, western areas and the southern area.

producing alfalfa, alfalfa seed and grains. Select localized cost information for which detailed information was available such as variable irrigation pumping costs were separately developed as discussed in the following paragraphs.

The referenced study was based upon 1972 price data. This cost profile was updated to 1976 using the farm wages paid, machinery, fertilizer and fuel price indexes specified in Table C-23 of Appendix C. The operation productivity assumptions used between machinery profiles 1-3 for establishing and producing alfalfa, alfalfa seed and grains are summarized in Table C-22 and the productivity index listing of Table C-23 of Appendix C. The custom harvest rates for machinery profile 2 were based upon the assumptions listed in Table C-24 of Appendix C.

The variable costs per acre were computed for the 3 machinery profiles to establish and produce barley, other grains, alfalfa hay and alfalfa seed. Table III-13 lists the production profiles developed and their corresponding referenced data in Appendix C.

TABLE III-13
VARIABLE COST REFERENCES

CROP	PRODUCTION PROFILE	APPENDIX C TABLE REFERENCE(a)
Barley	Establish Year	C-17
Grain	Produce Year	C-18
Alfalfa	Establish Year	C-19
Alfalfa Hay	Produce Year	C-20
Alfalfa Seed	Produce Year	C-21

(a) Note: References do not include total variable costs.

SOURCE: BRI SYSTEMS, INC.

Operation production profiles were then developed to obtain the average annual variable costs over the 10 year period of the analysis. Table III-14 lists the 3 production profiles which were developed and specifies their corresponding data references in Appendix C.

TABLE III-14
OPERATION VARIABLE COST PROFILES

PRODUCTION PROFILE	APPENDIX C TABLE REFERENCE(a)
Grain to Alfalfa Hay	C-39
Grain to Alfalfa Seed	C-40
Grain to Multiple Crops	C-41

(a) Note: References do not include total variable costs.

SOURCE: BRI SYSTEMS, INC.

OTHER VARIABLE COSTS GIVEN CONSIDERATION

Although such production variables as taxes, principle and interest are generally considered as fixed costs, they were treated as a variable cost in the analysis because the size of the operation was unknown. These variables were computed in terms of dollar costs per acres and considered as another cost item to be added to the variable costs specified in Table III-14. Table C-25 in Appendix C specifies the total average annual cost estimate per acre for these items for each study Quadrant. The land values for each study Quadrant are based upon the assumptions summarized in Table C-26 of Appendix C.

The relationship shown in Figure 3-14 was used to compute the variable irrigation costs (dollars per acre) in the analysis. As denoted previously in the physical resource discussion and discussed in detail in Chapter 5.0, the irrigation water duties(29) of the Nevada resource land areas will vary considerably. An average water duty was assumed for each study Quadrant to develop this variable cost factor, based upon the physical resource study findings. Table C-27 of Appendix C specifies the assumptions used for each study Quadrant.

IRRIGATION COSTS

$$V_{IRR} = \frac{P*L*Pc}{Eff} + OM*L$$

Where:

V_{IRR}	=	Variable irrigation costs (dollars per acre-feet)
P	=	Power to lift 1 acre-foot (kwh; assumes 100 percent efficiency)
L	=	Water lift (feet)
Pc	=	Power cost (dollars per kwh)
Eff	=	Overall efficiency (assumed equal to 0.54)
OM	=	Operation and maintenance costs (dollars per foot of lift)

FIGURE 3-14
VARIABLE IRRIGATION COST DETERMINATION
SOURCE: BRI SYSTEMS, INC.

Figure 3-15 shows the relationship between water lift and pumping costs developed for one valley in Nevada. The relationship shown provides guidance for evaluating the effect of water lift on pumping costs. As seen in Table C-27 of Appendix C, the Phase I pumping costs (per acre-foot) were based upon general averages for each study Quadrant. The Phase II variable costs were based upon the specific physical resource characteristics of each valley as discussed in

(29) Acre-feet requirements per acre of land irrigated.

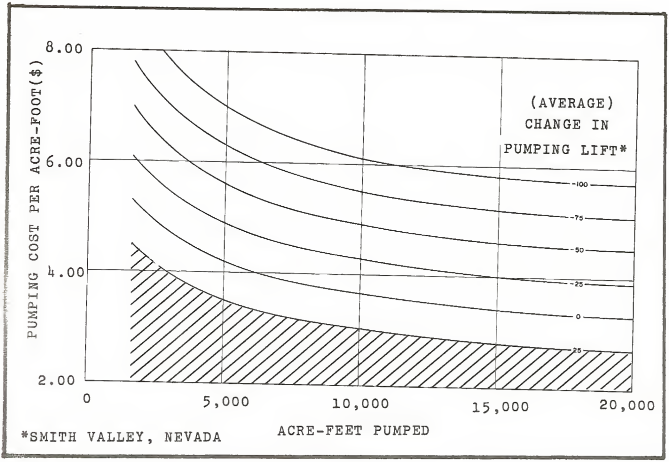


FIGURE 3-15
WATER LIFT AND PUMPING COST RELATIONSHIP
SOURCE: UNIVERSITY OF NEVADA, RENO, NEVADA

CROP PRODUCTION

The assumptions made in evaluating the crops produced, the production yields and market prices are discussed in the following paragraphs. Table III-15 identifies one of the resources which was referenced in the study to identify the production potentials existing in the state. Information was obtained from the U.S. Department of Agriculture, University of Nevada, Nevada Department of Conservation and Natural

CROP	PRODUCTION UNITS	1970 PRODUCTION	1960 PRODUCTION	PERCENT PRODUCTION TREND	PROJECTED FUTURE PRODUCTION TREND
Alfalfa	Tons	534,000	356,000	Up	Up
Alfalfa Seed	Cwt	8,813	300	Up	Up
Wild & Other Hay	Tons	300,000	242,000	Level	Other Up; Wild Down
Corn Silage	Tons	45,000	70,000	Level	Up
Cotton-seed	Tons	1,200	2,900	Down	Up
Barley	Bu	930,000	444,000	Up	Down
Winter Wheat	Bu	630,000	105,000	Up	Up
Spring Wheat	Bu	180,000	352,000	Down	Down
Oats	Bu	156,000	86,000	Level	Down
Potatoes	Cwt	118,000	220,000	Down	Down

TABLE III-15
NEVADA CROP PRODUCTION TRENDS

SOURCE: Census Of Agriculture and Division of Water Resources Forecasts For The Future-Agriculture, Carson City, Nevada, 1974.

Resources and the U.S. Department of Commerce to provide guidance for this analysis. As mentioned earlier in this Chapter, the producer will make many choices with regard to crop production. One cannot predict his choices, but the potentials for producing respective crops based upon physical resource factors suitability and market economics can be estimated.

The primary crops selected were alfalfa hay, alfalfa seed and grains (i.e., wheat). The establishment crop was assumed to be barley. Allowance was also made for potato production in the northern Nevada regions.

COMMODITY YIELD ASSUMPTIONS

The production yields per acre for grains, alfalfa hay and alfalfa seed were developed for each study Quadrant for both, crop establishment and producing years. Table C-28 of Appendix C specifies the crop yields for the 12 study Quadrants. The reference data base for each study Quadrant consisted of yield statistical information developed in past U.S. Department of Agriculture and State of Nevada, Department of Conservation and Natural Resource studies. Tables C-29 thru C-31 and Table C-42 of Appendix C summarize the information and assumptions which were used in developing the crop yield estimates, i.e., Table C-28. The estimates are based upon a weighted average of 1973-74 Nevada crop yields and projected 1980 crop yields as discussed in the footnotes of the referenced tables.

MARKET PRICES

Table C-32 specifies the market prices for wheat, barley, alfalfa hay, alfalfa seed and potatoes which were used in the economic analysis. The "expected price" denoted in Table C-32 of the Appendix is based upon the weighted minimum, weighted average and weighted maximum prices shown in the referenced table. These market prices, also listed in Table C-33 of the Appendix, are based upon the assumptions and calculations shown in Tables C-34 thru C-38 and Table C-31 of Appendix C.

The "expected Price" of each commodity used in the analysis is an average annual expected price over the 10 year analysis period. As shown in the referenced tables of Appendix C, it takes the projected monthly and yearly market fluctuations into consideration.

PHASE I ECONOMIC ANALYSIS

Tables C-2 thru C-10 of Appendix C summarize the computations that were developed to determine the production acres for the preliminary economic analysis. In the Phase I economic analysis (Chapter 6.0), an estimated absolute average, preferred average and desired average number of production acres were developed for each water profile and used as a basis for evaluating the economic potentials of the national resource lands. The Nevada resource lands identified to satisfy the physical resource criteria have varying degrees of potentials (30). The limitations present were evaluated based upon the procedure discussed in Chapter 6.0.

PHASE II ECONOMIC ANALYSIS

The national resource lands which met the preliminary economic

(30) Refer to Chapter 5.0 discussion.

feasibility criteria (Chapter 6.0) were then investigated in greater detail. Chapter 4.0 summarizes the findings of this analysis.

It must be recognized that many uncertainties arise in the variables of the analysis. Figure 3-16 shows the variability of just one economic factor, crop yields. As shown in the figure, an average value was used in the analysis.

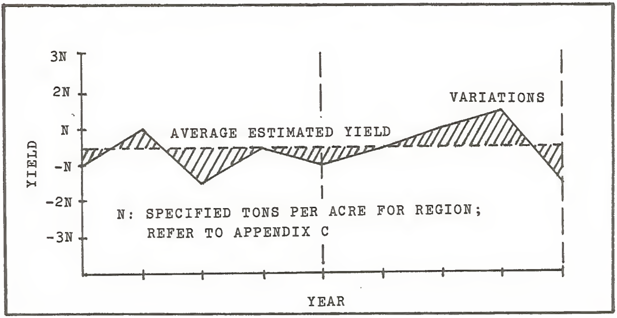


FIGURE 3-16
TRENDS IN ALFALFA HAY YIELDS VARIABILITY
SOURCE: Farm Size and Its Relation To Volume Of Production, Nebr. Agr. Exp. Station Bul. 346.

Another factor which can be important on many of the natural resource lands is the distance to the market. Figure 3-17 illustrates this relationship in general terms. Average estimated values were used for such costs in the computations as denoted in the references in Appendix C.

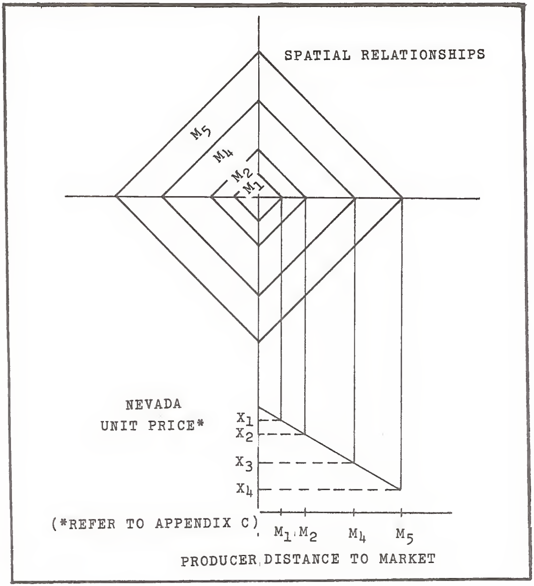


FIGURE 3-17
MARKET DISTANCE RELATIONSHIP
SOURCE: BRI Systems, Inc.

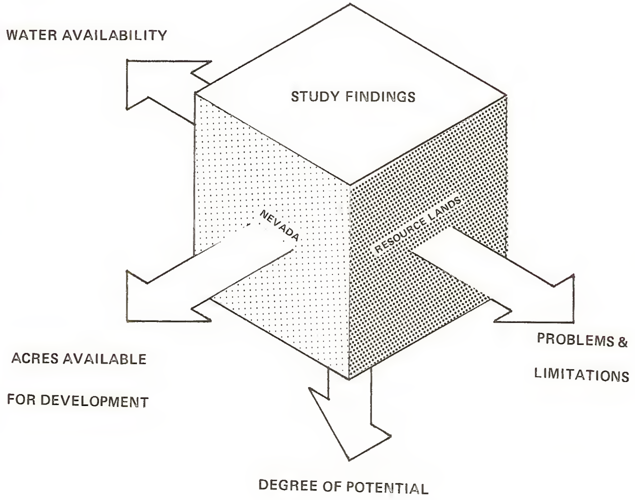
It must be recognized that production output is not the only necessary ingredient in the measure of economic viability on the national resource lands. The spatial factors of location and distance to market(s) for farm products is important in determining whether the farm operation will continue to operate as an economic unit.

Total transportation costs include the costs of product handling, transport, delivery, and related product inventory investment costs, if applicable. The cost of money to the operator is an important variable.

The market demand characteristics and market substitutability factors are also important and highly influenced by spatial location of the operation. The size of the average demands and fluctuations present in the demands for the operator's products at his nearest market influence the prices to be received. Similarly, the total transportation costs of substituting one market center for another, based upon demands, can also influence these costs. The operation has to adjust to uncertainties. A spatial location that offers flexibility is significant to operation economics. Unfortunately, this flexibility is limited in many of the areas that offer potential for agricultural production.

CHAPTER 4.0

STUDY FINDINGS



4.0 PHYSICAL RESOURCE AND ECONOMIC FEASIBILITY ANALYSIS FINDINGS

BACKGROUND

This chapter presents the findings of the physical resource and economic feasibility analysis. The criteria discussed in Chapter 3.0 were used to evaluate each of the Nevada valleys. The physical resource criteria was applied initially and each valley was evaluated for its potential to meet the criteria specified in Chapter 3.1. Chapter 5.0 provides further information about each of the valleys which met the physical resource criteria. The Nevada valleys that were identified as having above marginal-to-good potentials for agricultural development upon the national resource lands were then evaluated for their economic feasibility, i.e., the feasibility of a producer to sustain a livelihood upon the Nevada resource lands from crop production.

THE LANDS OF EIGHTEEN NEVADA VALLEYS MEET THE STUDY FEASIBILITY CRITERIA

This chapter summarizes the potentials of the Nevada valleys that met both the physical resource and economic feasibility criteria. Eighteen valleys met the joint criteria and are discussed in the following paragraphs. The valleys offering the greatest potential, based upon the resources present, are discussed first. This is followed by a discussion of the other valleys which met the joint criteria but offer lessor opportunities. The last part of this Chapter discusses some of the reasons as to why the other valleys did not meet the physical resource and/or economic feasibility criteria.

FEASIBILITY ANALYSIS FINDINGS

Figure 4-1 shows the production acreages that were determined for

Nevada resource land production in each of the valleys that met the physical resource and Phase I economic analysis criteria. The acreages shown are based upon the Phase II economic analysis findings which are discussed in this Chapter. The available national resource land acreages for potential development in each valley, the estimated operation production size (acres) to attain a livelihood and the figure-of-merit of each area are shown in Figure 4-1.

VALLEY LOCATION REFERENCES

The following discussions include a reference to a Quadrant (Quad) for identification. Reference is made to Chapter 5.0 in locating the lands of any particular valley discussed on the following paragraphs.

PRODUCTION OPERATION SIZE COMMENTS

The operation size for crop production that is specified for the valleys has been based upon numerous assumptions, discussed in Chapter 3.0. Caution is to be taken in referencing this value. The assumptions made for each area are important and they must be recognized when a specific value of acreages is referenced. Many factors are involved in an analysis and extensive on-site investigation of each area found satisfying the study criteria should be pursued to fully verify each of the assumptions made.

PHASE II ECONOMIC ANALYSIS BACKGROUND

The assumptions used in the Phase II analysis consisted of a refinement of the Phase I economic information as discussed in Chapter 3.2. The objective was to investigate the economic potentials of the Nevada resource lands that were found to satisfy

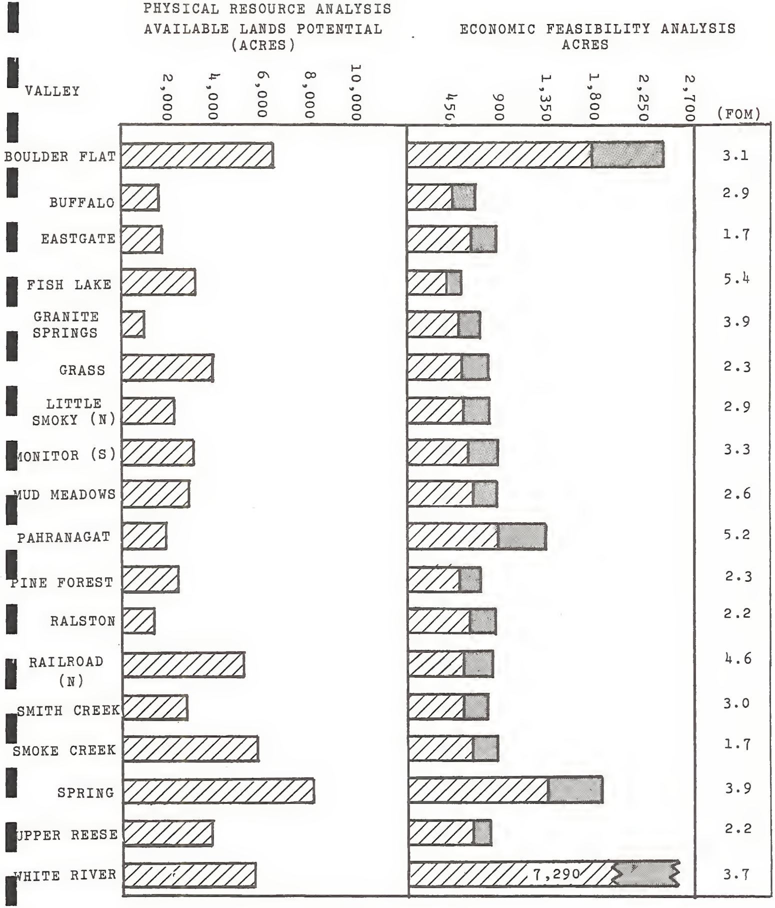


FIGURE 4-1
STUDY FINDINGS
SOURCE: BRI SYSTEMS, INC.

the physical resource and Phase I economic analysis criteria in greater detail. The findings are listed in the individual valley discussions on the following pages.

The guidelines used in Phase II included the reference base discussed in Chapter 3.2 which consisted of:

A. A similar 10 year period of analysis referencing 1976 as the initial year for evaluation,
B. Use of the commodity prices shown in Table C-32 of Appendix C,
C. Using more specific crop yield data (Table C-28; Appendix C) that was pertinent to the location of the Nevada resource lands under evaluation.
D. Recomputation of the variable water costs for each valley (based upon the cost relationships specified in Table C-27 of Appendix C) utilizing the average water lifts required in each specific valley as were determined during the physical resource analysis; A summary of the water profile costs is shown in Figure 4-2,
E. Referencing the land costs of Table C-25(Appendix C) which were pertinent to the location of the Nevada resource lands being evaluated.
F. Utilizing the production variable cost profile specified in Table C-39 (Appendix C) which was pertinent to the Nevada resource lands being evaluated,
G. Using the modified desired income value discussed in Chapter 3.2, (Phase II Desired Income), and
H. Referencing machinery profiles 1 and 2 described in Table C-13 (Appendix C).

The terms used in the following discussion of this Chapter are defined in Table IV-1.

FINDINGS SUMMARY

Only fifteen of the eighteen valleys meeting the physical resource criteria have economical or feasible solutions. Spring Valley, the White River Valley, and Boulder Flat are included in the discussion of this chapter because these areas contain national resource lands which are physically suitable for crop production. The economic solutions indicate that agricultural development is possible, but generally not feasible.

The national resource lands in Fish Lake Valley, Railroad Valley, Granite Springs Valley, Monitor Valley, Smith Creek Valley, Little Smoky Valley, and Buffalo Valley offer the greatest potential for development.

The national resource lands in the Pahranagat Valley, Mud Meadows Valley, Grass Valley, Pine Forest Valley, the Upper Reese River Valley, and Ralston Valley should also be considered for agricultural development. The national resource lands in these valleys have limitations present, but appear to offer marginal-to-good development opportunities.

The national resource lands in Smoke Creek and Eastgate Valleys offer the least overall potential, although the potentials are found to be economically feasible.

TABLE IV-1
TERMS REFERENCED IN CHAPTER 4.0 DISCUSSION

Pump Cost	Variable irrigation cost per acre.
Duty	Irrigation water requirement, acre-feet per acre.
Fixed Cost	Average annual fixed costs over period of analysis.
Total Fixed	Average annual total of fixed costs and desired income.
Revenue	Average annual Py; product of price per yield times yield per acre expressed in terms of dollars per acre; average annual value shown over period of analysis.
Variable Cost	Average annual variable cost of production over period of analysis.
Acres(1)	Production acres based upon costs, yields and revenue specified above.
Acres(2)	Production acres for fixed cost profile 2.
Operations	Maximum number of production operations in the valley on the national resource lands.

SOURCE: BRI SYSTEMS, INC.

4.1 FISH LAKE VALLEY (SUBBASIN 117)

The national resource lands in Fish Lake Valley (Quad 9) offer good potentials for crop production as may be seen by the phreatophyte growth in Figures 4-3 and 4-4. The waters of the valley are overappropriated, considering permitted and supplementary water rights which are discussed in Chapter 5.0, but water use in the valley is much less than the water rights granted (certificates) and permitted rights existing in the valley. Past reconnaissance studies by the U.S. Geological Survey and the State of Nevada have shown that much greater utilization of the water resources is possible and that less than one-half of the perennial yield is currently consumed.

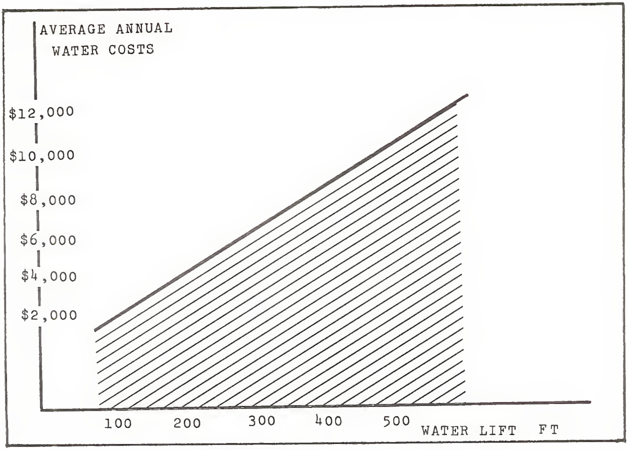


FIGURE 4-2
ANNUAL WATER DEVELOPMENT COST PROFILE
SOURCE: Refer to Table C-11, Appendix C

FIGURE 4-3
NEVADA RESOURCE LANDS IN FISH LAKE VALLEY
SOURCE: BRI SYSTEMS, INC.

FIGURE 4-4
NEVADA RESOURCE LANDS IN FISH LAKE VALLEY
SURROUNDING AGRICULTURAL DEVELOPMENT
SOURCE: BRI SYSTEMS, INC.

The diversion of surface water from available streams could be extended in this valley, similar to the pipelines and ditches that convey such streams as Cottonwood, Leidy and McAfee Creeks. Such diversions would provide additional surface waters to supplement the available ground waters for agricultural development on the national resource lands.

It is estimated that a minimum of 3,000 acres of the national resource lands could be placed into agricultural production in Fish Lake Valley. It has also been determined that an operation should consist of 330-490 acres seen in Table IV-2 to sustain an average livelihood in the valley. Thus, at least, 6 operations of this size are feasible on the national resource lands in Fish Lake Valley.

The State of Nevada must be consulted prior to any development in this valley on the Nevada resource lands; such development could potentially reduce the current spring discharges and in turn impact current farm operations along with fish and wildlife.

TABLE IV-2
FISH LAKE VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	5.80	$/A
Duty	3.1	AF/A
Fixed Cost	25,552	$/YR
Total Fixed	45,684	$/YR
Revenue	203.09	$/A
Variable Cost	110.11	$/A
Acres(1)	491	A
Acres(2)	336	A
Operations	6	-

SOURCE: BRI SYSTEMS, INC.

4.2 PAHRANAGAT VALLEY (SUBBASIN 209)

The Pahranagat Valley (Quad 11) offers potential development opportunities for at least 1 operation on the national resource lands. Present developments in the valley use nearly all of the natural spring discharge, but additional ground waters are available to adequately irrigate up to a total of 1,800 acres.

The areas offering the greatest potential for future agriculture based upon ground water development are located south of Hiko. The water quality of the valley, both spring discharge and the underflow, degrades as it flows southward towards Lower Paranagat Lake.

Nevada resource lands along the lower bottom lands of the valley have low depths to ground water. It is estimated that an operation of 830-1,200 acres in these areas would be required to attain the desired income level criteria of Chapter 3.0 as shown in Table IV-3.

TABLE IV-3
PAHRANAGAT VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	7.25	$/A
Duty	5.0	AF/A
Fixed Cost	26,147	$/YR
Total Fixed	46,309	$/YR
Revenue	203.56	$/A
Variable Cost	165.36	$/A
Acres(1)	1,212	A
Acres(2)	834	A
Operations	1	-

SOURCE: BRI SYSTEMS, INC.

4.3 RAILROAD VALLEY (SUBBASIN 173)

Railroad Valley is located in Quadrants 7, 8 and 10 in Chapter 5.0. The valley has only two communities of any size, the Duckwater Indian Reservation and Currant, which are seen in the map shown in Figure 4-5. The population of the valley is small and the current economic activities of the valley are based upon cattle production and related activities. The valley has the only oil production in Nevada; the wells are located at Eagle Springs south of Currant.

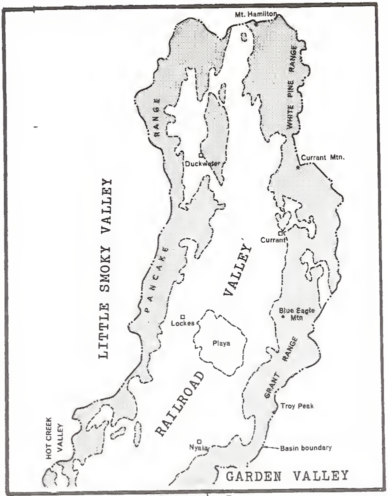


FIGURE 4-5
THE RAILROAD VALLEY AREA
SOURCE: BRI SYSTEMS, INC.

Irrigation in the area is for pasture grass and alfalfa. Most of the water is obtained from springs: areas irrigated with springflow total about 5,000 acres, including approximately 3,000 acres in the Duckwater area and about 1,000 acres along the east side of the valley between Blue Eagle Springs and Crows Nest, to the southwest. Water use in areas irrigated by springflow totals approximately 12,000 acre-feet per year. This represents about two-thirds of the total discharge from irrigated and nonirrigated areas of meadowgrass and other wet-area phreatophytes associated with the springs. Only one area of appreciable size, the thin strip of land along Currant Creek, relies on streamflow for irrigation. About 600 acres are farmed in this area.

The more suitable soils and a longer growing season are found in the southern portions of Railroad Valley (Subbasin 173(A)), although, in general, greater water availability for development upon the Nevada resource lands is found in the northern portion of the valley (Subbasin 173(B)).

It is estimated that a minimum of 5,000 acres of the national resource lands may be developed in this valley. The size of the production operations on the national resource lands to attain the desired income levels is dependent upon the operation location within the valley.

Desert Land Entry permits have been allowed in the past on about 7,600 acres in northern Railroad Valley, including 1,600 acres near Green Spring Ranch, 2,694 acres near Currant, and 3,285 acres near Nyala. Only a small fraction of the Desert Land Entry areas have been worked. Water consumption in the farmed Desert Land Entry areas may be on the order of 2,000-2,500 acre-feet per year, all of which comes from ground water sources. It has been estimated that operation sizes to meet the desired income levels must vary between 550-800 acres as shown in Table IV-4.

It should be noted that a possible future use of ground waters in Railroad Valley is for a supplemental supply for the Las Vegas metropolitan area, about 150 miles to the south. Although the estimated unit cost for water importation from Railroad Valley is high, the possibility could receive further consideration as Las Vegas water needs grow in the future.

TABLE IV-4
RAILROAD VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	7.25	$/A
Duty	3.0	AF/A
Fixed Cost	26,147	$/YR
Total Fixed	46,309	$/YR
Revenue	168.02	$/A
Variable Cost	110.23	$/A
Acres(1)	801	A
Acres(2)	551	A
Operations	6	-

SOURCE: BRI SYSTEMS, INC.

4.4 SPRING VALLEY (SUBBASIN 184)

Spring Valley located in Quadrant 8 offers potential for development on about 8,000 acres of the national resource lands. Only a small portion of the relatively abundant ground water resources are used in the valley; prior Federal and State Government reconnaissance studies of the area have indicated that at least 60,000 acre-feet of water is discharged annually by low value plants such as greasewood, rabbit brush and saltgrass.

The upstream areas of the valley appear to offer good potententials for agricultural development based upon the availability of suitable soils and ground waters. Pumping depths in this area are moderate.

It is estimated that 4 operations averaging about 1,600 acres could be developed in the upper valley areas as shown in Table IV-5. The lower valley areas require greater lifts for ground water and have been identified to also have soil quality and water quality problems. Operation in these areas is very marginal.

TABLE IV-5
SPRING VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	10.89	$/A
Duty	3.1	AF/A
Fixed Cost	27,709	$/YR
Total Fixed	47,871	$/YR
Revenue	153.09	$/A
Variable Cost	127.87	$/A
Acres(1)	1,898	A
Acres(2)	1,309	A
Operations	4	-

SOURCE: BRI SYSTEMS, INC.

4.5 GRANITE SPRINGS VALLEY (SUBBASIN 78)

Granite Springs Valley, located in Quadrant 1, has been found to offer soils and waters of suitable quality for cropping. Only a limited amount of the Nevada resource lands could be developed in this area, based upon the physical resource criteria discussed in Chapter 5.0.

It is estimated that 450 acres of the national resource lands may be developed in the valley. This may be sufficient for 1 operation. The acreages calculated for an operation in the valley to attain the desired income levels are estimated between 480-695 acres. Figure 4-6 shows the water depth characteristics of the valley and indicates the depth to water profile of the valley showing areas having depths of less than 50 feet, 50 to 200 feet and above 200 feet. Table IV-6 summarizes the economic analysis findings for this valley.

TABLE IV-6
GRANITE SPRINGS LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	7.25	$/A
Duty	3.3	AF/A
Fixed Cost	26,147	$/YR
Total Fixed	46,309	$/YR
Revenue	190.76	$/A
Variable Cost	124.00	$/A
Acres(1)	694	A
Acres(2)	479	A
Operations	0-1	-

SOURCE: BRI SYSTEMS, INC.

4.6 WHITE RIVER VALLEY (SUBBASIN 207)

The White River Valley, located in Quadrants 8 and 11, was one of the few valleys identified to have agricultural potential on the Nevada resource lands in the southern portions of the state.

It is estimated that about 5,500 acres of the national resource lands may be developed in this valley. Such development is possible based upon the availability of suitable national resource lands, but it is not seen to be generally economically feasible. Table IV-7 shows that an operation would have to consist of over 7,000 acres to provide the desired income for the producer. If one assumes that only alfalfa seed is grown, along with 10 years of excellent prices and yields, the required production size is reduced, but still isn't within any feasible range for development by one producer.

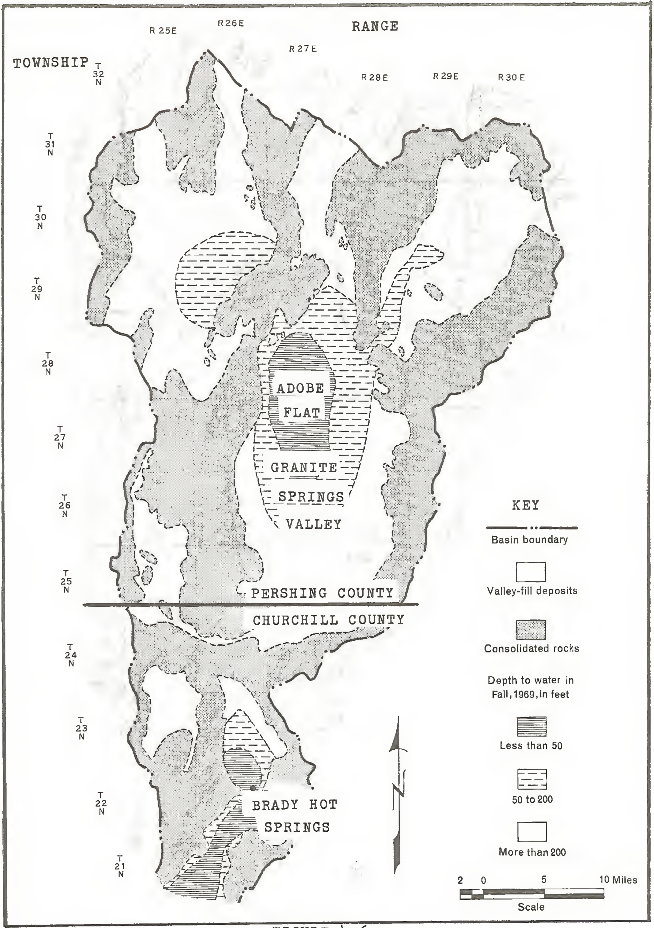


FIGURE 4-6
WATER DEPTHS IN GRANITE SPRINGS VALLEY
SOURCE: Division of Water Resources, Carson City, Nevada

TABLE IV-7

WHITE RIVER VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	10.89	$/A
Duty	5.0	AF/A
Fixed Cost	27,709	$/YR
Total Fixed	47,871	$/YR
Revenue	153.09	$/A
Variable Cost	148.56	$/A
Acres(1)	10,568	A
Acres(2)	7,291*	A
Operations	0-1	-

*Low yields projected; not economically feasible.
SOURCE: BRI SYSTEMS, INC.

4.7 MONITOR VALLEY SOUTH (SUBBASIN 140(B))

The physical resources present in the southern portion of Monitor Valley (Quad 7) will support development on about 3,000 acres of the Nevada resource lands. The valley has available ground waters to support agricultural production on these acreages, based upon the estimated perennial yield and current waters unappropriated in the valley.

It is estimated that between 3-4 agricultural operations could be developed in this valley, based upon an operation size of 812 acres (or 560 acres for fixed cost profile 2) as shown in Table IV-8.

TABLE IV-8
MONITOR VALLEY (SOUTH) LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	7.25	$/A
Duty	3.1	AF/A
Fixed Cost	26,147	$/YR
Total Fixed	46,309	$/YR
Revenue	168.02	$/A
Variable Cost	110.96	$/A
Acres(1)	812	A
Acres(2)	560	A
Operations	3-4	-

SOURCE: BRI SYSTEMS, INC.

4.8 BOULDER FLAT AREA (SUBBASIN 61)

The Boulder Flat Area, located in Quadrant 3, has been determined to offer potential, based upon water availability, for additional agricultural development on a total of 6,300 acres. Since much of the topography of the national resource lands is unsuitable, questions arise if this total amount of land can be successfully developed.

The valley offers one of the longer growing seasons of the northern region and has the available ground waters to support agricultural production.

It has been estimated that in the areas of the valley having suitable soils and relatively low depths to ground water, an operation of between 1,670-2,425 acres would be required to attain the desired income level. The opportunities for finding areas of good soils that are contiguous for an agricultural operation are present, but marginal.

TABLE IV-9

BOULDER FLAT LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	10.89	$/A
Duty	3.2	AF/A
Fixed Cost	27,709	$/YR
Total Fixed	47,871	$/YR
Revenue	138.47	$/A
Variable Cost	118.72	$/A
Acres(1)	2,424	A
Acres(2)	1,673	A
Operations	2-3	-

SOURCE: BRI SYSTEMS, INC.

4.9 SMITH CREEK VALLEY (SUBBASIN 21)

The Smith Creek Valley, located in Quadrant 6, has been identified to offer potential for development on a total of 2,650 acres of the national resource lands.

Present water development in Smith Creek valley consists of the irrigation of about 160 acres of alfalfa and pasture from Smith Creek, 160 acres of alfalfa and pasture from Campbells Creek, and some 100 acres of alfalfa from Petersons Creek. Additionally, small amounts of ground water from wells supply livestock and domestic requirements. The total amount of surface and ground water used is only a little more than 1,000 acre-feet per year in this valley. It has been determined that areas both north and south of the playa in the valley may be the most favorable areas for future development. The depths to water are moderate and the chemical quality of the ground water is relatively good. It is estimated that operations of 530 to 770 acres could be developed on the national resource lands of this valley.

TABLE IV-10
SMITH CREEK VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	7.25	$/A
Duty	3.1	AF/A
Fixed Cost	26,147	$/YR
Total Fixed	46,309	$/YR
Revenue	184.27	$/A
Variable Cost	124.01	$/A
Acres(1)	768	A
Acres(2)	530	A
Operations	3	-

SOURCE: BRI SYSTEMS, INC.

4.10 LITTLE SMOKY VALLEY (SUBBASIN 155(A))

The northern portion of Little Smoky Valley, located in Quadrant 7, offers potential for development on about 2,125 acres of the Nevada resource lands. As compared to the southern portions of the Little Smoky Valley which have physical resource limitations and great depths to ground water, many parts of the northern valley offer suitable soils, suitable water quality and moderate depths to reach sufficient ground waters for irrigation.

It is estimated that between 2-3 operations can be developed in this valley of size between 510-745 acres as shown in Table IV-11. One of the problems to be faced in the northern valley area is that the growing season, based upon a killing frost temperature of 28°F, is just about 100 days. The southern valley areas have a longer growing season, but are generally unsuitable for agricultural development.

TABLE IV-11
LITTLE SMOKY VALLEY (NORTH) PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	5.80	$/A
Duty	3.1	AF/A
Fixed Cost	25,522	$/YR
Total Fixed	45,684	$/YR
Revenue	168.02	$/A
Variable Cost	106.46	$/A
Acres(1)	742	A
Acres(2)	512	A
Operations	2-3	-

SOURCE: BRI SYSTEMS, INC.

4.11 BUFFALO AND MUD MEADOWS VALLEYS (SUBBASINS 131 AND 26)

Very little detailed reconnaissance information is available for Buffalo Valley, located in Quadrant 2, and Mud Meadows Valley found in Quadrant 1. The information that is available indicates that both of these valleys offer potential for agricultural development.

The water use versus water availability portion of the physical resource analysis resulted in identifying 1,580 acres and 2,720 acres in Buffalo and Mud Meadows Valleys, respectively, for potential agricultural development. Potential problems arise in that the growing season of these valleys, although acceptable for the analysis, is considered very marginal.

Further reconnaissance of both valleys is required prior to developing any final recommendations with regard to agricultural development upon the available national resource lands. Based upon the information that is available, it has been determined that operations of size 440-645 acres at Buffalo Valley and 580-840 acres at Mud Meadows Valley would be required to attain the minimum income levels at moderate ground water depths; this is shown in Tables IV-12 and IV-13.

TABLE IV-12
BUFFALO VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	10.89	$/A
Duty	3.1	AF/A
Fixed Cost	27,709	$/YR
Total Fixed	47,871	$/YR
Revenue	194.69	$/A
Variable Cost	120.15	$/A
Acres(1)	642	A
Acres(2)	443	A
Operations	2	-

SOURCE: BRI SYSTEMS, INC.

TABLE IV-13
MUD MEADOWS VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Cost	10.89	$/A
Duty	3.1	AF/A
Fixed Cost	27,709	$/YR
Total Fixed	47,871	$/YR
Revenue	190.76	$/A
Variable Cost	133.83	$/A
Acres(1)	841	A
Acres(2)	580	A
Operations	3	-

SOURCE: BRI SYSTEMS, INC.

4.12 GRASS VALLEY (SUBBASIN 138)

Grass Valley, located in Quadrant 7, offers a potential for development on about 3,750 acres of the national resource lands. It has been determined that areas south and west of the playa represent the most favorable areas for the development of wells, where the depths to water are moderate and where the chemical quality of the ground water is believed to be relatively good. However, this does not preclude other areas as being suitable for development. In Grass Valley, conditions for development appear favorable along the lower parts of the alluvial apron and upper parts of the valley lowlands.

It is estimated that an operation of size 515-750 acres would be required to attain the desired income level in the more favorable valley areas as shown in Table IV-14.

TABLE IV-14
GRASS VALLEY LANDS PRODUCTION PROFILE

ITEM	VALUE	UNITS
Pump Costs	5.80	$/A
Duty	3.2	AF/A
Fixed Cost	25,522	$/YR
Total Fixed	45,684	$/YR
Revenue	168.02	$/A
Variable Cost	107.04	$/A
Acres(1)	749	A
Acres (2)	517	A
Operations	5	-

SOURCE: BRI SYSTEMS, INC.

4.13 PINE FOREST AND UPPER REESE RIVER VALLEYS (SUBBASINS 28 AND 56)

The Pine Forest Valley area, located in Quadrant 1, and Upper Reese River Valley, located in Quadrant 6, are estimated to have development potentials similar to the Grass Valley which was discussed in the prior paragraph. Both of these valleys have national resource lands that will support crop production and available ground waters. Both valleys are also faced with the problems of unpredictable and early frosts that can occur in any period.

About 2,225 acres of the Nevada resource lands can be developed in Pine Valley and up to 3,700 acres have potential for development in the Upper Reese River Valley. In the most favorable valley areas, an operation of size between 470-680 acres at Pine Valley and 540-780 acres in the Upper Reese River Valley would be required to attain the desired income level. Table IV-15 summarizes the determined production profiles of these valleys and the valleys discussed in the following paragraphs.

4.14 RALSTON VALLEY (SUBBASIN 141)

The Ralston Valley, located in Quadrant 7, has a potential for agricultural development that may be measured as slightly less than is present at Pine and the Upper Reese River Valleys. Present water development in the valley is largely confined to the well field in Ralston Valley used to supply municipal requirements for Tonopah. The average annual withdrawal for this purpose is reported to be about 50 million gallons of water, or about 150 acre-feet.

It has been determined that about 1,260 acres on the national resource lands could be developed. Under the most favorable conditions, the operation size should be between 560-815 acres

TABLE IV-15

PRODUCTION PROFILES OF SELECT NATIONAL RESOURCE LANDS

ITEM	PINE FOREST	UPPER REESE	RALSTON	SMOKE CREEK	EASTGATE	UNITS
Pump Costs	7.25	7.25	7.25	10.89	10.89	$/A
Duty	3.1	3.2	3.1	3.1	3.1	A
Fixed Cost	26,147	26,147	26,147	27,709	27,709	$/YR
Total Fixed	46,309	46,309	46,309	47,871	47,871	$/YR
Revenue	190.76	184.27	168.02	190.76	184.27	$/A
Variable Cost	122.55	124.73	110.96	133.83	135.29	$/A
Acres(1)	679	778	812	841	977	A
Acres(2)	469	537	560	580	674	A
Operations	3	4-5	1	6-7	1	-

SOURCE: BRI SYSTEMS, INC.

in this valley to meet the desired income level.

4.15 SMOKE CREEK AND EASTGATE VALLEYS (SUBBASINS 21 AND 127)

Smoke Creek Valley, located in Quadrant 1, and Eastgate Valley, located in Quadrant 6, have similar agricultural development potentials based upon the physical resource criteria. About 5,640 acres in Smoke Creek and 1,580 acres in Eastgate Valleys may be developed.

Ground water suitability for agricultural use in Smoke Creek is generally related to location of the source of supply with respect to the playa deposits present. Suitable water for forage crops is available in the alluvium bordering the playas but water in the upper areas of the playa deposits is highly saline and alkaline. The nearly flat lands around the playa, although suited to farming, tend to be fine-grained and of poor chemical and physical characteristics. The water level in these areas is also shallow, and leaching has been difficult. These factors limit the suitability of the lands for irrigation. Agricultural development in the valley is more influenced by the chemical quality of the available water than by the quantity of water available.

Past reconnaissance studies of this area have also indicated that future recycling of the ground waters for intensive irrigation may tend to degrade the chemical quality of the water, particularly if commercial fertilizers are used in substantial quantities, and if the soils contain leachable salts. Extensive agricultural ground water research is needed in the valley to determine the potential hazards arising from the reuse of water, some of which may only be marginal for agricultural use.

Eastgate Valley is part of the Dixie Valley drainage system, along with Cowkick, Fairview, Jersey, Pleasant, Stingaree and the Bell Flat Valleys. Ground water in Eastgate, Cowkick, and Stingaree Valleys moves westward into Dixie Valley and then north towards the Humboldt Salt Marsh; whereas, in the central part of Dixie Valley, for example, ground water moves radially from the margins of the valley toward the playa. Additional development in Eastgate Valley will influence the developments of the Dixie Valley. If additional ground water development is discouraged in Eastgate, for example, along with Cowkick, Stingaree, Fairview, and Jersey Valleys so as not to intercept ground water underflow to Dixie Valley, the estimated maximum draft that the ground water reservoir in Dixie Valley can sustain is estimated on the order of 15,000 acre-feet per year. Additional development in Pleasant Valley, on the other hand, is seen to have no appreciable affect on the available supply to in Dixie Valley. Development in Eastgate Valley will impact the Dixie Valley ground water system and must be closely coordinated with the State of Nevada.

It has been determined that the operation size in these valleys should range between 580-840 acres and 675-980 acres in Smoke Creek and Eastgate Valley, respectively, to attain the desired income.

4.16 COMMENTS REGARDING VALLEYS FOUND UNACCEPTABLE FOR DEVELOPMENT

Chapter 5.0 discusses the physical resource characteristics of all valleys that were found to have some degree of potential, although perhaps marginal, including those which did not meet the overall criteria for development. In most situations, valleys were discounted due to either a lack of available water resources for development, poor soils, severe water quality problems and/or an insufficient growing season. The following paragraphs indicate examples of typical valleys which fall into the respective categories.

BIG SMOKY VALLEY (SUBBASIN 137)

The Big Smoky Valley, located in Quadrants 6, 7 and 9 represents a valley that offers areas of suitable soils and water quality and a growing season to support agricultural development. The waters of the valley are overappropriated; this can prevent additional development from occurring. Yet, much greater utilization of the water resources is possible. Pipelines and lined ditches, for example, could increase the efficiency of water in the valley. Thirteen of the some 40 major streams in the area have been diverted to pipelines or lined ditches near their canyon mouths. This efficient diversion and conveyance of water could be extended to the other streams which are now allowed to flow in their natural channels or diverted to unlined ditches. Such streams as Kingston, Peavine, Pablo, Ophir, Jefferson, Broad, Barker, Wisconsin, Last Chance, and Decker Creeks are candidates for future pipelines. The construction of impoundments in such areas as Birch, Bowman, Jefferson, Jett, Kingston and Pablo Creeks and the South Twin River could also increase the water resources of the valley, if these dams are found to be economically feasible.

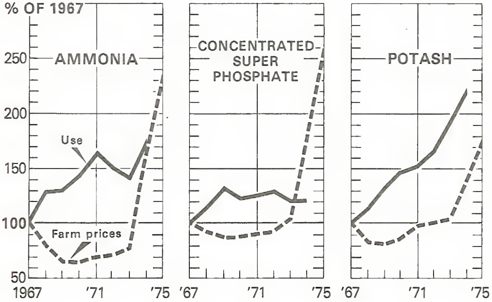
CONTINENTAL LAKE AND DUCK LAKE VALLEYS (SUBBASINS 2 AND 16)

Continental Lake Valley, located in Quadrant 1, is primarily a sheep and cattle ranching area, although production of crops such as alfalfa seed on portions of the valley's 95 square mile floor may be feasible. Duck Lake Valley also has soils along the elevated valley floor and on the alluvial fans that are suitable for irrigated crop production. Both areas have a short growing season and the average period between killing frosts at Duck Lake Valley, for example, is 75 days based upon the 19 years of records that are available. These valleys and others having similar characteristics, such as the Ruby Valley and Maggie Creek Valley, were not given further consideration in the analysis because of the limitations influencing the period of crop production.

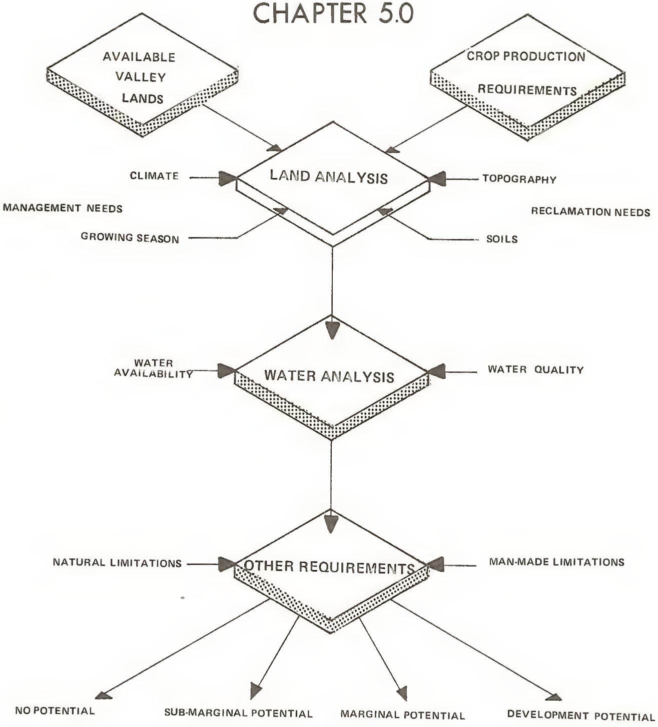
CHAPTER 5 DISCUSSES OTHER VALLEYS HAVING POTENTIALS

Reference is made to Chapter 5.0 for further information about the other valleys in the state which offer agricultural potential upon the national resource lands.

FERTILIZER PRICES AND USE



CHAPTER 5.0



PHYSICAL RESOURCE ANALYSIS

5.0 PHYSICAL RESOURCE FEASIBILITY OF AGRICULTURAL PRODUCTION ON NEVADA NATIONAL RESOURCE LANDS

BACKGROUND

The physical resource feasibility of the national resource lands in the State of Nevada is summarized in this Chapter. The feasibility included an evaluation of the 255 subbasins of the state. The study was based upon the assumptions and guidelines presented in Chapter 3.0.

SUMMARY OF CONCLUSIONS

Table V-1 shows the results of the feasibility study. Good potentials for reclamation and agricultural production on the national resource lands were found to exist in 2 Nevada Valleys. A total of 4,800 acres was identified on these lands. Average-to-good potentials were identified on an additional 18,950 acres in Nevada valleys.

The findings show that average-to-good potentials for agricultural development upon the Nevada resource lands exist in a total of 8 valleys or 3.2 percent of the total subbasins in the state.

Potentials were identified for the development of an additional 39,610 acres in 18 other Nevada valleys, with limitations present. These limitations include greater depths to reach sufficient water for irrigation, local water quality problems and/or the presence of sodium or localized soil salinity problems. The requirements for leaching and hence salt control were considered in a generalized manner for the individual valleys; on-site investigations would be required to evaluate the potential soil management programs and in turn the adequate volume of water needed for each of the valleys identified.

TABLE V-1
PHYSICAL RESOURCE FEASIBILITY SUMMARY

	SUMMARY OF POTENTIAL	TOTAL NO. OF ACRES	NO. OF VALLEYS	PERCENT OF TOTAL BLM NATIONAL RESOURCES LANDS IN NEVADA(a)
1.	Good Potentials Exist	4,800	2	0.01
2.	Average-To-Good Potentials	18,950	6	0.04
3.	Potentials Exist; Limitations Present	17,585	8	0.04
4.	Potentials Exist; Greater Limitations Present	22,025	10	0.05
5.	Marginal Potentials Exist	20,070	5	0.04
6.	Submarginal-To-Marginal Potential	25,685	21	0.05
7.	Submarginal Potential	4,435	9	0.01
	TOTALS	114,550	61	0.24

(a)Based upon Public Land Statistics, 1974, U.S. Department of the Interior, 1975.

SOURCE: BRI SYSTEMS, INC.

Marginal potential for agricultural development was identified on an additional 20,070 acres located in 5 Nevada valleys. In these valleys, ground water is available to support additional agricultural production, but topography and soil suitability impose many limitations upon the opportunities present.

Submarginal-to-marginal potential for agricultural production upon the Nevada resource lands of 30 additional valleys was also identified. The total area of these 30 valleys consists of about 30,000 acres. The opportunities are extremely limited in these valleys. Operations would not be economically feasible in these valleys as is discussed in Chapter 6.0. The valleys are listed because they do contain some national resource lands that meet the physical resource requirements for development, but in most cases their potential for agricultural production is submarginal as is seen in the corresponding Figure-Of-Merits (FOM) in Table V-2. This is further discussed in the following paragraphs of Section 5.0.

POTENTIALS OF INDIVIDUAL VALLEYS

Table V-2 lists the valleys and the number of national resource land acres identified as having potential in each valley. A referenced Quadrant (Quad) is also listed for each valley in the table. The state was divided into 12 Quadrants for the purpose of the study as is shown in Figure 5-1. The valleys in each Quadrant which were identified to offer some degree of potential for future agricultural development upon the national resource lands are discussed on the following pages. The Quadrant 1 discussion is located in Chapter 5.1. The remaining Quadrant discussions follow in the subsequent sections of Chapter 5.0.

Each valley identified in Table V-2 is separately discussed and a summary of the study findings are presented for each of the discussions. A map is provided for additional reference. The map is codified to show why respective valleys (or valley areas) did not meet the physical resource requirements.

RESOURCE REFERENCE DATA IS PROVIDED IN APPENDIX B

Appendix B located in the Supplement (Vol. 2) to this report specifies the computed Figure-Of-Merits (FOM) for each subbasin area which corresponds to the maps shown on the following pages of this chapter. A total of 12 arrays are presented for each of the 12 Quadrants of the State. The physical resource criteria for each array factor discussed in Chapter 3.1 are also presented in Appendix B.

5.1 NEVADA QUADRANT 1: NORTHWEST AREA

The northwestern region of Nevada consists of the Northwest Basin and parts of the Black Rock Desert, Humboldt River, West Central, Truckee River and Western Basins. The area is shown in Figure 5-2. This region includes 28 valleys and parts of 9 other subbasins.

Table V-3 lists the five valleys which were identified to have potential for crop production. Granite Springs offers the highest potential for development in this region although the number of acres that can be developed are minimal. Other potential areas include Mud Meadows, Pine Forest, Smoke Creek and Honey Lake Valleys. Each of these valleys offer limited agricultural production opportunities based upon the physical resource criteria given consideration.

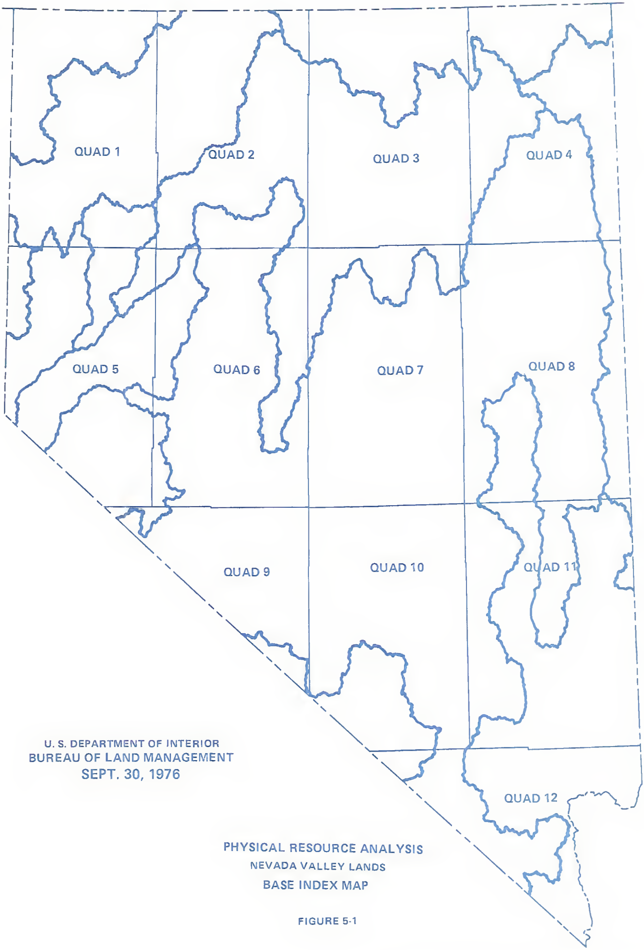


FIGURE 5-1

DRAWN BY BRI SYSTEMS, INC., PHOENIX, ARIZ.

TABLE V-2
SUMMARY OF NEVADA VALLEYS HAVING
NATIONAL RESOURCE LANDS AGRICULTURAL POTENTIAL

	VALLEY NAME	NEVADA HYDROGRAPHIC DESIGNATION	POTENTIAL ACRES TO BE DEVELOPED	FIGURE OF MERIT	REFERENCE QUADRANT
1.	Good Potentials Exist (a)				
	Fish Lake	117	3,000(b)	5.4	9
	Pahranagat	209	1,800	5.2	11
	Subtotal		4,800		
2.	Potentials Exist For Reclamation And Development(c)				
	Railroad (North)	173(B)	5,000(d)	4.6	7
	Big Smoky (Tonopah)	137(A)	- (e)	4.3	6
	Spring	184	8,000	3.9	8
	Granite Springs	78	450	3.9	1
	White River	207	5,500	3.7	8
	Dixie Valley	128	- (e)	3.5	6
	Subtotal		18,950		
3.	Potentials Exist; Limitations Present(f)				
	Coal	171	1,000	3.3	11
	Monitor (South)	140(B)	3,000	3.3	7
	Boulder Flat	61	6,300	3.1	3
	Smith Creek	134	2,650	3.0	6
	Walker Lake (Whiskey Flat)	110(C)	400	3.0	5
	Long	175	530	2.9	8
	Little Smoky (North)	155(A)	2,125	2.9	7
	Buffalo	131	1,580	2.9	2
	Subtotal		17,585		

TABLE V-2
(Continued)

VALLEY NAME	NEVADA HYDROGRAPHIC DESIGNATION	POTENTIAL ACRES TO BE DEVELOPED	FIGURE OF MERIT	REFERENCE QUADRANT
4. Potentials Exist; Greater Limitations Present(g)				
Mud Meadows	26	2,720	2.6	1
Pine Forest	28	2,225	2.3	1
Grass	138	3,750	2.3	7
Ralston	141	1,260	2.2	7
Pahroc	208	560	2.2	11
Upper Reese River	56	3,700	2.2	6
Goshute	187	4,000	2.2	4
Newark	154	510	2.1	7
Pilot Creek	191	2,300	2.1	4
Steptoe	179	1,000	2.0	8
Subtotal		22,025		
5. Marginal Potentials Exist(h)				
Huntington	47	11,500	1.8	3
Smoke Creek	21	5,640	1.7	1
Eastgate	127	1,580	1.7	6
Railroad (South)	173(A)	-	1.5	10
Carico	55	1,350	1.5	7
Subtotal		20,070		
6. Submarginal-To-Marginal Potentials Exist(i)				
Garden	172	1,050	1.4	11
Patterson	202	400	1.4	11
Antelope (North)	186(B)	800	1.4	4
Great Salt Lake	192	2,000	1.4	4
Clovers	64	1,500	1.3	2
Snake	195	5,000	1.3	8

TABLE V-2
(Continued)

VALLEY NAME	NEVADA HYDROGRAPHIC DESIGNATION	POTENTIAL ACRES TO BE DEVFLOPED	FIGURE OF MERIT	REFERENCE QUADRANT
6. (Continued)				
Delamar	182	1,200	1.2	11
Hot Creek	156	240	1.2	7
Churchill	102	470	1.2	5
East Walker Lake	110(A)	270	1.1	5
Pleasant	130	1,040	1.1	2
Rhodes Salt Marsh	119	325	1.1	9
Mesquite Valley	163	200	1.0	12
Lower Moapa	220	750	1.0	11
Hamlin	196	800	1.0	8
Clayton	143	700	1.0	9
Pine	53	5,200	1.0	3
Thousand Springs (Rocky Butte)	189(C)	1,000	1.0	4
Honey Lake	97	1,000	1.0	5
Winnemucca	80	600	0.9	5
Edwards Creek	133	1,140	0.9	6
Subtotal		25,685		
7. Minimal Potentials Exist: Submarginal(j)				
Monitor (North)	140(A)	2,500	0.7	7
California Wash	218	150	0.5	11
Forty Mile Canyon	227(A)	250	0.3	10
Oasis	228	225	0.3	10
Queen	116	200	0.3	9
Carson Desert	101	-	0.3	5
Ione	135	910	0.2	6
Huntoon	113	200	0.1	9
Indian Springs	161	-	0.1	10
Subtotal		4,435		

TABLE V-2
(Continued)

8. <u>No Potential Identified On National Resource Lands</u>

All remaining Nevada valleys not listed.

COMMENTS:

(a) These Nevada lands were found to offer the best potential in the analysis findings.

(b) The acreas to be developed in this valley are highly predicated upon approval from the State of Nevada for water rights. Water is available that far exceeds the resource being utilized; although appropriations currently limit any future development in the valley.

(c) The Nevada resource lands in these valleys offer average-to-good potential for reclamation and agricultural development.

(d) The southern areas of the valley (173(A)) offer more suitable soils, although greater ground water resources are found in the northern portion of Railroad Valley.

(e) Opportunities would be available if additional waters could be imported into the valley area.

(f) Limitations are present upon many of the natural resource lands such as great water depths, water quality and soil problems.

(g) Potentials exist upon some of the Nevada resource lands; salinity, alkalinity and other problems must be evaluated by on-site investigations.

(h) The potentials are very marginal upon the Nevada resource land areas shown.

(i) The potentials are submarginal-to-marginal for specific valley areas; refer to following Chapters for further information.

(j) Submarginal potentials existing on the Nevada resource lands in the valleys shown.

SOURCE: BRI SYSTEMS, INC.

TABLE V-3
NORTHWEST (QUAD 1) AREA VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT(a)
78	Granite Springs	3.9
26	Mud Meadows	2.6
28	Pine Forest	2.3
21	Smoke Creek	1.7
97	Honey Lake	1.0

(a)Based upon a scale from 0 to 10; the higher the value, the greater the development potential.

SOURCE: BRI SYSTEMS, INC..

SUMMARY OF EXISTING POTENTIAL OF QUAD 1 LANDS

Table V-4 summarizes the estimated number of acres determined available for agricultural development in each of the valleys in the Quadrant 1 region. The comments of the Table indicate the limitations that have been identified for potential development on the national resource lands.

GRANITE SPRINGS VALLEY

The Granite Springs Subbasin consists of 618,880 acres(1). About 34 percent of the lands in this valley are above 5,000 feet altitude. The combined perennial yield and available recycled irrigation water of the valley is estimated to be

(1) The number of acres in the valley vary for respective informational resources. For example, Water Reconnaissance Report No. 55 identifies a total of 626,000 acres for the area as compared to 618,880 acres listed in (unpublished) State Engineer Nevada Hydrographic Area Records.

TABLE V-4

QUAD 1 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Granite Springs	78	450	(a)
Mud Meadow	26	2,720	(b)
Pine Forest	28	2,225	(a)
Smoke Creek	21	5,640	(c)
Honey Lake	97	(d)	(d)
TOTALS		11,035	

COMMENTS:

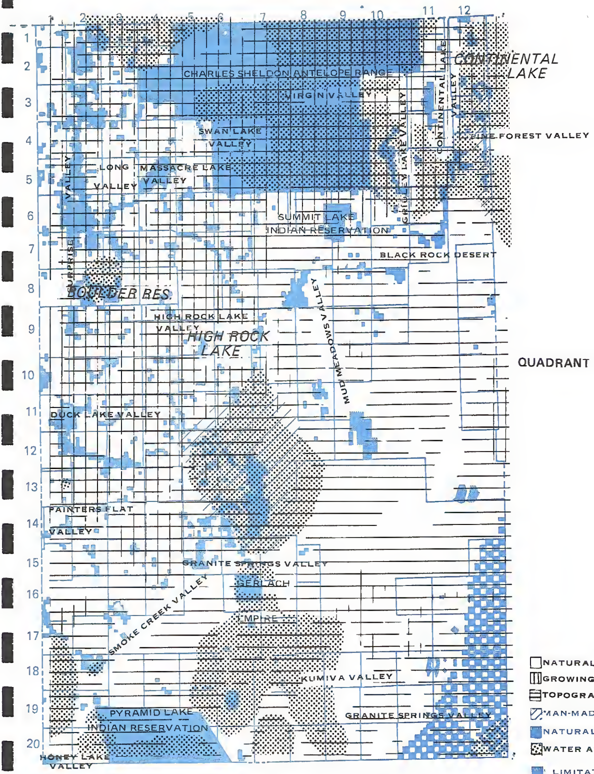
(a) Good potential exists on natural resource lands.
(b) Topography may place limitations upon development of some of the lands.
(c) Soil and water quality may place some limitations upon development of lands.
(d) Refer to Quad 5 discussion in this Chapter.

SOURCE: BRI SYSTEMS, INC.

between 4,500-6,110 acre-feet. The ground water is derived from precipitation in the valley and from inflow from Kumiva Valley. It is sufficient to irrigate between 1,365-1,850 acres.

Ground water rights appropriated in the valley consists of 44.5 acre-feet of certified rights and another 72.8 acre-feet of water rights currently in pending status. Assuming a water duty of 3.3 acre-feet per acre in Granite Springs Valley, between 400-500 acres of Nevada resource lands have potential for agricultural development. This represents less than 1 percent of the total lands in the valley that have soils suitable for crop development(2)

(2) 182,000 acres of acceptable-to-good soils are estimated to be present in Granite Springs Valley.



QUADRANT 1: NORTHWEST AREA

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

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FIGURE 5-2

MUD MEADOWS VALLEY

The Mud Meadows Subbasin offers agricultural development opportunities, although the opportunities present are limited because of the steepness of the alluvial slopes and the salinity problems identified in the valley.

The average annual ground water available to support development in the valley is estimated at between 6,000-16,000 acre-feet. A wide variation occurs in the perennial yield estimates of the information resources available.

Ground water appropriations at Mud Meadows Valley total 2,560 acre-feet. Over 600 acre-feet of this water is supplementary to existing surface water rights. Total rights include 2,598 acre-feet and 4,875 acre-feet of certified rights and vested rights, respectively. Assuming a water duty of 3.1 acre-feet per acre in this valley and an average annual ground water availability of 11,000 acre-feet, it is estimated that 2,720 acres may be further developed for agricultural purposes. Such development on the Nevada resource lands is highly predicated upon further on-site investigation of the soils to determine their local suitability for agriculture.

PINE FOREST VALLEY

Pine Forest Valley has a perennial yield estimated to total 20,000 acre-feet. Allowing for recycled irrigation water, the ground water availability of the valley is estimated to total 26,000 acre-feet annually.

Current ground water rights account for 19,105 acre-feet or 73 percent of the available supply. This includes 9,973 acre-feet of certified water rights and 9,132 acre-feet of permitted rights.

The average annual ground water available for further development is estimated at 6,895 acre-feet. This is sufficient to irrigate 2,225 acres and represents 7.2 percent of the total lands containing good soils in this valley.

Surface water rights in the valley include 26,781 acre-feet consisting of certified rights (11,123 acre-feet), permitted rights (2,957 acre-feet), rights pending by the state (6,975 acre-feet) and proofs or vested rights (5,726 acre-feet).

SMOKE CREEK VALLEY

The Smoke Creek Valley Subbasin includes an area consisting of 627,200 acres. The total available ground water in the subbasin is estimated at 20,800 acre-feet annually; about 16 percent or 3,310 acre-feet of this water has been appropriated(3).

The lands offering opportunities for agricultural development lie along the western portions of the valley. Assuming a water duty of 3.1 acre-feet per acre in this valley, some 5,640 acres may be developed. The analysis FOM is low for the valley lands due to identified salinity-alkalinity problems in many parts of the valley.

HONEY LAKE VALLEY

The Honey Lake Valley Subbasin consists of 123,520 acres. The available ground water in the valley is estimated at 10,400 acre-feet annually. Only 10 percent of this water is appropriated(4).

(3) 1,663 acre-feet of certified water rights; the balance are vested rights.

(4) Certified water rights total 1,087 acre-feet.

Only a small portion of this valley is included in Quad 1 and the included area is not suitable for agricultural development. Reference is made to Chapter 5.5 (Quad 5 discussion) for further information about the valley's potential.

OTHER AREAS HAVING AGRICULTURAL POTENTIAL BUT PHYSICAL RESOURCE LIMITATIONS

At least 12 other valley areas have soils and a surrounding topography that would support some degree of agricultural production, but they have an extremely short growing season. The findings of the analysis do not include any valley areas that have a growing season of less than 100 days. Valleys which fall into this category in Quadrant 1 include:

- Black Rock Desert (28*)
- Continental Lake Valley (2)
- Duck Lake Valley (16)
- Gridley Lake Valley (3)
- High Rock Lake Valley (25)
- Kumiva Valley (79)
- Long Valley (9)
- Massacre Lake Valley (8)
- Painters Flat Valley (18)
- Surprise Valley (14)
- Swan Lake Valley (7)
- Virgin Valley (4)

5.2 NEVADA QUADRANT 2: NORTHCENTRAL AREA 1

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

The northcentral area (Qaudrant 2) consists of 10 valleys and parts of 17 other subbasins. It includes some portion of the Northwest, Black Rock Desert, Snake River, Humboldt, West

*Hydrographic subbasin reference number.

Central, Carson River and Central Basins of Nevada.

Table V-5 lists the valleys which were found to offer potential for agricultural development. The three valleys of this region which offer such opportunities include Buffalo, Clovers and Pleasant Valleys.

TABLE V-5
NORTH CENTRAL (QUAD 2) AREA VALLEYS OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
131	Buffalo	2.9
64	Clovers Area	1.3
130	Pleasant	1.1

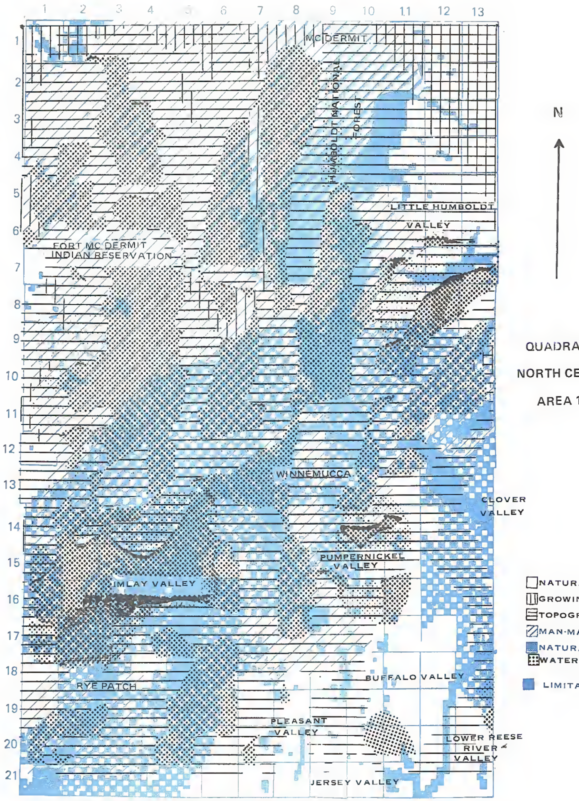
SOURCE: BRI SYSTEMS, INC.

SUMMARY OF EXISTING POTENTIAL OF QUAD 2 LANDS

Over 4,100 acres of Nevada resource lands have been identified as being suitable for agricultural production in Quadrant 2; only one-third of these lands have relatively good potential. Table V-6 lists the three valleys where future cropping potential has been identified which may be seen in Figure 5 3. The following paragraphs summarize the analysis findings.

BUFFALO VALLEY

The Buffalo Valley Subbasin consists of 322,560 acres located in the southeastern part of Quadrant 2. About 15 percent of the lands in this subbasin have been identified as suitable



QUADRANT 2:

NORTH CENTRAL

AREA 1

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY
- LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

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FIGURE 5-3

TABLE V-6
QUAD 2 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE
Buffalo	131	1,580
Clover Area	64	1,500(a)
Pleasant	130	1,040
TOTALS		4,120

(a)Includes Quadrant 3 totals.

SOURCE: BRI SYSTEMS, INC.

for agricultural development.

Ground water rights in the valley amount to 24.03 cfs; this is approximately equivalent to 5,550 acre-feet. The balance of water rights in the valley are surface water rights used for irrigation.

The average annual ground water available in the valley is estimated at 10,400 acre-feet. Considerating current appropriations, this allows for 4,900 acre-feet to be used for additional development purposes and would support the agricultural production of 1,580 acres on the Nevada resource lands.

CLOVER VALLEY AREA

The Clovers area lies in Quadrant 2 and 3. The subbasin consists of 460,800 acres. About 49 percent of the lands in the subbasin are considered marginally suitable for agricultural production purposes.

Ground water rights in the valley total 12,758 acre-feet of certified rights and 8,241 acre-feet of permitted rights. An additional 22,480 acre-feet of rights are pending and under investigation by the state of Nevada.

The combined perennial yield of this valley, Kelly Creek and Pumpernickel Valleys is estimated at between 72,000-93,000 acre-feet. Assuming that only 30 percent of the pending rights in this valley will be transferred into certified water rights, an estimate of 1,500 additional acres is made for potential development on the national resource lands. Further reconnaissance is needed in the valley area to fully quantify the perennial yields of this area prior to any development.

PLEASANT VALLEY

The north and central parts of Pleasant Valley are located in the southern portion of Quadrant 2. The Pleasant Valley sub-basin consists of 182,400 acres; about 9,000 of these acres have been identified as being marginally suitable for agricultural production.

Ground water availability in this valley is estimated at 3,900 acre-feet annually. At the current time, 261 acre-feet of this water has been appropriated to irrigate 74.4 acres. It is estimated that water is available for the additional development and production of 1,040 acres of Nevada resource lands.

OTHER AREAS HAVING AGRICULTURAL POTENTIAL BUT LIMITED WATER AVAILABILITY

Five other valley areas were identified as being suitable for agricultural development: the Little Humboldt, Imlay, Pumpernickel, Jersey, and Reese Valleys. These valleys are not included in the findings (Tables V-3 and V-4) due to the many uncertainties arising with regard to additional water availability.

The Little Humboldt Valley lies in the northeast part of Quadrant 2. The entire subbasin (Quadrants 2-3) consist of 624,000 acres; some 5 percent of the national resource lands have been identified as being suitable for agricultural production.

The average annual ground water available in the valley is estimated at 10,400 acre-feet. Some 6,615 acres are currently under irrigation. The patented lands utilize the valley areas more suitable for agricultural production and have appropriated about 73 cfs of the available ground waters. This also includes supplemental water rights.

The Imlay and Pumpernickel Valleys are over appropriated when one considers both, certified and permitted water rights. Water use generally falls short of water appropriations, but the patented lands may be expected to use all the water that is available.

The ground waters of the Lower Reese River Valley have also been extensively appropriated. Total ground water rights in the valley include 17,064 acre-feet. This includes 12,337 acre-feet of certified rights and 4,727 acre-feet of permitted rights. An additional 2,560 acre-feet of ground water appropriations are in pending status by the State of Nevada.

5.3 NEVADA QUADRANT 3: NORTHCENTRAL AREA 2

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Quadrant 3 includes portions of the Snake River and Humboldt

River Basins. There are 12 valleys in this region and portions of another 14 subbasins.

Figure 5-4 shows the area being discussed and specifies the valleys that offer agricultural potential. The four valleys identified to have cropping potential are listed in Table V-7.

TABLE V-7
NORTH CENTRAL (QUAD 3) AREA VALLEYS OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
61	Boulder Flat	3.1
47	Huntington	1.8
64	Clovers	(a)
53	Pine	1.0

(a) Refer to Chapter 5.2.

SOURCE: BRI SYSTEMS, INC.

Figures 5-5 through 5-8 show the characteristics of the region under discussion. The community of Elko is shown in Figure 5-5. The Dixie Creek-Tenmile Creek and South Fork Valley areas are shown in the following figures. Areas as the South Fork Valley have soils which would support agricultural production. They are not included in the findings of the analysis because of growing season and/or water availability limitations.

SUMMARY OF EXISTING POTENTIAL OF QUAD 3 LANDS

A total of 23,000 acres have been identified in Quadrant 3 to have potential for agricultural development. Most valleys

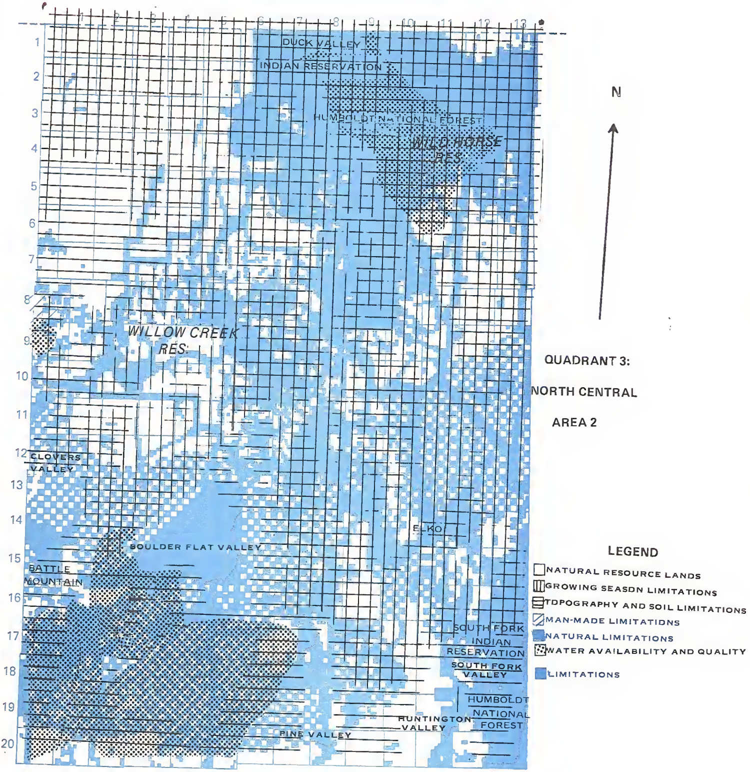

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FIGURE 5-4

have both, soil and water quality problems. This is further discussed in the following paragraphs. Table V-8 lists the potential agricultural acres identified on the national resource lands in each valley.

TABLE V-8
QUAD 3 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Boulder Flat	61	6,300	(a)
Huntington	47	11,500	(b)
Clovers	64	(c)	(c)
Pine	53	5,200	(d)
TOTALS		23,000	

(a) Marginal-to-suitable soils.
(b) Topography and soils will place limitations on many lands.
(c) Refer to Chapter 5.2.
(d) Soils will place limitations upon many national resource lands.

SOURCE: BRI SYSTEMS, INC..

BOULDER FLAT AREA

The Boulder Flat Subbasin consists of 348,160 acres; about 35 percent of the area is considered suitable for agricultural development.

The perennial yield of the valley is estimated at 39,000 acre-feet. About 18,625 acre-feet of the available ground waters have been appropriated(5) in addition to numerous surface water appropriations(6). The ground water available

(5) Includes supplemental water rights.
(6) Surface water appropriations total 14.47 cfs.

for additional development is estimated at 20,375 acre-feet. This is sufficient to irrigate 6,300 acres of national resource lands.

The lands offering greater agricultural development potential are the bottomlands of the valley, many which have been acquired for the Rye Patch Reservoir. The remaining lands are marginal-to-suitable for agricultural development and require on-site investigations to determine their suitability for crop production.

HUNTINGTON VALLEY

The Huntington Valley Subbasin consists of 503,680 acres; about 10 percent of the area's soils are considered suitable for agricultural development.

The perennial yield of the valley is estimated at 38,000 acre-feet; only 1,208 acre-feet of the available ground waters have been appropriated. Surface water rights total 4,478.6 acre-feet and represent the primary source of irrigation water for the valley.

Ground water availability for future development is estimated at about 37,000 acre-feet annually. This is sufficient to irrigate 11,500 acres in this region. In addition, the Hylton Dam, when constructed, could offer additional water resources for the valley.

Although the area has a relative abundance of water for future agricultural development production, it is given a low (FOM) rating because many of the Nevada resource lands are unsuitable for development. On-site investigations are required to identify those bottomlands and gently sloping lands which will support crop production.

FIGURE 5-5
VIEW OF ELKO, NEVADA, SUBBASIN 49
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-6
DIXIE CREEK AREA (48) NATIONAL RESOURCE LANDS
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-7
EXAMPLE OF AGRICULTURAL LANDS IN SOUTH FORK AREA, SUBBASIN 46, SOUTH OF ELKO, NEVADA
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-8
WILD HAY LANDS SEEN IN SUBBASIN 46
SOURCE: BRI SYSTEMS, INC.

PINE VALLEY

Pine Valley is located in the southern part of Quadrant 3 and the northern area of Quadrant 7. The subbasin consists of 641,280 acres; about 4 percent of the region is considered to have lands suitable for agricultural production.

The perennial yield of Pine Valley is estimated at 26,000 acre-feet. About 23 percent of the ground waters are appropriated along with numerous surface water filings in the valley.

It is estimated that approximately 18,000 acre-feet of ground waters are available for additional use. This would irrigate 5,200 acres of the national resource lands.

The valley is given a low (FOM) rating because of the overall unsuitability of many Nevada resource lands for crop production. Water quality problems have been identified within the valley and will place further limitations upon reclamation programs.

5.4 NEVADA QUADRANT 4: NORTHEAST AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Quadrant 4 includes portions of the Snake River, Humboldt River, Central and Great Salt Lake Basins. A total of 11 valleys and parts of 10 other subbasins are included within this region.

Figure 5-9 shows the area under discussion. Five valleys have been identified to offer agricultural production potential.

In addition, four other valleys were identified to have very marginal potential. They are not included in the study findings for the reasons discussed below.

The Bruneau River Valley has some lands that may offer potential, based upon soils and topography characteristics, but the area is faced with a short growing season. The available lands that will support crop production are limited in the valley due to the general rough features of the terrain.

The Goose Creek Valley area also experiences a short growing season. Furthermore, it is not near any reliable market area.

Independence Valley has two problems of significance: a short growing season and a lack of adequate water. Water of any suitable quantity has not been reached in this valley at depths extending 200-300 feet and beyond.

Steptoe Valley is an area that offers potential, based upon the physical land characteristics, but faces water unavailability problems. This valley is further discussed in Chapter 5.8.

TABLE V-9
NORTHEAST (QUAD 4) AREA VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
187	Goshute	2.2
191	Pilot Creek	2.1
186(B)	Antelope Valley (North)	1.4
192	Great Salt Lake	1.4
189(C)	Thousand Springs (Rocky Butte)	1.0

SOURCE: BRI SYSTEMS, INC.

SUMMARY OF EXISTING POTENTIAL OF QUAD 4 LANDS

The potential acres that may be developed in the five valley areas identified in Quadrant 4 are listed in Table V-10. The potential opportunities present are marginal. Other areas within this Quadrant have soils more suitable for crop production such as the Ruby Valley, subbasin 176. The valley has a growing season less than 100 days and is not given further consideration.

GOSHUTE VALLEY

The Goshute Valley Subbasin lies in the southeastern portion of Quadrant 4. The area consists of 610,560 acres; between 20-25 percent of the subbasin has been identified as having soils suitable for agricultural production.

The ground water availability of the valley is estimated at

TABLE V-10
QUAD 4 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Goshute	187	4,000	(a)
Pilot Creek	191	2,300	(a)
Antelope North	186(b)	800	(b)
Great Salt Lake	192	2,000	(c)
Thousand Springs (Rocky Butte)	189(c)	1,000	(c)
TOTALS		10,100	

(a) Many natural resource lands are unsuitable and require local on-site investigations for crop production assessment.
(b) Poor water quality may limit crop production potentials.
(c) Water quality and salinity problems arise and may limit potential opportunities.

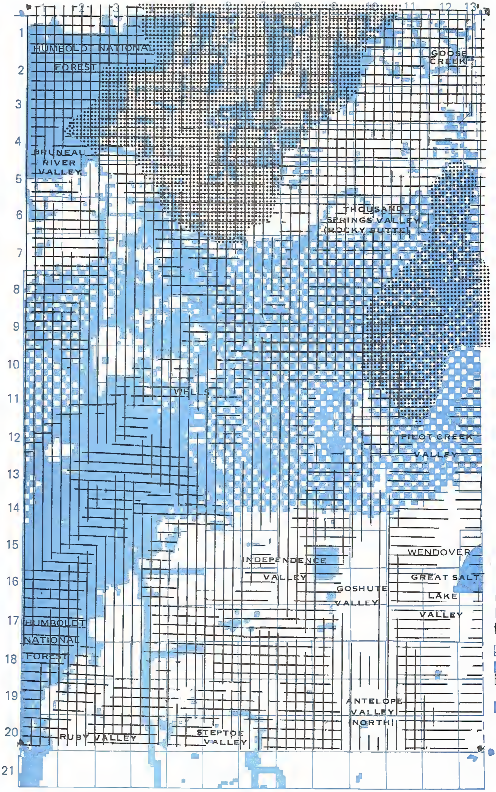
SOURCE: BRI SYSTEMS, INC.

14,300 acre-feet. Appropriated water rights account for 11 percent of this total(7) with another 24 acre-feet currently in pending status by the State of Nevada.

Water is available in the valley, but as in the case of many other Nevada valley areas, it must be salvaged from natural discharge sources or a future overdraft will occur. This requires spacing of wells located near areas of abundant phreatophytic growth to lower water levels uniformerly.

Ground water is available to irrigate an additional 4,000 acres in this valley. The valley is given a relatively low (FOM) value because of the large amount of unsuitable national

(7) Certified rights: 328 acre-feet; Permitted rights: 1,311 acre-feet.



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QUADRANT 4:

NORTHEAST AREA

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY
- LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

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FIGURE 5-9

resource lands present and the poor water quality that exists in many of these national resource areas.

PILOT CREEK VALLEY

The Pilot Creek Subbasin consists of 208,640 acres; about 22 percent of the area is considered to have soils of acceptable-to-good qualities for agriculture. Streamflow is primarily used for irrigation in the valley. Surface water rights include 1,973 acre-feet of certified rights and 42 acre-feet of vested rights.

It is estimated that the annual ground water availability in the valley is 6,500 acre-feet. Only 5.6 acre-feet of this water has been appropriated. Water is available to irrigate between 2,000-2,700 acres of Nevada resource lands in the valley. Many of the soils on the national resource lands are unsuitable for agricultural production; on-site investigations are required to fully evaluate those lands which will offer crop production opportunities.

ANTELOPE VALLEY NORTH

About 24 percent of the 172,800 acres of this subbasin have been identified as being suitable for agricultural production. The ground water availability of the valley is estimated at 2,600 acre-feet annually; only 92 acre-feet of this water is appropriated. Surface water rights in the valley total another 222 acre-feet for irrigation purposes.

Water is available to irrigate approximately 800 acres of the Nevada resource lands in the northern part of Antelope Valley. Water quality is poor in many parts of the valley; thus on-site investigations are required to fully evaluate the areas having the greatest opportunity for crop production.

GREAT SALT LAKE VALLEY

This valley lies in the southeast of the Quadrant, bordering the State of Utah. The subbasin consists of 324,480 acres.

The ground water availability of the valley is estimated at 6,500 acre-feet annually; only 5.6 acre-feet of these waters have been appropriated. Surface water appropriations amount to another 941 acre-feet(8).

Water is available to irrigate 2,000 acres of national resource lands in the valley. Much of the valley contains soils which are unsuitable for agricultural production; the valley also experiences salinity problems. On-site soil investigations are required to determine the specific potentials that exist in valley areas which appear favorable for development.

THOUSAND SPRINGS (ROCKY BUTTE) VALLEY

About 2 percent of the 117,120 acres in this subbasin are considered to have soils suitable for agricultural production. The valley's ground water availability is estimated at 2,600 acre-feet annually. No ground water appropriations have been identified. Surface water rights amount to 15,493 acre-feet, plus an additional 20,416 acre-feet based upon proof of vested rights. Surface waters are used extensively for irrigation in the valley.

Ground water is available to irrigate between 900-1,100 acres

(8) Certified rights: 669 acre-feet; Permits: 180 acre-feet; Proofs: 92 acre-feet.

in the valley. Local studies of the soils, water quality and water table depth must be made to identify those valley areas that will offer the best cropping potentials.

5.5 NEVADA QUADRANT 5: WEST CENTRAL AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Quadrant 5 includes parts of the Humboldt River, West Central, Truckee River, Western Nevada, Carson River and Walker River Basins of Nevada. This area includes 25 valleys and portions of 13 other subbasins.

The area under discussion is shown in Figure 5-10. The natural resource lands of seven valleys have been identified in this area as being suitable for agricultural crop production. Only two of these valleys offer average-to-good potentials as is shown in Table V-11. The potential of the other five valleys is very limited. This may be seen by a comparison of the valley physical resource FOM's shown in Table V-9.

SUMMARY OF EXISTING POTENTIAL OF QUAD 5 LANDS

Table V-12 lists the acreages of the valleys in Quadrant 5 found to offer agricultural potential. Reference is made to the FOM's developed for the valleys shown in Table V-11. It is seen that good potential exists for the development and agricultural production on only about 400 acres in Quadrant 5. Many limitations are present in the remaining valleys and only marginal development potentials exist. The San Emido Desert is typical of these areas. It has relatively good soil characteristics, but unavailable water for development.

TABLE V-11

WESTCENTRAL (QUAD 5) AREA VALLEYS OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE RIGURE OF MERIT
78	Granite Springs	3.9
110(c)	Walker Lake: Whiskey Flat Area	3.0
102	Churchill	1.2
110(a)	East Walker Lake: Schurz Area	1.1
97	Honey Lake	1.0
80	Winnemucca	0.9
101	Carson Desert	0.3

SOURCE: BRI SYSTEMS, INC..

TABLE V-12

QUAD 5 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Granite Springs	78	(a)	(a)
Walker: Whiskey Flat	110(c)	400	(b)
Churchill	102	470	(c)
Walker: Schurz	110(a)	270	(c)
Honey Lake	97	1,000	(d)
Winnemucca	80	610	(e)
Carson Desert	101	(f)	(f)
TOTALS		2,750	

Comments:

(a) Refer to Table V-2.

(b) Military installations in the area may limit the potential development of the national resource lands.

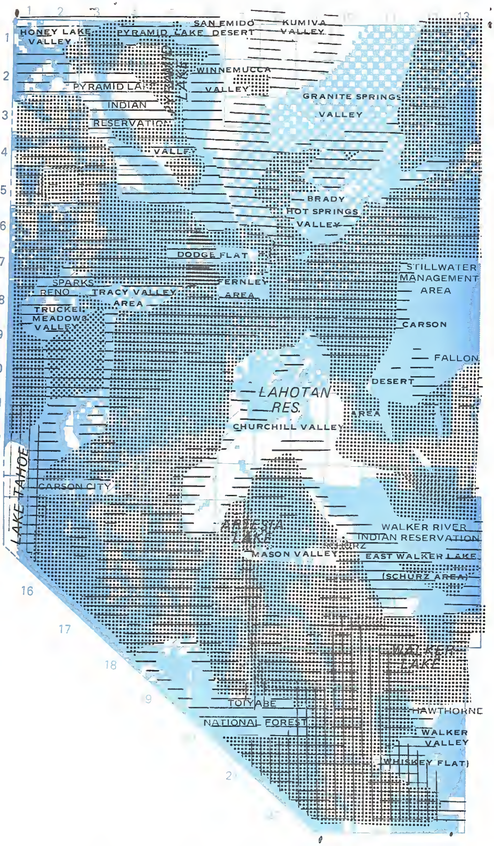
(c) Perennial yield not known with any degree of certainty; future investigations are required in the area.

(d) Many of the more suitable lands are privately owned. On-site investigation is required to fully evaluate the soils of the national resource lands.

(e) Opportunities appear at the north end of the valley.

(f) Very marginal opportunities are present.

SOURCE: BRI SYSTEMS, INC.



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QUADRANT 5.

WEST CENTRAL AREA

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY LIMITATIONS

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FIGURE 5-10

GRANITE SPRINGS

This valley is discussed in Chapter 5.1. Reference is made to the discussion and Table V-2 for information about the agricultural potentials of Granite Springs' national resource lands.

WALKER (WHISKEY FLAT) AREA

This valley lies in the southern portion of Quadrant 5, the southwestern portion of Quadrant 6, and the northern part of Quadrant 9. The subbasin consists of 346,240 acres. About 10 percent of the lands have soils which would support agricultural production.

The estimated annual ground water availability of this subbasin is 6,500 acre-feet. Approximately 4,900 acre-feet of the available ground waters have been appropriated(9). A balance of 1,600 acre-feet is available for future development. This would be sufficient to irrigate between 400-480 acres of the Nevada resource lands.

U.S. military installations are located in this area. This could be a deterrent to future development on the national resource lands and does limit the potential that exists.

CHURCHILL VALLEY

Churchill Valley is located in the central portion of Quadrant 5. The subbasin consists of 307,200 acres; about 5 percent of the lands have soils which are suitable for agricultural production.

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(9) About 40 cfs has been appropriated in subbasin 110(c).

The perennial yield of the valley is uncertain. The valley is estimated to have a storage capacity of 740,000 acre-feet of ground water. Appropriated water rights in the valley amount to some 6,300 acre-feet. Assuming a water duty of 3.6 acre-feet per acre in this valley and an available annual yield of about 8,000 acre-feet, it is estimated that some 470 acres of Nevada resource lands may be developed.

WALKER (SCHURZ) AREA

This valley lies north of the Walker Whiskey Flat area and consists of 321,280 acres. About 27 percent of the lands are estimated to contain soils suitable for agricultural production.

Water appropriations in the valley include 115.8 acre-feet of surface waters(10) and 22.1 acre-feet of ground waters(11). The perennial yield of the valley is uncertain and estimates have ranged between 1,000 acre-feet and 15,000 acre-feet. The findings conservatively use the lower estimated perennial yield value. Based upon this assumption, it is seen that water is available for the development of only 270 acres.

HONEY LAKE VALLEY

The Honey Lake Valley Subbasin lies in the northwestern part of Quadrant 5, overlaps into Quadrant 1 and borders the State of California. The subbasin consists of 123,520 acres.

The available ground waters of the valley are estimated at

(10) Walker Indian Reservation, 1906 priority.

(11) Nevada Highway Department: 10.1 acre-feet; Private source: 12.0 acre-feet.

10,400 acre-feet annually; about 1,090 acre-feet of this water has been appropriated.

Many of the suitable lands in this valley are in private ownership. It is assumed that about 50 percent of the available ground water would be used by these sources. Based upon this assumption, it is estimated that the remaining available ground water could be used to irrigate an additional 1,000-1,200 acres if suitable soils can be identified on the national resource lands.

WINNEMUCCA VALLEY

This area lies in the northern part of the Quadrant and consists of 237,440 acres. About 1.3 percent of the lands in this valley are estimated to have soils suitable for agricultural production.

The available ground water of the valley is estimated at 3,900 acre-feet annually. Slightly over 1,900 acre-feet of this resource is appropriated(12) leaving a balance of 2,000 acre-feet. This is sufficient to irrigate an additional 575-650 acres. Surface water appropriations in the valley consist of an additional 410 acre-feet(13).

The north end of the valley appears to offer opportunities for future agricultural development and should be investigated for cropping purposes on the Nevada resource lands.

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(12) Permits: 1,600 acre-feet; Pending rights: 320 acre-feet.

(13) Certificates: 372.5 acre-feet; Permits: 33.4 acre-feet; Proofs: 4.3 acre-feet.

CARSON DESERT

The Carson Desert subbasin consists of over 1 million acres located in the eastern part of Quadrant 5 and western part of Quadrant 6. The newland Project is a valuable resource in providing irrigation water to this valley.

The perennial yield of the valley is not known with any degree of certainty. Current water appropriations total 6,783 acre-feet(14) and an additional 27,660 acre-feet of vested rights.

A very low priority is given to the area for any future development on the available Nevada resource lands because of water availability limitations. The valley is included in the analysis findings to identify the area as one possible candidate for future investigation should additional water resources be identified.

Figure 5-11 shows the Carson Desert area along the southeastern portion of the subbasin. These lands are typical of many of the Nevada resource lands of this region. The community of Fallon, located in the subbasin, is shown in Figure 5-12.

OTHER AREAS HAVING POTENTIAL BUT LIMITED WATER AND/OR SUITABLE SOILS AVAILABILITY

Subbasin 108, Mason Valley, is typical of the valleys in this Quadrant and in the State of Nevada that have lands suitable for agricultural production, but very limited water resources. The valley is shown in Figures 5-13 and 5-14. The available

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(14) Includes both, certificates and permits.

FIGURE 5-11
VIEW OF SALT BASIN IN THE CARSON DESERT SUBBASIN
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-12
VIEW OF FALLON, NEVADA, DOWNTOWN AREA
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-13
SUBBASIN 108: MASON VALLEY FARM AREA
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-14
SUBBASIN 108: MASON VALLEY FARM AREA
SOURCE: BRI SYSTEMS, INC.

ground water of the valley is estimated at 25,000 acre-feet. Ground water rights in Mason Valley total 127,417 acre-feet(15) with an additional 18,572 acre-feet of ground water rights pending by the State.

Figure 5-15 shows the Tracy area (subbasin number 83) located in the north central part of Quadrant 5. The national resource lands of the Fernley subbasin, adjoining the Tracy area are also overappropriated. Other valleys which fall into the same category in this region include Brady Hot Springs Valley, Dodge Flat and Truckee Meadows. The Pyramid Lake Valley (subbasin number 81), on the other hand, has ample water but a topography that is not condusive for agricultural development.

5.6 NEVADA QUADRANT 6: CENTRAL AREA 1

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Quadrant 6 includes portions of the Humboldt River, Carson River, Walker River and Central Nevada Region Basins. There are 12 valleys and portions of 20 other subbasins included in the area shown in Figure 5-17.

Table V-13 lists the valleys that have been identified to have agricultural potential within this Quadrant. Three valleys (i.e., Walker Lake (Whiskey Flat), Smith Creek and the Upper Reese River Valley) offer above marginal-to-good potentials for agricultural production. Limitations are present at the other valleys identified.

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(15) Certificates: 65,784 acre-feet; Permits: 61,633 acre-feet.

FIGURE 5-15
SUBBASIN 83: TRACY AREA AGRICULTURAL AREA
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-16
SUBBASIN 76: FERNLEY AREA NATIONAL RESOURCE LANDS
SOURCE: BRI SYSTEMS, INC.

TABLE V-13
CENTRAL AREA 1 (QUAD 6) VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
110(c)	Walker Lake (Whiskey Flat)	3.0
134	Smith Creek	2.2
56	Upper Reese River	2.2
127	Eastgate	1.7
133	Edwards Creek	0.9
135	Ione	0.2
137(A)*	Big Smoky (Tonopah Flat)	4.3
128*	Dixie Valley	3.5

*Refer to discussion of valley areas.

SOURCE: BRI SYSTEMS, INC..

SUMMARY OF EXISTING POTENTIAL OF QUAD 6 LANDS

A total of 9,980 acres has been identified for agricultural development and production in Quadrant 6. Average-to-good potential exists at Walker Lake and above marginal potential is present for 6,350 acres within the Smith Creek and Upper Reese River Valleys. Submarginal-to-marginal potential exists at the remaining valleys identified in Table V-14. Each of the valleys listed in Table V-12 are further discussed in the following paragraphs.

SMITH CREEK VALLEY

Smith Creek Valley lies in the northern part of Quadrant 6 and adjoins the Upper Reese River Valley. The subbasin consists of 372,480 acres; about 32 percent of the area is estimated to contain soils suitable for agricultural production.

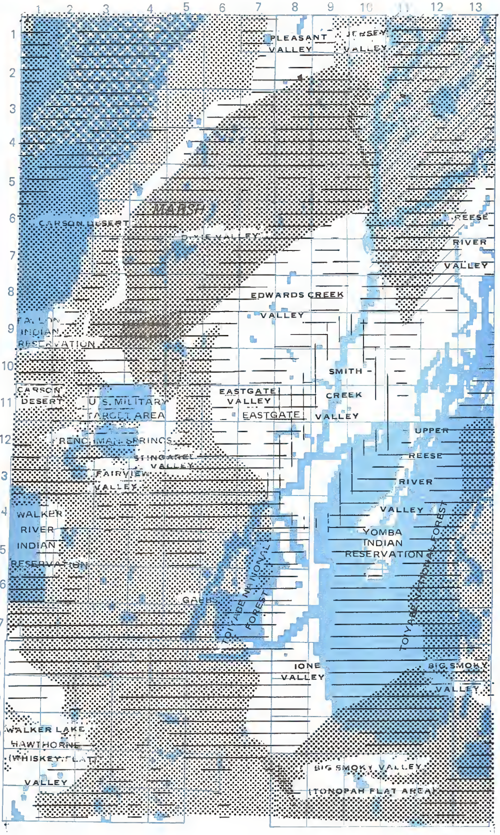
TABLE V-14
QUAD 6 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Walker Lake (Whiskey Flat)	110(c)	(a)	(a)
Smith Creek	134	2,650	(b)
Upper Reese River	56	3,700	(c)
Eastgate	127	1,580	(d)
Edwards Creek	133	1,140	(e)
Ione	135	910	(f)
Big Smokey (Tonopah)	137(A)	-	(g)
Dixie Valley	128	-	(g)
TOTALS		9,980	

Comments:
(a) Refer to Chapter 5.5.
(b) Potential appears to exist at northern and southern ends of the valley.
(c) Growing season limitations, but suitable soils present.
(d) No ground water appropriations in the valley.
(e) Most of appropriations are permitted rights.
(f) Marginal potential available.
(g) Opportunities would be present if water could be imported to the area.

SOURCE: BRI SYSTEMS, INC.

The perennial yield of the valley is estimated at 10,000 acre-feet. Ground water appropriations in the valley are well below this figure. Allowing for irrigation water recycling, it is estimated that an additional 2,500-2,800 acres may be irrigated in the valley. The areas appearing suitable for crop production are located at the northern and southern ends of the valley. Figures 5-18 and 5-19 portray the national resource lands that are present in this valley.



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QUADRANT 6:

CENTRAL AREA 1

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

DRAWN BY BRI SYSTEMS, INC., PHOENIX, ARIZ.

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SEPT. 30, 1976

FIGURE 5-17

FIGURE 5-18
NATIONAL RESOURCE LANDS IN SMITH CREEK VALLEY,
SUBBASIN 134
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-19
ALPINE LOCATED IN THE SMITH CREEK VALLEY,
SUBBASIN 134
SOURCE: BRI SYSTEMS, INC.

UPPER REESE RIVER VALLEY

The Upper Reese River Valley Subbasin is located along the eastern portion of Quadrant 6 and consists of 728,320 acres. Between 15-20 percent of the lands of the subbasin are considered suitable for agricultural production. The area includes the Yomba Indian Reservation which produces alfalfa using flood irrigation practices with water from the Reese River.

Various estimates of the ground water perennial yield of the valley have been identified. It is estimated that the perennial yield of the area is at least 24,000 acre-feet. This would provide some 31,200 acre-feet of water annually, allowing for irrigation recycling. About 19,000 acre-feet of the waters are appropriated. This leaves a balance of 12,200 acre-feet; the available waters are sufficient to irrigate between 3,450-3,950 additional acres in the valley.

The Austin Cemetary located west of the community of Austin is shown in Figure 5-20. Discussions with senior residents of the area indicate that the grasses contained within the cemetary area, shown in Figure 5-20, are typical of the vegetation that existed throughout the valley at the early part of the century, prior to the extensive grazing which took place in the region during this period. Figure 5-21 shows the wild hay lands found along the Reese River flood plain in subbasin 56.

EASTGATE VALLEY

Eastgate Valley shown in Figure 5-22 lies southeast of Dixie Valley in the central part of Quadrant 6 between Cowkick and Smith Creek Valleys. The subbasin consists of 138,240 acres; about 9 percent of the area is considered to contain soils

FIGURE 5-20
AUSTIN CEMETARY LOCATED WEST OF AUSTIN IN SUBBASIN 56
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-21
WILD HAY LANDS IN UPPER REESE RIVER VALLEY, SUBBASIN 56
SOURCE: BRI SYSTEMS, INC.

suitable for agricultural production.

The valley obtains surface water runoff from the nearby mountains on the order of 2,200 acre-feet annually. These waters are used for irrigation purposes and diverted into Edwards Creek Valley; inflow from Campbell Creek also enters the valley which eventually discharges into Cowkick Valley, Figure 5-23, adjoining Eastgate Valley. Surface water appropriations include 5,047 acre-feet of certified rights and 2,820 acre-feet of vested rights.

The perennial yield of the valley is estimated at 4,000 acre-feet. Allowing for irrigation recycling, this would provide water to irrigate between 1,480-1,680 acres. No ground waters have been appropriated in Eastgate Valley.

EDWARDS CREEK VALLEY

Edwards Creek Valley lies to the northeast of Eastgate Valley. The subbasin consists of 266,240 acres. About 18 percent of the area is considered to have soils suitable for crop production.

Ground water appropriations in the valley total 6,613 acre-feet; about 45 acre-feet are certified and 6,568 acre-feet are permitted rights. The annual water availability of the valley is estimated at 10,400 acre-feet. This will provide water to irrigate an additional 1,060-1,220 acres of national resource lands in this valley.

IONE VALLEY

The Ione Valley lies south of Edwards Creek and Smith Creek Valleys along the east central area of Quadrant 6. The

FIGURE 5-22
NATIONAL RESOURCE LANDS IN EASTGATE VALLEY AREA,
SUBBASIN 127
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-23
FARM AREA IN COWKICK VALLEY,
SUBBASIN 126
SOURCE: BRI SYSTEMS, INC.

subbasin consists of 294,400 acres; about 6 percent of the area is estimated to contain soils suitable for crop production.

Surface water appropriations total 2,642 acre-feet. Certified rights include 633 acre-feet of this total.

Ground water appropriations in the valley total 892 acre-feet. Slightly over 132 acre-feet of these are certified rights.

Allowing for an annual ground water availability on the order of 3,900 acre-feet, a total of 3,000 acre-feet of water is available for future irrigation purposes. This is sufficient to irrigate between 860-960 acres of Nevada resource lands in this valley.

OTHER AREAS WHICH HAVE SUITABLE SOILS BUT FACE WATER AVAILABILITY LIMITATIONS

Two other valleys have been identified as being suitable for agricultural production, but lack available waters to support the additional development on the national resource lands. They are discussed in the following paragraphs.

BIG SMOKY (TONOPAH FLAT) VALLEY

The Tonopah Flat Subbasin of Big Smoky Valley consists of over 1 million acres; about 15 percent of the lands are considered suitable for crop production.

The total Big Smoky region which includes subbasins 137(A) and 137(B) is estimated to have an annual ground water availability of 92,450 acre-feet(16). Appropriated water rights include

(16) Includes irrigation water recycling.

97,687 acre-feet(17) plus an additional 23,106 acre-feet of vested rights.

The Tonopah Flat area's ground water appropriations are estimated at 18,290 acre-feet in comparison to a total annual water availability, including recycling, of between 7,800-8,400 acre-feet. This total includes supplemental water rights. Current water resource appropriations are much greater than the available water supply of the valley and limits future development from occurring.

DIXIE VALLEY

Dixie Valley, Figure 5-24, lies in the north central portion of the Quadrant 6. The subbasin consists of some 833,920 acres; about 30 percent of the area is estimated to be suitable for agricultural production.

The valley has 2,300 acre-feet of surface water runoff which is augmented by 5,600 acre-feet inflow from Jersey, Pleasant and Stingaree Valleys. Surface water appropriations are primarily used to irrigate about 142 acres in the southern valley and another 213 acres at the northern part of the valley. Other water appropriations include minor stockwatering, mining and milling purposes.

Ground water rights total 17,636 acre-feet(18) in the southern parts of the valley and 14,657 acre-feet in the northern portions of the subbasin. The combination of the certified and permitted water rights far exceeds the estimated perennial yield of the valley. As such, this is a deterrent to any new

(17) Certificates: 84,894 acre-feet; Permits: 12,793 acre-feet.

(18) Certificated: 2,920.6 acre-feet to irrigate 730 acres; Permitted: 14,715.3 acre-feet to irrigate 3,679 acres.

agricultural development in the area.

Figure 5-25 shows the Nevada resource lands in Stingaree Valley, Subbasin 125, which is south of Dixie Valley. Other valleys in the Quadrant are also shown in Figure 5-26 and 5-27. Fairview Valley, adjoining Stingaree Valley, is seen in Figure 5-26. The Carson Desert Valley area, discussed in Chapter 5.5, is shown in Figure 5-27.

5.7 NEVADA QUADRANT 7: CENTRAL AREA 2

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Portions of the Humboldt River and Central Nevada Basins are included in Quadrant 7. There are 7 valleys and portions of 12 other subbasins in the area shown in Figure 5-28. Table V-15 lists the valleys that are discussed in this Chapter.

TABLE V-15
CENTRAL AREA 2 (QUAD 7) VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
173(B)	Railroad Valley (North)	4.6
140(B)	Monitor Valley (South)	3.3
155(A)	Little Smoky Valley (North)	2.9
138	Grass Valley	2.3
141	Ralston Valley	2.2
154	Newark Valley	2.1
55	Carico Valley	1.5
156	Hot Creek Valley	1.2
140(A)	Monitor Valley (North)	0.7

SOURCE: BRI SYSTEMS, INC.

FIGURE 5-24
ENTRANCE TO DIXIE VALLEY,
SUBBASIN 128
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-25
NATIONAL RESOURCE LANDS IN STINGAREE VALLEY,
SUBBASIN 125
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-26
FAIRVIEW VALLEY, SUBBASIN 124, VIEWING FRENCHMAN SPRINGS
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-27
CARSON DESERT, SUBBASIN 101,
LOOKING NORTH TOWARDS THE SALT WELL
SOURCE: BRI SYSTEMS, INC.

SUMMARY OF EXISTING POTENTIAL OF QUAD 7 LANDS

Table V-16 summarizes the valley potentials of Quadrant 7. The following paragraphs discuss the opportunities present within each valley. Railroad Valley (North) offers the best potential of the valleys in this Quadrant as indicated in Table V-15. The potential opportunities present at valleys such as Carico, Hot Creek and Monitor (North) are marginal-to-submarginal.

TABLE V-16
QUAD 7 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE
Railroad (North)	173(B)	5,000(a)
Monitor (South)	140(B)	3,000
Little Smoky (North)	155(A)	2,125
Grass	138	3,750
Ralston	141	1,260
Newark	154	510
Huntington	47	(b)
Carico	55	1,350
Pine	53	(b)
Hot Creek	156	240
Monitor (North)	140(A)	2,500
TOTALS		19,735

Comments:
(a) Refer to discussion in text; potential overdraft condition exists.
(b) Refer to Table V-6 in Chapter 5.3.

SOURCE: BRI SYSTEMS, INC.

RAILROAD VALLEY (NORTH)

Railroad Valley (North) is located along the southeastern portion of Quadrant 7, western part of Quadrant 8, and the northern portion of Quadrant 10. The subbasin consists of over 1.3 million acres.

The available ground water in the valley is estimated between 75,000-91,000 acre-feet. Appropriated ground waters in the valley total 27,137 acre-feet(19). An additional 5,882 acre-feet of rights are currently pending.

Ground water is available in the valley to irrigate an additional 12,000-18,000 acres. About 8,000 acres are currently under irrigation.

Suitable soils which will support crop production are estimated to exist on over 200,000 acres within the valley. Good potential exists in this valley for agricultural development along with the valley bottomland areas which contain fine textured soils of the alluvial plains. Similar to conditions arising in many of the other Nevada valleys, land reclamation practices will be required to remove salt and sodium prior to any crop production. Another problem that arises in the valley is the low waterholding capacity of the soils. Irrigation practices of the valley must take this into consideration.

The subbasin has soils suitable for crop production along the valley areas between Duckwater and Currant. The soils become saline below Currant and better soils are again located south of Nyala (subbasin 173(A)). Reference is made to the discussion in Chapter 5.10 for further information on subbasin 173(A) and 173(B).

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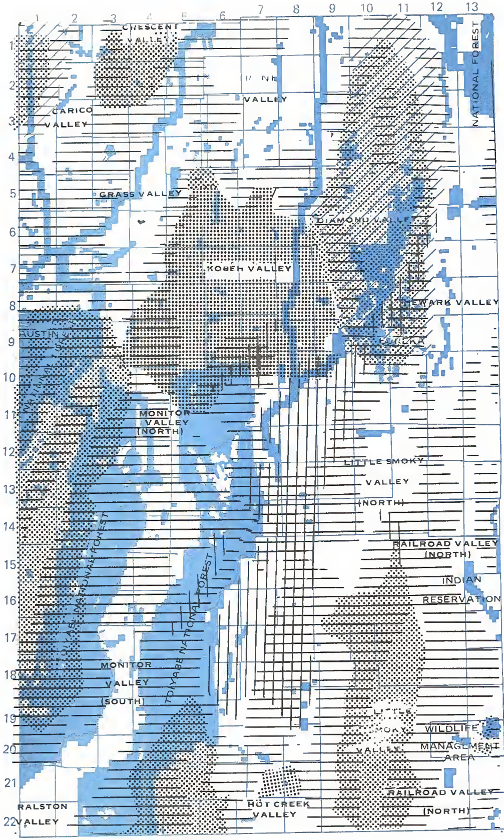
(19) Certificates: 3,422 acre-feet, and Permits: 23,715 acre-feet.



QUADRANT 7:

CENTRAL AREA 2

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

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FIGURE 5-28

MONITOR VALLEY (SOUTH)

Monitor Valley lies along the southwestern part of Quadrant 7. The subbasin consists of 325,760 acres; about 15 percent of the area is estimated to contain soils suitable for crop production. The more suitable soils are located in areas along Meadow Creek.

Various estimates have been developed in prior reconnaissance studies with regard to the perennial yield of this valley. The yield has been estimated to range between 8,000-10,000 acre-feet. Allowing for irrigation water recycling, it is estimated that water is available to irrigate between 3,000-4,000 acres in the valley.

Water appropriations in the valley are primarily surface water rights with the majority of such rights in pending status by the State of Nevada. Ground waters are available to irrigate an additional 3,000 acres. Figure 5-29 shows the Big Smoky Valley area adjoining Monitor Valley. The typical national resource lands in Monitor Valley are shown in Figure 5-30.

LITTLE SMOKY VALLEY (NORTH)

The northern portion of the Little Smoky Valley is located in the northeastern part of Quadrant 7. The subbasin consists of 378,240 acres. About 20 percent of the area is considered to have soils suitable for crop production.

The available ground water in the valley is estimated at 6,500 acre-feet. Water rights total 1453.5 acre-feet(20) with another 11.6 acre-feet of ground water appropriations in pending status by the state. It is estimated that ground water is available to irrigate an additional 2,000-2,250 acres in the valley.

(20) Includes subbasins 155(A) and 155(B).

FIGURE 5-29
VIEWING BIG SMOKY VALLEY, LOOKING EAST IN SUBBASIN 137(B)
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-30
NATIONAL RESOURCE LANDS IN MONITOR VALLEY, SUBBASIN 140
SOURCE: BRI SYSTEMS, INC.

GRASS VALLEY

The Grass Valley Subbasin consists of 380,800 acres. The valley is located in the northwestern part of Quadrant 7.

The subbasin's perennial yield is estimated at 13,000 acre-feet. Ground water availability has been determined to be about 16,900 acre-feet annually. Appropriations for ground water are estimated at about 2,790 acre-feet. A balance of 14,110 acre-feet is available for future irrigation. This is sufficient to irrigate between 3,500-4,000 acres of the Nevada resource lands in this valley.

It is estimated that about 64,000 acres of land in the valley contain soils suitable for crop production. The valley offers good potential for future agricultural development.

RALSTON VALLEY

The Ralston Valley subbasin lies in the southwest portion of Quadrant 7 and portions of Quadrants 9 and 10. It consists of 621,440 acres; about 17 percent of the subbasin's lands are considered to be suitable for agricultural production purposes.

The available ground water in the valley is estimated at 5,850 acre-feet. Current ground water appropriations total 1930.93 acre-feet plus an additional 52.29 acre-feet in pending status (21). Surface water appropriations total 7,636.91 acre-feet in the valley plus an additional 424 acre-feet in pending status. Ground water is available in Ralston Valley to irrigate an additional 1,260 acres of Nevada resource lands.

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(21) Certificates: 1,196.85 acre-feet; Proofs: 672.09 acre-feet; Permits: 61.99 acre-feet.

NEWARK VALLEY

Newark Valley is located along the northeastern portion of the Quadrant. The subbasin consists of 512,640 acres; about 16 percent of the area is considered to have soils suitable for crop production.

The available water in Newark Valley is estimated to total 23,400 acre-feet annually, allowing for irrigation recycling. Prior to 1970, a total of 17,010 acre-feet of this was appropriated(22); since this period an additional 23.25 cfs has been appropriated for irrigation(23), stock and mining purposes. It is estimated that current ground water appropriations total about 21,810 acre-feet. Water is available to irrigate an additional 510 acres in the valley.

Many of the Nevada resource lands have poor soils and heavy salt concentrations. On-site investigations are required to identify those lands suitable for reclamation and cropping. Figures 5-31 and 5-32 show the typical national resource lands that are present in this valley.

CARICO VALLEY

The Carico Valey Subbasin adjoins Grass Valley in the northwestern portion of Quadrant 7. The subbasin consists of 240,640 acres; about 15 percent of the subbasin is estimated to have lands suitable for crop production.

The available ground water in the valley is estimated to total 5,200 acre-feet annually. Only 842 acre-feet of the ground

(22) Certificates: 9,790 acre-feet; balance are permits.

(23) To irrigate 1,200 acres.

FIGURE 5-31
VIEWING WESTERN ENTRANCE TO NEWARK VALLEY,
SUBBASIN 154
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-32
NATIONAL RESOURCE LANDS EXISTING AT NEWARK VALLEY,
SUBBASIN 154
SOURCE: BRI SYSTEMS, INC.

waters have been appropriated. Waters are available to irrigate an additional 1,350 acres in this valley.

HOT CREEK VALLEY

Hot Creek Valley lies in the southern part of the Quadrant. The subbasin consists of 663,040 acres; about 18 percent of the lands are estimated as being suitable to support agricultural production.

The available ground waters are estimated at 7,150 acre-feet annually. Water appropriations in the valley total approximately 6,400 acre-feet. Water rights have priorities ranging from 1872 to 1974, many of these valley rights utilize the available surface stream flows.

Assuming a water duty of 3.1 acre-feet per acre in the valley, it is estimated that an additional 240 acres may be irrigated. The valley has many national resource land areas containing unsuitable soils; on-site investigations are required to identify the potentials of the available national resource lands.

MONITOR VALLEY (NORTH)

This valley lies below the Kobeh Valley and adjoins the northern portion of Big Smoky Valley in the western portion of Quadrant 7. It is directly north of the Monitor Valley (South) subbasin discussed in the prior paragraphs.

The northern Monitor subbasin consists of 338,560 acres; about 12 percent of the lands are estimated to contain soils suitable for cropping purposes. The perennial yield of the valley is estimated at 8,300 acre-feet. Most water appropriations in the valley are surface water rights; only 266 acre-feet of the ground waters have been appropriated. Waters are available to irrigate between 2,000-3,000 acres in this valley in areas containing soils as are found at Stoneberger Creek.

OTHER AREAS HAVING GOOD SOILS BUT WATER AVAILABILITY LIMITATIONS

The Kobeh Valley seen in Figure 5-33 and Diamond Valley shown in Figure 5-34 are typical of other subbasins in Quadrant 7 that offer suitable soils for agricultural purposes but have severe water availability limitations. In the Kobeh Valley, for example, ground water appropriations total 107.6 cfs. Assuming a duty of 1 cfs per acre in this valley, a water overdraft of 14,000 acre-feet exists. Figure 5-35 shows a portion of the lands in Diamond Valley that have been placed into agricultural production. Typical lands of the Little Smoky Valley discussed in the prior paragraphs are seen in Figure 5-36. The Crescent Valley Subbasin is typical of other valley areas within this Quadrant that offer good soil potentials but are short of water resources to support further developments.

5.8 NEVADA QUADRANT 8: EAST CENTRAL AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Quadrant 8 includes portions of the Central Nevada, Great Salt Lake and Colorado River Basins. There are 8 valleys and portions of 15 other subbasins included in the area shown in Figure 5-37. Table V-17 lists the valleys that were identified to have agricultural potential in this Quadrant.

FIGURE 5-33
NATIONAL RESOURCE LANDS IN KOBEH VALLEY,
SUBBASIN 139
SOURCE: BRI SYSTEMS, INC.

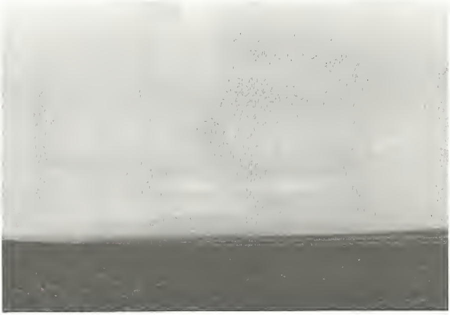


FIGURE 5-34
NATIONAL RESOURCE LANDS IN DIAMOND VALLEY,
SUBBASIN 153
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-35
AGRICULTURAL LANDS IN DIAMOND VALLEY,
WEST OF EUREKA, SUBBASIN 153
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-36
NATIONAL RESOURCE LANDS IN LITTLE SMOKY VALLEY,
SUBBASIN 155A
SOURCE: BRI SYSTEMS, INC.

TABLE V-17
EAST CENTRAL AREA (QUAD 8) VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
184	Spring Valley	3.9
207	White River Valley	3.7
175	Long Valley	2.9
179	Steptoe Valley	2.0
195	Snake Valley	1.3
196	Hamlin Valley	1.0

SOURCE: BRI SYSTEMS, INC.

SUMMARY OF EXISTING POTENTIAL OF QUAD 8 LANDS

Table V-18 lists the acreages of the valleys that appear to offer potential in Quadrant 8. Good potentials appear at Spring and the White River Valleys. The potential for agricultural production on the Nevada resource lands in Snake and Hamlin Valleys is marginal; this is further discussed in the following paragraphs.

SPRING VALLEY

Spring Valley lies along the eastern portion of Quadrant 8. The subbasin consists of over 1 million acres; about 10 percent of the area is considered to have soils that are suitable for crop production.

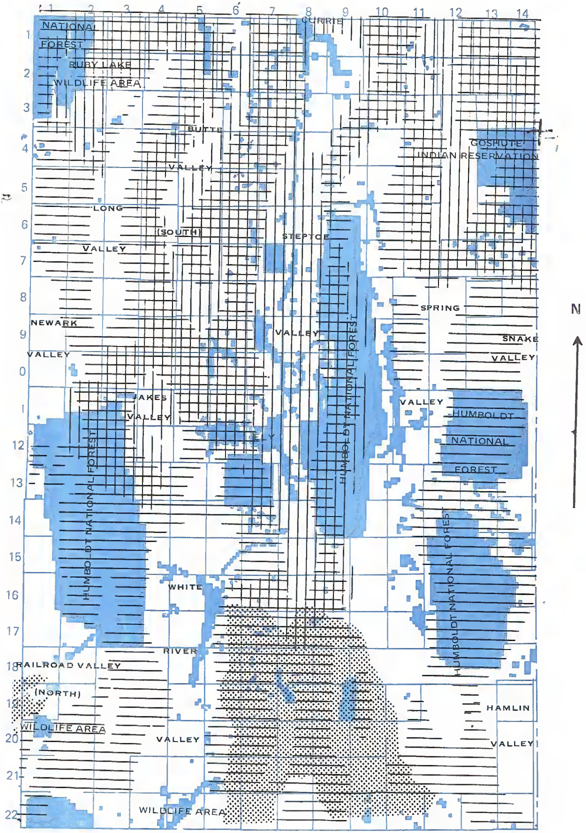
The available ground water in the valley is estimated to total 110,500 acre-feet annually, allowing for irrigation water recycling. About one-fourth of this water has been appropriated(24). An additional 8,000 acre-feet are in pending status

(24) Certificates: 3,308 acre-feet; Permits: 22,380 acre-feet.

QUADRANT 8:

EAST CENTRAL AREA

U. S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
SEPT. 30, 1976



1 INCH EQUALS APPROXIMATELY 16 MILES

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LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY
- LIMITATIONS

FIGURE 5-37

TABLE V-18
QUAD 8 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Spring	184	8,000	(a)
Railroad (North)	173(B)	(b)	(b)
White River	207	5,500	(a)
Long	175	530	-
Newark	154	(b)	(b)
Steptoe	179	1,000	-
Snake	195	5,000	(c)
Hamlin	196	800	(c)
Jakes Valley	174	-	(d)
TOTALS		20,830	

Comments:
(a) High potential exists.
(b) Refer to Chapter 5.7.
(c) Marginal potential.
(d) Growing season less than 100 days; although limited potential exists, it was not considered in analysis findings, also potential water problems on resource lands.

SOURCE: BRI SYSTEMS, INC.

by the state for mining use in the subbasin.

Some portions of the valley are unsuitable for agricultural production. On-site investigations are required to identify those areas which may best be reclaimed and where water depths are economical for potential wells. It is estimated that water is available throughout the subbasin to irrigate an additional 20,000 acres. The most suitable production areas appear upstream from the predominant valley phreatophyte regions where good water quality and moderate pumping lifts are offered. It is estimated that 6,000-10,000 acres of national resource lands may be reclaimed and developed in these areas of the valley.

Irrigation in the valley is primarily from surface streams. About 3,500 acres are under irrigation. Only 10 irrigation wells exist in the large valley; they are used to supplement surface flows in drought years. The maximum ground water pumpage in any given year has not exceeded 300 acre-feet.

Development potential in the southern part of the valley is also available but must be planned so that the ground water outflow to Hamlin Valley is not affected.

WHITE RIVER VALLEY

The White River Valley Subbasin is a very large area consisting of over 1 million acres located in the southern portion of Quadrant 8. About 20 percent of the subbasin is considered to contain soils that would support agricultural production.

The available ground water of the valley is estimated to be between 42,000-48,000 acre-feet annually. Ground water has been used since 1869 in this valley and current appropriations total about 50 cfs. Assuming that 1 cfs is required to irrigate 1 acre in the valley, the ground water appropriations are estimated to total 15,000 acre-feet.

Allowing for a water duty of 5 acre-feet per acre in the White River Valley, it is estimated that ground water is available to irrigate an additional 5,000-6,000 acres of national resource lands.

LONG VALLEY

Long Valley lies in the northeastern portion of this Quadrant. The subbasin consists of 416,640 acres. About 18 percent of the subbasin is considered to contain soils suitable for agricultural production.

The available ground water in Long Valley is estimated at 6,500 acre-feet annually. About 188 acre-feet of this water has been appropriated; another 63 acre-feet is in pending status by the State of Nevada. The remaining water use in the valley is from surface flows. Over 190 acre-feet of surface-waters have been appropriated.

It is estimated that ground water is available to irrigate an additional 1,500-1,700 acres in this valley. Many uncertainties arise with regard to the magnitude of the perennial yield in Long Valley. For this reason, the estimated yield has been reduced by two-thirds in the findings of the analysis and it is assumed that 500-560 acres may be irrigated until more substantial reconnaissance surveys of the valley are made.

STEPTOE VALLEY

Steptoe Valley lies in the northern portion of Quadrant 8. The subbasin consists of over 1 million acres; about 10 percent of the valley is considered to contain soils suitable for agricultural production.

Water is primarily used for municipal and industrial purposes in this subbasin. Agricultural use of water is currently satisfied by available springs. Ground water usage in the valley averages between 1,000 to 3,000 acre-feet annually.

It is estimated that 70,000 acre-feet of water is available each year throughout the entire valley. A large number of water appropriations exist in the valley and there are also uncertainties present with regard to the perennial yield of the valley. It is conservatively stated that an opportunity exists to irrigate about 1,000 acres of the national resource lands within the valley.

SNAKE VALLEY

The Snake Valley Subbasin lies in the eastern portion of Quadrant 8. The area consists of 497,280 acres; about 5 percent of the valley is considered to have soils suitable for agricultural production.

The available ground water in the valley is estimated at 39,000 acre-feet, although there are reports available (reference Bibliography) that consider this total to be conservative.

Most water in this valley is obtained from surface flows. Surface water appropriations total 14,303 acre-feet. There is also an additional 5,843 acre-feet of vested rights and 22,666 acre-feet in pending status within the subbasin.

Ground water appropriations total 8,043 acre-feet(25). Water is available to irrigate a minimum of 10,000 additional acres in this valley. It is estimated that a minimum of 5,000 acres of the Nevada resource lands can be developed and irrigated within the Snake Valley.

HAMLIN VALLEY

The Hamlin Valley Subbasin consists of 264,320 acres. Only about 6 percent of the valley is considered to have soils suitable for agricultural production.

(25) Certificates: 2,867 acre-feet; Permits: 5,176 acre-feet.

The available ground water in Hamlin Valley is estimated to total 6,500 acre-feet annually. Only 1 ground water appropriation has been made in the Valley(26). About 850 acre-feet of the surface waters are appropriated for irrigation.

The water table depth in Hamlin Valley is extremely deep. Wells must be drilled to considerable depths. Much of the valley also contains poor-to-unsuitable soils for agricultural production. On-site investigations are required to identify the lands within this valley that do offer agricultural potentials. It is estimated that about 800 acres of the national resource lands may be reclaimed and placed into agricultural production.

5.9 NEVADA QUADRANT 9: SOUTHWEST AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

The southern portion of the Walker River Basin and part of the Central Nevada Basin and Death Valley Basin are included in Quadrant 9. There are 12 valleys and portions of 11 other subbasins included in this Quadrant which is shown in Figure 5-38. Table V-19 lists the valleys identified to have potential in this Quadrant. The potential of the valleys shown is very marginal, except for Fish Lake Valley.

SUMMARY OF EXISTING POTENTIAL OF QUAD 9 LANDS

Table V-20 lists the acreages that have a potential to be developed in Quadrant 9. A problem arises in Fish Lake Valley in that the waters required for the additional development,

(26) Made in 1936 for 0.25 cfs (5 acre-feet).

TABLE V-19
SOUTHWEST (QUAD 9) AREA VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
117	Fish Lake*	5.4
119	Rhodes Salt Marsh	1.1
143	Clayton	1.0
116	Queen	0.3
113	Huntoon	0.1

*Refer to discussion in text; overdraft condition.

SOURCE: BRI SYSTEMS, INC.

although not currently being used, may never be available for use in reclaiming the Nevada resource lands that offer high production potentials. The opportunities in the other valleys shown in Table V-18 are very marginal.

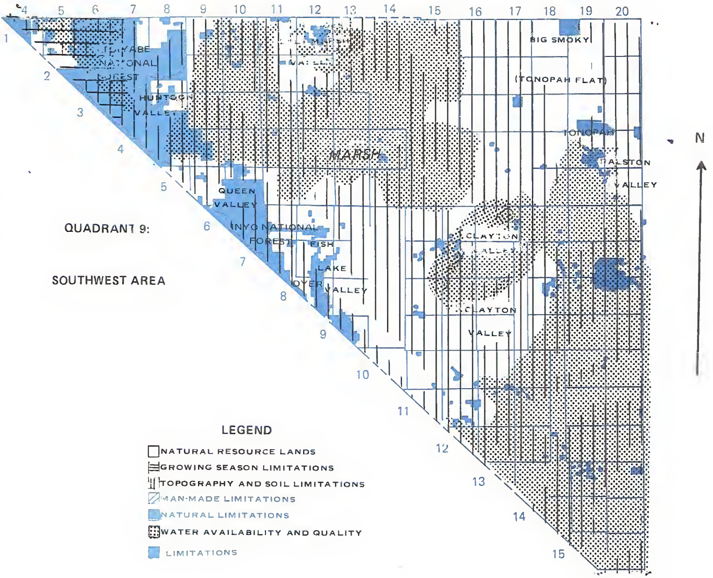
FISH LAKE VALLEY

Fish Lake Valley is located along the California-Nevada border in the western portion of Quadrant 9. The subbasin consists of 451,840 acres. The available ground water of the valley is estimated at 39,000 acre-feet annually. Ground water appropriations in Fish Lake Valley include 18,093 acre-feet of certified water rights and 11,150 acre-feet of permitted water use totaling 29,243 acre-feet. Supplemental ground water rights amount to another 19,150 acre-feet in this valley. Surface water rights in the valley include another 31,700 acre-feet.

The valley offers high potential for agricultural production as is seen in Figures 5-39 thru 5-42. All the water use

QUADRANT 9:

SOUTHWEST AREA



1 INCH EQUALS APPROXIMATELY 16 MILES

U. S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
SEPT. 30, 1976

DRAWN BY BRI SYSTEMS, INC., PHOENIX, ARIZ.

FIGURE 5-38

TABLE V-20
QUAD 9 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Fish Lake	117	3,000	(a)
Big Smoky (Tonopah)	137(A)	-	(b)
Ralston	141	-	(c)
Walker Lake (Whiskey Flat)	110(C)	-	(d)
Clayton	143	700	(e)
Rhodes Salt Marsh	119	325	(e)
Queen	116	200	(e)
Huntoon	113	200	(e)
TOTALS		4,425	

Comments:
(a) Excellent potentials available if ground waters can be made available, refer to discussion in text.
(b) Refer to Chapter 5.6.
(c) Refer to Chapter 5.7.
(d) Refer to Chapter 5.5.
(e) Very marginal opportunities exist.

SOURCE: BRI SYSTEMS, INC.

permitted has not been developed in the valley. Assuming that past history repeats itself with regard to appropriations in valleys in Nevada, it is estimated that perhaps only 10,000 acre-feet of the 30,000 acre-feet of permitted and supplemental ground water rights in the valley would eventually be approved and certified. Under such an assumption, water would be available to irrigate an additional 3,000 acres of national resource lands located along the valley bottomlands.

The valley offers a long growing season, soils highly suitable for crop production and one of the more favorable opportunities for new agricultural development in the State, should the

FIGURE 5-39
FARM AREA IN FISH LAKE VALLEY
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-40
ORCHARD AND FARM ALONG FISH LAKE VALLEY BOTTOMLANDS, SUBBASIN 117
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-41
EXAMPLE OF RECENT DEVELOPMENT IN FISH LAKE VALLEY, SUBBASIN 117, ADJOINING NATIONAL RESOURCE LANDS
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-42
AGRICULTURAL AREA NEXT TO NATIONAL RESOURCE LANDS IN FISH LAKE VALLEY, SUBBASIN 117
SOURCE: BRI SYSTEMS, INC.

needed water resources be approved for appropriations by the State of Nevada.

CLAYTON VALLEY

The Clayton Valley Subbasin lies in the southeastern portion of Quadrant 9. The subbasin consists of 355,200 acres; about 2 percent of the area is considered to have soils suitable for agricultural production.

The valley's ground water availability is estimated at 28,600 acre-feet annually. Less than 1,000 acre-feet of this water has been appropriated.

Although water is available to irrigate some 5,000-6,000 acres in this valley, the high salinity hazard present places many limitations upon potential development opportunities.

It is estimated that a marginal opportunity exists for the development of 600-800 acres in this valley based upon the findings of future on-site reconnaissance investigations.

RHODES SALT MARSH VALLEY

This valley is located in the northern portion of Quadrant 9. The subbasin consists of 127,360 acres; about 10 percent of the subbasin is considered to have soils suitable for agricultural production.

The more suitable valley bottomlands are in private ownership leaving little opportunity for national resource land developments.

The available ground water is estimated at 1,300 acre-feet annually. Only 49 acre-feet of this resource has been appropriated.

A marginal potential exists to reclaim and develop 300-350 acres of the Nevada resource lands within the valley.

HUNTOON AND QUEEN VALLEYS

The Huntoon and Queen Valleys located in Quadrant 9 offer submarginal potential for agricultural development.

In the Huntoon Valley, only a small amount of the available 1,300 acre-feet of ground waters have been appropriated(27) allowing about 1,000 acre-feet for future development.

Surface water appropriations are predominant of all water rights in Queen Valley and total 4,000 acre-feet. An additional 2,127 acre-feet of surface water rights are in pending status. Forty acres are irrigated in Queen Valley by ground water(28). An availability of about 700 acre-feet is offered for future developments.

The Nevada resource lands in these two valleys contain bad-to marginal topography and poor-to-marginal soils. The potentials that are present are considered very marginal. It is estimated that a maximum of 200 acres of national resource lands may be developed in each of the valleys.

5.10 NEVADA QUADRANT 10: SOUTHCENTRAL AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

(27) Two filings: 1.0 cfs and 2.8 cfs.

(28) 1971 appropriation.

Quadrant 10 includes most of the Death Valley Basin and portions of the Central Nevada Basin. There are 14 valleys and portions of 13 other subbasins included in this area which is shown in Figure 5-43.

Table V-21 lists the opportunities that have been identified within this Quadrant. The following paragraphs summarize the findings of the potentials of the lands within the Quadrant.

TABLE V-21
SOUTHCENTRAL (QUAD 10) AREA VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
173(A)	Railroad* (South)	1.5
227(A)	Forty Mile Canyon	0.3
228	Oasis	0.3
161	Indian Springs	0.1

*Refer to discussion in text.

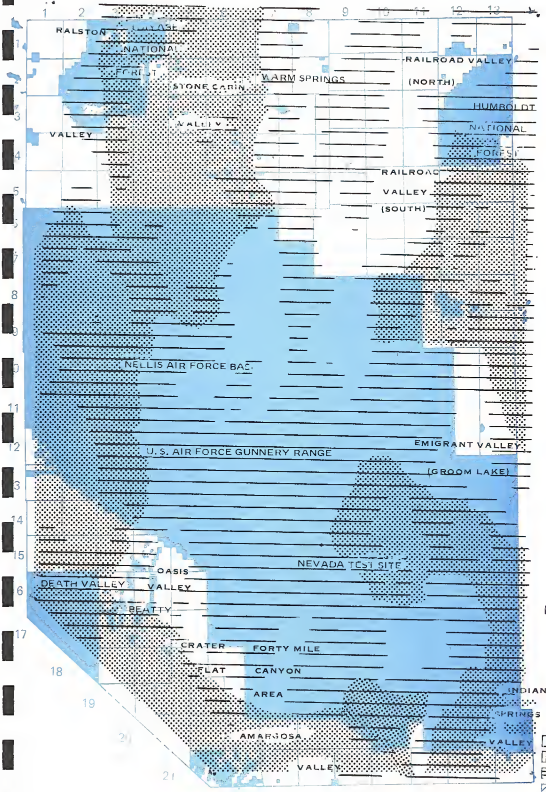
SOURCE: BLM, Reno, Nevada.

SUMMARY OF EXISTING POTENTIAL OF QUAD 10 LANDS

Table V-22 lists the acres that could be potentially developed in this Quadrant. A future water availablity problem projected to arise in Railroad Valley is discussed in the following paragraphs. The other valley areas offer submarginal potentials for agricultural development. Areas not discussed because of limitation present, but which may offer a very slight degree of potential for the future include Crater Flat, Emigrant Valley, and Stone Cabin Valley.

RAILROAD VALLEY (SOUTH)

Subbasin 173(A), Railroad Valley (South), lies directly below



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QUADRANT 10

SOUTH CENTRAL AREA

U. S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
SEPT. 30, 1976

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

DRAWN BY [redacted] SYSTEMS, INC., PHOENIX, ARIZ.

FIGURE 5-43

TABLE V-22
QUAD 10 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Railroad (South)	173(A)	-	(a)
Railroad (North)	173(B)	-	(b)
Ralston	141	-	(b)
Hot Creek	156	-	(b)
Forty Mile Canyon	227(A)	250	(c)
Oasis	228	225	(c)
Indian Springs	161	-	(d)
TOTALS		475	

Comments:
(a) Refer to discussion in text; potential water overdraft condition.
(b) Refer to Chapter 5.7.
(c) Marginal potential exists; salinity a problem in the area.
(d) Potential limited, based upon water availability.

SOURCE: BRI SYSTEMS, INC.

the northern subbasin of Railroad Valley (173(B)) which was discussed in Chapter 5.7. The southern subbasin consists of 385,920 acres.

The more suitable soils in this valley are found along the valley bottomlands extending from Nyala to Diablo and at the most southern bottomland portions of the subbasin. The area offers opportunities for agricultural production, but is faced with a problem similar to that discussed for Fish Lake Valley in Chapter 5.9. Numerous ground water permits have been granted in the valley. If all of the permits were fully developed, a water overdraft condition would exist. Current pumpage is minor and much less than the appropriations which have been made.

There are more suitable soils in the southern portion of Railroad Valley than exist in Subbasin 173(B) (Refer to Chapter 5.7). It is estimated that a total of 12,000-18,000 additional acres could be irrigated within the entire valley. Water development planning must consider the potentials of both, the northern and southern portions of the valley and the future status of current water appropriations. If the prior appropriations are not developed into beneficial water uses, high potentials are present for the valley. On the other hand, it is not possible to specify the additional acreages that could be developed without knowledge of the position that the State of Nevada would take with regard to additional appropriations in this area since such developments could result in a long term overdraft condition.

In summary, the northern portions of subbasin 173 offer available water whereas the southern portions of Railroad Valley offer greater amounts of soils more suitable for agricultural production. The transport of water from the northern portions to the southern valley would even increase the potentials for agricultural production on the national resource lands.

FORTY MILE CANYON, OASIS AND INDIAN SPRINGS VALLEYS

Forty Mile Canyon and Oasis Valleys are located in the southern portion of Quadrant 10. These areas are not developed and offer submarginal potentials for agricultural development.

Forty Mile Canyon Valley has ground water available for a use totaling 5,200 acre-feet annually. Only 89 acre-feet of the ground waters have been appropriated plus an additional 1,467 acre-feet of surface water flows in the subbasin. The area has poor soils and is located along side the Atomic Energy

Commission test lands; this has to be an additional deterrent to future development. Any significant water development in the area is also foreseen to impact downstream areas such as the Amargosa farm area and must be carefully planned.

The Oasis Valley has some suitable lands present along the Amargosa River, although for the most part, many of the 294,400 acres present in this subbasin are highly saline. It is estimated that 2,600 acre-feet of ground waters are available in the valley. About 1,688 acre-feet of the available waters are appropriated along with an additional 11,569 acre-feet of surface waters and 553 acre-feet of vested rights in the area. If suitable lands could be identified along the river flood plains, about 200-250 acres could potentially be developed. Indian Springs experiences a similar situation and has a very limited perennial yield.

5.11 NEVADA QUADRANT 11: SOUTHEAST AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

The valleys of Quadrant 11 are located within the Great Salt Lake, Escalante Desert, Colorado River and Central Nevada Basins. There are 19 valleys and portions of 20 other subbasins included in this Quadrant which is shown in Figure 5-44. Table V-23 lists the valleys that have been found to offer potential in this Quadrant.

SUMMARY OF EXISTING POTENTIAL OF QUAD 11 LANDS

Table V-24 lists the acres found to offer potential for agricultural production in the valleys of Quadrant 11. Good potentials appear to exist in the Pahranagat and Coal Valleys. As

TABLE V-23
SOUTHEAST (QUAD 11) AREA VALLEYS OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
209	Pahranagat	5.2
171	Coal	3.3
208	Pahroc	2.2
172	Garden	1.4
202	Patterson	1.4
182	Delamar	1.2
220	Lower Moapa	1.0
218	California Wash	0.5

SOURCE: BRI SYSTEMS, INC.

denoted by the relative FOM's listed in Table V-23; the potentials are marginal for the remaining valleys. This is discussed in the following paragraphs.

TABLE V-24
QUAD 11 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Pahranagat	209	1,800	(a)
Coal	171	1,000	(a),(b)
Pahroc	208	560	(b),(c)
Garden	172	1,050	(c)
Patterson	202	400	(c)
Delamar	182	1,050	(b)
Lower Moapa	220	750	(d)
California Wash	218	150	(b)
TOTALS		6,760	

Comments:
(a) Good potentials exist.
(b) Great depths to water limitations present.
(c) Marginal soils limitations present.
(d) Topography and soil limitations present.

SOURCE: BRI SYSTEMS, INC.

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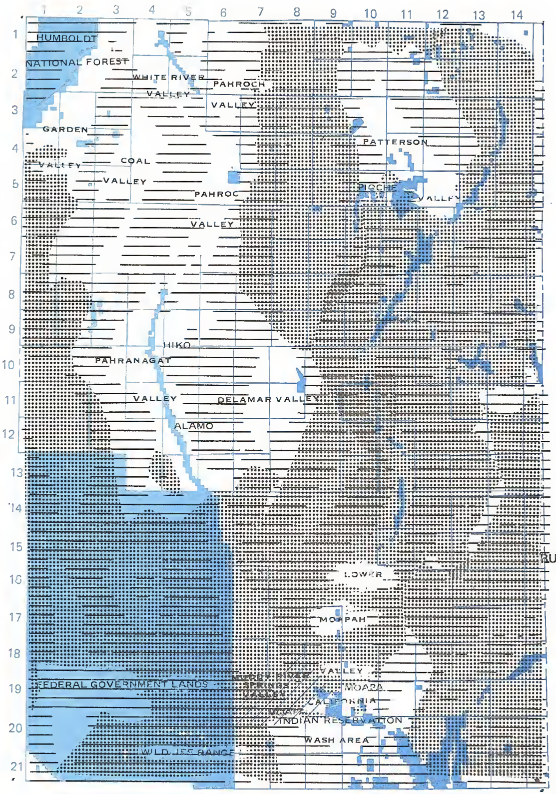

QUADRANT 11

SOUTHEAST AREA

U. S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
SEPT. 30, 1976

LEGEND

- NATURAL RESOURCE LANDS
- GROWING SEASON LIMITATIONS
- TOPOGRAPHY AND SOIL LIMITATIONS
- MAN-MADE LIMITATIONS
- NATURAL LIMITATIONS
- WATER AVAILABILITY AND QUALITY
- LIMITATIONS

1 INCH EQUALS APPROXIMATELY 16 MILES

DRAWN BY BRI SYSTEMS, INC., PHOENIX, ARIZ.

FIGURE 5-44

PAHRANAGAT VALLEY

The Pahranagat Valley is located in the south central portion of Quadrant 11. The subbasin consists of 491,520 acres; about 7 percent of the subbasin is considered to have soils suitable for crop production.

Present development in the valley utilizes nearly all of the natural spring discharge. This amounts to about 25,000 acre-feet each year. Water has been used in the valley for many years for agricultural purposes. As agricultural production requirements were increased, water works were developed at Hiko, Crystal and Ash Springs to convey and distribute water resources to the valley.

The waters of the springs in the valley were adjudicated in 1929. The decree establishes a water duty of 1 cfs per 100 acres for 3,018.05 acres of harvest lands and 1,953.57 acres of diversified pasture lands.

Typical crops grown in the area over the many years of agricultural production include alfalfa, corn, milo maize, wild hay, wheat, barley, oats and truck garden vegetables.

It is estimated that 32,500 acre-feet of ground waters are available in the valley annually. Certified ground water rights total 482 acre-feet(29). Permitted ground water rights total an additional 4,500 acre-feet. These waters are used to irrigate 900 acres in the valley. An additional 340 acre-feet of irrigation and stockwatering rights are in pending status. Supplementary ground waters are also appropriated in Pahranagat Valley.

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(29) Irrigation: 450 acre-feet, domestic use: 2 acre-feet, and stockwatering: 30 acre-feet.

Ground waters are available to irrigate an additional 5,440 acres in this valley. Allowing for the some 3,635 acres that are governed by the supplementary water rights, it is estimated that a minimum of 1,800 acres of the Nevada resource lands may be further developed for agricultural purposes and irrigated in the valley.

Figure 5-45 shows one of the areas in the valley which has been placed into agricultural production. An example of the national resource lands existing in the valley is shown in Figure 5-46. Figures 5-47 and 5-48 portray other features of this valley which offers good potential for future agricultural development.

COAL VALLEY

Coal Valley lies in the northwest portion of Quadrant 11. The subbasin consists of 294,400 acres; it is estimated to have soils suitable for agriculture production on about 22 percent of the subbasin's lands providing that water resources are found to be economically available.

About 7,800 acre-feet of ground waters are available in the valley annually. Current ground water use is minor and primarily consists of range stockwatering purposes. Over 57 acre-feet of the ground waters are certified rights and another 6 acre-feet consist of vested rights. The status of an additional 5 acre-feet of ground water rights are pending by the State of Nevada.

It has been stated in the reconnaissance reports of this valley that the available ground waters supplied from the current wells do not adequately support the grazing range activities. This may be due, in part, to the costs associated with obtaining the waters; in most parts of the valley, wells must

FIGURE 5-45
AGRICULTURAL AREA IN PAHRANAGAT VALLEY,
SUBBASIN 209
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-46
NATIONAL RESOURCE LANDS IN SUBBASIN 209
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-47
GAME RESERVE AREA LOCATED IN THE PAHRANAGAT VALLEY,
SUBBASIN 209
SOURCE: BRI SYSTEMS, INC.

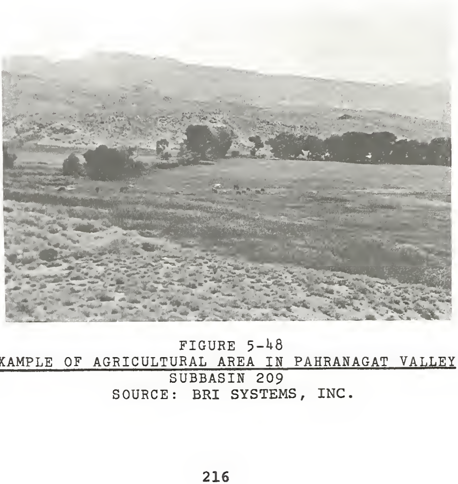


FIGURE 5-48
EXAMPLE OF AGRICULTURAL AREA IN PAHRANAGAT VALLEY,
SUBBASIN 209
SOURCE: BRI SYSTEMS, INC.

be drilled some 250-400 feet.

It is estimated that the 7,730 acre-feet of available ground waters of the valley could irrigate about 1,940 acres. There appear to be soils suitable for agricultural production on some 1,000 acres of the national resource lands if the ground waters can be economically obtained.

PAHROC VALLEY

The Pahroc Valley is located in the northern portion of Quadrant 11. The subbasin consists of 325,120 acres.

The ground water availability of this large valley is estimated at 2,860 acre-feet annually. Only 20 acre-feet of these waters have been appropriated and the status of another 40 acre-feet of the ground waters is pending by the State of Nevada. Water is available to irrigate about 560 acres of the Nevada resource lands of the valley.

Problems to be faced in Pahroc Valley in developing the lands include identifying a contiguous area of suitable soils where the well depths are economically feasible and in obtaining water of a quality suitable for irrigation.

Current use of the ground waters in Pahroc Valley are limited to livestock watering needs. The great depth to water in many parts of the valley and the quality factors are a deterrent to development; on-site investigations are required on the Nevada resource lands to further evaluate the potentials for irrigation of the 560 acres on the national resource lands.

GARDEN VALLEY

Garden Valley is located in the northwestern portion of Quadrant 11 and a portion of Quadrant 10. The subbasin consists of 315,520 acres; about 8 percent of the area is considered to contain soils suitable for agricultural production.

Surface water appropriations in the valley include 1207.6 acre-feet, plus an additional 7.4 acre-feet of pending rights and 932.6 acre-feet of vested water rights. Only 777 acre-feet of the estimated available ground water supply of 7,800 acre-feet has been appropriated.

The northern portions of the valley offer low water depths and marginal-to-suitable soils(30). Future opportunities for agricultural development are foreseen to exist in this area. It is estimated tha a maximum of between 1,900-2,250 additional acres could be developed in this valley. It is estimated that at least one-half of this development could occur on the national resource lands, a total of 1,050 acres, if suitable areas can be identified by on-site investigations.

PATTERSON VALLEY

Patterson Valley is located in the north eastern portion of Quadrant 11. The subbasin consists of 267,520 acres, much of which has a topography that is unsuitable for agricultural production. Only about 3 percent of the subbasin is considered to have soils that will support crop production.

The area is primarily undeveloped. It is estimated that between 4,500-6,500 acre-feet of ground waters are available in the valley annually. Water appropriations total 2,015 acre-

(30) Less than 25 feet in many parts of this area of the valley.

feet; the majority of this use is for municipal purposes(31). Another 771 acre-feet of ground water rights are in a pending status by the State of Nevada.

It is estimated that the ground waters in the valley available for further development total 3,715 acre-feet. This would irrigate an additional 740 acres in the valley. About 400 acres of the Nevada resource lands could be irrigated in this valley. Suitable soils and available water are the primary deterrents to any large development in this valley.

DELAMAR VALLEY

Delamar Valley is located in the central portion of Quadrant 11. The subbasin consists of 245,120 acres; about 13 percent of the area is considered to have soils suitable for agricultural production.

The ground water availability in the valley is estimated at 3,9000 acre-feet annually. No appropriations have been made and all waters are available for future development purposes. The major limitation to agricultural production in the valley are the great depths required for drilling to obtain adequate water for irrigation. Wells may have to be drilled in excess of 700 feet in many areas of the valley. If the need were great enough to drill for the available water, it is estimated that about 1,200 acres may be irrigated.

LOWER MOAPA VALLEY

The Lower Moapa Valley subbasin adjoins the California Wash area to the east. The subbasin consists of 161,280 acres;

(31) Permitted rights for municipal purposes total 1,809.5 acre-feet; the balance of the appropriations are certificated rights.

about 5-6 percent of the area is considered to have soils suitable for agricultural production.

The Muddy River is the primary source of irrigation for the valley. The ground water available in the valley is estimated at 19,000 acre-feet annually. Water appropriations for 1,635 acre-feet have been made for this resource. The status of an additional 9,148 acre-feet of ground waters are pending by the State of Nevada.

It is estimated that 8,215 acre-feet of ground waters are available to support additional agricultural production in this valley. This would be sufficient to irrigate between 1,400-1,600 acres.

On-site investigations of the Nevada resource lands are required in this valley to identify the topographic acceptable areas which may offer more suitable soils for agricultural development.

Considering the projected needs of the private interests in the valley, it is estimated that a maximum of 750 acres of Nevada resource lands may be developed in the Lower Moapa Valley.

CALIFORNIA WASH

The California Wash subbasin is located in the southern portion of Quadrant 11 and the northern portion of Quadrant 12. Irrigation in the area is primarily from surface water flows(32) and only 501 acre-feet of the ground waters have been appropriated. Requests have been made in the valley to appropriate

(32) The Muddy River provides about 34,000 acre-feet of water to the valley annually.

another 10,000-12,000 acre-feet. These requests are still pending.

Very little of the Nevada resource lands may be developed for cropping purposes in this valley. Limited potentials are present. Leaching of the soils to keep salts downward, below the effective plant root zone, is a very necessary practice in this valley and places additional requirements upon water needs for irrigation. It is estimated that 300 acres may be developed in this area, assuming that future on-site investigations would identify areas where the water depths are economically feasible. Due to the many limitations present in the valley, an overall estimate of 150 acres has been determined as the number of Nevada resource land acreages that could potentially be reclaimed and placed into production until comprehensive soil surveys of the lands are performed. Figure 5-49 shows an example of the national resource lands present in the subbasin. The lands of the Muddy River Springs subbasin which adjoins the California Wash to the north are shown in Figure 5-50.

5.12 NEVADA QUADRANT 12: SOUTHERN AREA

AREAS OFFERING DEVELOPMENT OPPORTUNITIES

Quadrant 12 includes the southern portions of the Colorado River and Central Nevada Basins and the southeastern Death Valley Basin area. There are 10 valleys and portions of 9 other subbasins included in the area which is shown in Figure 5-51. Table V-25 lists the one valley which was identified in Quadrant 12 as having marginal agricultural development potential. No potential was identified for any of the other valleys, aside from a small portion of the California Wash

FIGURE 5-49
NATIONAL RESOURCE LANDS IN THE CALIFORNIA WASH AREA,
SUBBASIN 218
SOURCE: BRI SYSTEMS, INC.

FIGURE 5-50
NATIONAL RESOURCE LANDS IN THE MUDDY RIVER SPRINGS VALLEY,
SUBBASIN 219
SOURCE: BRI SYSTEMS, INC.

area which was discussed in Chapter 5.11.

TABLE V-25
SOUTH AREA (QUAD 12) VALLEYS
OFFERING DEVELOPMENT POTENTIAL

HYDROGRAPHIC AREA DESIGNATION	VALLEY NAME	RELATIVE FIGURE OF MERIT
163	Mesquite Valley	1.0
218	California Wash Area	(a)

Comments:
(a) Refer to Chapter 5.11 discussion.

SOURCE: BRI SYSTEMS, INC.

SUMMARY OF EXISTING POTENTIAL OF QUAD 12 LANDS

Only one valley was found to offer any potential in Quadrant 12, except for a small area of the California Wash area which was discussed in Chapter 5.11. It has been determined that agricultural production potentials exist in the Mesquite Valley, but only on about 200 acres of the national resource lands. The potentials are marginal as discussed in the following paragraphs and summarized in Table V-26.

MESQUITE VALLEY

Mesquite Valley is located along the western portion of Quadrant 12. The subbasin consists of 151,040 acres; about 5 percent of the area is considered to have soils suitable for crop production.

The available ground waters in the valley are estimated to total 2,730 acre-feet annually. About 1,315 acre-feet of

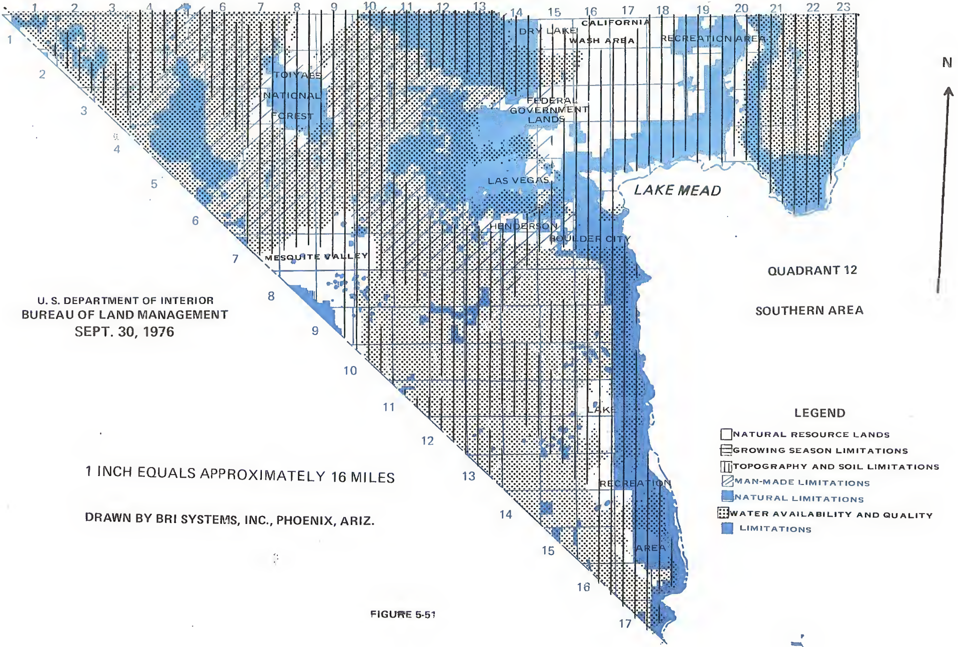
TABLE V-26
QUAD 12 VALLEY POTENTIALS

VALLEY	HYDROGRAPHIC DESIGNATION	ESTIMATED DEVELOPMENT ACRES AVAILABLE	COMMENTS
Mesquite Valley	163	200	(a)
California Wash	218	(b)	(b)

Comments:
(a) Suitable soils may place limitations on development.
(b) Refer to Chapter 5.11 discussion.

SOURCE: BRI SYSTEMS, INC.

these waters have been appropriated. It is estimated that ground waters are available to irrigate an additional 395-460 acres in the valley. Many of the more suitable lands existing in the valley are in private ownership. On-site investigations are required to identify the areas in the valley which would offer the best potentials for agricultural development on the Nevada resource lands. Projecting the private development water needs in the future, potential on 200 acres of the national resource lands is estimated in this valley.



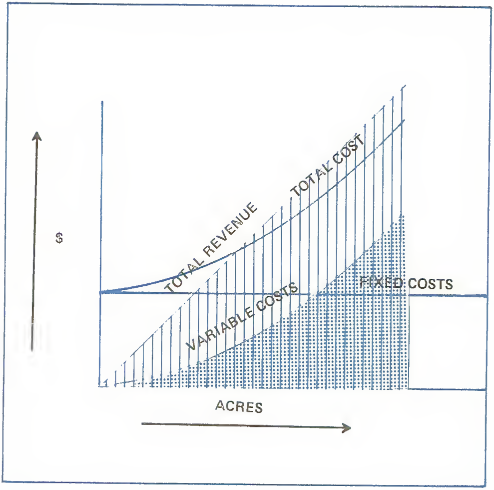
U. S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
SEPT. 30, 1976

1 INCH EQUALS APPROXIMATELY 16 MILES

DRAWN BY BRI SYSTEMS, INC., PHOENIX, ARIZ.

FIGURE 5-51

CHAPTER 6.0



ECONOMIC ANALYSIS

6.0 PRELIMINARY ECONOMIC FEASIBILITY OF AGRICULTURAL PRODUCTION ON NEVADA NATIONAL RESOURCE LANDS

BACKGROUND

The economic criteria discussed in Chapter 3.2 was used as a framework for assessing the economic potentials of the Nevada national resource lands. A combination of 3 operation profiles (i.e., machinery and equipment), 2 water development profiles and 3 crop production profiles was analyzed to develop the average estimated acres to meet a desired income level for each Nevada study Quadrant. The computed acres were then compared to the available acres in the valleys meeting the physical resource criteria as discussed in the following paragraphs. The findings of this preliminary (Phase I) analysis were used as the input for the more comprehensive economic analysis (Phase II) discussed in Chapter 4.0.

LANDS GIVEN CONSIDERATION IN THE ANALYSIS

All valleys discussed in Chapter 5.0 that were determined to have a physical resource feasibility that was considered marginal-to-good were further evaluated. The Nevada resource lands which were found to be either submarginal or submarginal-to-marginal in Chapter 5.0 were not given further consideration. With the current information known about these areas, they offer very little opportunity for development. The problems confronting potential development on the Nevada resource lands in each of these valleys were discussed in Chapter 5.0. The lands represent viable candidates for further investigation should more comprehensive studies in the future identify the availability of additional water resources.

AMPLE ACRES TO SUSTAIN AN AGRICULTURAL LIVELIHOOD WAS AN IMPORTANT ANALYSIS CONSIDERATION

The economic feasibility of the valleys offering potential for agricultural development upon the national resource lands takes into consideration many variables. One of the principal variables given consideration is the numer of acres (i.e., operation size) that should be placed into production in each valley in order to sustain an adequate livelihood. An adequate livelihood is assumed to be one which allows the producer to obtain a desired income level after expenses, that is at least equal to the average farm income for a family of four in the State.

The estimated average acres were computed for each Nevada study Quadrant to meet the desired income; they were then compared to the Nevada resource land acreages available in each valley that was found acceptable for development.

DEFINITION OF ACREAGES WHICH WERE TO BE EVALUATED

The following assumptions were made in evaluating the number of acres of each valley offering agricultural production potential:

A. The estimated number of acres available in a given valley was based upon the physical resource capabilities of the valley. The maximum number of acres of Nevada resource lands that could be developed within each valley is dependent upon variables such as available water of suitable quality, ample growing season and suitable soils;

B. For valleys that offer "good" physical resource potentials (high FOM), it was assumed that the estimated acres to be used for the economic analysis was equivalent to the maximum (available) acres that could be developed within the valley as identified by the physical resource analysis;

C. For valleys that had "minor physical resource limitations" (medium FOM), it was assumed that the estimated acres to be used for economic analysis was equivalent to 90 percent of the maximum (available) acres as defined in the physical resource analysis;

D. For valleys that had "greater physical limitations" (low FOM), it was assumed that the estimated acres to be used for economic analysis was equivalent to 75 percent of the maximum (available) acres defined in the physical resource analysis; and

E. For valleys that offer "marginal" agricultural development potentials based upon the physical resource criteria; it was assumed that the estimated acres to be used for economic analysis was equivalent to only 50 percent of the maximum (available) acres identified in Chapter 5.0.

The assumptions specified provide a safety factor in the analysis to account for unknowns and uncertainties in development and production. The magnitude of many requirements can only be determined by on-site study of each specific area. The estimated acres, shown in Chapter 5.0 and modified in accordance with the criteria specified above, were then compared to the acreages computed by the Phase I economic analysis criteria (Chapter 3.2) as discussed in the following paragraphs.

6.1 PHASE I ECONOMIC FEASIBILITY

The term "production (economic) feasibility" which is referenced in the following discussion for each Nevada study Quadrant is used to specify a number of acres, based upon the economic criteria of Chapter 3.2, which have been obtained from Table C-2 in Appendix C. The referenced Appendix Table lists an "absolute average minimum", "preferred average minimum" and "desired average minimum" number of acres computed for each study Quadrant in order to sustain a livelihood from crop production. When the development potential was considered marginal in a respective valley, the "desired average minimum" acres from Table C-2 was used as the basis for comparison of the operation size in the respective valley. For situations where physical limitations were present and a deterrent to the development potential, the "preferred average minimum" number of acres from Table C-2 was used. The "absolute average minimum" number of acres was used when the development potential in a given valley, based upon evaluation of the physical resource criteria, was considered to be good in Chapter 5.0.

An acreage profile in lieu of an absolute number is presented for each valley on the following pages. This profile is based upon the water development profiles for each valley. The higher value of the acreage profile shown in the tables of the following paragraphs assumes greater water lifts for irrigation ground waters to be pumped. It is estimated that the production acres for each valley would lie somewhere in between the profile of computed acres shown.

6.2 PRELIMINARY ECONOMIC ANALYSIS SUMMARY

Eighteen valleys were identified in the preliminary analysis as meeting both, the physical resource and preliminary (Phase I) economic criteria. The determined preliminary estimate of production acres (i.e., operation size) within each valley and the number of potential operations that may be developed on the Nevada resource lands in the respective valleys, based on the preliminary analysis given the physical resource limitations that were discussed in Chapter 5.0, are discussed in the following paragraphs.

QUADRANT 1 PRODUCTION FEASIBILITY

In study Quadrant 1, it was determined that an operation of minimum size 360-470 acres was required in Granite Springs Valley to meet the desired income level. An operation between 500-1,050 acres at Mud Meadows and Pine Forest Valleys and of 550-1,070 acres at Smoke Creek Valley were computed.

TABLE VI-1
QUAD 1 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Smoke Creek	5,640	Marginal	2,820	550-1,070
Mud Meadows	2,720	Limitations	2,040	500-1,050
Pine Forest	2,225	Limitations	2,000	500-1,050
Granite Springs	450	Good	450	360- 470

(a) Refer to Chapter 6.0 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 2 PRODUCTION FEASIBILITY

Only one valley was found to offer economic potential for development in Quadrant 2. As shown in Table VI-3, it was determined that an operation of 500-665 acres is required to sustain a livelihood in Buffalo Valley.

TABLE VI-2
QUAD 2 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Buffalo	1,580	Limitations	1,420	500-665

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 3 PRODUCTION FEASIBILITY

Two valleys were identified to have potential in Quadrant 3. In the Boulder Flat Valley, it was determined that an operation somewhere between 1,930-3,700 acres would be required to sustain a livelihood from agricultural crop production. In the Huntington Valley, the total available acres shown in Table VI-4, would have been required to meet the desired income level. The latter was viewed as a nonfeasible solution in this study because the lands offering agricultural potential are not necessarily contiguous to each other.

TABLE VI-3
QUAD 3 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Huntington	11,500	Marginal	5,750	(Not Feasible)
Boulder Flat	6,300	Limitations	5,670	1,930-3,700

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 4 PRODUCTION FEASIBILITY

In Quadrant 4, it was determined that all of the available acres shown in Table V-5 would be required to sustain a livelihood in the Goshute Valley. There were not enough available lands to sustain a similar livelihood in Pilot Creek Valley as shown in Table VI-5. In both valleys the solution was determined to be nonfeasible.

TABLE VI-4
QUAD 4 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Goshute	4,000	Limitations	3,000	(Not Feasible)
Pilot Creek	2,300	Limitations	1,725	(Not Feasible)

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc..

QUADRANT 5 PRODUCTION FEASIBILITY

There are insufficient lands available to sustain an economic livelihood in the Walker Lake (Whiskey Falt) area of Quadrant 5 as is shown in the following table. It was determined that an operation of at least twice the size shown would be required in this valley to meet the desired income, given the limitations present on the national resource lands.

TABLE VI-5
QUAD 5 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Walker Lake (Whiskey Flat)	400	Limitations	360	(Not Feasible)

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 6 PRODUCTION FEASIBILITY

Table VI-6 shows that the preliminary analysis identified the operation size to be somewhere between 750-1,725 acres to sustain a livelihood in Eastgate, Smith Creek and Upper Reese River Valleys.

TABLE VI-6
QUAD 6 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Dixie Valley	(b)	(b)	-	-
Big Smoky	(b)	(b)	-	-
Upper Reese	3,700	Limitations	2,775	750-1,725
Smith Creek	2,650	Limitations	2,385	750-1,725
Eastgate	1,580	Limitations	1,185	750-1,725

(a) Refer to Chapter 6.1 discussion.
(b) Requires imported water; refer to Chapter 5.0.

SOURCE: BRI Systems, Inc.

QUADRANT 7 PRODUCTION FEASIBILITY

Of the 7 valleys identified in Quadrant 7, it was found that five valleys met the criteria for both physical resource and economic feasibility given operations the size shown in Table VI-7.

TABLE VI-7
QUAD 7 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Railroad	5,000	Good	5,000	500-1,330
Grass	3,750	Limitations	2,815	550-1,465
Monitor (South)	3,000	Limitations	2,700	550-1,465
Little Smoky (North)	2,125	Limitations	1,915	550-1,465
Carico	1,350	Marginal	675	(Not Feasible)
Ralston	1,260	Limitations	945	550-1,465
Newark	510	Limitations	380	(Not Feasible)

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 8 PRODUCTION FEASIBILITY

Two valleys in Quadrant 8, Spring and the White River Valleys, were determined to offer potential for development based upon the physical resource and preliminary economic criteria. The other valleys do not have sufficient national resource lands available to sustain an economic livelihood as is shown in Table VI-8. All potentials are very marginal.

TABLE VI-8
QUAD 8 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Spring	8,000	Good	8,000	820-1,800
White River	5,500	Good	5,500	820-5,500
Steptoe	1,000	Limitations	750	(Not Feasible)
Long	530	Limitations	475	(Not Feasible)

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 9 PRODUCTION FEASIBILITY

Only one valley was determined to offer production potential in Quadrant 9. The potentials for Fish Lake Valley are shown in Table VI-9.

TABLE VI-9
QUAD 9 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Fish Lake	3,000	Good	3,000	350-1,135

(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

QUADRANT 10 PRODUCTION FEASIBILITY

No Nevada resource lands were found to meet the physical resource criteria in Quadrant 10. All valley areas identified are considered submarginal-to-marginal as discussed in Chapter 5.0.

QUADRANT 11 PRODUCTION FEASIBILITY

Of the 3 valleys identified in meeting the physical resource criteria in Quadrant 11, only the Pahranagat Valley was determined to offer economic potential. This is shown in Table VI-10. There were insufficient national resource lands available in Coal and the Pahroc Valleys to sustain a livelihood based upon the preliminary economic criteria.

TABLE VI-10
QUAD 11 ECONOMIC SUMMARY

VALLEY	TOTAL ACRES AVAILABLE	DEVELOPMENT POTENTIAL	ESTIMATED ACRES AVAILABLE(a)	PRODUCTION ECONOMIC FEASIBILITY (ACRES)
Pahranagat	1,800	Good	1,800	815-1,265
Coal	1,000	Limitations	900	(Not Feasible)
Pahroc	560	Limitations	420	(Not Feasible)

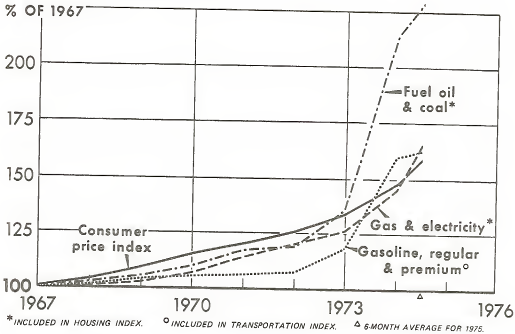
(a) Refer to Chapter 6.1 discussion.

SOURCE: BRI Systems, Inc.

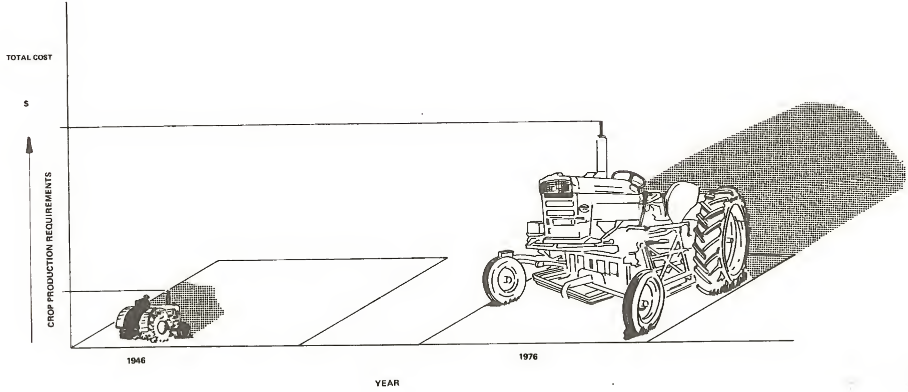
QUADRANT 12 PRODUCTION FEASIBILITY

No valleys were identified in Quadrant 12 that would meet the basic physical resource criteria and economic criteria for agricultural development on the national resource lands.

ENERGY PRICES



CHAPTER 7.0 STUDY CONCLUSIONS



7.0 STUDY CONCLUSIONS

The following paragraphs summarize the study findings. This is followed by a discussion of other factors which may influence these findings in the future and the conclusions reached.

7.1 SUMMARY OF PHYSICAL RESOURCE AND ECONOMIC ANALYSIS

The study findings are discussed in terms of the general physical resource and economic feasibility criteria which the national resource lands were evaluated against.

PHYSICAL RESOURCE FEASIBILITY OF EVALUATED LANDS

The Nevada resource lands of only 18 valleys (subbasins) out of a total of 255 Nevada subbasins met the physical resource and economic criteria of the study. This represents 7 percent of the subbasins in the state. The lands in 3 of these valleys, Boulder Flat, Spring and White River, were considered to be very marginal for agricultural production, based upon the economic results obtained, and were not given full consideration in the findings presented in this Chapter.

Table VII-1 lists a profile of important physical relationships about each of the 18 valleys which met the study criteria. Column 3 of this table shows the percent of current irrigated lands (acres) in each valley as compared to the total acres in the subbasin. All lands in the subbasin do not contain a topography and/or soils suitable for agricultural production. Column 4 of the table lists the percentage of lands (acres) that are estimated to be currently under irrigation as compared to the total acres of lands suitable for crop production in each valley. The last column of Table VII-1 presents an estimate of the irrigation ground water (acre-feet per year) that is available in each valley to the current irrigators; it assumes that all the waters are available to the acreages being irrigated for comparative purposes.

The values used in Table VII-1 are based upon information developed and provided by the Division of Water Resources. They do not reflect, in all cases, the final water availability values used in the study. As discussed in Chapter 3.1, the perennial yield values represented a starting point for the analysis. Available reconnaissance reports were researched for each valley, water duties were determined, current surface and ground water use was estimated, surface water availability was assessed and irrigation water recycling benefits were given consideration. Table VII-2 shows the perennial yield of each valley as has been determined in preliminary form, by the Division of Water Resources (DWR). It also shows in Column 3 the estimated water availability value used in the analysis for each of the valleys being discussed in this chapter.

Reference is made to Chapter 4.0 and Chapter 5.0 which discuss the potential development criteria that must be addressed in each valley shown in Table VII-1 and Table VII-2. Table VII-1 shows, for example, that water availability (Column 5) in Pine Forest, Fish Lake, the Pahranagat and Little Smoky (North) Valleys is critical and close coordination with the State Engineer, Division of Water Resources, is necessary for development in these valleys. The assumptions used for identifying development potential in each of these valleys was specified in Chapter 5.0. The needs to be addressed in development were discussed in Chapter 4.0. On the other hand, Table VII-1 also shows much water is available for development in valleys such as Granite Springs, Mud Meadows, Ralston, Monitor (North) and Eastgate Valleys. Its use is dependent upon economics and

TABLE VII-1

RESOURCE PROFILE OF VALLEYS MEETING CRITERIA

VALLEY NAME	NO.	IRRIGATED ACRES / TOTAL ACRES (%) (a)	IRRIGATED ACRES / GOOD SOIL ACRES (%) (b)	A-F / IRRIGATED ACRES (A-F/ACRE) (c)
Fish Lake	117	1.1	8.5	5.9
Pahranagat	209	1.0	13.8	5.3
Railroad	173B	0.3	2.0	21.4
*Spring	184	0.8	7.6	11.5
Granite Springs	78	**	**	4,500.0
*White River	207	0.6	0.8	6.0
Monitor	140B	0.1	0.3	66.7
*Boulder Flat	61	3.0	9.0	25.9
Smith Creek	134	0.1	0.3	25.0
Little Smoky	155A	0.2	0.8	8.8
Buffalo	131	0.1	1.0	12.5
Mud Meadows	26	**	50.0	260.0
Grass	138	0.4	2.0	8.7
Pine Forest	29	1.0	18.7	2.2
Upper Reese	56	0.8	5.0	10.7
Ralston	141	**	**	120.0
Smoke Creek	21	0.3	320.0	10.0
Eastgate	127	0.1	0.8	40.0

Comments:

* Economic analysis indicated these valleys to be very marginal; large production acreage requirement.

** Approximately equal to 0.

(a) Percent of acres currently under irrigation to total acres in the subbasin.

(b) Percent of acres currently under irrigation to acres of subbasin determined to have soils suitable for agricultural production.

(c) Available irrigation waters to the current irrigators of the valley expressed in terms of acre-feet/year per acre in the valley being irrigated.

SOURCE: Based upon preliminary information developed by the Division of Water Resources, Department of Conservation and Natural Resources, Carson City, Nevada.

TABLE VII-2
COMPARISON OF AVAILABLE GROUND WATERS* IN SELECT VALLEYS

VALLEY	DWR PY(a)	BLM TW(b)
Fish Lake	30,000	39,000
Pahranagat	25,000	32,500
Railroad (North)	75,000	91,000
Spring	100,000	110,500
Granite Springs	4,500	6,110
White River	37,000	48,100
Monitor	10,000	14,450
Boulder Flat	300,000(S)	39,000
Smith Creek	10,000	13,000
Little Smoky (North)	5,000	6,500
Buffalo	8,000	10,400
Mud Meadows	13,000	16,900
Grass	13,000	16,900
Pine Forest	11,000	13,650
Upper Reese	60,000(S)	48,100
Ralston	6,000	5,860
Smoke Creek	16,000	20,800
Eastgate	4,000	5,200

Comments:

* Table shows total water that is estimated to be available; it does not show current usage of the available waters (Refer to Chapter 5.0).

(S) System Yield.

(a) Division of Water Resources Perennial Yield estimate.

(b) BRI Systems, Inc. estimate of Total Water availability based upon average value of perennial yield estimates (Reconnaissance Reports) and allowing for irrigation recycling.

SOURCE: BRI Systems, Inc.

other factors, such as the Eastgate Valley influence on Dixie Valley's supply, for example. The relationships between valleys, when applicable, were discussed in Chapter 4.0.

ECONOMIC FEASIBILITY OF AGRICULTURAL PRODUCTION

Table VII-3 summarizes the findings of the economic analysis for fixed cost profile 1. This fixed cost profile assumed that the producer would invest in all equipment and machinery necessary to reclaim the lands, grow and harvest his crops, and transport them to market.

TABLE VII-3
ECONOMIC ANALYSIS FINDINGS FOR FIXED COST PROFILE 1
(Mean Acres = 789)

STANDARD DEVIATIONS	VALLEY FINDINGS (%)	MINIMUM ACRES	MAXIMUM ACRES
.6745	50.0	685	893
1.0	68.3	635	943
2.0	95.5	481	1,097
3.0	00.7	327	1,251

SOURCE: BRI Systems, Inc.

Table VII-3 is based upon 15 of the 18 natural resource valley lands shown in Table VII-1 and Table VII-2. The Boulder Flat, Spring and White River Valleys are not included. The analysis of the Nevada resource lands in these valleys resulted in identifying a solution that was feasible, as discussed in Chapter 4.0, but not practical. Considerable national resource land acreages were computed as being required for an economic operation in these valleys.

Table VII-3 shows that 50 percent of all solutions for the 15

Nevada valley lands fell between 685-893 acres. Over 95 percent of the solutions were between 481-1,097 acres, dependent upon the factors influencing the lands in each valley.

Many assumptions were made in the analysis. They have been discussed in Chapter 3.2. Chapter 3.2 also specified the numerous trade-offs that are available in production and the uncertainties that surround many of the variables associated with production and in turn, the production analysis.

The contingencies are recognized and must be treated accordingly. Correlations in the findings were also evaluated. This resulted in the identification of some general criteria for acreage determination.

ACREAGE DETERMINATION BASED UPON NET INCOME TRENDS OF A GIVEN VALLEY TO MEET THE DESIRED INCOME OF A PRODUCER

The assessment of the various study profiles (i.e., machinery, water development, etc.) showed that there were wide differences present in respective findings, based upon the assumptions used. A lower investment profile evaluated (i.e., refer to Appendix B; this profile has a greater variable cost associated with it) offered a reduction of the acreages required, assuming again, many conditions were met.

A relationship exists between the producer's net income (NI) per acre and the required production acreages to attain the desired average annual income. It is of the form

$$\text{(7-1) Production Acres} = \frac{1}{a + b\ (NI^*)} \ .$$

The coefficients, a and b, in Equation (7-1) were determined for the various (assumption) profiles shown in Appendix C.

*NI = Net Income = (Price per Production Unit) * (Production Units per Acre); i.e. NI = ($/Ton) * (Ton/Acre).

Regression analysis was used to define the coefficients, based upon 15 of the 18 Nevada resource valley lands which met the physical and economic criteria. Mean values were then established for the individual profiles and a general relationship was developed. Figure 7-1 shows the final equation that was developed.

FIGURE 7-1

PRODUCTION ACREAGE RELATIONSHIP TO NET INCOME

$$\text{Acres} = \frac{1}{(4.74 \times 10^{-5}) + (2.4 \times 10^{-5})\,(NI)}$$

Where

NI = Realized net income (dollars) representing realized gross income less variable production expenses per acre.

SOURCE: BRI Systems, Inc.

Figure 7-2 shows the general relationship between the net income value per acre and the number of acres in production for the Nevada resource lands of the study. It is based upon the 15 selected areas mentioned with an objective to meet the desired average annual income.

Figures 7-1 and 7-2 provide guidance for the acreage determination in a respective valley. If the realized net income (per acre) being received by other operators (i.e., realized gross income less variable production expenses) is obtained and inserted into the equation shown in Figure 7-2, the acreage computed will provide an estimate for the amount of lands that are required to attain the desired average annual income for the producer specified in Chapter 3.2.

If producers in a region are obtaining an average net income of $100 per acre, for example, Figures 7-1 and 7-2 show that approximately 410 acres are required in production within that region to attain the desired average annual income, assuming that the producer's production, in terms of yields, is similar to the average obtained in the region. If the net income were $125 per acre, about 325 acres would be sufficient for production. On the other hand, a net income of $75 per acre requires a production base of about 540 acres to meet the desired average annual income.

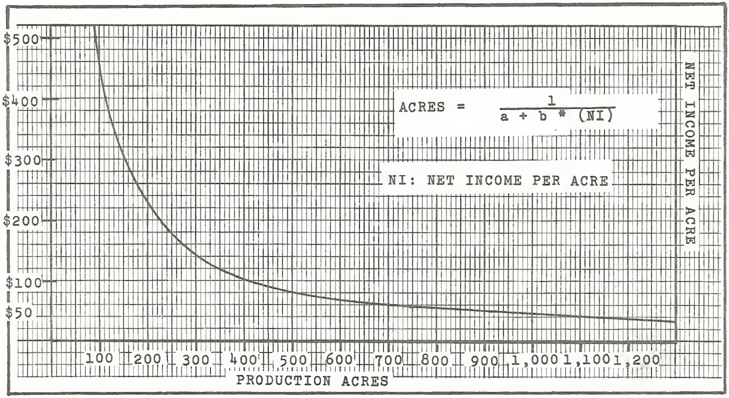


FIGURE 7-2
PRODUCTION ACREAGE-NET INCOME RELATIONSHIP
SOURCE: BRI Systems, Inc.

OTHER RELATIONSHIPS

There is a danger present in using analogies between valleys in the extent to which any two valleys are analogous. Although better data is available about certain valleys, as shown in Chapter 5.0, differences that arise in many factors make an analogy difficult. The optimum size of production will differ between valleys just as it will differ between enterprises.

Figure 7-3 shows a comparison of the cash flow profiles between various operation sizes evaluated in the study. It must be noted that the desired income is considered to be a part of the total fixed costs in the graph (i.e., assumes an additional fixed salary income to the producer), along with the other amortized investment costs.

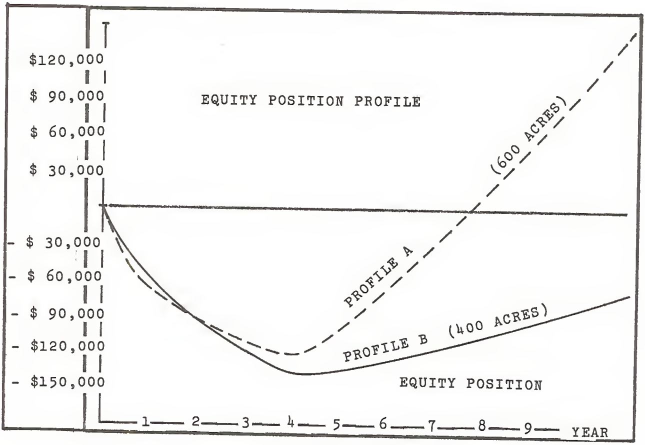


FIGURE 7-3
MODIFIED CASH FLOW PROFILE SUMMARY
(INCLUDES DESIRED INCOME AS A FIXED COST)
SOURCE: BRI Systems, Inc.

Figure 7-4 illustrates the general relationship that was found between operation size and irrigation water cost, expressed in dollars per acre-foot per acre, for the national resource lands in the 18 valleys given consideration. The water costs are based upon the water duties of each valley(1).

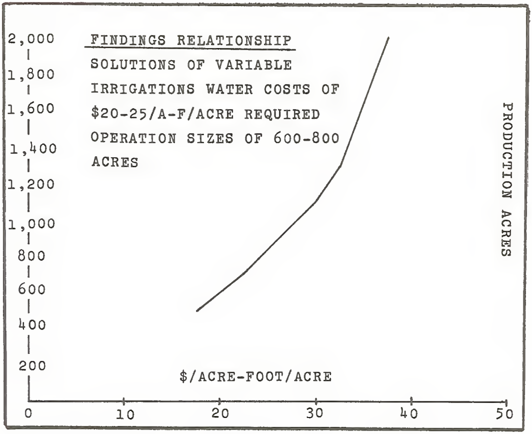


FIGURE 7-4
STUDY LANDS WATER COST RELATIONSHIPS
SOURCE: BRI Systems, Inc.

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1) Annual acre-feet/acre * water cost/acre-foot; water cost per acre foot shown in Appendix C.

SUMMARY OF VALLEY POTENTIALS

The following paragraphs summarize the study findings presented in Chapters 4.0 and 5.0.

NORTHWEST NEVADA POTENTIALS

In the northwestern part of the state, four valleys were identified to have national resource lands with potential for agricultural development. For the most part, these valleys are remote and are not near market centers.

The greatest potential, based upon suitable physical resources, exists at Granite Springs Valley, located in Quadrants 1 and 5. Granite Springs Valley and Pine Forest Valley offer average potentials from both, a physical resource and economic framework. The potentials are lower at Mud Meadows Valley and marginal in the Smoke Creek Desert Valley.

The producer will face the occurrence of climatic temperature extremes in these valleys, at times critical during the crop growing season, and could have difficulty in marketing his product and getting his products to market. On the average, a minimum of 480-580 acres in production would be required to attain the desired income in this region.

NORTHCENTRAL NEVADA POTENTIALS

Two valleys were identified in the Northcentral region to contain national resource lands offering potential. The Buffalo Valley lands, Quadrant 2, offer a potential which is about average from a physical resource viewpoint; production on these lands is economically feasible. The Boulder Flat area, or Boulder Valley, offers resource potentials but the area does not appear economically feasible for production unless a large operation is developed requiring a considerable investment.

WESTCENTRAL NEVADA POTENTIALS

Three areas in the west central region offer agricultural development potentials. Smith Creek Valley, Quadrant 6, offers the best potential in this region, from both a physical resource and economic basis. The potentials at the Upper Reese River Valley and in Eastgate Valley, Quadrant 6, is marginal. Operators in these areas may face difficulty in marketing their products and have a considerable distance to travel, over roads that will support product transport, to reach their markets.

EASTCENTRAL NEVADA POTENTIALS

Seven areas were identified in this region offering agricultural potential. The best potential exists at Railroad Valley and on the national resource lands in Monitor Valley. Physical resources at Spring Valley and in the White River Valley, Quadrant 8, are above average to support development, although the economics of operation are very marginal. The problems associated with these lands are discussed in Chapters 4.0 and 5.0.

Other valleys where potential exists include the Little Smoky Valley, Grass Valley, and the Ralston Valley; all are located in Quadrant 7.

OTHER NEVADA AREAS OFFERING POTENTIAL

Fish Lake Valley, Quadrant 9, and the Pahranagat Valley, Quadrant 11, are two valleys offering good potentials for agricultural development in southern Nevada. These valleys are among those which should be investigated initially for agricultural development opportunities.

7.2 OTHER FACTORS INFLUENCING AGRICULTURAL DEVELOPMENT

The lack of sufficient amounts of water is one of the biggest deterrents to the reclamation and agricultural production on the national resource lands in Nevada. Numerous studies have been made by the state to improve and/or increase the efficiency of water use. The Alternative Plans for water resources in Nevada describe the potential alternatives that have been developed(2). Unless some factors arise that would accelerate the projects, only a few developments would be available prior to the 1990-2000 period to be of any benefit to the lands.

CENTRAL NEVADA REGION PROJECTS

In the central region of the state, 29 reservoirs have been proposed. Nine of these could be constructed by the 1985 period and would provide for storage of about 7,000 acre-feet of water. They range from a 10 acre-foot storage capacity dam at Leidy Creek to a potential 4,600 acre-foot impoundment at Robinson Creek. It has been estimated that the 9 reservoirs would provide an additional 140,000 acre-feet of water at a cost of about $70 per acre-foot. Most of the water would be used by existing users of the region.

NORTHERN NEVADA PROJECTS

Over 42 potential reservoirs have been proposed for the northern region of the state. Fourteen of these projects, including Hylton, Tonkin, Rock Creek and Tuledad Reservoirs, are feasible by 1985-90. They would store about 191,000 acre-feet of irrigation water. The construction of additional and deeper wells

(2) Refer to Bibliography, State of Nevada; Plans are developed for each region of the state.

could further increase the seasonal supply up to 338,700 acre-feet. It has been projected that the 14 reservoirs could provide the additional surface waters at a cost of about $45 per acre-foot(3).

SOUTHERN NEVADA WATER NEEDS

The Pacific Southwest Water Plan(4) proposed two projects that would benefit the State of Nevada:

A. The Southern Nevada Water Supply Project to provide 270,000 acre-feet from Lake Mead for municipal and industrial water use in Clark County, including Nellis Air Force Base, and
B. The Moapa Valley Pumping Project to provide waters to supplement 3,300 acres of presently irrigated lands and for 6,000 acres of new lands in the Moapa Valley and Meadow Valley Wash along the Muddy River.

The additional water needs for the growing demands of southern Nevada influences future planning. Such demands may be met in part by the Colorado River and also by utilizing water salvage, ground water recovery and water importation systems; they may, for example, require water importation from the interior of Nevada (e.g., Railroad Valley). Many of the needs, both in southern and northern Nevada, have been recognized for many years. Foster, for example, recommended dams for additional irrigation water resources back in 1933(5).

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(3) Ibid.; Refer to Humboldt River Basin (Area III) Plan.

(4) U.S. Department of the Interior, Bureau of Reclamation, January, 1964.

(5) Foster, L.J., U.S. Department of the Interior, Report On The Humboldt River Investigations, Nevada, July, 1933.

NATURAL WATER RESOURCE PROFILE

Figure 7-5 compares the natural water resource situation of Nevada to the other western states. It is seen that the net supply of almost 2 million acre-feet for distribution is much less than the surrounding states. Other states which have a lessor supply shown in the figure, such as North Dakota for example, have surface water impoundments that provide for great storage capacities (the Main Stem System consisting of Fort Peck Lake (Montana), Lake Sakakawea (North Dakota) and 4 large reservoirs in South Dakota is such an example).

SUMMARY

Since the early settlement days, the people of Nevada have had a continuing problem in finding sufficient water to meet their demands in a region of prevailing water deficiency. This problem has been continually faced and solved in each area of the state throughout the years. Today, the principal water problems confronting the state are in areas where water has been found and placed into use. The problems generally arise because of water use. As people have become aware of its availability, they have found increasing use for the resource.

To ensure that further problems are not initiated by national resource land developments, one can only develop the lands which have sufficient water available to them. In most situations, this turns out to be ground waters. Ground water pumping is a very expensive proposition when it is the only source available to the irrigator. Therefore, its economics must be investigated on location, not in a general manner.

This study served to identify the areas that have potential for development. The problems to be faced in each area have also been identified. Comprehensive investigation is required at each site identified to have potential. The impacts of agriculture development upon the current water users in each valley (well location, for example) and the grazing operations in each valley should also be addressed during this investigation.

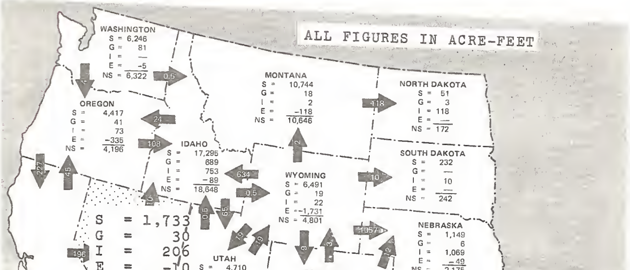

FIGURE 7-5
<u>NATURAL WATER SOURCE IMPORT AND EXPORT SITUATION</u>
SOURCE: Census of Agriculture, Dept. of Commerce

7.3 CONCLUSIONS

It has been stated by many persons that a major goal of resource development is to increase the capacity of the resource base needed to support private and individual enterprise. This may be true for public programs such as hydroelectric power developments, irrigation systems, waterways and grazing are intended to provide necessary additional resources for the private sector.

The marginal value product of a resource is a measure of its ratio of output value change per unit of input value change. The marginal value product of fertilizer in crop production, for example, is based upon the unit crop yield increase per acre for every unit (some determinable amount of pounds) of fertilizer that is applied to each acre. The "law of diminishing returns" is present in all such situations. Unit output will increase up to some point as further inputs are added. Eventually the amount of output added per unit of input will decrease. This is also true for the national resource lands.

The Nevada resource lands offer a marginal value product for crop production. This has been addressed in the study. It has been determined that on the average, a section of land would be required for a producer to attain a livelihood from production. What must also be given consideration in the future are the other potentials for the same lands. The marginal value product of these lands for grazing and other purposes must also be determined. The marginal value product is not simple to determine. It encompasses numerous land use decisions.

The study has shown that:

A. There are 18 valleys in Nevada that contain arable national resource lands with available water resources of suitable quality and associated climatic conditions that have the potential to support crop production,

B. It is considered economically feasible to produce crops in at least 15 of these valleys,

C. Although economic production acreages of 400-450 acres were determined in specific instances, a rule of thumb for the size of production should be at least one section of land, on the average, to provide the desired average annual income,

D. Because of the costs involved, even one section of land does not necessarily guarantee success; operator capitalization is needed to account for years in which poor yields or low market prices may arise,

E. Future water projects could be of benefit in reclaiming Nevada resource lands for crop production; they may offer additional waters to the valleys identified as well as others which did not meet the physical resource criteria because of a lack of water resources (Chapter 5.0). Such benefits are at least 10 years away, and in many situations, 20-25 years in the future,

F. Although the 15 valleys offer agricultural development potential, the degree of potential varies considerably at each valley (Chapters 4 and 5). On-site investigations are required to evaluate them in depth.

What the study cannot address must be determined by further study and investigation. Important factors that must be addressed include:

A. Do the Nevada resource lands that have suitable soils have water economically available to them--what specific depth is required for water pumping at each location?

B. How close together should the operations be in a particular valley to not affect downstream water users?

C. Although a combination of suitable soils, water availability and water quality exists for a valley, which resource land areas offer the best specific potential within each valley for development?

D. What impact does a more suitable physical location in the valley have on the economics of production?

E. Realizing the capital investment is needed for a successful operation, what guidelines are necessary, if any, to ensure that the lands may be successfully developed?

F. What impact will new developments have on current valley residents, the area and the state?