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U.S. Department of Housing and Urban Development
Region VIII, Denver, Colorado

FINAL

AREAWIDE ENVIRONMENTAL IMPACT STATEMENT FOR THE GRAND JUNCTION, COLORADO STUDY AREA

Abstract:

The Grand Junction, Colorado area is currently experiencing rapid development and growth as stimulated by expanding energy development. This Final Environment Impact Statement identifies and assesses the potential environmental consequences of the U.S. Department of HUD's proposed action for future federally assisted housing programs in the Grand Junction, Colorado study area in an effort to ensure adequate planning for the development of quality housing.

COMMENTS MUST BE RECEIVED BY: DEC 20 1982

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SUMMARY

The National Environmental Policy Act (NEPA) of 1969 as implemented by the U.S. Department of Housing and Urban Development's procedures outlined in 24 CFR Part 50, Protection and Enhancement of Environmental Quality; Department-wide Procedure, and adopted in accordance with the Council on Environmental Quality (CEQ) regulations, requires the preparation of Environmental Impact Statements on all projects determined by HUD to be a federal action significantly affecting the quality of the human environment. Federally assisted or insured housing programs as administered by HUD which include a number of dwelling units in excess of thresholds established by HUD for the area constitute such major federal action and consequently require the automatic preparation of an EIS for all such proposals and applications. Because of the projected rapid growth and subsequent development in the Grand Junction, Colorado area, HUD anticipates a significant increase in the number of proposals for federally assisted housing programs which will require the preparation of an EIS. To avoid potential review delays, minimize duplicative efforts, and reduce financial resource demands, HUD proposes to streamline the process through the preparation of the Areawide Environmental Impact Statement. This effort will ensure the continued development of quality housing programs in accordance to the CEQ regulations.

The areawide environmental impact statement was initiated for the Grand Junction, Colorado area, in an effort to minimize duplicative analysis, documentation and undue delays for completing potentially repetitive environmental impact statements for proposed federally assisted housing developments in the study area. The objective of this program is to eliminate the automatic necessity for preparation of formal environmental impact statements. Information provided in this document may be used as the basis for preparing environmental assessments as necessary.

The major issues addressed in this EIS are:

- Land Use Planning and Controls
- Housing
- Soils
- Water
- Infrastructure
- Community Services
- Transportation
- Hazards and Nuisances
- Historic Preservatives/Archaeology
- Noise
- Air Quality
- Endangered Species/Wildlife
- Floodplains and Wetlands

In general, it is anticipated that continued rapid growth as induced by energy development will place heavy service demands on the established communities within the Grand Junction study area. These demands will necessarily alter the socioeconomic characteristics of the area and careful planning and coordination among the various jurisdictions is paramount if a quality environment is to be maintained. Responsible planners should be cognizant of the potential population decline which often follows the exhaustion of energy development. Preparation of plans to accommodate the anticipated population influx should consider this possibility to minimize the long-term impacts of the short-term uses of the Grand Junction study area environment.

The development of this EIS represents an attempt to address the major growth related environmental issues on a broad comprehensive scale to identify potentially significant and sensitive environmental concerns for planning purposes. Information presented in this document is not intended to replace site specific investigations as necessary for responsible planning. Instead, it is intended to provide a guideline and tool for comprehensive and cohesive planning for the whole Grand Junction study area in an attempt to sustain a quality environment while providing services and facilities for potential rapid population increases.

It is recommended that HUD consider applications for housing assistance and/or insurance for development within the described Grand Junction study area without applying the automatic thresholds for site specific environmental impact statements. This then is the preferred alternative of HUD. Each proposal for housing assistance and/or insurance will be environmentally assessed utilizing the conditions described within Chapter 3 of this document entitled "HUD ENVIRONMENTAL GUIDELINES FOR APPROVAL OF HOUSING APPLICATIONS."

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INTRODUCTION

PURPOSE AND NEED FOR ACTION

This Areawide Environmental Impact Statement (EIS) has been developed in order that the U.S. Department of Housing and Urban Development (HUD) can more effectively comply with the National Environmental Policy Act (NEPA) and more efficiently process subsequent environmental reviews.

HUD's National environmental policy states: "Environmental impacts shall be evaluated on as comprehensive a scale as feasible, with a view of the overall cumulative impact of HUD actions and programs and those of other Federal Agencies, as well as the project specific impacts of a particular proposal" (24 CFR Part 50.5(c)). This requirement is satisfied by this areawide approach to environmental assessment of future development in the study area.

Departmental regulations (24 CFR Part 50) include a flexible threshold which dictates when an EIS is required for a housing development. This flexible threshold relates to the size of the community in which the development is proposed, e.g., the larger the community, the higher the threshold. Even with this flexibility, a number of HUD project level EIS's have been required in the study area and additional ones are likely to be required in the future. This Areawide EIS will permit HUD to process applications exceeding the threshold without automatically preparing a project level EIS.

The Areawide EIS also establishes a common data base for use by HUD, local and Regional governments, and private developers. Most of the data presented in this EIS existed at various local, Regional, State and Federal agencies in a multitude of formats and map scales. This EIS combines the data in one comprehensive document containing maps of a uniform scale. This data base will become HUD's primary source of information in the preparation of project level environmental assessments for future housing proposals. It is also anticipated that other governmental agencies and developers may utilize this data base in carrying out their planning and development activities within the study area.

DESCRIPTION OF THE ACTION

The action proposed by this EIS is to consider applications for housing assistance for development which are planned within the study area without applying the threshold for a project level EIS. This is to be accomplished by establishing this Areawide EIS which addresses significant environmental concerns which are relevant to HUD's decision-making process. Each proposal for HUD-assisted or insured housing (except those proposals which are categorically excluded from the NEPA process) which

is received after the completion of this Areawide EIS process will be subject to an Environmental Assessment regardless of the size of the proposed development. If the assessment indicates that the proposal is consistent with the evaluation in this Areawide EIS and no serious site-specific issues are revealed, no further environmental review will be required and a Finding of No Significant Impact will be issued. On the other hand, if the assessment shows that the proposal is not consistent with this Areawide EIS or that a serious site-specific environmental issue is surfaced; then an additional analysis will be undertaken. In rare instances, such an analysis could result in a project level EIS.

More specifically, HUD will make environmental assessments of proposals as follows:

1. Determine if the application constitutes a total development plan (master plan). If so, the review will proceed utilizing this Areawide EIS and pertinent site-specific information. If any portion of the area under review is within an area of concern identified in this areawide EIS, the guidelines herein will be followed prior to completing the environmental clearance.

2. Determine if the application is a part of a total development plan (master plan). If so, determine the portion of the plan which is owned or controlled by the applicant. This shall be the area subject to environmental review as described under paragraph 1, above. The reviewer will evaluate the total development plan's (master plan) impact on the applicant's proposal. If an adverse impact is identified, it will be considered and noted in the clearance.

In the case of HUD's processing residential subdivisions within the study area, there may be an exception to the above procedure. The Department may process such applications under its Local Area Certification (LAC) Program. Under this program the Department certifies certain local jurisdictions as having subdivision and environmental criteria and controls which are equivalent to or more stringent than those of HUD. Where such a certification has been issued, HUD only conducts an environmental review of those items which are not reviewed as stringently by the community as would be reviewed by the Department. In such a case, this Areawide EIS would be used as a data base for the limited environmental review. At this writing, there are no communities in the study area which have been certified by HUD.

PREFERRED ALTERNATIVE

The preferred alternative is to consider applications for housing assistance for development within the study area based on the findings and recommendations in this Areawide EIS without applying the Department threshold for an EIS.

CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES, INCLUDING AFFECTED ENVIRONMENT

This areawide environmental impact statement was initiated for the Grand Junction, Colorado area, in an effort to minimize duplicative analysis, documentation and undue delays for completing potentially repetitive environmental impact statements for proposed federally assisted housing developments in the study area. The objective of this program is to eliminate the automatic necessity for preparation of formal environmental impact statements for proposed projects which exceed those thresholds established by HUD for the area. Information provided in this document may be used as the basis for preparing environmental assessments as necessary. However, it must be understood that this areawide approach cannot address or encompass all of the environmental concerns of all specific proposed projects. Consequently, site-specific environmental issues must continue to be addressed on a case by case basis as applications are filed.

This chapter presents a discussion of the U.S. Department of Housing and Urban Development's proposed action for attaining the stated objectives as well as the potential alternatives otherwise required to comply with the National Environmental Policy Act of 1969 (NEPA). A comparative analysis of the proposed action and the available alternatives is presented. To provide a basis for the environmental analysis, this chapter also presents a defined boundary for the study area, a brief discussion of the physical and economic factors affecting growth, and population projections.

STUDY AREA BOUNDARIES

In association with the expanding energy resources development on the western slope of Colorado, the area in and around Grand Junction has developed into the major center for support activity. With an ideal location to provide services to the coal and oil shale regions and as the largest city on the western slope, Grand Junction has experienced extraordinary growth in the last few years. Combining a relatively mild, dry climate and an abundance of recreational potential with economic prosperity, this area has attracted a wide range of individuals. Consequent to this population influx, certain aspects of the social and natural environment have been affected.

In delineating an appropriate study area, it should be noted that much of the land adjacent to the Colorado River between Glenwood Springs and the Utah-Colorado border is subject to rapid population growth related to energy development. Of particular importance, however, is the area around Grand Junction, where support services for westslope development have centered, and the dynamics of population growth is

threatening to overwhelm the ability of local governments to provide essential services. In defining the study area, initial limitations were imposed in an effort to allow a more concentrated investigation of the potentially most severely affected areas. Thus, north and south limitations were imposed by the physical constraints provided by the terrain forming The Grand Valley that restrains large scale development using conventional technologies and techniques. The canyon of the Colorado River just beyond Cameo presents a natural termination of infrastructure services from the Grand Junction metropolitan area and is used as an eastward boundary. The western border was designated as the western edge of the City of Fruita. This western boundary of the study area should in no way be construed as the anticipated extent of western expansion within the Grand Valley. This boundary was intentionally set to allow for a more concentrated investigation over the defined study area. Specific boundaries for the areawide environmental impact statement are therefore 15 Road to the West, 40 Road to the East, L Road to the North, and A Road to the South, with the North-East boundary of the Colorado National Monument forming the South-West boundary of the study area. Figure 1 outlines the study area and shows present and projected growth areas as determined from current subdivision zoning maps and comprehensive plans prepared for Fruita and Palisade (8,9).

PHYSICAL AND ECONOMIC FACTORS AFFECTING GROWTH

The relatively mild, semi-arid meteorological conditions in the Grand Junction area coupled with the scenic nature of the Rocky Mountains' western slope provides a setting to attract people and encourage growth. However, the geological characteristics of this mountainous region will direct and concentrate growth in those areas most easily developed. In general, development is physically restricted to that portion of the study area away from the alluvial deposits at the foot of the Books Cliffs and the associated mesa. Additionally the hills formed from Mancos shale to the southeast of Orchard Mesa appear to restrict and discourage development owing to the extensive requirements for public services such as transportation facilities and utilities. Therefore, if the most optimistic population forecasts are realized, the current relatively high density areas can be expected to become more intensely developed due to the somewhat concentrating affect of these physical growth limiting characteristics.

Available water and air resources could pose additional limitations on growth in the Grand Junction area. Water supply facilities for treatment, storage, and transmission are currently being expanded in an effort to service the expanding needs. However, water availability to the area varies seasonally and at this time is not well-defined. Additionally the potentially large variety of future competing users is complex in this rapidly growing energy development area. Therefore, it is difficult to assess the potential limitation of water availability on the study area. It is important to note, however, that the current water

demands are approaching the present treatment capacity and additional facilities will be necessary to accommodate any significant anticipated growth.

The air quality in the study area is continuing to degrade and a portion of the Grand Valley is now designated a nonattainment region for particulates. This physical characteristic could discourage or limit growth by minimizing the issuance of industrial construction and operating permits or by reducing the environmental attractiveness of the area.

Historically, the agricultural industry has provided the economic base for the Grand Valley area. However, that economic base is rapidly being replaced by support services required for the energy development industry. While no shale oil development is occurring or is anticipated to occur in the study area, it is estimated that approximately 600 billion gallons of oil will be recovered from reserves of 1.3 trillion gallons trapped in shale oil rock in the Piceance Basin, which is located just north of the study area. Cost estimates for this development range to as high as $800 billion to be expended over the next 30 years (33). Although mining will not occur within the study area, the Grand Valley area will be the primary source of support services including housing, commercial business, entertainment, etc. Therefore, energy development on Colorado's west slope should be considered the single most important economic factor affecting growth in the study area.

It is of interest to note that at this time the prospects for employment currently exceed the availability of jobs resulting in unemployment uncharacteristic of a "booming" area. This condition should not be expected to persist if anticipated shale oil development induced employment is realized. However, the volatility of job availability in the area is exemplified by the recent cessation of the Colony Oil Shale Project and the subsequent direct and indirect job terminations. It is not within the scope of this report to analyze the potential of a continued "boom" in the study area, but rather to determine the effects increased housing, as indicated through recent trends and population projections, may produce on the area.

Population dynamics in the study area (48, 49, 53) are greatly affected by the energy resource development in the surrounding area which, in turn, is affected by such factors as energy prices on the world energy market, the ability and willingness of energy companies to develop new sources of energy, government policies, and the marketability of energy developed from local resources that are beyond control by local influence. The Colorado West Area Council of Governments (CWACOG) has developed three sets of population projections for the study area. The population projections used for this study are the mid-range projections developed by CWACOG, and adopted as the official projections by the Board of Directors of that organization. Because the CWACOG population projections extend only to the year 2000, the rate of increase projected between

1995 and 2000 was used to extrapolate data to 2005. A summary of the population information used for this study is provided in Table 1. Also included in Table 1 are recent population projections furnished by the City-County Planning Department through the year 2000 for Mesa County (40). The variation between these projections should be referenced as necessary throughout the text as available infrastructure capacities are reached for specific projection dates.

TABLE 1. POPULATION PROJECTIONS FOR MESA COUNTY, THE STUDY AREA AND OTHER JURISDICTIONS (53)

	1980	1985	1990	1995	2000	2005
Mesa County	81,530	118,745 94,907*	132,308 109,495*	137,842 112,279*	145,198 114,690*	152,893
Study Area	72,255	106,110	119,278	123,848	130,338	137,129
Grand Junction and Area	67,894	94,817	106,040	110,334	116,216	122,375
Fruita	2,810	9,532	10,884	11,098	11,098	12,192
Palisade	1,551	2,261	2,354	2,416	2,488	2,562

*Reference (40), May 1982.

PROPOSED ACTION AND POTENTIAL ALTERNATIVES

The National Environmental Policy Act (NEPA) of 1969 as implemented by HUD procedures outlined in 24 CFR Part 50, Protection and Enhancement of Environmental Quality; Department-wide Procedure, and adopted in accordance with the Council on Environmental Quality (CEQ) regulations, requires the preparation of Environmental Impact Statements on all projects determined by HUD to be a federal action significantly affecting the quality of the human environment. Federally assisted or insured housing programs as administered by HUD which include a number of dwelling units in excess of thresholds established by HUD for the area constitute such major federal action and consequently requires the automatic preparation of an EIS for all such proposals and applications. Because of the projected rapid growth and subsequent development in the Grand Junction, Colorado area, HUD anticipates a significant increase in

the number of proposals for federally assisted housing programs which will require the preparation of an EIS. To avoid potential review delays, minimize duplicative efforts, and reduce financial resource demands, HUD proposes to streamline the process through the preparation of this Areawide Environmental Impact Statement. This effort will ensure the continued development of quality housing programs in accordance to the Council on Environmental Quality (CEQ) guidelines.

Three potential alternative courses of action are identified for comparative purposes and are described below:

Alternative 1: Proposed Action

In accordance with the NEPA process, to consider applications for housing assistance for development within the study area based on the findings and recommendations in this Areawide EIS without applying the Department threshold for an EIS.

Alternative 2: Modified Action

To consider applications for housing assistance for development within the study area in only a portion of the Grand Junction, Colorado study area without applying the Departmental threshold for an EIS.

Alternative 3: No Action

To continue current practices or normal environmental processing of applications for housing assistance for development within the study area by applying the Department threshold of 500 units or more to determine the necessity for the preparation of an EIS.

COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The intention by HUD to adopt Alternative 1, Proposed Action, as the preferred alternative is to streamline the review procedure for processing federal assisted housing proposals while maintaining the environmental integrity of the study area. The development of this Areawide Environmental Impact Statement identifies the more salient and significant environmental concerns within the Grand Junction, Colorado study area and provides a basis for preparing site-specific environmental assessments for future federal housing assistance proposals in lieu of full Environmental Impact Statements. The potential environmental consequences of continued development in the study area are addressed in detail in Chapter 3 of this EIS and should be used as a guideline in

processing future proposals received. This recommendation will satisfy the objectives or intentions of HUD as discussed above.

The adoption of Alternative 2, Modified Action could partially satisfy HUD's objectives by designating only portions of the study area which could be exempted from the automatic requirement for the preparation of an EIS based on the Departmental threshold. However, from the results of the environmental characterization and analysis performed during the preparation of this EIS, no well-defined portions or subsections of the study area are apparent which distinctively separate and eliminate those areas from inclusion in the project study area. In addition, the significant environmental issues and characteristics of the study area are adequately addressed in this EIS providing a sufficient data base for preparation of environmental assessments in lieu of Environmental Impact Statements for review of federal housing assistance proposals where appropriate. From this assessment, adoption of Alternative 1 should not result in a less responsible environmental review of proposals, but alternatively should reduce review process effort.

Alternative 3, No Action, represents a continuation of current HUD policy to require the preparation of an Environmental Impact Statement as dictated by the Departmental threshold. With the anticipated rapid growth and subsequent development in the Grand Junction, Colorado study area, the number of applications or proposals for federally assisted housing could necessarily result in overwhelming the review process. This occurrence would lead to excessive delays in approving necessary housing projects resulting in insufficient housing for the increasing population. Additionally, sensitive environmental issues are more likely to be insufficiently addressed in the interest to expedite the review process. In either event, this alternative should be considered unacceptable.

CHAPTER 3

ENVIRONMENTAL CONSEQUENCES

This chapter presents a broad discussion of the anticipated environmental consequences or impacts associated with HUD assisted housing development in the Grand Junction study area. All the various issues required of this EIS were assessed during the initial scoping process in an effort to eliminate from further discussion those issues which are not considered significant to this program and specific study area. A preliminary assessment of all the major issues is available for review in the Preliminary Scoping Report dated March 1982 and is available upon request. A review or assessment of only those issues which are not considered to be of significant importance to this study is provided in the Final Scoping Report which is included in Appendix A of this EIS. Only those major issues which are considered to have significant importance to this EIS are addressed herein.

To develop the environmental assessment, each major issue is addressed separately. Initially, the existing conditions for each issue are presented to provide a basis for the assessment. Secondly, the potential impact of the proposed action for future HUD assisted housing development is addressed. Also included in this chapter is a discussion of adverse environmental impacts which cannot be avoided should the proposed action be implemented, the relationship between local short-term uses of man's environment and the maintenance and enhancement of long term productivity, irreversible and irretrievable commitments of resources which would be involved if the proposed action is implemented, and a discussion of environmental guidelines for HUD approval of housing applications.

IMPACT ASSESSMENT OF SIGNIFICANT ISSUES

Land Use Planning and Controls

Existing Conditions: The existence of comprehensive plans and policy statements concerning growth in the study area indicates the local awareness of potential development problems. Plans and policy statements, however, can alleviate potential problems only when they are supported by enforceable regulations to provide the infrastructural and social services required from an urban population. Figure 1 presents the present and anticipated growth areas as provided by zoning regulations and the comprehensive plans of Fruita and Palisade. Although development is not excluded from other portions of the study area, the greatest growth should be expected in the Redlands, Orchard Mesa, the Clifton area, and the Fruita area. These are also the areas where large scale water availability and sewage collection has recently occurred as a result of water and wastewater treatment facilities expansions and improvements. For example, the Ute Water Conservancy District recently completed water main expansions and the City of Fruita recently upgraded

its wastewater treatment facilities. In addition the completed construction of the Persigo Wash Treatment Plant and its associated interceptors will provide additional capacity.

Providing utilities is only the initial step in the development of a quality environment. Social services and physical preservations must also be addressed. The study area is currently characterized with transportation congestion, deteriorating air quality, and reduced per capita social services. Land use controls are easier to implement prior to any development, but implementation is seldom deemed necessary at the proper time. The Grand Junction study area is not an exception to this generalization. However, Mesa County, the Cities of Grand Junction and Fruita, and the Town of Palisade are each attempting to develop responsible land use controls as necessary. If development and implementation of these controls are not coordinated among the various jurisdictions, even the most responsible legislation could be counter productive. It is not suggested that a single unit be responsible for all planning in the study area, as the diversity of solutions presents a healthy debate. However, it is recommended that some form of enforceable policy be formed on each major issue. Without some form of policy, development will essentially result in accordance with a no action policy, and the cities, towns, and county, that will eventually inherit the needs of the development, will be forced to rely on the existing population to support that growth.

Potential Impacts: Potential impacts related to proposed housing developments that can be mitigated by land use planning and controls can be categorized as follows: 1) monetary losses from the community used to support development, 2) losses of other community resources by land use alteration, and 3) unacceptable alteration of the physical environment. An example of each is given below.

While subdivision regulations may provide some direction for road development, written policies should also exist to specify the agent responsible for street development and how the cost is to be allocated. Considerations used in developing this policy might include the principal of new development costs being derived from the developments. In addition, it may be desirable to assign the costs of new roadway development and construction to the primary users of the facility rather than to the community as a whole (9).

Conversion of prime and unique farmlands is an example of resource loses. While this issue has been addressed in the comprehensive plans and county policy statements, development pressures are successfully competing for prime and unique farmlands. The minimal protection afforded this resource is primarily due to an unstated policy that the agricultural land owner has a right to realize the potential profit from development of his property. Preservation techniques that have been used elsewhere, such as transfer of development rights or special

districting, have not been implemented within the study area. Thus, while awareness of the issue exists, the lack of a solid enforceable decision has created a "no action" policy.

An example of the impact on the physical environment is individual energy consumption. Wood for burning is easily obtained in the surrounding areas, and the popularity of wood burning as an economical source of heat combines with the particulate air quality problem and the relatively common winter air inversions to produce haze within the Valley.

Land use planning policies may dictate or direct the specific type of future development within the study area if enforceable. With a variety of local jurisdictions it is possible that well intended and responsible planning policies may be counter productive resulting in undesirable growth patterns and development. Therefore it is imperative that local jurisdictions coordinate their various policies to develop acceptable comprehensive policies. An example of the need for cooperation in developing land use policies is seen in the problems experienced by the Colorado National Monument from housing developments "being built adjacent to and often abutting the monument boundary. These include increases in damage to park features and property from people crossing the boundary directly from the development, and the potential for these people getting lost or hurt with resultant impacts on the monument's manpower and financial resources. The developments also have the potential of erosion or flooding damage that may naturally occur along the boundary" (71).

The desired type(s) of development must be identified by the local jurisdictions prior to the development of responsible and enforceable policies. To avoid undesirable growth patterns such as urban sprawl, strip development, and leapfrog development, specific policies and limitations may be imposed. These may include density zoning limitations, stategic placement of schools and other public buildings, and land set aside requirements. However it is emphasized that the growth type of development desired must first be identified before comprehensive and responsible policies can be formalized.

Although land use policies may be an effective mechanism for directing desired development, formulating and imposing these policies may be extremely difficult. It should not be assumed that a coordinated policy development effort will occur among the various jurisdictions within the study area. In addition, it is probable that a variety of desireable growth patterns will be identified resulting in potentially counter-productive compromise policies. Finally, it must be recognized that the imposition of specific planning policies may not direct or influence growth as intended.

In summation, however, it must be noted that these situations are not unique to the Grand Valley area, and recent cooperation, such as the water agreement between Grand Junction and Clifton, and large scale utilities provision, such as the Persigo Wash Treatment Plant and the proposed interceptor lines, indicate that the basis exists for a cooperative and workable approach to an orderly and quality growth in this area.

Housing

Existing Conditions: In 1980, there were approximately 28,180 housing units in the study area. These units were distributed within the study area as shown in Table 2. Table 3 shows the types of housing units that comprised the housing stock of the study area in 1970 and 1980. Comparison of the portions of the housing stock made up of single family, multi-family and mobile homes in 1970 and 1980 shows a trend away from single family homes to multi-family and mobile homes. It is expected that this trend will continue as prices of housing units continue to increase.

TABLE 2. HOUSING STOCK DISTRIBUTION

Location of Housing Units	Number of Units
Fruita	1,025 (47)
Grand Junction	12,639 (47)
Palisade	657 (47)
Unincorporated Area	13,859

TABLE 3. LOCAL TRENDS IN HOUSING TYPES (47)

	Percent of Total	
Type of Unit	1970	1980
Single family	80.2	67.9
Multi-family	12.6	17.9
Mobile homes	7.2	14.2

The Housing Assistance Plan developed by the City of Grand Junction in 1979 indicated that 10.4 percent of the total housing stock was substandard. Of owner-occupied housing, 6.4 percent was substandard, while 16.7 percent of renter-occupied housing was substandard.

According to one report, available housing is scarce with all available apartments rented, rent being $400 to $500 per month (25). However in accordance with the City-County Planning Department, local newspapers advertise the availability of many apartments for rent. The 1980 census reported 840 housing units available for rent and a median rent of $227 (40). Prospects for buying a home are better than locating a unit to rent, as there is a supply of new homes for sale (25). Average costs for a 1,500 square foot home is in excess of $70,000, although some builders are selling houses separately from the land on which the house is built. This arrangement reduces the cost of the home as well as provides a tax incentive for the builder. The builder will offer to sell the lot to the respective home buyer/owner after a five year period providing the builder with an assured income and deferred profits.

The Department of Housing and Urban Development has provided housing assistance in the study area through the Community Development Block Grant Program, Section 8 New Construction, and Section 8 Existing. The City of Grand Junction has used Community Development Block Grant funds for housing rehabilitation.

Potential Impacts: Estimated population and housing demand projections for the study area for the period 1980 to 2005 are provided in Table 4. Housing demands are projected for the study period using an estimated household occupancy of 2.86 persons per household as identified in the 1980 census. It is recognized that these housing demands may be conservative if current trends for decreasing household size continue.

As indicated in Table 4, demand for new housing units will be high during 1980 to 1985, and relatively high during 1985 to 1990. Demand falls considerably after 1990. These projections indicate that a total of 24,207 new housing units must be constructed in the study area between 1980 and 2005 to keep up with population growth, imposing an increase of 89.8 percent over the current number of housing units. These projections do not include replacements for housing units that are removed from the housing stock due to fire, displacement or deterioration. The number of units that must be replaced can be reduced by active maintenance of the existing housing stock through various rehabilitation programs such as those currently sponsored by the Department of Housing and Urban Development.

Every effort should be expended to coordinate energy companies, local governments and developers to ensure rational planning in housing development. Housing development must be closely timed with demand. Thus, energy companies should provide complete and timely estimates of their activities that will bring in new workers and thus increase demand for housing. These estimates should be made available,

and local governments should cooperate with developers to help ensure that the housing unit availability matches housing demand.

TABLE 4. PROJECTIONS OF HOUSING DEMAND (53)

	1980	1985	1990	1995	2000	2005
POPULATION	72,255	106,610	119,278	123,848	130,338	137,129
*		94,907	109,495	112,279	114,690	-
HOUSING DEMAND	26,961	39,780	44,507	46,212	48,634	51,168
**	26,961	35,413	40,856	41,895	42,795	-
5-YR. % INC.		48%	12%	4%	5%	5%
**		31%	15%	2.5%	2.1%	-
AVERAGE ANNUAL % INC.		9.6%	2.4%	0.8%	1%	1%
**		6.2%	3%	0.5%	0.4%	-

*Population projections from City-County Planning Department (40).
**Based on population projections from City-County Planning Department (40).

Soils Characteristics

Existing Conditions: Soils within the study area have been identified and described in the Soil Survey of the Grand Junction Area, Colorado (57) and the Soil Survey of Mesa County, Colorado (58). The former study investigated the Grand Valley area south of the Government High Line Canal and included Orchard Mesa and most of The Redlands area. The study describes soils primarily in relation to its agricultural use, but the mappings are reasonably detailed and note some wetlands in the Redlands area as well as identify the potentially corrosive saline and saline-alkali soil areas. A generalization of that study is presented herein. It is advised to refer to the survey for the specifics of any particular location.

The soils reflect the geology and climate in the area, being derived primarily from weathered Mancos Shale, mixed with eroded sandstones and/or acid igneous soil forming materials. The sparse vegetation produced by the dry climate has produced a soil with low organic and nitrogen contents, and the generally poor drainage has resulted in a

varied but often high salt content within the soil profile. The most prevalent salt is sodium sulfate, but calcium and magnesium salts are also present. Gypsum (calcium sulfate) is common where the soil derived from the Mancos Shale formation contains little alluvium eroded from the surrounding hills.

The Redlands area has an alluvium-derived loam soil that reflects its sandstone origin. This soils characterization progresses to a fine sandy loam in areas further away from the river. The sandy loam material is also derived from sandstone but is mixed with degraded igneous rock and some weathered shale and limestone. A large part of the Redlands consists of rough and broken terrain, sometimes referred to as Badlands, with steep slopes and shallow soil of unspecified origin with numerous rock outcroppings.

That part of Orchard Mesa south and southwest of Grand Junction is a relative flat clay loam area, an alluvium formed from acid igneous rock, sandstone, and shale, overlain with a shallow layer of wash. The high terrace area of Orchard Mesa further to the east is a former flood plain that contains a gravelly clay loam soil formed from acid igneous soil forming materials with a high lime content.

That portion of the study area north of the Colorado River and south of the Government Highline Canal slopes gently to the river. About one-fifth of the area near Grand Junction is a silty clay loam derived from the Mancos Shale, mixed in some places with fine-grained sandstone, with soil depths of four to 40 feet. The silty clay loam is generally regarded as providing poor traffic support and limited for shallow excavations or use as septic tank filter beds due to high seasonal water tables and slow permeabilities. Near Clifton and Fruita, a clay loam formed from Mancos Shale degradation mixed with a sandy alluvium from the Mesaverde formation, five to 30 feet thick, is found. This soil, however, has no severe use limitation and because it is generally considered prime farm land, residential growth on this preferred soil will reduce the amount of prime agricultural land in the area. Closer to the canal and west of Grand Junction, the soil becomes fine and very fine sandy loams. These are alluvial deposits over shale or sandstone and silt with shale derived sediments that range from one to ten feet thick.

Potential Impacts: Several potential soil related problems result from the area soils. High relief in the Redlands area provides a highly erodible surface. The high clay content in many of the soils derived from Mancos Shale will produce soils with high shrink-swell potential. Although proper engineering can overcome this potentially damaging force, recognition of the potential prior to the initial design phase is paramount. High concentrations of salts, found in numerous disjointed areas, may corrode concrete or metals that come in contact with the soil. High clay containing soils may also exhibit low

permeabilities. The undulating shape of the underlying Mancos Shale formation coupled with irrigation waters entering the unconfined aquifer has produced areas of perched water tables where water escaping via evapotranspiration has caused salts to accumulate degrading the agricultural potential.

Because a major portion of the study area was addressed in the 1955 soil survey, the resulting soils mapping was developed in relation to agriculturally related parameters. Thus, while saline and alkaline areas were mapped, soils that may restrict housing-related construction such as those with a high shrink-swell potential were not directly identified. To aggravate this problem, there is little agreement between the soils identified on the common boundaries of the two soil surveys. The ability to cross reference soils from the earlier survey and their construction related characteristics to soils of the 1978 survey would require the extensive services of a regional geologist or soils engineer. Therefore it is the responsibility of HUD to require a site specific soils investigation before approving or providing federal housing assistance for specific proposed projects. Areas which contain soils which are potentially corrosive or have a high shrink-swell potential are identified in Figure 2.

Topography and Geology

Existing Conditions: The study area exists entirely within the Grand Valley, a river valley roughly 12 miles wide and 35 miles long formed by the erosion of the Mancos Shale formation by the Colorado River. Elevations in the valley range from about 4500 feet to 4900 feet. The valley is defined by the Book Cliffs to the north, the edge of the Uncompahgre Plateau to the southwest, and low hills to the southeast that separate the Grand and Gunnison Valleys.

The area north of the Colorado River, including the communities of Palisade, Clifton, Grand Junction, and Fruita, consists of gently sloping alluvium underlain by the Mancos Shale. This formation is about 3800 feet thick and although impervious at greater depths, the Mancos Shale has a weatherized zone near the surface that may transmit water along joints, fractures, and bedding planes. This formation underlies most of the irrigated land, and because it contains a high concentration of salts, especially gypsum (hydrated calcium sulfate) that occurs in the joints and fractures, irrigation return water in the area tends to solubilize and transport these salts to the receiving body of water.

East of the Gunnison River, along the southern edge of the Colorado River, a river terrace underlain by Mancos Shale exists. Within a mile wide strip along the Colorado River, numerous orchards exist and the area is appropriately named Orchard Mesa. The terrace evolves into a series of hills also formed from the Mancos Shale. The

area to the south of the Colorado River downstream from its confluence with the Gunnison River is known as the Redlands. This bench area is a dip slope of the Uncompahgre uplift. Proceeding away from the river are successive outcrops of the Mancos Shale, Dakota Sandstone and Burro Canyon, and Morrison and Summerville formations. Some portions of this area are overlain with alluvium deposited by the Colorado and Gunnison Rivers while a large portion is overlain with alluvium eroded from the red sandstones of the Colorado National Monument.

Potential Impacts: The dynamic processes of the natural environment become hazardous only when man's activities interfere with the process. The terrain characteristics should be expected to constrain growth within the physical limitations of the Grand Valley, and impacts on housing imposed by the terrain will be experienced primarily within the Redlands region where residential growth will be intensive and in proximity to excessive slope areas. While excessive slopes will preclude normal development, the potential instability of slopes in the Redlands area may produce areas susceptible to rockfall, areas composed of landslide deposits that show evidence of past failure, or areas with slopes that show evidence of creep or past failures. A mapping of excessive slope areas is presented in Figure 3. However, it is recommended to refer to Geology for Planning in the Redlands Area, Mesa County, Colorado (26) for a more definitive mapping of potential problem areas in the Redlands. Unlike most soil hazards, those associated with unstable slopes are extremely difficult to economically control.

Mineral Resources

Existing Conditions: Mineral resources occurring within the study area are identified and discussed in the Mineral Resource Survey of Mesa County (33) and the map series Geology for Planning in the Redlands Area, Mesa County, Colorado (26). Mineral resources that have had various degrees of economic importance include uranium, vanadium, coal, clay, gem stones, fossils, decorative stone, and sand and gravel. Although uranium and vanadium are no longer processed within the study area, uranium mill tailings in the area have created special concerns. This topic is addressed in another section.

Gem stones and fossils have only minor economic importance but should be noted. The principal gem stones are barite, found in dry washes around the southern slopes of Mount Garfield, and opal found on Opal Hill, located one mile southwest of Fruita. Fossils are found in outcrops of the Morrison formation, the most notable being Riggs Hill, which was the site of the 1900 discovery of the large sauropod, Brachiosaurus. Another sauropod site is located 1.5 miles south of Fruita, east of Colorado 340. The Bureau of Land Management maintains a 200 acre paleontological site about two miles south west of Fruita. Of the sites noted, only Riggs Hill is within a developing area.

Building and decorative stone are found on the northeastern portion of the Uncompahgre Fault within the study area. Two quarries exist although neither is presently operating. Schwochow (33) indicates that either quarry could be reactivated with little adverse area impact but the development of new quarries would have to be within the constraints of environmental and economic concerns and is consequently considered not feasible. Also, local clay deposits are no longer mined for brick manufacturing or canal lining. Four abandoned clay pits have been identified in the study area but the possibility of a resurgence of this industry would depend on positive results of an extensive exploration, testing, and economic analysis program. One pit, located on 27 1/4 Road, 0.3 miles north of Patterson Avenue currently exists as a dump site as a result of its favorable soil permeability characteristics. Other clay pits are on 27 1/2 Road, 0.5 miles north of Patterson Avenue, 26 Road and I-70, and 1/4 mile southwest of Riggs Hill in the Redlands area. Bituminous coal is found in small quantities in the Redlands (26), but no activity associated with these exposed Dakota formation coals has been noted. ' These deposits are extremely small compared to the coal reserves found in other parts of the county and their mining should not be anticipated.

Sand and gravel operations constitute a major economic industry within the study area. Gravel deposits are widespread throughout the area from the Redlands and Orchard Mesa north to the Grand Valley Canal, but the principal mining activities occur on the Colorado River flood plain where overburden is at a minimum. Terrace deposits that occur in the Redlands and Orchard Mesa may be used locally if the overburden is not excessively thick, but most sand and gravel operations occur along the flood plain. Although several tracts along the Colorado River contain large aggregate reserves, the availability of this land to the industry will depend on zoning ordinances, adjacent land uses, reclamation potential, and flood plain control. It is therefore important to identify the major aggregate tracts which are as follows:

Heading west from Palisades, the first tract is a narrow area extending about three miles to 35 Road. The second area is the ancient river meander at Oldham Bottoms. This tract is over 700 acres and the northeastern portion has not been extensively mined. The southwestern area has been moderately mined while the middle area is devoted to orchards and consequently is unavailable for gravel. The area downriver between 32 Road and 29 Road is nearly exhausted.

West of Grand Junction to 24 Road most gravel mining has occurred on a large meander on the south side of the river. The reserves in the Rosevale area and adjacent to the west side of Grand Junction are unavailable resources due to existing roads, development, and unfavorable zoning. From 24 Road to 20 Road much of gravel north of the river has been mined although several areas remain on the north along with an area at 22 Road on the south side of the river. A large

gravel area also exists on a meander between 20 Road and Fruita with reserves on both sides of the river. Reserves become narrow west of 18 1/2 Road.

Potential Impacts: Decisions on the control of this resource should reflect 1) the economics of the aggregate being mined as close to its market as possible; 2) the realization of future needs of the resource; and 3) the ability to reclaim the land once the operations cease. In addition, the particulate nonattainment designation in the Grand Junction area indicates that restrictions on mining and hauling in close proximity to the city may be necessary to avoid further air quality degradation. The ability to reclaim mined areas is evident from the reclamation of several former pits along the river for use in agriculture, recreation, wildlife habitat, and homesites. Gravel deposits are currently managed through the imposition of access restrictions and zoning policies. However, the securing of the future availability of this resource is not feasible under current regulations. In addition, competition for property from the current housing demand is anticipated to continue to remove potential mining sites from development. Additional regulations concerning mining operations control community amenities such as minimum distances to property lines (30 feet) and residences (125 feet) and general restoration policies. It is anticipated that while development is further discouraged from encroaching on the flood plain area, these valuable aggregate reserves must be regulated to maintain future availability throughout the Grand Valley.

Prime and Unique Farmlands

Existing Conditions: Prime and unique farmland is identified as an important national resource in Public Law 95-87, and as such, must be considered when siting federally assisted housing developments. Agriculture formed the basis for the development of the Grand Valley, and the Valley continues to maintain a large amount of acreage that qualifies as prime and unique farmland. The specific criteria used to identify prime and unique farmlands in the Grand Valley are specified in the two U.S. Soil Conservation Service (SCS) publications, Criteria for Grand Valley Prime Farmland (13) and Unique Farmland (59). These areas as mapped by the SCS in Grand Junction are shown in Figure 4.

Prime farmland in the Grand Valley of Colorado "is land best suited for producing food, feed, forage, fiber and oilseed crops, and also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land but not urban builtup land or water). It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed, including water management, according to modern farming methods" (13).

"Unique farmland is land that is used for the production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality and/or high yields of a specific crop when treated and managed to modern farming methods. Examples of such crops are citrus, olives, cranberries, fruit, and vegetables" (59). Unique farmland in the Grand Junction area consists primarily of land currently used for orchards.

Potential Impact: Since projections show approximately a doubling of the population of the study area by the year 2005, much of the currently agricultural land near the municipalities of the study area will come under heavy pressure to be used for housing developments. However, the development of housing on areas designated as prime or unique farmland is highly discouraged by the goals and policies of the Mesa County Planning Commission as of June 15, 1976. In addition, the Agriculture and Food Act of 1981 established a national policy to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. This Act requires all federal agencies to ensure that their programs, authorities, and administrative activities are consistent with the national objective of protecting the nation's farmlands (73). Regulations implementing this Act have not been developed at this time.

Ground Water

Existing Conditions: Both confined and unconfined aquifer systems occur within the Grand Valley but neither are considered viable as a major source of community water. The confined aquifers predominately occur in the Entrada and Wingate sandstone formations. Forty-eight wells, mostly in the Redlands, have been identified in the area (31) but the low permeability of the host rock allows only small yields from the wells. Few wells have been developed since the 1950's when artesian hydrostatic pressures began to fall and the limited abilities of these aquifers were realized. Presently, two water supply systems, with a combined service of 350 taps, are located within the study area. Neither system is expected to increase its service area and future developments are not expected to use local ground water for their potable water source (52).

Unconfined aquifers occur in three forms above the Mancos Shale formation. Surface weathering of the shale produces cracks and fissures in the upper portion of the shale, forming a conveyance system for irrigation seeps and overload water to return to the surface. A second aquifer consists of alluvium and residual soils lying above the shale. The third aquifer exists in the ancient channels of the Colorado River. This latter aquifer, called the cobble aquifer, exists as a two to three mile wide swath through the valley and experiences recharge by the Colorado River, irrigation seeps, and the alluvial ground water

system. While the first two aquifers may be less than a foot thick, the cobble aquifer varies in thickness from 15-25 feet.

Water quality varies considerably within different areas of these three aquifers. The aquifer associated with the weathering of the Mancos Shale produces a base flow that increases by approximately five times in the summer months. Flow-weighted mean salinity concentrations average 4100 mg/L in the winter and 1200 mg/L in the summer. The alluvium aquifer water varies seasonally and areally due to a dillution effect from the higher quality irrigation waters entering the soils from April to October and the differences in chemical composition of the alluvium. Dissolved solid concentrations ranging from 300 to 124,000 mg/L have been reported but the mean value is 11,500 mg/L. Water quality in the cobble aquifer is estimated at about 10,000 mg/L dissolved solids but this value varies with depth, thickness, season, and proximity to a recharge area (4).

It is estimated that approximately 150,000 acre-ft of water enter these unconfined aquifers per year as a result of current irrigation practices while natural sources are estimated at supplying about one percent of the ground water. An increase in the level of the water table resulting from the irrigation practices has created some local conditions of perched water, high water tables, and saline soils. Perched ground water occurs during periods of heavy infiltration when the downward water movement is restricted by a layer of relatively low permeability. This condition may be temporary when the restricting layer is a clay seam within the aquifer or more permanent such as when the restricting layer is the unweathered portion of the shale formation. A high ground water table can result in the formation of a wetland or marsh area. Soil salinity may also be increased when soil capillary action transports saline water upward from the water table into an area where evaporation and transpiration removes the water but not the salts. These saline soils may then be unsuitable for certain crops. This condition is not irreversible, however, as a reduction in the ground water table may allow the salts to be leached out allowing the land to recover to its former productive state.

The existence of a seasonally high ground water table is especially noticeable in the area surrounding Fruita north of the Colorado River. During the irrigation season ground water tables may reach one to four foot depths beneath the soil surface. This condition precludes the use of septic tanks and indicates that, under present conditions, this land may be more suitable for agricultural purposes than for concentrated residential development (20).

Potential Impacts: Potential ground water impacts will be most severe in the portion of the study area north of the Colorado River where irrigation waters seasonally recharge the unconfined aquifers. Future impacts, however, must be related to the as yet undetermined

effects of the Grand Valley unit of the Colorado River Basin Salinity Control Project. If the stage one development succeeds in mitigating the saline ground water flow from irrigation seeps and runoff percolation, then a continuation of the project would decrease the salt loading to the Colorado River from irrigation seeps and runoff percolation within the study area. The lowered quantity of seep and runoff percolation would also reduce some existing seasonal wet areas or highly saline areas returning some of the land to potential agricultural or urban use. However, an increase in housing has been noted as creating the potential for "urban irrigation." Similar salinity problems may occur from excess lawn and garden watering but the magnitude of the problem, in relation to the existing salt loading, cannot be presently determined. Control of urban irrigation could be accomplished through either an educational program or through the imposition of a more stringent water rate schedule.

Water Quality

Existing Conditions: Ground water quality within the Grand Valley reflects the geologic formation containing the aquifer. The unconfined aquifers lying above the Mancos Shale formation are recharged primarily from irrigation system seeps and deep percolation, and the quality as well as quantity varies with the irrigation seasons. Confined ground water found in the older formations is generally a soft, sodium bicarbonate-sodium sulfate water resulting from the natural softening process of cation exchange caused by clay minerals in the formations. Specific data on these waters has been presented by Lohman (31) and are not addressed herein. It is recognized that artesian water currently supplies an estimated 350 taps in the study area. However, the declining water yield, reduced artesian pressure, and lack of anticipated growth for the two artesian systems indicates that future development is not expected to rely on this water as a water source (52). It should be noted that the recharge areas for the artesian aquifers are outside of the study area.

Major surface water sources contributing to the study area include the Colorado and Gunnison Rivers and Plateau Creek. Discharges reported for the 1980 water year (October 1979 to September 1980) are shown in Table 5 (61). Other sources of surface water are creeks and washes that drain Orchard Mesa, the Uncompahgre Plateau, and the Book Cliffs and associated mountains. Flows in these streams are generally intermittent, with larger flows resulting from spring runoff from the higher elevations or flash flood conditions following locally heavy rains. Some streams maintain a minimum flow even during dry seasons because of irrigation practices. These flows are not generally considered usable. No natural lakes exist in the study area. Walker Lake, however, located on the Colorado River about 5 miles west of Grand Junction, is a 100 acre lake formed from an abandoned gravel pit. This lake is operated as a wildlife refuge by the Colorado Division of

Wildlife. The annual (1977) water balance within the Grand Valley is presented in Table 6.

While water quality in the Colorado River in the vicinity of Grand Junction and Fruita is classified B-2, suitable for warm water biota, the Colorado West Area Council of Governments has noted that the protection of these waters for fish and wildlife is a major problem. Specific water quality parameters in the study area that have exceeded the May 1979 state criteria for drinking water have included alkalinity, copper, fecal coliform, iron, magnesium, manganese, mercury, pH, phosphorus, total dissolved solids, total suspended solids, and zinc. Furthermore, the potential for ammonia toxicity occurring within this century was identified in the 1975 Water Quality Management Plan, Colorado River Basin (WQMP) report prepared by the Colorado Department of Health (1). This water quality management plan recommends classifying the Colorado River in the Grand Valley as water quality limited. This classification means that the water quality does not meet state standards and is not expected to meet these standards even after application of secondary treatment to all municipal discharges and best practicable treatment to all industrial point discharges (20).

Water quality data for the Colorado and Gunnison Rivers is published in USGS publications, and is presented herein only as necessary. The normal flow in these rivers is relatively constant from September through mid-April as are parameter concentrations. From mid-April through August, however, flows may attain values an order of magnitude greater than during the winter months and a subsequent decrease in the concentrations of specific water quality parameters occurs. The anticipated water quality can become somewhat distorted if the flow weighted annual averages are used for representation determinations. For example, irrigation water and river water sampled during the snowmelt period produces concentrations indicating a possible potable water source. Flow weighted averages may also appear marginally acceptable as a water source, but a hard water with high total dissolved solids levels generally occurs for more than seven months of the year during the lower flows period. Concentrations of some specific water constituents during low flow conditions are presented in Table 7. These values are presented for the Colorado River entering and leaving the Grand Valley and the Gunnison River near the Grand Junction confluence.

The water quality degradation occurring in the Colorado River as it flows through the Grand Valley area is a result of three major causes: 1) the poorer quality of the Gunnison River water entering the Colorado River, 2) the influx of irrigation waters as discussed in the irrigation section, and 3) municipal and industrial waste flows (4). The Gunnison River and irrigation influx are especially responsible for increases in hardness, alkalinity, and sulfates. Water quality problems

TABLE 5. MAJOR SURFACE WATER FLOWS FOR 1980 WATER YEAR (61)

Location	Flow Max(cfs)	Mean(cfs)	Min(cfs)	Total(ac-ft)
Colorado River, 5.9 miles Upstream from Grand Valley Project Diversion Dam	20,000	4,188	1,600	3,040,000
Gunnison River, 8 miles S.E. of Grand Junction	13,100	3,098	850	2,249,000
Plateau Creek, 1.1 mile Upstream from Mouth	1,410	217	64	157,400

TABLE 6. ANNUAL WATER BALANCE IN THE GRAND VALLEY (4)

	(Acre-Feet)
Inflow	
Colorado River	2,700,000
Gunnison River	1,610,000
Plateau Creek	110,000
Precipitation	80,000
Return flow from imported municipal and industrial sources and streams draining the Book Clifs and Uncompahgre uplift	10,000
Total Inflow	4,510,000
Losses	
Crop consumption	(150,000)
Phreatophyte consumption	
Along irrigation structures	(60,000)
Along Colorado and Gunnison Rivers	(20,000)
Evaporation	(20,000)
Total Losses	(250,000)
Outflow From Valley	4,260,000

TABLE 7. SURFACE WATER CHARACTERISTICS (NON-SUMMER FLOWS) (61)

Location	Hardness (mg/L as $CaCO_3$)	Calcium (mg/L as Ca)	Sodium (mg/L as Na)	Alkalinity (mg/L as $CaCO_3$)	Sulfate (mg/L as SO_4)	Chloride (mg/L as Cl)	TDS (mg/L)
Colorado River Near Cameo	250-270	70-75	120-140	140-150	130-170	160-190	600-700
Gunnison River Near Grand Junction	240-570	60-150	40-90	110-170	200-560	< 20	400-1000
Colorado River Near State Line	300-460	70-120	90-110	100-190	110-450	70-100	600-900

arising from the discharge of municipal wastewaters, especially that containing an excess ammonia concentration, is anticipated as noted in the Colorado River Basin WQMP previously referenced. A recent study prepared for the USEPA (1) developed effluent ammonia loadings for both the proposed expansion of the existing lagoon system at Fruita and the anticipated Grand Junction activated sludge wastewater treatment plant at Persigo Wash. The study noted that until further testing confirms or denies the maintenance of a 0.02 mg/L instream ammonia concentration as being a "safe" level of nontoxicity to fish populations (several endangered fish species are found in this reach of the Colorado River), month-by-month discharge allocations of ammonia are advisable. This recommendation is a result of the toxicity of ammonia resulting from the unionized form whose concentration relative to total ammonia concentration (NH_3 + NH_4^+) increases with increased water temperature and pH. The high temperature and pH coupled with low flow conditions in the Colorado River during September makes that month the most susceptible for ammonia toxicity. Also, diffuser outfalls are recommended to mix the effluent across the entire river. A dye tracer study has shown that the Colorado River water mixes fairly slowly. Should the ammonia criteria be increased to 0.06 mg/L, ammonia control practices would not be necessary (1).

It should also be noted that while the USGS identified a maximum selenium concentration in this reach of the Colorado River of .011 mg/L (federal drinking water standards mandate 0.01 mg/L), the 1981 report by Ford, Bacon and Davis, Utah, Inc. (17) reports selenium levels of .048 mg/L above the uranium mill tailing pile and .077 mg/L downstream from the pile.

Potential Impacts: As population increases in the study area, significant impacts on the water quality of the surface water in the area, with emphasis on the Colorado River, include increased ammonia loading, increased dissolved solids loading, and decreased potential for recovery of endangered fish species. A decrease in the occasionally excessive fecal coliform counts may not be resolved with the construction of the Persigo Wash treatment plant depending on the currently unspecified source of the bacteria. Other parameters should not be expected to change considerably.

The ammonia toxicity problem is compounded by the assumption that an ammonia concentration of 0.02 mg/L as N is the highest concentration of unionized ammonia that will assure the safety of endangered fish species found in the area. The decision to not impose ammonia control at the Persigo Wash plant was based partially on an assumed concentration which has yet to be verified. Because a typical domestic wastewater contains 12-50 mg/L NH_3 (as N), the ability of the receiving stream to dilute and assimulate this load is critical. The predesign report of the Persigo Wash facility (60) indicates that effluent discharge will be to an existing drainage wash and thence to the Colorado

River. The ammonia investigations report (1) indicates that diffuser outfalls should be used to assist in the dispersion of the ammonia in the Colorado River.

Conventional municipal wastewater treatment practices do not significantly reduce dissolved solids concentrations and an increase of 65,000 people in the study area should be expected to increase the dissolved solids loading to the Colorado River by about 5,000 tons per year. Deliterious effects should, however, be relatively minimal as compared to the salt loading from irrigation practices which is estimated to be 780,000 tons/year. Additionally, it is noted that the Colorado River at the Utah border transports over 3.7 million tons of salt annually. Thus, increased dissolved solids would increase the salt loading by about one-tenth of one percent.

Because water supply sources for the study area generally originate in the Colorado or Gunnison River watersheds, a recent U.S. Fish and Wildlife Service biological opinion regarding the Battlement Mesa development should be noted. In that opinion, the reduced flow in the Colorado River caused by human consumption was determined to be "reasonably expected to appreciably reduce the likelihood of recovery of the endangered fish species," and Battlement Mesa developers may be required to pay $14,000 for their estimated 0.07 percent flow reduction from the Colorado River. This topic is presented in greater detail in the endangered species section of this report.

Storm Water Disposal

Existing Conditions: The original drainage patterns in the Grand Valley have changed considerably since the valley was developed. This change has resulted primarily from construction of irrigation systems, the subsequent land leveling, and in some cases, the filling of natural drainageways. The application of irrigation waters to marginally drained soil overlying the Mancos Shale created wet spots or seep areas that dictated the construction of ditches to drain these areas of persistent water. Seepage control in the study area is the responsibility of drainage, irrigation, and water users associations, but these responsibilities are limited to field and irrigation water drainage. Development on former agricultural land can increase surface runoff for a given rainfall but would not be under the jurisdiction of the entities presently responsible for seep control.

Storm water within the City of Grand Junction flows into the combined sewer-stormwater collection system adding to the presently hydraulically overloaded treatment facility. As growth continues separate collection systems may become necessary but this problem has not yet been addressed. However, new subdivisions are restricted from the use of combined sewer systems (52). The City of Fruita presently experiences storm drainage problems as a result of past street system

construction which occurred before the adoption of a comprehensive planning guide. Most streets lack curbs and gutters and water in the streets causes traffic interruptions as well as pedestrian inconveniences during rainy weather or snow melts. The 1979 Comprehensive Plan indicates that Fruita has endorsed a 1978 study recommending elevations and standards for curbs and gutters including the installation of curbs along streets that presently have none. New developments will require sidewalks where curbs are installed (8).

The use of irrigation channels remains important to the development of a comprehensive drainage plan. A 1981 drainage study (16) assumed storm runoff interception by canals and noted that only in the case of extremely severe rainfall events would the canal system be unable to intercept historic runoff. The planned use of irrigation canals, however, is generally unacceptable because canal capacity usually decreases in a downstream direction as water is progressively diverted for use. Also, tailwater and wastewater reuse through canal and lateral interception may constitute a decreed water right. In some cases, directing runoff into canals or laterals may be unavoidable. As the Colorado River basin salinity control project continues, canals and laterals will be concrete lined thereby increasing their hydraulic efficiency. Engineering as well as legal studies will be necessary to determine the feasibility of their use as drainage structures in specific instances.

Potential Impacts: Design guidelines for storm water management in Mesa County have recently been formulated based on a 1981 report on drainage in the Grand Valley area (16). This report identified 67 drainage basins in the Grand Valley outside of those basins previously studied or found within the City of Grand Junction. Storm magnitude versus frequency charts were developed for the area, and a methodology for determining the runoff capabilities for 2, 5, 10, and 100 year storm events was presented. The report also provided recommendations for the operation of a viable storm water management system in the Grand Valley including recommendations for information to be required as part of development proposals.

Subsequent to this report, the Design Guidelines for Storm Water Management in Mesa County, Colorado report was developed addressing drainage planning, design criteria, and reporting requirements. These guidelines allow the design engineer and developer "considerable latitude in the design of the drainage system" yet require proper documentation on the drainage system. The guidelines also require the drainage plan to be compatible with future developments and subsequent effects within the entire basin.

The requirements stated in the guidelines include a preliminary and a final drainage plan and report. The preliminary plan requires a site drainage plan, basin drainage plan, and drainage report.

The final drainage plan and report consists of a site drainage plan and construction plans for storm sewers, open channels, and special structures. The final drainage report must include calculations for street runoff capacity, culvert design, and open channel designs. In addition, the report is required to present hydraulic grade lines for storm sewers, design features for detention ponds, and an erosion control plan. Intensity duration curves and runoff coefficients are presented along with nomographs for design use. An extensive section on erosion control is also included.

This design guideline is a useful and necessary planning document and given an adequate review and effective construction enforcement will allow for proper storm water disposal in the study area. However, as developments, especially industrial and commercial, are built, the runoff characteristics of the individual watershed may change drastically and the cumulative downstream effects from a series of developments along the same watershed may not be noted on any individual drainage report. This condition is especially hazardous in areas prone to short, high intensity rainfall, and a continuous review of watersheds experiencing intense development should be performed to assure the success of the drainage guidelines.

Irrigation

Existing Conditions: Irrigation has been practiced in the Grand Valley since the first settlers arrived in 1881 and realized the agricultural potential of the area. The Grand Valley Canal was completed in 1886 and by 1920 the Bureau of Reclamation's Grand Valley Project had constructed the Government High Line and two Orchard Mesa canals. In accordance with the U.S. Department of Interior, agriculture remains the principal industry in the Valley with approximately 71,000 acres of cropland and orchards using 630,000 acre-feet of irrigation water annually (5). In 1949, the Grand Valley Water User's Association assumed the operation and maintenance of the project's canals with the exception of the Orchard Mesa Division and an associated powerplant. Other canals are owned and operated by various private water user organizations. The irrigation network is listed in Table 8 and shown in Figure 5.

Most of the canals, laterals, and farm ditches are open earth channels set in uncompacted alluvial soil or the weathered zone of the Mancos Shale. Some have been severely eroded resulting in an increase in cross sectional area and subsequently increasing the amount of water lost through seepage. Many laterals are owned and operated independently from the canals and increased costs of labor and materials, coupled with the deteriorating conditions in parts of the system, have resulted in owners incorporating for operation and maintenance. Maintenance costs are primarily canal and lateral cleaning, bank stabilization, and weed control.

TABLE 8. GRAND VALLEY IRRIGATION (4)

Canal	Owner/Administrative Agent	Description	Length (Miles)	Acres Served	# Laterals
Government Highline Canal	*Grand Valley Water User's Association	Water From Grand Valley Diversion Dam 8 miles upstream from Palisade	54	25,900	101
Orchard Mesa Power Canal	*Orchard Mesa Irrigation District	Water from Government Highline Canal 4.6 miles below Diversion Dam siphon under Colorado River	3.5	560	14
Mesa Canal #1 Mesa Canal #2	*Orchard Mesa Irrigation District		31.6 (combined)	6,830 (combined)	161 (combined)
Price Ditch	Palisade Irrigation District	Water from Government Highline Canal at the Price-Stub Pumping Plant northwest of Palisade	9.1	3,710	109
Stub Ditch	Mesa County Irrigation District		10.2	900	46
Grand Valley Canal	Grand Valley Irrigation Company	Water diverted from Colorado River at Palisade	12.5	4,230	55
Mesa County Ditch	Grand Valley Irrigation Company	Water diverted from Grand Valley Canal at Lewis Creek, east of Fruitvale	<4	1,090	18
Grand Valley Highline Canal	Grand Valley Irrigation Company	Begins at terminus of Grand Valley Canal north of Grand Junction	23.5	7,240	78
Grand Valley Mainline Canal	Grand Valley Irrigation Company	Begins at terminus of Grand Valley Canal north of Grand Junction	14	7,760	62
Independent Ranchmens	Grand Valley Irrigation Company	Water from Grand Valley Mainline Canal	11.8	2,310	38
Kiefer Extension	Fruita Canal and Land Company	Begins at terminus of Grand Valley Highline Canal north of Fruita	15.4	5,970	37
Redlands Power Canal and Associated Service Canals	Redlands Water and Power Company	Water diverted from Gunnison River 2 miles above confluence with Colorado River	N/A	4,500	N/A
	Individual Operations	Private power diversions	N/A	500	N/A

*Part of the Bureau of Reclamation's Grand Valley Report

Numerous cross-drainage structures constructed to transport natural flows from the Book Cliffs across the Government Highline Canal to natural drainage units are inoperable due to the accumulation of silt and debris during the 60 years of canal operation. Flows accumulate behind the upper canal bank until they overtop the structure bringing sediment and debris into the canal. In some cases canal overflows occur resulting in erosion of the downhill bank. A special problem exists along the Stub Ditch where Highway 70 cross-drainage structures empty into that canal. Flows in Stub Ditch sometimes exceed its capacity spilling onto downhill fields and county roads. Current practices for flow control include monitoring weather conditions to determine when large amounts of natural runoff will occur and subsequently opening canal wasteways to release the excess flows into existing drains. Sediment and debris accumulations are removed by either dragline or backhoe. (4).

As noted in the ground water discussion, seepage from the irrigation system combined with current irrigation practices assists in the net accumulation of dissolved salts in the Colorado River as it flows through the Grand Valley. An estimate of annual salt loading from the Grand Valley is 780,000 tons as shown in Table 9.

TABLE 9. ANNUAL SALT LOADING TO COLORADO RIVER FROM GRAND VALLEY IRRIGATION PRACTICES (5)

Source	Tons Per Year
Canal seepage	240,000
Lateral seepage	230,000
On-farm ditch seepage	160,000
Deep percolation from irrigation	140,000
Surface runoff from irrigated lands	10,000
	780,000

In an attempt to reduce this salt loading, the Colorado River Basin Salinity Control Project was authorized under Public Law 93-320. This two-segment program is being conducted by the Department of the Interior, Bureau of Reclamation and the Department of Agriculture, Soil Conservation Service. The program consists of lining canals, replacing lateral or ditches with piping where appropriate, and on-farm irrigation improvements. It is emphasized, however, that water users associated with this program cannot increase the acres historically irrigated or expand the use of water in any other way as an end result of the program.

Potential Impacts: The result of this program is expected to reduce salt loading to the Colorado River by 410,000 tons annually but additional benefits should include better drainage control in the Highway 70 corridor, a reduction in the unconfined water table and a subsequent improvement in certain saline and alkali soils formed by a high or perched water table. Local information on the project is available through the Grand Valley Salinity Coordinating Committee (10).

The objective of this program is to return currently nonarable lands to use either for agriculture or as potential housing areas. For land returned for housing uses, urban irrigation practices such as lawn and garden watering should be maintained at a rate sufficiently low to preclude the subsequent reformation of a perched water table; a condition that would become evident as foundation instabilities occurred. Overall, the salinity control program should have a beneficial impact on housing and drainage within the study area.

Water Supply

Existing Conditions: Five major and at least two minor water suppliers provide domestic water to the study area. The minor suppliers, Reed Mesa Water and Artesian Water, provide artesian water to an estimated 250-350 connections in the Redlands area. Although one of these companies has recently added about six new taps, the expansion of these water companies is considered unlikely due to limited aquifer yields, low permeabilities in the water bearing strata, and the rapid growth of the Ute Water Conservancy District (UWCD). Artesian water also supplies bulk and bottled water throughout the area. The five major domestic water suppliers are Clifton, the Cities of Grand Junction and Fruita, the Town of Palisade, and the Ute Water Conservancy District.

As a preface to discussion of the major water suppliers, it is important to note that while water rights are a legal necessity in Colorado, the ability of a purveyor to furnish water also depends on 1) the capability of the treatment facilities, including storage and transmission capacities and 2) the yield of the water supply source. However, it is also noted that the proposed Dominguez Reservoir Project, which includes the construction of a dam on the Gunnison River upstream from Whitewater, could provide a storage facility for municipal and industrial water in addition to hydroelectric power as authorized by Public Law 92-577. The draft feasibility report and a draft environmental impact statement for this project has been distributed by the Bureau of Reclamation. The Colorado Water Conservation Board is requesting the Bureau to complete the feasibility study including a municipal and industrial water supply alternative and will seek a congressional appropriation for continuation of the planning process (72). The projected yield for the Dominguez Reservoir Project would be approximately 48 MGD of available water for treatment and use. This

quantity is in excess by twice the estimated water requirements for the study area for the year 2005 as determined from the projected population of Mesa County (14).

The City of Grand Junction has rights to stored water on the Grand Mesa and direct flows in Kannah Creek and the Colorado and Gunnison Rivers. Water treatment is accomplished with the addition of aluminum sulfate and polyelectrolyte in a lime process at the 14.5 MGD capacity treatment plant. During peak months this plant produces finished water at near capacity but the addition of two filters, expected to be completed by 1986, will expand the treatment capacity to 20 MGD. Also, through an agreement with the Clifton Water District, the City of Grand Junction is able to obtain 4 MGD of treated water from Clifton providing a present capacity of 18.5 MGD and a 1986 forecasted capacity of 24 MGD. Raw water transmission lines between the Purdy Mesa and Kannah Creek water treatment plant have a current capacity of 14 MGD. An additional 8 MGD may be pumped from the Gunnison River but the inability to store river and creek water coupled with low priority water rights indicates that raw water supply shortages may exist during drought periods (52). A single larger raw water transmission line has been proposed but is not yet scheduled for installation.

The Grand Junction water system shown in Figure 6 serves most of the area within the city limits. The number of service connections increased from 7700 to 8000 between 1978 and 1980 and if the current growth rate continues, the present facilities, including the proposed filter additions, will reach capacity in 1990. Planning for an expansion or new water treatment plant should be initiated soon. Water system improvements proposed through 1985 include painting water tanks, upgrading intake equipment, replacing water mains, and upgrading lines for fire protection. Cost of these four projects is estimated at $610,000, to be funded by local water revenues.

The Clifton Water District shown in Figure 6 has water rights to 4.7 billion gallons of Colorado River water per year (12.87 MGD average) and may also purchase up to 1 MGD from the Grand Junction raw water supply. The current facilities use iron chloride addition, flocculation, sedimentation, filtration, and post chlorination, with a polyelectrolyte addition during the snow melt runoff months. The current 8 MGD capacity is being expanded to 12.5 MGD. This improvement is expected to be completed in mid 1982. Plant storage is 10 MG which is augmented by 1 MG storage within the distribution system. The district has grown in excess of 20 percent each year since 1974 and in 1980 it served 4800 taps (15000 people). Besides the filter plant addition, transmission mains are being installed along 31, 33, and 34 Roads.

The Town of Palisade uses water from several Grand Mesa reservoirs and springs and is currently enlarging the capacity of the

major raw water storage facility, Cabin Reservoir, from 39 MG to 244 MG. The water is currently treated by microstraining followed by chlorination. The Town is investigating upgrading the existing 1 MGD unit to a 5 MGD filter treatment plant (65). Costs for the various plans range from $1 million to $2.5 million. The Town currently has a moratorium on water taps outside the town boundaries but would have the capacity to serve about 15,000 people when the planned improvements are completed.

The City of Fruita has water rights to 618 acre-feet of water in five reservoirs on Pinon Mesa, located 20 miles south of the city. The water is treated in a 350 gpm neptune microfloc modular treatment unit, located near the west entrance to the Colorado National Monument. This unit and the 100,000 gallon treated water storage tank are presently considered inadequate in terms of capacity. A 1976 study recommended that Fruita's water needs be provided by the UWCD (19) but the 1979 Comprehensive Plan (8) stated an objective to continued use of Pinon Mesa water. Recent legal, transmission line, and quantity and quality problems with the Pinon Mesa water prompted a 1980 feasibility report (18) to recommend the blending of Colorado River water with the Pinon Mesa waters. The City has obtained the rights to 25 cfs of Colorado River water but has not yet arranged financing for the recommended 1 MG storage tank and a treatment plant expansion to double the present capacity.

Much of the present water distribution system also requires upgrading. This distribution system is interfaced with the UWCD system and Ute water is used during peak demands and for fire protection. The inability of the Fruita system to withstand Ute water pressures, however, mandates the use of pressure reducing valves along with the automatic system that supplies Ute water to the Fruita water system when the existing pressure reaches a predetermined low.

The UWCD provides treated water to areas of the Grand Valley not serviced by the municipal districts. In addition it is capable of supplementing water to the other districts. The UWCD maintains the Rapid Creek Treatment Center, located northeast of Palisade, which has a present capacity of 10 MGD. This facility will be expanded to 22 MGD within two years. Raw water is derived from four sources including a series of lakes on Grand Mesa, Coon Creek, Mesa Creek, and the Colorado River. The UWCD has expanded considerably in the last decade increasing the number of connections from 4525 in 1970 to 13,657 in 1981 and 14,439 in February 1982. Present expansion plans are indicated for the Horizon Drive area, Orchard Mesa, the Redlands, and the area south of IH 70 between Palisade and Grand Junction. The size of the service area indicates that a series of storage tanks will be required. The UWCD personnel anticipate expanding the present 18.5 MG storage at four locations to 33.5 MG at six locations within the near future. Tap fees are expected to increase from $2,100 prior to July 1, 1981 to $3,600

after July 1, 1984. The UWCD currently holds absolute water rights of 34 cfs and 31 cfs conditional (37).

Potential Impacts: The total anticipated water treatment capacity of the various districts serving the study area will exceed 60 MGD by the mid-1980's. This capacity should be sufficient to serve a total population of approximately 300,000 users.

Because of the seasonally poor quality of the Colorado and Gunnison River waters with respect to dissolved solids concentrations, it is desireable to augment these sources with a higher quality alternate water supply source during low flow periods for dilution purposes. The desired alternate water sources may be located on the Mesa. However these streams are also subject to low flow occurrences during drought conditions. Construction of the Dominguez Reservoir could secure the availability of water for use during drought conditions as well as dilute seasonal extremes of dissolved solids.

The Ute Water Conservancy District, through its ability to construct water improvements in unincorporated portions of the study area, is in a position to encourage or direct growth in specific areas. At the same time, the benefit of this large water district in terms of assisting development in growth-desired area should be realized. The imposed tap fees reduce the necessity of established customers having to pay for the expanding services to new customers.

Consolidation of all the districts in the study area should not be expected as long as individual districts maintain a desire for self-sufficiency, such as was stated in the Town of Fruita Comprehensive Plan (8). The control of water availability is a dominant manmade constraint on growth within the study area and a cooperative effort among UWCD, the cities and town, and the County Development Board will be necessary for orderly growth to proceed. It should be acknowledged that the Board of County Commissioners or their authorized representative are required to distribute to the State Engineer a copy of plans for proposed subdivisions in unincorporated areas to ensure that a dependable water supply is available (76).

Sewerage

Existing Conditions: Recent population increases and length of time required for conception to construction of wastewater treatment plants has resulted in hydraulic overloading at several study area wastewater treatment plants. To correct the deficiencies, Fruita and Clifton #2 are upgrading their lagoon systems while construction of the Valley Wide Sewer Project, expected to provide relief for the present problems in the Grand Junction area, should begin in March 1982.

The Grand Junction sewer system receives wastewater from several sanitation districts in addition to the city. The collection system is a combined stormwater-sanitary sewer that serves approximately 20 square miles and about 40,000 individuals. While new subdivisions are required to have separate collection systems, the upgrading and separation of the existing collection system is not presently planned but will probably occur as the individual sanitation districts achieve line capacities. The city treatment plant, a 5.7 MGD average design capacity two stage trickling filter, has been in violation of the permitted water quality discharge limitations on an average of two out of three months for the last three years. An interim wastewater treatment facility began operation in late 1981 providing an additional 1 MGD capacity. This plant is scheduled to continue operating until the permanent treatment plant is constructed. Construction on the Persigo Wash Treatment Plant is scheduled to begin in March 1982 and be completed in May 1984. In association with this facility, a valley wide sewer project is underway to increase collection ability in the area.

The city wastewater treatment plant treats the collected sewage from four additional sanitation districts as shown in Figure 6 and five small collection systems as described below (52).

The Fruitvale Sanitation District serves an area between 28 and 30 Roads, and between F Road and the Denver and Rio Grande Railroad. Built in 1956, this system was originally designed to serve a rural population. Consequently most of the collection and interceptor lines are 8 inch vitrified clay pipes. In 1980 this district served 3,200 taps. One line extension is proposed for 1982-1983. This improvement is expected to accommodate growth in the district through 1985.

The Ridges Metropolitan District provides the water system, and recreational facilities as well as wastewater collection for the Ridges planned development located 1-1/2 miles west of Grand Junction. Water is supplied by the UWCD. Following completion the development is expected to include over 5,000 dwelling units (54) all of which will be served by the district (40). Between 1981 and the 1988 completion date, $4.6 million is scheduled to be expended for the installation of a sewer system with funding provided by system revenues, revenue bonds, and state aid.

The Central Grand Valley Sanitation District serves a large area between Grand Junction and Clifton. Formed in 1969, this district was originally intended to serve a rural low density population. The district served 3,700 taps in 1980 but anticipated development has resulted in planned improvements that will expand the collection capacity by 4,000 to 6,000 taps by 1983.

The Orchard Mesa Sanitation District serves an area south of Grand Junction between the Colorado and Gunnison Rivers. Formed in 1976

this district was designed to serve a population of 20,000. In 1981 the district served 1900 taps or about 5,500 people. Because of the current excess capacity no capital improvements are planned before 1985.

The following are temporary improvement districts that provide collection service only. The purpose of these units is to provide financing for local sewer lines. These temporary districts are expected to disband when payments are completed within two or three years.

Heatheridge
Fairway Sewer District
North 26-1/2 Street
Sunset Terrace Sewer Association
Galaxy-Fairway Park-Bella Vista Sewer Association

Several additional sanitation districts exist in the vicinity of Grand Junction which provide wastewater treatment. These systems are described below and presented in Table 10.

The Clifton Sanitation District #1 serves 614 taps in the Clifton area. Built in the mid-1950's, the collection system is composed of vitrified clay and concrete sewer pipe. Excessive infiltration rates and pipe decay necessitated extensive repairs in 1978. Recent replacement and extensions utilized PVC pipe. The treatment facilities consist of four nondischarging lagoons with a capacity of 0.136 MGD.

The Clifton Sanitation District #2 was built in the mid 1960's and was designed to serve low density residential areas. The original sewer pipes were vitrified clay but recent extensions utilized PVC pipe. The treatment facilities consist of two disjointed plants. The east plant was recently upgraded from a 2-cell to a 3-cell lagoon with a 0.42 MGD capacity. The west plant is currently being upgraded to a 3-cell lagoon that will have a 1.6 MGD capacity. Both plants chlorinate the effluent prior to discharging to the Colorado River (east plant) and to an irrigation ditch that flows to the Colorado River (west plant). These improvements should provide capacity for an additional 5,600 taps.

The Panorama Improvement Districts #1, 2, and 3 serve the Monument Village area and Broadway subdivisions. The two-cell aerated lagoon treatment facilities have a 0.22 MGD capacity and served about 370 taps in 1980 with an average flow of 0.06 MGD. Because the facility is operating well below capacity no capital improvements are planned before 1985.

The Monument Meadows subdivision served 65 Taps in 1979 and has a 0.02 MGD capacity package treatment plant. The collection system is reported to have grade and alignment problems (52). The treatment plant is scheduled to be abandoned when the Persigo Wash Treatment Plant and the Goat Wash Interceptor Sewer are completed.

TABLE 10. EXISTING AND PROJECTED SEWAGE SYSTEM CAPACITIES (52)

District	No. Existing Taps	Present Capacity (MGD)	Total Tap Capacity	Projected Taps 1985	Projected Capacity 1985 (MGD)	Projected Tap Capacity 1985
Grand Junction[1]	17,200	5.7	17,500[2]	36,000	6.7-12.5	20,615-38,462[2]
Clifton #1	614	0.136	741[3]	N/A[4]	0.218	973[3]
Clifton #2	2,000	0.8	3,200[5]	7,600	2.02	7,680[5]
Panorama	370	0.22	880	[6]	0.22	880
Monument Meadows	65	0.02	80	[7]	--	--
Nara Rado	91	0.025	100	[7]	--	--
Bluffs West	30	0.01	400	[7]	--	--

[1] Grand Junction includes all taps on the city system plus Central Grand Valley Sanitation District, Orchard Mesa Sanitation District, Fruitvale Sanitation District, Heatheridge, Ridges and Paradise Hills, all of which are treated by the city.

[2] Tap capacity is based on 130 gallons per person and 2.5 persons per household which are the figures being currently used by the City of Grand Junction.

[3] Tap capacity is based on CSD #1's own figures of 80 gallons per person and 2.8 persons per household.

[4] "Ultimate development plans call for a capacity of .54 MGD by the year 2000. No data on the projected number of taps in 1985 is available.

[5] Based on the EPA standard of 100 gallons per person per day and local average of 2.5 persons per household.

[6] Information not available.

[7] Data not applicable as these systems will tie into city/county system when completed.

The Tiara Rado Subdivision served 91 taps in 1981. The 0.025 MGD extended aeration package plant handled an average 0.018 MGD in 1980 and has been in noncompliance with the State discharge requirements at various times (60). The installation of the Tiara Rado Interceptor will eliminate the use of this plant when the Persigo Wash facility is completed. This interceptor is designed to handle the flows from the Panorama Improvement Districts should that district decide to use the service as well.

The Bluffs West-Goat Wash system serves the Bluffs west and Loma Rio subdivisions with a 0.1 MGD treatment plant. Serving 30 taps in 1980 this plant is operating at about one-tenth its capacity. This system will interface with the Persigo Wash facilities when completed.

Several small collection and treatment systems also exist in the study area, each of which generally serves a single facility. These units which will interface with the Valley Wide Sewer system when completed are:

Department of Energy (nondischarging)
Scenic School - 12,000 gpd, serves school only
Mobile City - 30,500 gpd, serves trailer park
Western Engineers Plant - 10,000 gpd, serves commercial/industrial area
Coors-City Market - 100,000 gpd, serves industrial area.

Fruita and Palisade have also recently completed 201 facility plans. In Palisade, the population design capacity of the two existing nondischarging lagoons is approximately 2,800 people. These lagoons were operating at about 2/3 capacity in mid 1981. The collection system is limited to the areas where gravity flow may be used with the remainder of the 201 area using septic tanks. Planned improvements scheduled before 1987 include replacing the Main Street trunk line with a grant from the Oil Shale Trust Fund (9). Construction of this trunk has begun. Engineering is also being performed to reseal the existing lagoons, install aeration and chlorination units and apply for a discharge permit (65). These improvements are expected to cost around $200,000 and estimates of the future population that may be served are not yet available. An extension of the collection system beyond the current boundaries, however, is not intended.

The wastewater treatment facilities for Fruita consist of a two-cell lagoon system. The east cell has a capacity of 13.1 MG and is equipped with four 7.5 hp floating aerators. The west cell has a design capacity of 14.7 MG. After treatment the effluent is disinfected and discharged to Little Salt Wash. Total surface area is 19.7 acres for a design population of about 2,550. However the system occasionally operates at above design capacity as a result of a serious infiltration problem that doubles the wastewater flow during the May to October

irrigation season coupled with the flow contributed by the public schools that includes enrollments from outside the City of Fruita (8). The 1977 201 wastewater treatment facilities plan recommended a deepening of the existing cells, a division of the east cell into two cells, and the installation of a more effective aeration and baffle system to promote aerobic degradation. It was also determined that upgrading the present system to accommodate the infiltration flow was more cost effective than repairing or replacing the existing collection lines (20). These improvements will allow 1.25 MGD to be treated, and after correcting for the estimated 200,000 gpd infiltration, the upgraded plant will serve over 10,000 people at their current rate of water use. Recent communications (44) indicate that the Fruita sewer system improvements have been corrected and may presently serve a population of 12,000.

Potential Impacts: Completion of the Persigo Wash Waste Treatment Plant and the associated interceptor lines will expand and improve the wastewater treatment capability within the Grand Junction 201 boundary. Installation of the treatment plant will alleviate several small package treatment plants. However, the capacity of the Persigo Wash WWTP will be realized within the first five years of its use as a 12.5 MGD treatment plant is expected to serve a population of 98,500 (52). An expansion to 25 MGD capacity is currently being planned. Due to the extensive amount of time needed for financial considerations, it is imperative that planning on this addition be expedited to assure its completion before the 12.5 MGD capacity is hydraulically surpassed. Also, developers are encouraged to coordinate their needs with local land use planners so that additional wastewater may be adequately collected and treated (68).

The recent improvements to the Fruita system will not only improve sewage collection and treatability within the city limits, but the interceptors proposed in the 201 Facilities Plan (20) will serve growth north and south of the city as well as the highway 340 area south of the river and the G road area between Broadway and the River. Much of the land within the 201 study area experiences a seasonally high water table and is therefore not amenable to the use of septic tanks. Construction of the interceptors should therefore alleviate the potential use of septic tank systems as well as direct growth into specified predetermined areas.

The Town of Palisade Comprehensive Plan (9) does not specify an expansion of the Palisade sewage collection area beyond the current boundaries that form the extent of a gravity flow system. Space is, available, however, by infilling to accommodate a sizable population increase within the boundaries of the Palisade sewage collection area. The nonexpansion indicates that developments between the Clifton Sanitation District #2 and Palisade as well as developments in Central and East Orchard Mesa will require the use of either septic tanks or package

treatment plants. The use of package units is discouraged in the study area (36). These units have often operated unsatisfactorially both in the study area and across North America primarily because a qualified operator was not present to maintain the equipment. Should development occur between Clifton and Palisade, the use of septic tanks may not be appropriate as dictated from results of percolation tests.

Solid Waste

Existing Conditions: There is currently one county dump, located south of the study area and a separate Mesa County landfill located near Fruita. The county dump is maintained by the County Road Department and is approaching capacity. Negotiations are currently underway with the Bureau of Land Management to lease an additional 140 acres at the southern site (40). Solid waste removal service is provided by Grand Junction within the incorporated area while two private firms serve the remainder of the county. The status of the county dump in September 1982 is that another trench has been dug to accommodate an additional six months of waste disposal. An agreement with the BLM has been reached on the use of an additional site, and the necessary county certification has been issued. Use of this site will begin by June 1983, when road and site preparation is completed and after maintenance (county or private) responsibilities have been determined (70).

Potential Impacts: There are two potentially adverse impacts that should be noted to assist future solid waste planning in the study area. First, as population density increases, the solid waste generated per capita increases. Therefore a landfill that might have an initial anticipated 10 year service life in a growth area may be expected to reach capacity in 7 to 8 years. Also, in areas where development occurs but trash removal remains on a voluntary basis (i.e. use of a private service) the practice of illegal refuse dumping along seldom traveled country roads increases. The City of Fruita has recognized this potential problem in its comprehensive plan and noted that individual hauling should be discouraged. Soil and ground water characteristics in the Grand Junction area should not preclude locating dump sites near this growth area. In any event, the availability of solid waste disposal facilities must be considered before approving federally assisted housing programs.

Utilities

Existing Conditions: As shown in Figure 6 those portions of the study area where extensive development is anticipated are serviced by the Ute Water Conservancy District. Wastewater service, as previously noted, will be provided to major subdivisions within the Fruita and Grand Junction 201 study area boundaries. Excluded from areawide collection and treatment are those areas north of I-70, between 19 and

16-1/2 road, Central and East Orchard Mesa, and the area between the Clifton #2 Sanitation District and the Palisade Sewage Collection District. Telephone service is provided throughout the study area by Mountain Bell. Electricity is provided by the Public Service Company and by Colorado Ute. In general, the Public Services company serves the Cities of Grand Junction and Fruita, the Town of Palisade, and most of the Redlands while Colorado-Ute supplies the remainder of the area via the Grand Valley Rural Power Lines, Inc. Electricity is available through an interregional electrical grid system that will be augmented with the construction of a 500,000 kW generating plant to be built 25 miles N.W. of Grand Junction.

Potential Impacts: The potential impacts of water and wastewater services are discussed in their respective sections. Of particular importance is the proposed construction of the 500,000 kilowatt generating unit eight miles north of Mack. In association with this project will be the construction of an electrified railroad connecting the unit to the Salt Creek Mining Company in Garfield County. Peak construction force is estimated at 1,100 people and the plant will require a permanent operating force of 150 employees. The mining of 1.75 million tons of coal would require an estimated permanent operating force of 250-300 individuals as determined from data reported by the Bureau of Land Management for typical operating mines on the Colorado Western Slope (15). The proximity of Fruita to the sites indicates that Fruita should expect a surge of construction personnel when construction begins. This increase will place demands on the City of Fruita and its commercial businesses to provide additional school facilities, community services, and retail and business operations. The recent wastewater treatment system upgrading will provide service to 12,000 individuals, but the condition of some water mains may indicate that new feeder mains be installed to supply newly developing areas. High ground water during the irrigation season dictates that water improvements be installed during the winter months. Communication and cooperation between city officials and Colorado-Ute personnel should begin as soon as possible, to resolve these potential problems.

Schools

Existing Conditions: The study area is served by School District #51. In 1981 the district had enrolled 3239 high school students, 3,664 junior high school students, and 8,966 elementary students. At that time the district had sufficient capacity for 3 800 high school students, 3,100 junior high school students, and 7,190 elementary students. This capacity was sufficient to accommodate the high school students but deficient for accommodating the junior high and elementary students.

To alleviate this deficiency, a $31 million bond issue was passed to allow the construction of seven new elementary schools and one

new junior high school. One elementary school is scheduled to open in July 1982 and the remaining six are scheduled to open in September 1982. Construction of the new Mt. Garfield Junior High School is scheduled for completion in early 1983. Grand Junction High School, Central High School, and Fruita Junior High School are currently undergoing renovations under capital improvement funding.

The school district is also considering adoption of a year-round school program which would allow more efficient use of the district's facilities (38). Table 11 shows the capacity of each school in the district under both the traditional school year (TSY) and the year-round school (YRS) concept. The table also shows the year that the school's capacity will be reached under each type of schedule.

Potential Impacts: The largest increase in student population has been in the elementary grades. Thus, most of the new construction in the district is intended to meet that demand. However, the district has scheduled to upgrade the four high schools in the district for use by the current elementary population as it reaches the high school level. School District #51 expects to have a total enrollment of 22,404 students by 1990, compared to its 1981 enrollment of 15,869. It appears that with the completion of the scheduled construction in 1982, School District #51 will have sufficient capacity to accommodate the existing enrollment. However additional construction will be required to meet the enrollment demand by the year 2000 if projected population increases are realized.

Law Enforcement

Existing Conditions: In addition to the police departments of the Cities of Grand Junction and Fruita and the Town of Palisade, the study area is served by the Mesa County Sheriff's Department and the Colorado State Patrol. The Grand Junction Police Department (GJPD) currently has 64 officers, a support staff of 15, and 29 police vehicles. The State of Colorado Department of Local Affairs recognizes a standard of two officers per 1,000 people is often used to determine the adequacy of police mobility. The 1979 Town of Fruita Comprehensive Plan indicates that Fruita has five officers and two police cars while the 1981 Town of Palisade Comprehensive Plan indicates that Palisade has four officers and three vehicles. Thus, each of the incorporated areas exceeds the standards in terms of personnel per 1,000 population. Cooperation and coordination exists between these police departments, as noted by Fruita's police calls being radioed from the Grand Junction Police Department and minor laboratory work being performed by the GJPD.

The Mesa County Sheriff's Department (MCSD) is generally responsible for law enforcement within the county outside the municipal limits of incorporated communities. There are currently 50 officers and

TABLE 11. PUBLIC SCHOOL ENROLLMENTS AND CAPACITIES (56)

	Enrollment Oct., 1981	Capacity TSY	Capacity YRS	Year That Capacity Will be Reached TSY	Year That Capacity Will be Reached YRS
HIGH SCHOOLS:					
Grand Junction HS	1153	1400	1960	1991	*
Central HS	989	1000	1400	1981	*
Fruita Monument HS	916	1000	1400	1986	*
Palisade HS	181	400	560	1991	*
JUNIOR HIGH SCHOOLS:					
East Junior High	565	550	770	1981	*
West Junior High	592	550	770	1981	*
Orchard Mesa Junior High	728	700	980	1981	*
Fruita Junior High	821	700	980	1981	*
Brookcliff Junior High	772	600	840	1987	*
Mt. Garfield Junior High	under const.	700	980	1987	*
Palisade	188				
ELEMENTARY SCHOOLS:					
Shelledy Elementary	653	700	980	1984	*

Continued

TABLE 11 (Continued)

	Enrollment Oct., 1981	Capacity TSY	Capacity YRS	Year That Capacity Will be Reached TSY	Year That Capacity Will be Reached YRS
ELEMENTARY SCHOOLS (Continued):					
Loma Elementary	245	350	490	1987	*
Scenic Elementary	532	425	595	1985	*
Broadway Elementary	716	475	665	1985	*
Wingate Elementary	under const.	525	735		
Pomena Elementary	421	325	455	1981	1984
Appleton Elementary	298	275	425	1981	*
Columbus Elementary	488	315	515	1984	1990
Lincoln OM Elementary	729	475	665	1984	1990
Mesa View Elementary	under const.	525	525		
Taylor Elementary	437	525	735	1986	*
Clifton Elementary	872	525	735	1981	1983
Fruitvale Elementary	756	350	490	1981	1983

Continued

TABLE 11 (Continued)

	Enrollment Oct., 1981	Capacity TSY	Capacity YRS	Year That Capacity Will be Reached TSY	Year That Capacity Will be Reached YRS
ELEMENTARY SCHOOLS (Continued):					
Chatfield Elementary	722	525	735	1981	1983
Nisley Elementary	441	425	595	1981	1983
Thunder Mountain Elementary	under const.	525	735		
Orchard Ave. Elementary	456	400	560	1981	1985
Tope Elementary	405	375	525	1981	*
Lincoln Park Elementary	370	350	490	1981	*
Columbine Elementary	425	375	525	1981	*

*Indicates beyond 1991, the limit of student forecasts.

34 support personnel on the Sheriff's Department. However, the national standard for rural law enforcement is one officer and two support personnel per 1,000 population. With a rural population of about 50,000, a deficiency exists in the amount of support staff. The budget of the MCSD may also be strained by potential improvements to jail facilities that could be federally mandated subsequent to current legal actions. The Colorado State Patrol maintains a district office in Grand Junction and serves Mesa County and part of Garfield County with 12 officers, 8 support personnel, and 14 cruisers.

Potential Impacts: As population increases, it is anticipated that the City of Fruita and Town of Palisade will continue to provide a staff level equal to or greater than the noted standard. This standard, however, may not adequately reflect the law enforcement needs of Grand Junction. Grand Junction provides the service, retail, and entertainment facilities for a much greater number of people than its municipal population indicates, and it has been assumed that the GJPD, even with an officers to population ratio above the state standards and national average, is currently understaffed (52). The Sheriff's Department is also considered to be deficient in support staff, and with the increasing rural growth, the current deficiency will be accentuated. Based on population projections, the GJPD and the Mesa County Sheriff's Department will each require 92 officers for effective law enforcement in the year 2005.

Social Services

Existing Conditions: Social services in the study area are provided by the Mesa County Department of Social Services. The services provided by this department and the number of cases in each category as of December 1981 are shown in Table 12.

TABLE 12. SOCIAL SERVICE CATEGORIES, AND NUMBER OF CASES, DECEMBER 1981 (46)

Aid to Families with Dependent Children	629
Indochinese Refugee Assistance	14
Aid to Needy Disabled	774
Aid to the Blind	18
Old Age Pension	1,333
General Assistance	24
Food Stamps	1,575
Social Services	661

In addition, there are about two dozen social service organizations serving senior citizens, handicapped individuals, retarded citizens, refugees, single parents, widowed people, and others in the study area. These organizations, along with numerous youth, fraternal, church, labor, and veterans organizations, provide a multitude of humane and charitable contributions to the community, and in many instances relieve some of the burden of government financed social services. In addition to creating a higher quality of life, the self pride resulting within the community from such positive actions should be noted.

Potential Impacts: As an increase work seeking population moves to the area, the demographic characteristics of the population will change, altering the percentages of the categories in Table 12 in relation to the total number of cases. Furthermore, the total number of cases is expected to increase. This change will become especially predominant as job seekers move into town, have few available resources, and find that jobs within the study area, along with rental housing, are scarce (25). This situation is likely as media coverage of energy development occurs which encourages the unemployed to seek employment in other areas.

Another problem affecting the Department of Social Services is the reduction of personnel due to federal budget cuts. As the population of Mesa County continues to grow, the Department could face serious problems unless additional funds are made available for staff.

Fire Protection

Existing Conditions: Fire protection in the study area is currently provided by six departments which cooperate through a mutual aid pact. Those districts, shown in Figure 10, are as follows:

- City of Grand Junction
- Palisade Rural Fire District
- Clifton Rural Fire District
- Lower Valley Rural Fire Protection District
- Central Orchard Mesa Rural Fire District
- East Orchard Mesa Rural Fire District

Fire insurance classes are established in the study area by the Insurance Service Office in accordance with the Fire Suppression Rating Schedule. These classes reflect certain specific factors of the fire department, water supply, and communications that are important to the insurance underwriters in determining fire insurance rates. The classification system is not intended as a rating of individual fire departments (45). The classification system ranges from class 1 to class 10. A rating of 10 is given to those areas that have no fire protection. Fire suppression rates in the study area range from class 6 to class 9. The City of Grand Junction is rated as class 6. The Grand

Junction rural area is rated class 9 with the exception of areas within 1,000 feet of a fire hydrant or five miles of a fire station at which the rating is increased to class 8. The City of Fruita and the Lower Valley Rural Fire Protection District are rated as class 7 to 8. The City of Palisade is rated class 8. The Clifton area is rated class 8 to 9. The Central Orchard Mesa area is rated class 9 (42).

The Grand Junction Fire Department consists of 64 professional fire fighters and has 11 trucks at four stations. The City of Fruita Fire Department is a volunteer department, with 17 to 22 volunteers and two trucks. Palisade's Fire Department is also volunteer and maintains three trucks. The Clifton Rural Fire District consists of 20 volunteer firemen, and has four trucks and one station. The Lower Valley Rural Fire Protection District consists of 25 volunteer firemen, three trucks and one station. The Central Orchard Mesa Rural Fire District consists of 18 volunteer firemen, 1 truck and 1 station. The East Orchard Mesa Rural Fire District is manned by volunteer firemen and serves the primarily agricultural area.

Grand Junction Fire Department's equipment is relatively old. The latest truck is a 1976 model and two are 1955 models (52).

Five areas in the study area are currently insufficiently served by fire protection. These areas include a narrow residential area between Grand Junction and Clifton, the area surrounding Walker Field, the area along River Road between the city limits of Grand Junction and I-70, the Redlands west of 23 Road, and the area north of I-70. The Grand Junction Fire Department plans to build an additional fire station at Walker Field which will eliminate the current inadequacy in that area. The department also plans to relocate Station #2 farther east to upgrade fire protection in the residential area between Grand Junction and Clifton (52). It has also been noted that fire departments have encountered difficulties in responding to fires in county subdivisions where the fire apparatus cannot reach a house when cars are parked on the narrow county road being used as an urban street (66).

Potential Impacts: Continued residential development in the study area will dramatically increase the demand for fire protection services. The costs of providing this service will increase significantly as the trend toward low density development continues. A major potential problem in providing the necessary fire protection is the sizing of water lines and location of fire hydrants (42). Residential developments must also be planned to facilitate access by fire-fighting equipment.

All of the fire departments in the study area will be required to continually upgrade to satisfy demand. This upgrading will require the purchase of new and better equipment as well as an increase in the number of personnel available. It is likely that the all-volunteer

departments will be forced to hire some full-time professional fire fighters.

If protection services are not maintained to meet future demands a substantial increase in insurance rates to homeowners will necessarily follow. It is obvious that inadequate fire protection will result in clear threats to life and property.

Health Care

Existing Conditions: There are currently four hospitals in Grand Junction and a combination hospital/nursing home in Fruita. These hospitals provide a total of 364 beds for patients. An additional 115 beds are available at the Veterans Administration Hospital. The U. S. Department of Human Resources and Service recommends four beds per 1,000 population. Hospitals in the Grand Junction area serve several counties in western Colorado as well as eastern Utah. An indication of the present capacity of the hospitals to serve the population is the current 80 percent occupancy rates experienced by the public hospitals in Grand Junction (St. Mary's/Mesa Memorial and the Grand Junction Osteopathic Hospital) during 1980. Part of the relatively low occupancy rate was attributed to the large percentage of younger people living in the area.

A variety of extensive services are provided by the hospitals. Due to limited financial resources and a desire not to duplicate services requiring expensive equipment, not all hospitals provide the same services. St. Mary's Hospital is currently experiencing a three phase construction and equipment acquisition program to be completed in 1989 at a total cost of $31 million. This expansion will reinforce St. Mary's status as the largest hospital and therapy center on the western slope. Also notable is the St. Mary's Air Life, a helicopter ambulance service initiated in 1980 as a joint venture between St. Mary's, Air Methods Inc., and eight energy development companies.

In addition to hospitals, six nursing homes and one rehabilitation center are found in the study area: four nursing homes located in Grand Junction, the one in Palisade, the Lower Valley Hospital and Nursing Home in Fruita, and a rehabilitation center providing both therapy and rehabilitation programs in Grand Junction. The western Colorado Health Systems Agency recommends 66.2 beds per 1,000 population over 65 years of age as a standard for nursing homes. This standard imposes a 1981 Mesa County requirement of 560 beds. The current bed total is 517.

Potential Impacts: The quality of health care in the study area is excellent and will improve as equipment acquisitions occur as part of the St. Mary's Hospital improvement program. The forecast for beds needed, however, is not a clear issue. If the present occupancy rate to population rate continues, 544 beds will be needed by the year

2005. If the ratio of beds per 1,000 population is used in coordination with the 25 percent of St. Mary's admissions during 1980 being from areas outside of Mesa County, 815 beds will be required in the year 2005. St. Mary's will add 40 beds during its construction program resulting in 404 beds available in the study area. It is anticipated that unless further improvements are planned the demand for beds will exceed the supply by 1990. With respect to long-term health care facilities, the current deficiency of beds will increase rapidly. A projected Mesa County 1985 elderly population of 11,350 will require 751 beds which is 234 beds in excess of that presently available. Thus, while the quality of medical care in the study area is excellent the future lack of available beds is indicated.

Air Transportation

Existing Conditions: Air service to the Grand Junction study area is provided at Walker Field located five miles north of Grand Junction. The study area is served by four scheduled airlines which are Continental, Frontier, Transwestern Airlines of Utah, and Aspen Airways. In addition, two charter services with a total of 36 planes, 28 pilots, and nine helicopter services are available. The Airport Master Plan written in 1974-5 is now outdated and is scheduled for revision in 1982. There were 119,000 total operations recorded at Walker Field during 1981 which more than doubled that in 1973. Due to this excessive increase, the airport is currently implementing a five year (1980-85) Capital Improvements Program that includes runway construction, land acquisition, installation of new lighting systems, and equipment acquisition.

Potential Impacts: The scheduled improvements for Walker Field indicate the anticipation of increased air traffic from commercial passengers, air taxi operations, and private use. Although the extent of anticipated increase is difficult to assess at this time, the proposed acquisition of over 1,000 acres of land will assure a zone of protection as well as provide for future airport development.

Rail Transportation

Existing Conditions: Both passenger and freight service are provided by the Denver and Rio Grande Western Railroad. Passenger trains arrive from Denver on Monday, Thursday and Saturday and from Utah on Tuesday, Friday and Sunday. Trains depart to Denver on Tuesday, Friday and Sunday and to Utah on Monday, Thursday and Saturday.

Table 13 shows the daily train movements through the study area. It is obvious that the majority of train traffic is related to freight and coal rather than passenger movement. Most freight and passenger trains move east and west while the majority of trains moving south are coal trains.

TABLE 13. DAILY TRAIN MOVEMENTS WITHIN STUDY AREA (39)

Direction	Type	Number of Trains	Cars/Train	1985 Projection Number of Trains
West	freight	16	60	16
	coal	8	80	8
	passenger	1	5	0
	local	2	N/A	N/A
East	freight	23	60	20
	coal	ca. 3	50 - 60	2
	passenger	1	5	0
	local	0	0	0
South	freight	0	0	0
	coal	8	70	8
	passenger	0	0	0
	local	1 (as needed)	2	0

Potential Impacts: The influence of railroads on passenger traffic is small compared to road and air transportation. This condition is expected to continue throughout the study period. In addition to noise impacts, railroads carry potentially hazardous materials and the probability of tank car spills, although fairly low, does exist. Chemical feedstocks, compressed gases, flammable liquids, and corrosive materials are commonly transported by rail, and historically, a typical railroad tank car spill involves 10,600 gallons (55).

Projections for future rail traffic are unavailable beyond 1985 due to the current dynamic nature of the energy industry and its extensive dependence on the railroads. Increased coal mining and oil shale development will of necessity result in increased rail movements if such development occurs. In addition, the potential merger between the Union Pacific and the Missouri Pacific Railroads will affect future rail traffic movements (6).

Increased rail traffic combined with increased road traffic may warrant the installation of grade-separated crossings at several grade-crossings. An "exposure factor" is often used to determine the need for grade-separated crossings. This factor is determined by multiplying the average daily traffic volume at the crossing by the number of daily train movements. Exposure factors above 75,000 justify a separated crossing. This recommended guideline was recognized and addressed in the Town of Palisade Comprehensive Plan. Average daily

traffic counts for all grade crossings within the study area are not currently available, which precludes the determination of exposure factors. During application reviews for federally assisted housing projects, estimations of increased traffic may be performed in association with the Colorado Department of Highways to determine if the exposure factor will be exceeded, warranting the construction of grade separated crossings. However, it is important to note that state funding and assistance for this construction is limited (9).

Road Transportation

Existing Conditions: Interstate and regional bus transportation is provided by Continental Trailways and Wilderness Transit. Fifteen taxis and nine motor freight carriers also serve the area. Recently, a countywide bus service was implemented, providing some form of transit into Grand Junction from outlying communities.

The study area is serviced by five major highways which are State Highways 6, 50, 146, 340 and Interstate 70. A highway map of the study area is shown in Figure 7. In accordance with the 20 year projected traffic volumes and current design capacities of major highway segments within the State of Colorado as reported in the 1980 Colorado Traffic Volume Study, none of the highway segments within the study area are expected to exceed their respective design capacities during the study period. However with the recent rapid development in the Clifton and Redlands areas, the design capacities of State Highways 146 and 340 respectively are currently exceeded and both are in need of expansion. In addition it appears the State Highway 6 and 50 is approaching its design capacity and it is anticipated that this design capacity will be exceeded within the study period. This discrepancy emphasizes the effects of rapid growth within the study area and is indicative of the resulting potential deterioration of infrastructure services.

To alleviate the highly congested problem on State Highway 146, a five year plan has been initiated to improve and widen this roadway and State Highway funds are available for this construction. These improvements are scheduled to begin in the summer of 1982 with the construction of a grade-separated railroad crossing.

In response to the rapid growth in the Redlands area, spot safety improvements were installed in 1980 on State Highway 340. Although these improvements assisted in reducing congestion, major expansion improvements are necessary to achieve the desired level of service throughout the study period. However funds are not available for these improvements and currently no plans are being developed. A two lane Mesa County road is currently being planned to join State Highway 340 with State Highway 6 and 50 at 24 road. This construction should remove a portion of traffic from 340 but is not anticipated to solve the major projected congestion problem.

Potential Impacts: Due to a lack of State funding for necessary roadway improvements and construction, the level of service on roadways within the study area should be anticipated to continue to deteriorate. The expansion of State Highway 146 may alleviate current traffic congestion associated with the rapid growth in the Clifton area but the completion of this construction is scheduled in five years. Continued development in the Redlands area will result in unacceptable traffic conditions in that area if funding for improvements to State Highway 340 or additional access are not made available. At this time, such necessary funding is not available.

An example of a potentially hazardous access situation is the area along State Highway 6 from Fruita to its intersection with Interstate 70, and from Clifton to Palisade. This section will be increasingly affected by commercial development along its frontage. Sections of State Highway 6 are currently two-lane and are not wide enough for protected left turn lanes.

To minimize the potential impacts associated with access to highways, the Colorado State legislature recently passed the State Access Code. Implementation of the State Access Code is the responsibility of the Colorado Department of Highways in the Grand Junction study area. Proposed developments within the study area must be reviewed by District III of the Colorado Division of Highways to assess the impacts of all new or changed access points and a permit must be received prior to construction of a new housing development. Any new housing subdivision should be submitted for review during the preliminary design stage in order that requirements can be incorporated into the design of the overall development.

Uranium Mill Tailings

Background Information: From 1950 to 1970 approximately 2.2 million tons of uranium-vanadium ore derived from the Uravan Mineral Belt was processed at the Climax Uranium Company mill. This facility was located in Grand Junction north of the Colorado River upstream from its confluence with the Gunnison River. Tailings from the operation were stored on-site except for about 300,000 tons used in construction-related activities in and around the city between 1951 and 1966. The tailings were used as foundation material and back fill under and around commercial, public, and private structures as well as base material for streets, driveways, swimming pools, and sewer lines. Preliminary surveys conducted by the Colorado Department of Health and the U. S. Public Health Service in the mid 1960's indicated excessive radon concentrations associated with these areas. Consequently the use of mill tailings was stopped. Steps were then initiated to determine acceptable radon concentrations in terms of public health as well as methods to attain these levels on sites where tailings had been used.

Radon 222 is a decay product of radium 226 which is a significant radioactive waste product found in the mill tailings. Radon 222 is one of 14 dominant decay products produced in the naturally occurring uranium 238 radioactive degradation chain. Radon is of particular concern because it occurs as a chemically inert gas with a relatively short half-life and produces a succession of particulate decay products that emit both alpha and beta particles. As a gas, radon 222 is capable of diffusing through concrete, such as a foundation slab constructed over mill tailing fill material, and accumulating in the living space above. This occurrence could result in lung exposure to the inhabitants to both the radon 222 and its short lived decay products. The deposition of these radon daughters in the lungs has been shown to produce an increased risk of lung cancer among uranium miners.

The Grand Junction remedial program was subsequently established by Public Law 92-314, approved June 16, 1972, and amended by Public Law 95-236, effective February 21, 1978. This program provides 75 percent federal assistance, when matched by 25 percent state funding, for limiting radiation exposure in structures built between January 1, 1952 through June 16, 1972 where uranium mill tailings had been used during construction. This voluntary program uses preliminary gamma testing followed by extensive radon sampling to determine the eligibility of each structure. Public Law 95-236 was enacted to extend the deadline for application to the program, clarify problems concerning reimbursement to individuals not covered in Public Law 92-314, and to authorize additional federal funding for the project.

Existing Conditions: As of August 31, 1981, 30,618 locations had been surveyed for gamma radiation. A total of 657 structures that had applied to the program were found eligible for remedial action. An additional 5,555 locations were identified as containing mill tailings but did not emit radiation levels sufficient for participation in the program. Application for inclusion in the remedial program were terminated on June 16, 1980. Of the 657 structures identified as eligible for remedial action assistance, 433 have undergone rehabilitation at a cost of approximately $12,500,000. Completion of remedial action is expected in December 1985. This program including post-remedial radon sampling is scheduled to close in March 1987.

Three forms of remedial action, or combinations of the three, are considered viable for radiation reduction. The most effective as well as the most costly is removal of the tailings from the property. Over 86 percent of the structures treated have had tailings removed to a state depository adjacent to the existing Climax tailings pile as indicated in Figure 5.

While the Grand Junction remedial program is applicable only to land with structures, the potential public health hazards resulting from the 1.9 million tons of tailings remaining at the mill site and

areas where tailings were used as fill material on property are addressed in Public Law 95-604. This law, enacted November 8, 1978, designates approximately 25 uranium mill processing sites throughout the nation. Any property in the vicinity of each site that is "contaminated with residual radioactive materials derived from such site" (2), with the exception of those sites covered under Public Law 92-314, are eligible for a 90 percent federally funded remedial program. Grand Junction has been listed as a high priority site but the initial areal and ground-level radiological surveys are not yet scheduled for this area. A recently updated engineering assessment of the 1.9 million ton mill tailing depository has been performed by Ford, Bacon and Davis Utah Inc. (17). This study presents results of radiological and trace contaminant levels in and around the 61 acre mill tailing site. This report notes that the primary health hazards result from radon gas exhalation from the pile. Additionally it was determined that soil and water contamination outside the tailings area is not significant.

Potential Impacts: While the above report delineated areas of excessive gamma radiation and radon concentrations outside the tailing site, the EPA, pursuant to the request for a technical opinion from HUD (28), determined that a potentially hazardous waste site may exist within a circle of 1-1/2 mile radius centered at the tailings pile. Housing within this area subject to HUD assistance will require testing for elevated gamma radiation levels prior to the issuance of each building permit. However, it is of interest to note that the Ford, Bacon and Davis report stated that elevated gamma radiation levels do not persist beyond 0.25 miles outside of the tailings property and has a negligible health impact to the local population compared with exposure from the more dispersed radon daughter products (17).

Presently, the Colorado Department of Health is performing radiation surveys on subdivision proposal sites. A property owner or developer may, however, sign a waiver to circumvent the survey by assuming responsibility for potentially deliterious affects of radioactive presence. This waiver is not extensively used even though the health affects of long term exposure to low level radiation from the use of mill tailings in construction related activities remains a topic of debate among the professional community in Grand Junction.

At the present time no single remedial plan for stabilizing the uranium mill tailings pile has been adopted. However, of the eight alternatives investigated in the Ford, Bacon, and Davis report, three alternatives identified disposal or stabilization sites within the study area while three other alternatives identified disposal sites located within 1-1/2 miles of the study area boundary. The process of mill tailings transportation should be reviewed in relation to potential health impacts and travel routes, including the potential impact on area housing prior to selecting the alternative.

High Voltage Lines

Existing Conditions: No electrical lines at or above 230 kV are indicated in the study area on recent highway maps.

Potential Impacts: A 500,000 kW electric generating station is proposed for construction north of Mack located near the Colorado-Ute Electric Association. This facility will require the construction of a high voltage transmission line to connect to the interregional power grid system. The exact location for this transmission line has not been established and its location designation is expected to be controversial. If located in a projected growth area, this potential hazard or nuisance corridor can be designated as a greenbelt buffer zone or otherwise publicly utilized by the local planning jurisdictions.

Canals

Existing Conditions: The extensive canal network constructed throughout the area presents two possible problems for a suburban population. First, seepage from earth lined canals produces stagnant mosquito breeding conditions. Besides being a nuisance, several mosquito species found locally are capable of transmitting human and animal diseases. The tulex tarsales may carry both western and St. Louis encephalitis which is a viral infection affecting mammals including humans. Several mosquito species may also carry Venezuelan equine encephalitis. However, encephalitis has not been reported in the area in recent years. The malaria vector mosquito, Anopheles freeborni is also found in the area, but the local meteorological conditions are not conducive to the spread of the associated virus.

A second canal related hazard exists as few protective structures such as restrictive fencing, nets before siphons, or escape ladders exist along or in the canals. This neglect becomes a problem as previously rural lands adjacent to canals become the play areas for children living in recently constructed, nearby subdivisions. Despite restrictive law, canals are presently used for unauthorized recreation and an average of three drownings per year occur in the irrigation channels. The location of canals within the study area is shown in Figure 5.

Potential Impacts: When development occurs in proximity to irrigation systems mosquito problems will persist where water seeps form breeding areas. Control of the breeding areas by county officials will depend on the identification of all seepage or standing water areas. The successful completion of stage one of the Grand Valley Unit of the Colorado River Salinity Control Project will allow the lining of irrigation channels to continue which should control the number of wet stagnant areas occurring from irrigation seeps. This action will assist in mosquito control.

The unauthorized recreational use of irrigation canals should be expected to continue unless either protective structures are installed around the canals or other sufficient recreational opportunities are provided. In relation to developing areas, subdivision developers and residents should be aware of the hazard and either erect protective barriers along canal use areas or provide recreation potential within the neighborhoods.

Pesticide and Herbicide Use

Existing Conditions: Herbicides, insecticides, fungicides, and fertilizers are the four basic types of chemicals used for agricultural purposes in the Grand Valley. Herbicides are used for weed control in fields and where vegetative growth in the irrigation canals restricts water flow. Applications of 2,4-D and similar chemicals are applied at specific areas of plant concentrations to control broadleaf weeds. In ditches with low gradients or slopes, sedimentation may occur due to low flow velocities causing silt bars to form. These areas promote algae and moss growth which is controlled by physical removal of the bars. In some instances, such as in the Price and Stub ditches, aquatic weed killers are practical. Solutions containing xylene or toluene are applied once or twice during the irrigation season.

Insecticide usage is more extensive than herbicide use in the area reflecting the greater potential economic harm from insects than from undesireable plants. Major insecticides used are parathion and malathion. The current trend is towards the use of more toxic but less persistent insecticides and herbicides. Some area orchardists have introduced the wasp macrosentrus ancylivorous to control the oriental fruit moth, peach twig bores, and coddling moths by natural predation. The wasp has been 70 to 90 percent effective in this application.

Agricultural fertilizers used reflect the general deficiency of nitrogen and phosporous found in the Grand Valley soils. Ammonium nitrate (34-0-0), phosphate (0-45-0), and ammonium phosphate (18-46-0) are the fertilizers most often used for farm crops while ammonium sulfate (21-0-0) is frequently used for orchard crops. Rates of application vary but 200-300 pounds of ammonium phosphate, and 100 pounds of ammonium nitrate per acre are typically used on larger farms.

Potential Impacts: As development continues, certain subdivisions will border productive orchards and farmlands. While this condition is favorable to homeowners in terms of noise and sight barriers, residents should be aware of the seasonal insecticide or herbicide practices, especially if aerial applications are practiced. The chemicals noted are considered safe when properly handled. However, women in the first few months of pregnancy should avoid inhalation of these airborne sprays. This potential problem may be reduced through cooperation between adjoining land owners if an awareness of the

situation initially exists. Alternatively, deed restrictions may be considered in the event of potentially severe conditions. It should be noted that, in accordance with the Colorado Revised Statutes 35-3.5-101, those engaged in agriculture cannot be considered to become public or private nuisances as a result from changes in surrounding land uses (73).

Flash Floods

Existing Conditions: Flash floods occur in areas where short duration, high intensity rainfalls occur over a high relief or otherwise relatively impermeable ground cover. Figure 2 shows the areas of potential flash flooding occurrence. Such potential exists in the study area where washes and creeks drain such areas as the Colorado National Monument and the alluvial foothills adjacent to the Book Cliffs. Specific areas of inundation related to a 100-year storm have been identified for the Big Salt, Little Salt, and Reed Washes near Fruita, Leach Creek and the Horizon Drive Channel near Grand Junction (22), and the Redlands area (26). Projected 100-year storms of various durations were detailed in the 1981 drainage report by Armstrong Engineers and Associates, Inc. (16). That report also identified drainage basins within the study area and indicates the availability of a computer program designed to predict water elevations along any specific drainage creeks or washes in relation to the time and intensity of rainfall.

Potential Impacts: As development continues, additional impervious cover will increase the amount of runoff as well as decrease the time to peak intensity. Thus, in the lower reaches of the watersheds, away from the high relief areas and closer to the Colorado River, greater impervious coverages will produce a greater volume of runoff which can peak quickly and be receding prior to augmentation from upstream flows. On the other hand, impervious cover in the mid to upper reaches causes intense runoff to reach downstream areas before the downstream runoff can flow into the Colorado River, creating greater flash flood potential.

Several flood control structures exist on creeks and washes flowing from the alluvium foothills of the Book Cliffs and the existing irrigation system is known to intercept a large amount of surface runoff (16). Although canal systems should not be considered for runoff control because canals are usually constructed with decreasing cross sectional areas downstream, it has been predicted that only in the event of an extremely severe rainfall will the canal system be unable to intercept historic runoff (16). Nevertheless, it should be noted that even with the existing drainage criteria in effect, runoff patterns should be expected to alter with development, and systematic reviews of major drainage areas should be periodically performed to determine these effects.

Odors

Existing Conditions: The occurrence of odors is a subjective topic, and no odor studies within the Grand Valley are available.

Potential Impacts: Odor complaints are referred to the local health department and usually result from industrial processes or improperly operating wastewater treatment facilities including septic tank effluent and improperly operated package treatment plants. It is not inconceivable that the Persigo Wash Treatment Plant will periodically present temporary odor problems. However, due to the plant location and prevailing winds, odors should not be experienced by residential populations. Package plants, however, are usually situated on the edge of a development where the malodorous air of a poorly operated facility is experienced throughout the development. Developments which are not serviced or which do not have access to wastewater collection lines will be prone to this condition and excessive complaints will often indicate improperly treated wastewater that constitutes an even greater health problem.

Historic Preservation/Archaeology

Existing Conditions: The study area has long been a habitation for various groups of people and therefore contains many historic and prehistoric sites and structures. In order to protect the nation's historic heritage, the National Historic Preservation Act of 1966 requires the consideration of any effect of a Federal action on significant cultural resources. Any action considered under this EIS must give due consideration to effects on cultural resources in the study area.

It is difficult to conduct a full survey of the study area to identify and assess all potential cultural resources. However, a list of all sites and structures in the study area that have been included on the National Register of Historic Places are listed in Appendix B. This list contains the addresses of each of the three listed sites and structures, and a mapping of their location is therefore not deemed necessary. In addition, this appendix contains a list of all sites and structures that have been identified as being eligible for inclusion in the National Register of Historic Places.

Potential Impacts: It is essential that the proposed action implemented by HUD be considered with specific regard to the sites and structures listed. It is also possible that development may be planned for areas that contain undiscovered cultural resources. Therefore, any action taken must give due consideration to undiscovered or unidentified cultural resources on the proposed site.

Any development proposed for federal assistance must be subject to the requirements of the Protection of Historic and Cultural

Properties, as issued by the Advisory Council on Historic Preservation (36 CFR Part 800) and adopted by the Department of Housing and Urban Development. HUD, in consultation with the State Historic Preservation Officer, is responsible for the identification of properties included in or eligible for inclusion in the National Register of Historic Places, and for the determination of any potential effect on eligible properties which might result from HUD's action. If any effect is likely to occur to the characteristics which qualify a property for the Register, HUD must request the comments of the Advisory Council on Historic Places.

Noise

General Information: The noise acceptability for any specific site is determined by the outdoor day-night average sound level (DNL) in decibels (dB). A DNL at or below 65 dB is considered acceptable while a DNL above 75 dB is unacceptable (29). Noise levels in the range between 65 and 75 dB are normally considered unacceptable for residential use but attenuation may be possible through the use of special construction techniques or the use of sound barriers situated between the sound source and the site. The primary noise sources found in the study area are roadways, railways, and airport activities. Figure 8 presents the Walker Field noise contours as well as those noise corridors within the study area where noise levels must be determined on a site specific basis. The development of noise contours for the road and rail noise sources is based on HUD guidelines (29), while the contours for Walker Field were derived by Isbill and Associates and received from the FAA (64). It should be noted that HUD requires combining noise levels from each source where more than one noise source may be present.

Existing Conditions: Road noise contours shown in Table 14 were developed from data presented in the 1980 Colorado Traffic Volume Study. That report separates vehicular traffic into four categories and provides data for State Highways 6, 50, 146, and 340 as well as the business loop of Interstate 70 in the study area. Along with each stretch of highway, a 20 year multiplier is provided which was revised for a 25 year estimate and used for noise contours projected to the year 2005.

Mesa County zoning regulations presently mandate a minimum setback distance of 100 feet from the center line of the right-of-way along major highways or roads, 80 feet from the center line of the right-of-way along secondary highways or roads, 60 feet from the center line of the right-of-way along collector streets or roads, and 50 feet from the center line of the right-of-way along other streets or roads for all residentially zoned areas. Because of these regulations, only those areas with 65 dB contours greater than 80 feet from the right-of-way centerline are presented. A detailed noise analysis for the

TABLE 14. ROAD NOISE CONTOURS

	From	To	Feet to 65 dB		Feet to 75 dB	
			Present (1980)	Future (2005)	Present (1980)	Future (2005)
HWY 70	WCl Fruita	JCT 340	140	210	29	44
	JCT 340	ECl Fruita	145	280	30	58
	JCT 6, Loop 70	26 Road	130	160	27	33
	EUl Grand Junction	Jct 70 (Clifton)	150	230	33	50
	JCT 70 (Clifton)	Jct 6 (NE Palisade)	180	275	110	61
HWY 340	22¼ Road	Monument Road	130	190	27	40
	Monument Road	WCL Grand Junction	90	140	20	31
HWY 146	B¼ Road	SH 70	90	140	20	31
HWY 50	Pitkin Avenue	Unaweek Avenue	130	170	28	37
	Unaweep Avenue	B¼ Road	170	225	36	47
	B¼ Road	SCl Grand Junction	140	185	30	39
	SCl Grand Junction	30 Road	130	170	21	28
HWY 6	Jct 340	ECl Fruita	70	110	15	23
	ECl Fruita	Weigh Station	75	115	18	28
	Weight Station	Jct 70	350	520	60	89
	Jct Loop 70 (Clifton)	Clifton	100	140	21	29
	Clifton	SWL Palisade	65	95	14	21

Abbreviations: Cl = City Limit
Ul = Urban Limit

upgrading of State Highway 146 is presented in Noise Study, Project RS 0146(5) (34).

Railway noise contours were developed for each of the western, eastern, and southern directions of Denver and Rio Grande track heading out of Grand Junction. Daily rail movements were presented in Table 13, along with a discussion of projected rail traffic estimates. Table 15 presents distances from the center of the tracks to the 65 and 75 dB levels. It should be noted that the effective distance to a certain noise level more than quadruples when the site is near a grade crossing that requires prolonged use of the train's horn or whistle. For this study excessive noise level areas are shown as noise corridors and any site within these corridors should receive a site specific noise analysis.

TABLE 15. DISTANCE FROM THE CENTER OF TRACKS TO RESPECTIVE NOISE LEVELS (feet)

Railway	65 dB	75 dB
West of Grand Junction	310* 1000	68* 210
East of Grand Junction	300* 950	64* 200
South of Grand Junction	150* 480	40* 102

*Denotes proximity to grade crossing requiring use of the train horn or whistle.

Noise rating contours for Walker Field were developed in 1975 by Isbill and Associates. Their 1984 Composite Noise Rating (CNR) contours as shown on Figure 8 are the most current noise contours for Walker Field which are acceptable to the Federal Aviation Administration (FAA). These CNR values of 100 and 115 approximate Noise Exposure Forecasts (NEF) values of 30 and 40 respectively (62). The day-night average sound level (DNL) approximates NEF + 35 (63).

The FAA anticipates adoption of new DNL noise contours for Walker Field sometime after May 1983 (64). Upon adoption by FAA, HUD will evaluate the new contours for any substantive changes (more than a 20 percent decrease or increase in area of impact) from the original CNR contours. If no substantive changes are found HUD will issue new DNL contours as a part of this EIS without comment.

Noise generated by helicopter traffic is increasing within the study area. Because helicopter flight paths are not as restricted as fixed wing craft by the FAA, helicopter noise contours are meaningless and are not plotted. Control of helicopter traffic is dependent on local ordinances.

Potential Impacts: Continual exposure to excessive noise may be physiologically damaging to animals and humans. While extreme consequences such as hearing losses may result from periodic exposure to noise levels greater than those indicated in this discussion, the continual exposure to noise levels above 65 dB may result in anxiety and/or stress reactions and subsequent internal physical damage.

Mitigation of excess noise levels is often possible by erection of barriers that may also increase the aesthetic appeal of adjoining residences. The use of wooden or earthen barriers is most effective for road and rail noise mitigation but not necessarily effective for airport noise reduction.

Air Quality

Existing Conditions: Air quality in the Grand Junction area is reported through the Air Quality Program of the Colorado Department of Health. This program maintains three particulate and one gaseous pollutants monitoring sites within the study area in addition to a particulate pollutant monitoring site located just outside of the eastern boundary on the Colorado River at Island Acres State Park. The location of these facilities is shown in Figure 5. Particulate pollutants monitored include total suspended particulates (TSP), lead, iron, manganese, nitrates, and sulfates, and total thoracic particulates (TTP). Gaseous pollutants monitored include carbon monoxide and sulfur dioxide. Nitrogen dioxide and nitric oxide are not measured by the Colorado Department of Health in the Grand Junction area. Sources and health affects of lead, carbon monoxide, and TSP are found in the 1980 Colorado Air Quality Data Report (3). Additional data as reported in the 1980 report for each of the above parameters in the study area is presented in Appendix C.

Total suspended particulate levels are high throughout the study area and the part of Grand Junction that exceeds primary TSP standards (shown in Figure 5) formed the basis for the 1980 designation of the entire study area, except for that portion East of 25 Road and North of J Road (essentially the portion of the study area comprising the Book Cliffs), as a TSP nonattainment area. As a consequence, the state implementation plan, designed to reduce the TSP concentrations within the nonattainment area applies throughout the projected growth areas shown in Figure 1, and actions that could decrease the air quality or delay the attainment of TSP standards would necessitate specific

mitigation measures to comply with Section 176(c) of the Clean Air Act (77).

Studies released in 1978 (11,27) showed that the major particulate sources contributing to the nonattainment status were roadways (paved and unpaved), cleared areas, vehicular exhaust, fuel combustion, and construction practices. Suggestions and cost analysis for a remedial program are presented in Table 16. A computer model was used by the Colorado Department of Health to predict TSP levels under the proposed implementation program. Twelve point sources were identified, of which two, the Gray Western Refinery west of Fruita and the Cameo power plant east of Palisade are considered major point sources. The power plant was not considered in the predictive modeling because of its location "in complex terrain" and the refinery was assessed as producing 98 percent of the 8,970 tons of particulate emissions annually. The refinery was modeled as maintaining its 1977 level of particulate emissions and continued to show a major impact in the Fruita area. However, this level is currently within federal standards for TSP and it is predicted to stay within the standards (27). This point source combined with all other point sources accounted for less than 2.5 percent of the particulate concentration found in the nonattainment area. Therefore, while the refinery is a major particulate source for Fruita, it is a minor particulate source for the Grand Junction nonattainment area.

Potential Impacts: The major particulate emission sources for the nonattainment area were determined to be 1) traffic related (unpaved roads, reentrained dust from paved roads, exhaust), 2) coal and wood combustion, and 3) dust from construction activities. Increased development indicates that none of the above three particulate emission activities should be expected to decrease. Furthermore, the incidence of climatic inversions occurring within Grand Valley is well-documented, especially during the winter when particulate concentrations "hang" over Grand Junction. The increased popularity of wood and coal burning stoves coupled with the availability of both fuel sources aggravates this problem during the cold months. Of the methods proposed to reduce the particulate emissions, none were directed at the control of coal and wood combustion and only one is directly applicable to construction activities. As vehicular traffic continues, smog precursors, especially oxides of nitrogen, should increase creating greater potential for smog formation. Oxides of nitrogen are not currently monitored within the study area.

It should also be noted that part of the decision to locate the proposed 500,000 kilowatt generating unit on the site north of Mack was a result of air quality considerations. The unit is scheduled to provide particulate, sulfur dioxide, and nitrogen oxides controls using baghouse filters, a flue gas scrubber, and advanced boiler design. Any emissions from this plant will be more pronounced in the Fruita area.

TABLE 16. GRAND JUNCTION TSP PREMEDIAL PROGRAM (11)

System	Costs		Air Quality Benefits
	Government	Public & Private	Reduction from Anticipated 86.0 $\mu g/m^3$ 1982 Geometric Mean
Expanded bikeway network	$ 25,800 startup	--	0.4 $\mu g/m^3$ Combined
Increased carpooling	Minor	Minor	
Improved mass transit	N/A	N/A	Not Significant
Control of major dirt and mud carryout sources	$ 9,000/year	$ 8,375/site/year	3-4 $\mu g/m^3$
Improved street cleaning	$100,700/year	--	1.8 $\mu g/m^3$
Paving & stabilizing unpaved roads and alleys	$576,000 initial plus $400-9,300/year*	--	4.4 $\mu g/m^3$
Chemical stabilization of railroad yards	$3,500/year	$27,600-77,00/year	6.7 $\mu g/m^3$

*Stabilization costs of unpavedroads would be $11,200 to $20,130 per year but savings from reduced maintenance costs of proposed paved roads would save $10,800 per year.

Endangered Species

Existing Conditions: In general, the Endangered Species Act (ESA) prevents the disruption of listed species of plants and their necessary habitats by man's activities. The State of Colorado also restricts the disturbance of the plants and animals on the federal list as well as those species on the state's list.

In a letter dated 23 December 1981, Area 5 of the U.S. Fish and Wildlife Service stated that the "following Federally listed threatened or endangered species may be expected to occur within or near the impacted area" (43):

FISH

Colorado squawfish (Ptychocheilus lucius)
Humpback chub (Gila cypha)
Bonytail chub (Gila elegans)

BIRDS

American peregrine falcon (Falco peregrinus anatum)
Arctic peregrine falcon (Falco peregrinus tundrius)
Bald eagle (Haliaeetus leucocephalus)

MAMMALS

Black-footed ferret (Mustela nigripes)

PLANTS

Spineless hedgehog cactus (Echinocereus triglochidiatus var. inermis)
Uinta Basin hookless cactus (Sclerocactus glaucus)

The following is an additional list of endangered or threatened species that have been found in nearby counties and may possibly be found in the study area:

FISH

Razorback sucker (Xyrauchen texanus) (4, 30)
Greenback cutthroat trout (Salmo clarki stomias) (12)

BIRDS

Eskimo curlew (Numernius borealis) (12)
Whooping crane (Grus americana) (4)

PLANTS

Knowlton's hedgehog cactus (Pediocactus knowltonii) (12, 50)
Mesa-verde cactus (Sclerocactus mesae-verdae) (12, 50)

In addition it was mentioned that four more plant species from Mesa County had been proposed by the USFWS (December 1981) as candidates for the threatened and endangered list. These are:

Grand Junction milkvetch (Astragalus linifolius)
Catseye (Cryptantha aperta)
Catseye cliffdwellers candlestick (Cryptantha elata)
Phacelia (Phacelia submutica)

Under the Colorado Department of Natural Resources, Colorado Natural Areas Program, the State of Colorado also identifies two reptiles of Special Concern which are the longnose leopard lizard (Gambelia wislizenii) and the western yellowbelly racer (Coluber constrictor mormon). The USFWS has also listed the Lomatium latilobum on the Notice of Review Category 2 taxon (75).

A Mapping of the habitats of threatened and endangered species within the study area has not been included for the following reasons. The noted fish species are found in the rivers of the study area and all of the Colorado and Gunnison River portions within the study area are their habitats. While the references cited list the study area as "potential habitat" for the endangered species of birds discussed, none of the area is shown as critical habitat, although river bottom woodlands are potential resting places for the bald eagle, and the U.S. Department of Interim has indicated that bald eagles are seen within the study area, particularly around Fruita, during the winter (71). Also, no maps were found in the references that show any particular portions of the study area as habitat for the endangered species of plants listed. Although some of these plants may be growing in the study area, knowledge of specific population locations does not exist. State maps indicating known localities of endangered, threatened, rare, and Special Concern species are retained by the Colorado Natural Heritage Inventory and are available upon request (75).

Potential Impacts: It is possible that housing developments in the study area will be proposed for areas that contain one or more of the above listed species. Site specific inspections are unavoidable for most proposed developments since the exact locations of all populations of all of these species is currently unknown. Small populations of the plants are especially likely to be overlooked by general surveys of the entire study area. Several generalizations concerning potential impacts are possible since previous requests by HUD for consultation from the USFWS concerning the effects of housing developments near the study area

(specifically the Battlement Mesa Community Development Project, Northeast of Grand Junction) may be partially applicable.

The Bald Eagle is known to winter in the river edge forest both north and south of the Grand Junction area. Eagles usually avoid concentrations of people and would therefore be further adversely affected by increased population pressures near the river within the study area. The USFWS "biological opinion" for the Battlement Mesa development suggests several mitigating measures for the potential effects to the eagle populations. These measures are not specified in this report but are included by reference to the Battlement Mesa opinion (41).

More detailed studies have been completed addressing the populations of endangered fish mentioned above. In general, housing developments in the study area are not expected to have significant negative effects on the likelihood of continued survival of the species. However, the reduction of instream river flows caused by consumptive use of water by the increased human population will probably be determined by the USFWS to be "reasonably expected to appreciably reduce the likelihood of recovery of the endangered fish species" (41). The deleterious effects of increased water depletion on endangered species is also noted in the biological opinion developed for the Ridges subdivision. The Ridges biological opinion states, "As a result of the CRFP study the FWS has determined that the Colorado squawfish and humpback chub are experiencing declines in their present habitat and without active reclamation action will become extinct. Any further degradation of their environment such as water depletion will likely accelerate the extinction of their species if not properly offset by active conservation measures" (67,70).

In addition to those species officially listed as endangered, other wildlife important to the study area will be significantly affected as growth continues to expand into the rural areas. For example, a small resident mule deer herd is known to exist along and use the Colorado River bottom year round within the Grand Junction study area. As growth continues it is suspected that this entire deer population will be removed from the area.

The Grand Valley also supports a significant pheasant population providing a recreational hunting value as well as a wildlife value. As rural areas are removed for development, this pheasant population should be expected to decrease with a corresponding recreational and wildlife loss. Nuisance animals such as skunks and raccoons, can be expected to increase (74).

Floodplains

Existing Conditions: The 100-year floodplain for the unincorporated areas of Mesa county were delineated in a 1978 Flood Insurance Study conducted by the Federal Insurance Administration (FIA) (22). Specific water courses studied included the Colorado and Gunnison Rivers and Leach Creek and the Horizon Drive Channel near Grand Junction. Results of this study are presented in Figure 9. The 100-year floodplain for Fruita was prepared by the FIA in 1981 (23) and for Grand Junction in 1978 (21). Flood hazard information for the Colorado River within the town of Palisade was prepared for the county in 1978 and the Indian Wash floodplain study is in progress (72).

Flooding on the Colorado and Gunnison Rivers results from rapid snow melt in the higher elevations during May, June, and July. Rainfall on melting snow may increase the flood flow that is characteristically large volume, long duration, of moderate peak flows, and often displays a diurnal fluctuation. The major floods found in the smaller watersheds, the creeks, streams, and washes, are usually caused by cloudbursts occurring over areas of slowly permeable soils. These convective-type storms are common during the late summer and early fall, are of small areal extent, and produce about half of the annual precipitation within the Grand Valley. Seven major floods have occurred on the Colorado River since records began with the most recent being June 1957. Flooding of this river has resulted in inundation of streets, lawns, and gardens and deposition of sand, silt, and debris, and flooding of basements and lower floors in the Riverside Park, Rosevale, and Connecticut Lakes sections southwest of Grand Junction. Farming and ranching operations along the river have experienced lost crops, damaged orchards, and isolation of people and cattle.

Flooding has been controlled through dam and levee construction and, more recently, through the imposition of county ordinances. Levees exist along the south bank of the Colorado River west of the confluence of the Gunnison River and the north bank upstream from the Grand Avenue bridge. These structures provide protection to residents in the Connecticut Lakes and Riverside Park areas, respectively. A levee along the east bank of the Gunnison River protects the Atomic Energy Commission installation. A Soil Conservation Service floodwater-retarding structure built on Indian Wash near the Book Cliffs provides protection from the 100 year flood to the eastern portion of Grand Junction.

Potential Impacts: Executive Order 11988 mandates that all agencies participating in any action related to floodplain areas must "act, not merely consider, reducing risk, minimizing adverse impacts, and restoring and preserving floodplain values" (24). An eight step decision-making process was developed for agencies involved to follow in order to satisfy E.O. 11988 (24). These steps are as follows:

1. Determine if the proposed agency action is located within the 100-year floodplain. This step may be performed in the study area by using the existing floodway maps published by National Flood Insurance Agency.

2. The agency must publicize its intent to locate the proposed action in the 100-year floodplain.

3. All practical alternatives to locating in this floodplain must be identified and evaluated.

4. All impacts of the proposed action in the floodplain must be identified. In addition the agency must determined whether the action might support floodplain development that has additional impacts.

5. Identifiable impacts must be minimized.

6. The proposed alternative is, at this time, reevaluated in relation to the conclusions of steps 3, 4, and 5.

7. If the agency head determines that the only practical alternative is to locate the action in the floodplain, public notice of the reasons for this decision and the alternatives considered must be given.

8. The proposed action may be implemented after allowing a reasonable amount of public response time.

In addition to this federal mandate, Mesa County has adopted floodplain regulations and incorporated low hazard and floodway zones into county zoning maps. New or revised development in these areas is subject to approval of the County Commission and must exclude (32):

1. storage of floatable or potentially detrimental material,
2. disposal of solid wastes,
3. residential use,
4. creation or deposition of additional debris, and
5. introduction of fill, structures, or storage materials that could adversely affect the flood flow.

The Fruita ordinance concerning the floodplain states that "no building can occur" in these areas (8).

As previously discussed, the floodplain of the Colorado River contains large amounts of fairly easily recoverable sand and gravel deposits that should be secured for rational use and future availability. These deposits are not controlled by current zoning regulations. Previous gravel operations have reclaimed mined areas into park and wildlife areas and this practice should be further encouraged. The parks and recreation master plan (35) has proposed a Colorado River Park

System encompassing 12 miles of Colorado River shoreline to be developed into 21 recreational sites, at least one of which is currently an ongoing gravel operation. Proper development of this park system will control development in the floodplain, increase inner city recreational opportunities, and possibly provide a tourist/retail zone such as in Denver.

Wetlands

Existing Conditions: The wetlands of the study area are found primarily along the main channels of the Colorado and Gunnison Rivers. However, many small, seasonal wetland communities are found along the larger tributary creeks and at seepage areas adjacent to irrigation canals within the study area. These are primarily cattail marshes that grow during the spring and summer and dry up during the fall and winter.

In the predominantly agricultural setting of the Grand Junction area, these small wetlands provide habitat for a variety of wildlife that would not otherwise be able to survive. Some of these "wetlands" fall under the jurisdiction of the U.S. Army Corps of Engineers (COE), i.e., they contain wetland species of vegetation and are found in conjunction with rivers having an average annual flow of 5 cfs or greater. Although the COE may extend their jurisdiction to any "environmentally significant wetland" regardless of size, many of the smaller "wetland" areas will probably not be considered within the COE jurisdiction because they are extremely small, ephemeral, and will not remain after lining of the irrigation canals is completed by the Grand Valley Salinity Control Project.

Potential Impacts: Executive Order No. 11990, May 24, 1977, directed federal agencies to ensure the protection of the Nation's wetland areas. Maps delineating known wetlands in the area should be completed during 1982 by the U.S. Fish and Wildlife Service for the National Wetland Inventory Program. These maps will give the potential developer an initial understanding of the extent and sitings of wetlands that could require special considerations. Only those areas that currently contain wetland habitat should present developmental concerns since no more wetland is expected to be naturally created within the study area in the near future. At such time as these maps become available they will be disseminated to all recipients of this statement to be incorporated into this statement. Such incorporation should not be construed as a statement supplement, amendment, or addendum but as additional information which will not effect HUD's action as a result of this statement.

Although it is possible to build a housing development on a wetland area, the mitigation of the loss of wetland habitat may be extremely costly to the developer. Proposed mitigation criteria include (51): 1. Creation of wetlands at a ratio appropriate to the value of

the filled habitat (typically from 3:1 to 10:1), 2. Stream habitat improvement, 3. Conveyance of the improved wetland to a public agency or group for management, 4. Linking of the created wetland with a larger wildlife area. Other mitigation techniques are listed in this publication for compensation of loss of wetland habitat of varying significance. Although these are not necessarily officially binding on housing developers, they show the potential mitigation measures that developers may be requested to commit funds for, prior to being able to proceed with planned development in a wetland area.

It is generally suggested that housing developments be located away from wetland areas so that they not produce adverse effects on nearby wetlands. These conditions will avoid the problems discussed above.

ADVERSE AND UNAVOIDABLE IMPACTS WHICH CANNOT BE AVOIDED

Potential impacts resulting from housing developments within the study area have been discussed in the specific sections. The following is a summation of adverse and unavoidable impacts that may be anticipated should present and historical conditions persist.

1. The primary mineral resource found in the study area, sand and gravel, will be irreversible utilized in construction related activities.

2. The extent of prime and unique farmlands will diminish, and production of those crops associated with prime and unique farmlands will subsequently decrease.

3. Unconfined ground water may diminish in quality, depending on the continuation of the Grand Valley Salinity Control Project, the cessation of agricultural irrigation on farmlands that become housing areas, and the extent of urban irrigation.

4. Some quantity of flow will be lost from the Colorado River as local water supplies originate within that watershed.

5. The ammonia concentration of the Colorado River will increase as the amount of treated and discharged wastewater increases, creating a potentially toxic environment for local fish populations.

6. Noise levels in the identified corridors and in proximity to the Walker Field Airport will increase.

7. Endangered species of birds, fish, and plants, and possibly one mammel, may experience habitat reduction and a subsequent loss of survival potential.

8. Certain small wetland areas may be eliminated, reducing the habitat of indigenous wildlife species.

9. Air quality within the study area will continue to deteriorate as particulate and smog precursor emissions are increased.

10. Some aspects of the physical environment are preclusive to development, i.e., their impact will be on housing development instead of from housing development. These issues include excessive slopes, corrosive and high shrink-swell potential soils, a high seasonal water table, uranium mill tailings, and floodplains.

11. The high cost of housing presently prevents the majority of families from purchasing housing. Rental property in the study area is currently scarce, and the future demand for rental units is expected to exceed the future demand for owner occupied houses.

12. Anticipated development, especially industrial and commercial, will increase the peak intensity loads of stormwater runoff drainage paths.

13. Overcrowding in schools will exist, but recent construction and facilities improvements should alleviate the immediate overcrowding problem.

14. Water pressure and storage problems will persist in some areas with marginal fire protection due to inadequacies in the water distribution systems.

15. Social service demands should be expected to increase at the expense of local taxpayers.

16. While the quality of health care is excellent, the number of available hospital and health care beds will fall below the desired level. This impact will be especially poignant with regard to potential nursing home patients.

17. Traffic conjestion will worsen, and access problems onto major arteries will continue. If additional funds are not made available for highway improvements, traffic conditions in specific areas such as the Redlands will become unacceptable.

18. Air traffic through Walker Field will increase, necessitating the improvements noted in the current five year plan as a minimum requirement to meet future demands.

19. Canals will continue to be a hazard from unauthorized use.

How Unavoidable Adverse Impacts May Be Mitigated

The following is a discussion of potential mitigation procedures for minimizing the adverse impacts stated above. These procedures are not absolute, and any procedure actually implemented will require an extensive analysis of the situation that is far beyond the scope of this EIS.

1. Sand and gravel deposits are somewhat protected by their occurrence within the 100 year flood boundaries. Zoning ordinances are not currently capable of controlling this resource, but could be revised for this purpose. Also, deposits should be mined as close to their use site as possible to minimize road spill and the associated increase in particulate emissions from paved roads.

2. Prime and unique farmland preservation must occur on the local level and should be based on economic and environmental considerations, the needs of future generations, the social benefits derived from agriculture and any other considerations which local governments identify as important (73). Several techniques are available and can be implemented to incourage agricultural preservation. Alternative techniques include tax incentives, transfer or purchase of development rights, and formation of special districts. Tax incentives by basing the assessed value of agricultural property on its value as agricultural land rather than then higher market value assessed for residential or development property is used in Colorado and has been found to be effective, at least temporarily, for preserving agricultural land. Transfer of development rights can be used to restrict the use of specific property by transferring the right to develop that property to another piece of land. This technique is only useful if development is carefully controlled and restricted by local entities. This technique is useful in restricting development on a long-term basis, but is difficult to implement due to the problem of locating alternative desired sites. Purchase of Development Rights can be used whereby ownership of the land does not change. This technique is effective but is costly to the jurisdiction which purchases the development rights (9). Special districts can also be formed in which agricultural landowners agree to maintain land in agricultural use. This technique can be effective but depends on voluntary participation by all landowners in the district and cannot be implemented on an individual basis (9).

3. The problems with unconfined ground water quality, if found to persist after the Salinity Control Project is implemented and if found to result from urban irrigation, will require either education of the homeowner regarding efficiency of lawn and garden watering,

and/or imposition of watering controls either through local ordinances or increased cost of water.

4. As long as surface water remains the primary water source in the study area, loss of Colorado River water through domestic use should be expected. The determination of the adverse effect, if any, on endangered aquatic species by a housing development will be made on a site-by-site basis. In the event of such a determination, appropriate mitigation measures must be developed in consultation with the U.S. Fish and Wildlife Service. These measures may include, but not necessarily be limited to, development of water resources which are not part of the Colorado River system or participation with the U.S. Fish and Wildlife Service in a plan for recovery of these species. This participation could be similar to that agreed to by the developers of the Ridges subdivision in Grand Junction and the new town of Battlement Mesa. The participation agreement was based on the percentage of the annual depletion of the flow of the Colorado River caused by their development. The participation in this recovery plan by these developers was strictly voluntary as HUD has determined that there is no basis at this time to solicit developer participation.

HUD Headquarters staff and the U.S. Department of Interior Endangered Species staff are currently discussing a policy agreement concerning endangered species. In addition, the General Counsel's Office of HUD has been asked for a legal interpretation of HUD's responsibility in this matter in view of the limited ability of HUD to control decision-making and subsequent related activities.

5. If the species of fish which inhabit the wastewater receiving waters are found to suffer from ammonia toxicity, treatment plant improvements incorporating nitrogen removal should be considered. Additionally the installation of a diffuser outfall at the Persigo Wastewater Treatment Plant may be necessary.

6. Noise is difficult to control or mitigate but may be buffered through use of wooden or earthen barriers. Certain home construction techniques may also minimize noise impacts. Barriers should be used when development occurs adjacent to noise corridors and excess noise corridors should be zoned appropriately.

7. Habitat of the endangered species should be delineated and protective measures implemented. A biological search for the noted plants should be conducted at all development sites to develop a plan to prevent their destruction.

8. Many of the small, seasonal wetland areas will be removed after the Salinity Control Project is implemented. For other wetlands, developers may mitigate adverse impacts by 1) creating new wetlands, 2)

improving stream habitat, 3) allowing a public agency manage the wetland, or 4) link created wetland with a larger wildlife area (51).

9. Particulate and smog problems will persist within the study area as particulate emissions are naturally high in this semi-arid area. Of the control measures proposed (11), the control of mud and dirt carryout, road paving and stabilization, and stabilizing railroad yards would be most effective but would also be most expensive. Construction practices that could minimize air quality deterioration include the use of water when scraping land, installing wind screens, furrowing perpendicular to the prevailing wind direction, and wetting down or planting vegitation on dirt piles (69). Air quality problems resulting from the use of fireplaces or wood stoves is minimized by proper combustion, fuel, and equipment. Poor combustion or the use of green, sappy wood will produce air pollutants as well as present a safety problem with stack residues. Wood burning stoves should be air tight and stacks should be tall enough to allow the proper draw (69).

10. Constraints imposed by the physical environment may often be resolved through engineering. However, in many cases, the expense is not justifiable. High shrink-swell potential and corrosive soils often require special construction techniques but the soils must be identified prior to foundation placement. Steep slopes present problems with utilities placement as well as instability and rockfall or landslide potential. High seasonal water tables preclude the use of septic tanks, and floodplain development must respond to Executive Order 11988.

11. The affordability of housing is being reviewed at several levels of government. However some home builders are also actively addressing the problem. One builder has sold 150 homes in the Grand Junction area by selling the houses separate from the land on which they are constructed. After a period the developer intends to sell the lots to the respective home owners. Until housing becomes affordable, rental units will remain in high demand in this area.

12. As impervious cover increases within a given drainage basin the respective peak runoff indicators should be periodically revised. Even cities with zero increased runoff drainage regulations have experienced substantial 100-year flood crest increases, and in at least one instance, severe flooding occurred causing extensive property damage and loss of lives. Commercial and industrial development should be encouraged in the lower portion of individual drainage areas instead of the upper reaches. Other mitigation procedures involve improving the hydraulic conductivity of the drainage channels through the removal of brush and snags, dredging bars, straightening bends, or lining the channels. Dredging and debris removal must constitute an ongoing program to be effective, while lining should use stepped sidewalls where the channel passes through residential sections and is otherwise not protected from unauthorized access. It should also be noted that

channel improvements, while increasing the capacity of the channel, may also increase erosion and cause ground instability in and adjacent to the stream. These conditions indicate the need for nonstructural solutions, including good floodplain zoning practices, for adequate flood control (72).

13. Eight schools are being or will soon be constructed, but the location of new schools is determined by anticipating development. The implementation of a year round school year is also being considered to alleviate overcrowding.

14. The original water distribution system for several portions of the study area was constructed in the 1940's and 1950's with cast iron pipe. Alkaline soils and seasonally high corrosive ground waters have deteriorated several pipelines, including main distribution lines, to the extent that replacement will soon be necessary. However, anticipated development demands for additional pipelines will supercede the pipeline replace demands due to deterioration. The water tanks being installed and planned by the Ute Water Conservancy District will provide a larger quantity of stored water. Fire protection, however, is limited not only by stored water capacity but also by the design of the distribution components. When distribution line sizes are small and pressures are low, fire protection capacity may not be sufficient irrespective of storage capacity. Local water supplies may also be extended by incorporating dwelling and landscaping water conservation measures (68).

15. Social services are funded primarily by state and federal actions, and if federal funds are reduced, state funds and energy related revenue sources should be investigated as funding alternatives. Alternatively, the multitude of social and human service organizations within the Grand Junction area may form a basis for the private sector to assume much of the responsibility for providing these services. The type of services extended by the private sector will reflect local attitudes, however, and some form of government organization is usually needed to assure that all of those qualified receive assistance.

16. After completion of the currently planned hospital improvements, a need for additional hospital and health care beds will exist. A strong capital improvements program may be needed, and the construction of nursing homes should be paramount.

17. The state highway system within the study area will not be sufficient to commute individuals from home to work, and new major roadways should be anticipated, especially in the Redlands area. Also, while that part of the study area north of the Colorado River and east of the Gunnison River has a sectional cross-grid road pattern, the roads being built in developments in the Redlands are not interconnected. These roads generally exit SH 340 branch and end in cul-de-sacs.

Consideration should be given to reducing this dendritic pattern in favor of a more continuous road pattern.

18. Walker Field is the second busiest airport in the state, primarily due to private and air taxi operations. Large scale improvements are currently ongoing, and the updated Master Plan, when completed, should provide the direction needed to implement improvements in the future.

19. Subdivisions in proximity to canals should attempt to make canal use unattractive either through restrictive barriers or by providing alternative recreational facilities.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Trade-off Between Short-Term Environmental Gains at the Expense of Long-Term Losses

Under current policies, the short-term gains are restricted to providing housing for the population that is increasing from people transferring into the area in an attempt to capitalize on the local economic surge. Long-term losses will include the loss of prime and unique farmland, increased air pollution, surface water degradation in both quality and quantity, increased noise, decrease in the habitat of and subsequently population of indigenous animals, and the potentially adverse effects on endangered fish living in the Colorado River. Also, if the area becomes a "boom town," there exists the possibility of a subsequent "bust." Should energy development be curtailed, a decline may occur due to actions beyond the control of local residents. The local economy would recede and the developments would become surplus housing.

Trade-Off Between Long-Term Environmental Gains at the Expense of Short-Term Losses

Long-term environmental gains will be realized only if the communities involved work together to form a cohesive and effective infrastructure network to form the basis for a rational and quality growth. Short-term losses will be in terms of community services and will lag behind development until a financial base equivalent to the population's needs can be realized.

Extent to Which Future Options are Foreclosed

The land available for housing within the study area has been constrained by the physical surroundings. Development is precluded in much of the area by excessive slopes and floodplain zones, and much of

the remaining area consists of agricultural lands. Continued development will remove agricultural land from the county. Also, the migration of people into the area is and will continue to overwhelm the lifestyles of long time residents to the extent that the control of growth and beliefs regarding quality of life will be shifted to the mass of recent arrivals. It is consequently the responsibility of the new residents to respond to quality of life decisions. If no concern is voiced, the effective implementation of a growth plan will be remote.

Irreversible or Irretrievable Commitments of Resources

Material: Irretrievable material resources committed to the area will include those used in the construction industry and the energy required for transportation. These will include:

sand and gravel,
lumber,
petrochemical products, and
glass.

Natural: Natural resources that would be irretrievably lost during development include:

natural vegetation,
small animals,
large animal habitat, and
farmland.

Cultural: The irretrievable loss of cultural resources will have to be determined on a site specific basis. Numerous sites of potential archaeological and/or historical significance exist within the study area. Sites of archaeological/historical significance are presented in the appendices. Cultural resources determined to be eligible and which may be affected will be afforded protection as set forth in 36 CFR Part 800.

ENVIRONMENTAL GUIDELINES FOR APPROVAL OF HOUSING APPLICATIONS

Assistance and/or insurance for housing proposals will be approved provided that the following conditions are met. Issues not included in these guidelines are beyond the scope of HUD's authority and responsibility.

Housing Location

Proposals located within the projected growth areas as indicated in Figure 1 will be approved without further regard to this issue. All other proposals will be considered on a case-by-case basis. HUD

encourages growth and development within the projected growth areas but recognizes the prerogative of local governing bodies in this matter.

Terrain

Proposals located outside areas of steep slopes or slope instability as indicated in Figure 2 will be approved without further consideration of this issue. Proposals located within areas of steep slopes or slope instability must be accompanied by an assurance that the recommendations for construction prepared by a qualified professional will be followed. HUD discourages any construction on steep slopes or slope areas of instability.

Mineral Resources

Proposals located in areas containing mineral resources will be approved without further regard to this issue. HUD recognizes the prerogative of local governing bodies to approve development in such areas. The primary mineral resources located within the study area have been identified as sand and gravel. The recovery of these resources is most economically feasible within the Colorado River floodplain. HUD's required compliance with Executive Order 11988 provides the maximum protection of these resources available to HUD.

Prime and Unique Farmlands

Proposals located outside those areas of prime and/or unique farmland as indicated in Figure 4 will be approved without further consideration of this issue. HUD discourages the use of such lands for housing development but recognizes the prerogative of local governing bodies to approve such use. Therefore, proposals located within those areas of prime and/or unique farmlands as indicated in Figure 4 will be approved on a case-by-case basis.

Ground Water

Proposals located north of the Colorado River must be accompanied by an assurance that the recommendations for foundation construction contained in a soils investigation report prepared by a qualified professional will be followed. Proposals located south of the Colorado River will be considered on a case-by-case basis concerning this issue.

Storm Water Disposal

Proposals will be approved without further consideration of this issue provided that they are accompanied by a certification that the drainage system design has been approved by the local governing body, is equivalent to HUD's standards, and that the design specifications will be followed.

Sewage Treatment

Proposals will be approved without further consideration of this issue until June 1985, at which time the capacities will be reassessed. If the new capacities of sewage treatment facilities are not exceeded at that time approvals will continue without further consideration of this issue until capacities are exceeded.

Solid Waste

Proposals will be approved without further consideration of this issue until June 1987. At such time the capacities of existing landfills will be reassessed and if capacities have not been exceeded approvals will continue without further consideration of this issue.

Fire Protection

Proposals located in areas having ISO ratings of 1 through 8 will be approved without further consideration of this issue. Proposals located in areas having an ISO rating of 9 or 10 will be considered on a case-by-case basis and approved only after the applicant has demonstrated to HUD's satisfaction that provision of resources and/or facilities necessary to lower the fire rating to 8 or below is not feasible.

Noise

Proposals which are located in areas where the noise levels are "acceptable" (lower than 65 LDN) will be approved without further consideration of this issue. Those proposals which are located in "normally unacceptable" noise areas (65-75 LDN) will only be approved if the applicant can demonstrate that the noise can be attenuated in accordance with HUD Regulations (24 CFR Part 51). Those proposals which are located in "unacceptable" noise areas (greater than 75 DNL) will normally be rejected, but may be considered on a case-by-case basis.

Man-Made Hazards Uranium Mill Tailings

Proposals located in an area within 1-1/2 miles of the Grand Junction Uranium Mill Tailings site as indicated on Figure 5 will be approved only after review and determination by the Environmental Protection Agency (EPA) that no health or safety hazards to the residents of the proposal will be posed by this site.

All other proposals will be approved without further consideration of this issue provided that they are accompanied by documentation certifying that the site has been tested by the Colorado State Department of Health for elevated gamma ray readings and that any

materials producing elevated gamma ray readings have been or will be removed from the site of the proposal.

Man-Made Hazards - Irrigation Canals

Proposals which do not immediately abut or include any of the irrigation canals as indicated in Figure 5 will be approved without further consideration of this issue.

Proposals which immediately abut or include any of the irrigation canals as indicated in Figure 5 will be approved provided that the applicant restricts access to the canals in a manner acceptable to HUD.

Floodplains

Proposals located outside the identified 100-year floodplains will be approved without further consideration of this item. Proposals totally or partially located in the identified 100-year floodplain as indicated on Figure 9 and all appropriate Federal Emergency Management Agency floodplain maps will be approved only if HUD determines that such proposal is the only practicable alternative as required by E.O. 11988.

Wetlands

Proposals outside of Wetlands as defined in E.O. 11990 will be approved without further consideration of this issue. Proposals located in Wetlands (totally or partially) will only be approved if HUD determines that the proposal is the only practicable alternative as required by E.O. 11990.

Historic/Archaeological Resources

Proposals will be subject to a site-specific assessment of this issue. Eligible resources which are identified will be afforded protection as set forth in 36 CFR Part 800.

Endangered and/or Threatened Species

All proposals will be subject to a site specific assessment of this issue. Only those species and/or habitat specifically affected by the proposal will be afforded the protection required by the Endangered Species Act of 1973, as amended (Public Law 93-205) and as set forth in 50 CFR Part 402.

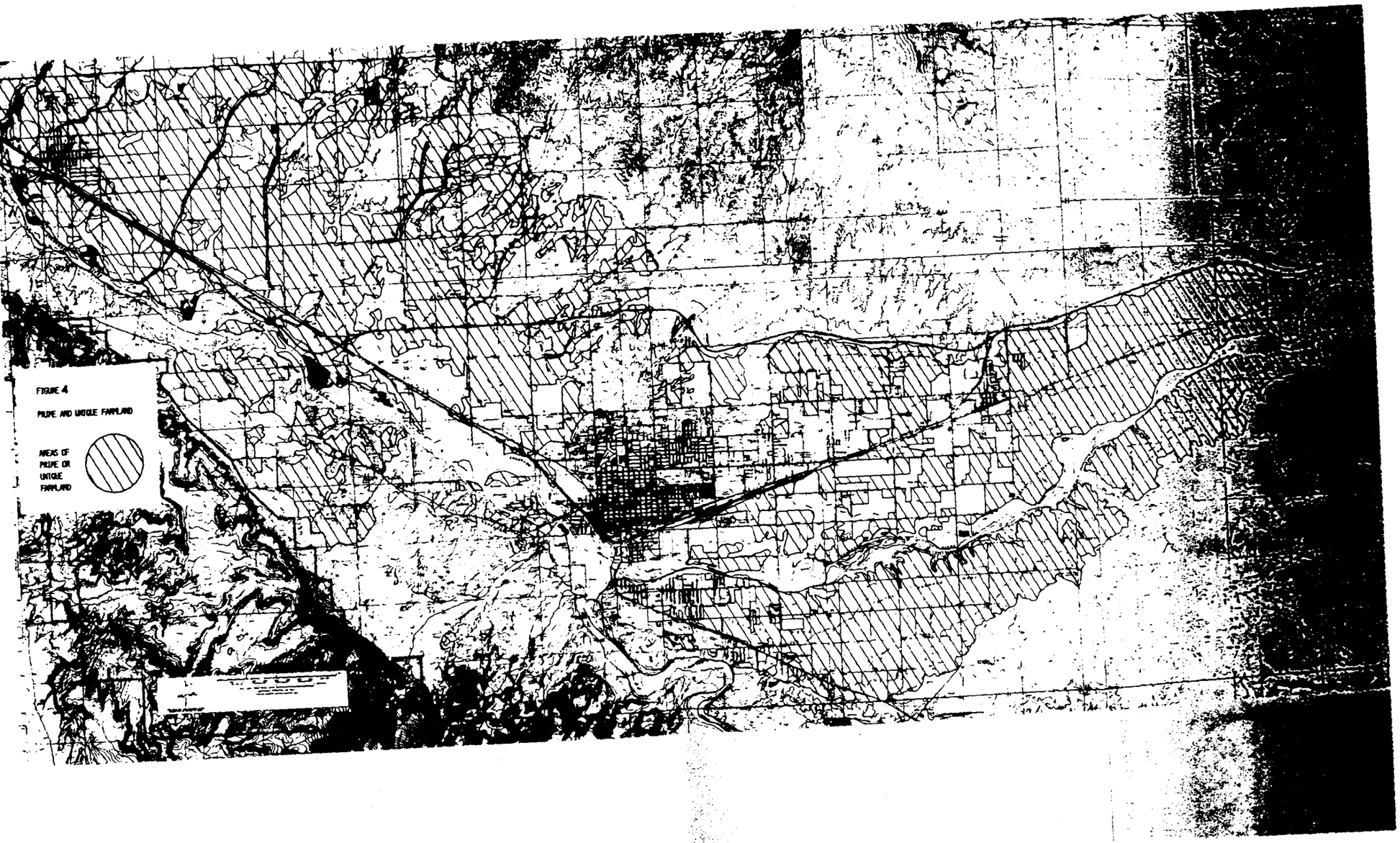
FIGURE 4
PRIME AND UNIQUE FARMLAND
AREAS OF PRIME OR UNIQUE FARMLAND