INTERIM REPORT — POPULATION / LAND USE

LARIMER–WELD REGION LAND USE ALTERNATIVES

ANALYSIS OF 20 YEAR GROWTH DEMANDS AND IMPACTS

Water Quality Management Plan

PREPARED BY
LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
LOVELAND, COLORADO
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NOVEMBER, 1977

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LARIMER – WELD REGIONAL COUNCIL OF GOVERNMENTS
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November 29, 1977

Dear Citizen:

The Larimer-Weld Regional Council of Governments is pleased to submit the following technical report on the Larimer-Weld Region Land Use Alternatives - Analysis of 20-Year Growth Demands and Impacts for your review. This document was prepared by staff and consultants under a U. S. Environmental Protection Agency Water Quality Management Technical Assistance Planning Grant and will serve as the basis for formulating plans for air quality, transportation, and water quality management for the Larimer-Weld Region (State Planning Region 2). Citizens, elected officials, and professional planners and engineers contributed many hours to the preparation of this document.

The purpose of the report is twofold: to promote discussion on how the citizen's of the region as trustees of land, air, and water resources for future generations wish to see the region grow and function; and to provide a sound technical basis for decision makers to set policies and implement programs which are socially and environmentally conscious and fiscally responsible.

The analysis contained in the report does not attempt to examine growth and land use demands on a detailed community or neighborhood basis. Rather, it is a regional analysis which illustrates how land use changes in one or more areas of the region could impact the region as a whole.

This technical document will be supplemented by a shorter Citizen's Summary Report which will be available for general distribution in the near future. I would urge your careful consideration of the content of this report. Following Public Hearings on alternatives, the report will become, in part, an element of the Regional Comprehensive Plan required by the U. S. Department of Housing and Urban Development.

Sincerely,

Charles D. Bowling
Chairman, Larimer-Weld COG

CDB:psj

208 AREAWIDE WATER QUALITY MANAGEMENT PLAN

LARIMER-WELD REGION LAND USE ALTERNATIVES
ANALYSIS OF 20 YEAR GROWTH DEMANDS AND IMPACTS

Prepared By

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October 1977

Prepared For

U. S. Environmental Protection Agency
Region VIII
1860 Lincoln
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The preparation of this report was financed in part through an Urban Planning Grant from the Department of Housing and Urban Development, under the provisions of Section 701 of the Housing Act of 1954, As Amended and through a Water Quality Management Technical Assistance Planning Grant from the Environmental Protection Agency under the provisions of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).

DISCLAIMER

This report has been reviewed by Region VIII, U. S. Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U. S. Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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CHAPTER 1.0

INTRODUCTION

The key to all land use related physical planning programs is an inventory of existing features and conditions, and projections of how these features may change over time in response to population and land use demands. The intent of this document is to provide a framework on which to base physical planning in the Larimer-Weld Region (State Planning Region 2).

The Larimer-Weld Regional Council of Governments was created in November 1973. Until mid-1975, this organization served primarily as an advisory group which conducted conceptual assessments of regional problems and performed reviews of federally funded projects in the region as an A-95 Clearinghouse. The Larimer-Weld Regional Council of Governments performed this function without the assistance of a region-wide data base or directly responsible professional planning and engineering staff to gather data or interpret the manner in which the region functioned internally or in relation to other adjacent areas of the State or the nation.

In April 1975, the Larimer-Weld Regional Council of Governments was designated an Areawide Waste Treatment Planning Agency by the Governor of the State of Colorado. With this designation came a responsibility for the Council of Governments to develop through the use of federal grant monies supplied by the U.S. Environmental Protection Agency, an Areawide Waste Treatment Management Plan. The federal law which authorized such a study was Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500).

In order to develop an Areawide Waste Treatment Management Plan and to identify and establish an effective and continuous process to control all sources of water pollution in the Region, it was evident that inventories and projections of economic activities, population, land use, and man-made and environmental features of the region be prepared. And, since all other physical and many social planning programs depend upon this kind of information, it was determined that the Areawide Waste Treatment Planning program would be a logical starting point to begin developing other needed data for the Region. This data base and analysis would be a common basis on which to develop air quality, transportation, and land use planning programs. And finally, the information contained in this document will become the foundation of a comprehensive land use planning process for the Region.

The following information in Chapter 1 details the need for developing land use related information and analysis. The remainder of the report is the result of that effort.

1.1 AN OVERVIEW OF PLANS AND PLANNING: WHAT AND WHY?

Plans are prepared as a means to provide a course of direction or establish a strategy to realize a particular goal. Plans are prepared and used by individuals and organizations both in the public and private sectors of the economy. A corporation will prepare a plan to maximize the utilization of its resources in attaining the highest possible return. A family will prepare a plan to budget its financial resources to facilitate buying a house, or one to invest its resources to provide a "comfortable life style". Developers prepare plans for specific projects; plans which entail the expenditure of resources to provide a service and obtain maximum return on their investment. Architects prepare plans to communicate to the contractor how a structure should be assembled. Governmental agencies prepare plans to provide public services and to insure sound expenditures for those services and necessary physical facilities to provide them.

1.1.1 Planning As A Means For Giving Direction

Webster's New World Dictionary defines the word "plan" as a "scheme for making, doing, or arranging something; project; program; schedule". Generally, three types of plans are prepared to attain varied goals and objectives:

1. _The Economic Plan_ defines strategies for the acquisition, expenditure, and/or gain of monetary resources.

2. _The Physical Plan_ defines strategies for the development and/or conservation of physical resources.

3. _The Social Plan_ defines strategies for the provision of services to a population base.

Action programs are necessary to each of these plans as the means for their implementation. In some cases, a "plan" is a composite of two or all three of the different types of plans (e.g., a plan for development of a subdivision necessitates both economic and physical and, in some cases, social plans).

1.1.2 Planning As A Dynamic Process

The course of developing a plan or "planning" is a dynamic process. It requires that problems be identified, goals be established, data be gathered and assembled and ultimately, that courses of action be prescribed to solve particular problems within the scope of the desired goals and the resources which are available. But because plans are developed in an environment which is ever-changing, they must constantly be re-evaluated in light of new information which becomes available. Therefore, plans and the process by which they are developed are a continuous effort.

Planning does not, in and of itself, guarantee achievement of desired goals or objectives without a thorough and realistic evaluation of alternative courses of action. A plan for whatever purpose may be nothing more than an idealistic desire or platitude. Planning must point to realistic means to attain realistic goals.

1.1.3 The Role of Governmental Agencies in Planning

A governmental agency undertakes planning to develop tools which guide decisions necessary for its orderly functioning; i.e., the provision of services to its population; the structure of the receipt and expenditure of financial resources; and the pattern of land use development and conservation. Planning relates to the use of the land, whether it is economic, physical, or social.

Certain premises and assumptions, as set forth below, illustrate the role, nature, and function of the planning process undertaken by governmental agencies.

1. The concerns and scope of planning should be as broad as the concerns of the government that it serves, the activities in which the government engages, and the decisions that it must make. Hence, planning must be a central, continuing, and integral working arm of the responsible government decision-makers.

2. The scope of planning should also be related to the tools at hand and resources available to carry out planning proposals.

3. Planning serves the legislative policy-making function by presenting meaningful and internally consistent policy recommendations for legislative consideration and action. It also serves the administrative function by enabling it to make consistent operating decisions.

4. A primary responsibility of the planning agency and the planning process is to assist the decision-maker in assessing the probable consequences and relative advantages of alternative courses of action, and to make recommendations regarding them. To fulfill this duty effectively, the planning agency should maintain complete, accurate, and up-to-date information on all aspects of the planning process.

5. A strong and balanced planning program includes the 1) identification of goals, issues, needs and problems, assets and opportunities; 2) systematic acquisition of relevant data; through analysis and projections of such data; 3) evaluation of alternative policies and courses of action; 4) formulation and adoption of policies and plans; nd (5) a realistic, ongoing program for implementation of the policies and plans.

Planning is a way of achieving orderly use of the land and consistent decision-making. Research, problem and opportunity identification, and recommendation are the primary means of planning. Economics, natural environmental systems, societal attitudes and characteristics, and political structures also must be carefully weighed and evaluated relative to alternative courses of action. Such care is necessary to produce a viable and credible plan.

1.1.4 Regional Planning in Larimer and Weld Counties

The Region is a 6,618 square mile land area characterized by rich and diverse resources. Situated on Colorado's northern boundary, the region stretches from the Southern Rocky Mountains to the Great Plains. Encompassing an important center of agricultural production, one of the fastest growing metropolitan areas of the United States, and a vast expanse of national park and forest land, the Region is unique in its cultural, economic, and environmental character.

Preparation and implementation of a regional land use plan or strategy will help insure orderly utilization and efficient management of the Region's resources. Without such a strategy, development could occur in a fashion that would create irreversible adverse consequences such as the disruption of the Region's agricultural activities, inability of public and quasi-public agencies to pay off their bonded indebtedness, and loss of the community identity of many rural and urban areas. The ultimate responsibility for implementing land use strategies rests with the city and county governments through the adoption of local land use plans, zoning and subdivision ordinances, and day-to-day land use decisions.

In this light, the regional planning process has been structured to assist local governments in realizing the regional impacts of local decisions and thereby further advance the coordinated use and management of the Region's resources.

Regional planning is a two-way process where information developed at the local level is incorporated into the regional planning process and information developed during the regional planning process is given to local governments for consideration. Resources of the regional planning process are used to add to and improve the data base, rather than to duplicate efforts previously undertaken by local governments.

The regional planning process has: 1) examined the principal environmental, economic, and socio-attitudinal determinants of land use; 2) defined their compatibilities and conflicts; 3) identified and evaluated alternative strategies to resolve the conflicts; and 4) recommended a preferred strategy for land use development. The knowledge and expertise of county and city planners and the attitudes and concerns of a cross-section of residents have been incorporated into the process. The adopted and proposed policies of the Region's counties and cities and special service districts have been considered in the definition of land use issues and formulations of alternative policies. Additionally, community preferences for the resolutions of conflicts and the regional distributions of land use have been weighed in the planning process.

1.2 LEGAL REQUIREMENTS FOR DEVELOPING A LAND USE PLAN

Various federally mandated technical planning and project funding assistance programs require that the topics of population growth, economic activity, land use development, and strategies to accommodate these needs are addressed to insure wise investment of federal dollars. The following discusses the statutory and administrative requirements and implications of not preparing and adopting a regional land use plan.

1.2.1 Federal Water Pollution Control Act Amendments of 1972

As a designated Areawide Waste Treatment Management Planning Agency, the Larimer-Weld Regional Council of Governments is charged with developing an Areawide Waste Treatment Management Plan (AWTMP). Necessary information for such a plan includes information on existing and projected land uses to determine means to provide for anticipated municipal and industrial waste treatment needs and to begin a process to control water pollution for such things as urban stream runoff, agricultural activities, animal confinement areas, mining, construction, and forest management activities. Authority for such activities is found in Section 208(b)(2)(C)(ii) which provides that the AWTMP include "the establishment of a regulatory program to regulate the location, modification, and construction of any facilities within such area which may result in any discharge in such area . . .". This provides authority for a management agency designated by the plan to regulate the location of new pollutant discharges by determining the location of treatment facilities and by seeking control of other pollutant sources.

Other authority of the AWTMP which requires that land use be considered is found in Section 208(b)(2)(F-H) which states that the plan will set forth procedures and methods including "land use requirements" to control to the extent feasible certain nonpoint sources of pollution.

The 208 water quality planning process does not directly require that local or regional land use plans be adopted in order to develop a water quality management plan. It does, however, imply that an effective land use planning process is a prerequisite to wise water quality management. The water quality management planning process utilizes, to the extent possible, information in adopted land use plans. However, to determine water quality impacts to existing or proposed land use configurations, it may recommend changes which would reduce water pollution. In areas where land use plans are not adopted, the planning process may provide input to encourage a land use plan which may result in less water quality degradation and fewer adverse impacts on other resources or services.

1.2.2 Federal-Aid Highway Act of 1970 and 1973 as Amended

The Federal-Aid Highway Act, Section 134 states that it is "in the national interest to encourage and promote the development of transportation systems, embracing various modes of transport in a manner that will serve the states and local communities efficiently and effectively". It also states that to accomplish this objective the Department of Transportation "will cooperate with the states in the development of long-range highway plans and programs which are properly coordinated with plans for improvements in other affected forms of transportation and which are formulated with due consideration to their probable effects on the future development of urban areas of more than fifty thousand population". Furthermore, that the Department of Transportation shall not approve any program for projects in any urban area of more than fifty thousand population unless it finds that such projects are based on a continuing comprehensive transportation planning process carried on cooperatively by states and local communities.

1.2.3 Clean Air Act of 1970 and 1977 as Amended

The Clean Air Act (Public Law 91-604) Section 110 requires that States develop State Implementation Plans (SIP's) for the implementation, maintenance, and enforcement of primary air quality standards for all regions in the State. The State submitted its SIP to the Environmental Protection Agency which found it to be deficient in several areas. One geographic area which was found to be deficient was the North Central Air Quality Maintenance Area (NCAQMA) of Larimer-Weld Region. EPA, therefore, required that the State resubmit the SIP with revisions by January 1979.

The reasoning behind such action is that the NCAQMA has been found in violation of three designated air pollutants under the National Ambient Air Quality Standards. These pollutants are total suspended particulates (TSP), carbon monoxide (CO), and photochemical oxidants (Ox). Violations for TSP have been recorded throughout the region, including Fort Collins and Greeley. The nature of TSP is largely from background and traffic or transportation related activities. CO and photochemical oxidant violations are attributable almost completely to transportation related activities, which occur within the NCAQMA and most likely the Denver region. In order to resolve these problems the EPA has requested that SIP revisions include among other things land use and transportation measures which would be required for attainment and maintenance of National Air Quality Standards for the above indicated pollutants. Of necessity this requires inventories and projections of population, land uses, transportation systems, and strategies to achieve the national standards now and in the future (see July 6, 1976, Federal Register 41:132:28001).

Section 176 of the 1977 amendments to the Clean Air Act generally states that the Administrator of EPA and the Secretary of Transportation shall not approve any projects or award grants other than for safety, mass transit, or transportation improvement projects related to air quality improvement or maintenance in any air quality control region in which any primary ambient air quality standards has not been attained, or in which local government or designated regional agency is not implementing requirements of the approved State Implementation Plan.

It also specifies that no other department, agency, or instrumentality of the federal government shall in any way support, provide financial assistance, or approve of any activity which is not in conformance with the adopted SIP.

In addition, Section 316 of the amendments further states that the Administrator of the Environmental Protection Agency may withhold, condition or restrict the making of any grant for a waste treatment works if he determines that: 1) such treatment works will not comply with applicable standards for new stationery sources as defined in Section 171 and emission standards for hazardous air pollutants in Section 112; 2) the construction of such treatment works would create new sewage treatment capacity that may cause or contribute to directly or indirectly, an increase in emission of any air pollutant in excess of specified increases, or such area or interfere with the applicable SIP for that state or any other state.

1.2.4 Housing Act of 1954 as Amended by the Housing and Community Development Act of 1974

The Comprehensive Planning Assistance Program or 701 Program is a continuing effort on the part of the Federal Government to encourage and financially support general purpose State and local government and regional associations of local governments in upgrading their comprehensive planning and executive management responsibilities.

Section 201 (d)(2) states that the Secretary (of HUD) shall make no grant after three years from the date of enactment to any applicant unless the Secretary is satisfied that the comprehensive planning being carried out by the applicant includes:

1. A housing element which takes into account all available evidence of the assumptions and statistical bases upon which to project zoning, community facilities, and population growth is based, so that the housing needs of both the region and the local communities will be covered in terms of existing and prospective population growth.

2. A land use element which shall include (a) studies, criteria, standards, and implementing procedures necessary for effectively guiding and controlling major decisions as to where growth shall take place within the recipient's

boundaries, and as a guide for governmental policies and activities, general plans with respect to the pattern and intensity of land use for residential, commercial, industrial, and other activities.

1.2.5 Intergovernmental Agreements

The Department of Housing and Urban Development and the Environmental Protection Agency have negotiated inter-agency agreements for the HUD 701 program and the EPA 208 Areawide Waste Treatment Management Program and Air Quality (State Implementation Program) Planning Programs. EPA, HUD, the Department of Transportation, and numerous other agencies have drafted similar formal or informal agreements to strive for consistency in this planning program and those of state and local government. The purpose of such agreements is to encourage inter-agency cooperation between various levels of government; secure agreement on implementation of programs; insure that land use planning undertaken for water quality or air quality purposes is developed in the broader context of comprehensive planning, and insure that work programs are complimentary rather than duplicative in the preparation of necessary data and analysis.

Failure to accomplish this could result in wasteful use of both public and private funds expended on projects and programs which were based on inconsistent data and analyses.

1.3 RELATIONSHIP BETWEEN PLANNING AND IMPLEMENTATION

The Larimer-Weld Regional Council of Governments is a designated State Clearinghouse for A-95 review of federal programs and projects having a significant impact on area and regional development as authorized under Title IV of the Intergovernmental Cooperation Act of 1968. The role of the Larimer-Weld Regional Council of Governments in this capacity is to insure that federal aid projects are consistent with regional and local comprehensive planning goals and objectives and encourage sound and orderly economic and social development of the region. The Larimer-Weld Regional Council of Governments is also a Regional Planning Commission pursuant to Colorado State Statute (1973 CRS 30-28 as amended). As such, the Larimer-Weld COG is responsible under State law to make and adopt a regional plan for the physical development of the territory within the boundaries of the region.

Implementation of regional water quality, transportation, land use, or other such plans rests solely with local governmental entities. No plan which has been developed and/or adopted by the Larimer-Weld Regional Council of Governments shall be effective within the boundaries of any county or incorporated municipality within the region unless such a plan has been adopted by the governing body of that county or municipality. Failure to adopt the plan, however, may in certain instances as described in Section 1.2 jeopardize that political jurisdiction and the region for future state or federal funding assistance requiring a specific regional plan element.

1.4 SUMMARY OF THE LARIMER-WELD PLANNING PROCESS

The regional land use planning process can be divided into the following six major phases:

1. Program Formulation
2. Inventory of Existing Conditions
3. Analysis of Opportunities and Constraints
4. Generation and Evaluation of Alternative Concepts
5. Final Plan Selection
6. Final Plan Implementation and Maintenance

Figure 1.4-A indicates the major components of the regional planning process. This report documents the work completed during the first four phases of this process and offers suggestions for plan selection, implementation, and maintenance. Based on formal review of the information presented by local, State, and Federal agencies and the public, a regional land use plan will be selected, adopted, and implemented.

Land use planning for the Region was conducted at two levels of detail. Within an approximate 2000-square mile area (as indicated in Figure 1.4-B) extending from approximately 10 miles north of Fort Collins to the southern border of the counties, detailed planning was conducted. This area has been designated as the Core Area. Within the remainder of the two-county area, a more generalized approach was followed, except in a limited number of areas where growth or development was judged to be a critical factor. This decision reflects the fact that 90 to 95 percent of existing development and population are located in the Core Area and that it is anticipated that the majority of regional growth will occur in the Core Area. Certain information has been compiled for the entire Region, while other information focuses on the Core Area.

Public participation has been, and will continue to be, an important component of the regional land use planning process. From the initial definition of the goals and objective through the generation of the alternative concepts a citizen's advisory group worked closely with the land use planning consultant. This group was composed of two committees established by the LWCOG: the Land Use and Transportation Planning Committee and the 208 Land Use and Population Subcommittee. The combined group included representatives from the rural and urban areas of both counties. In addition

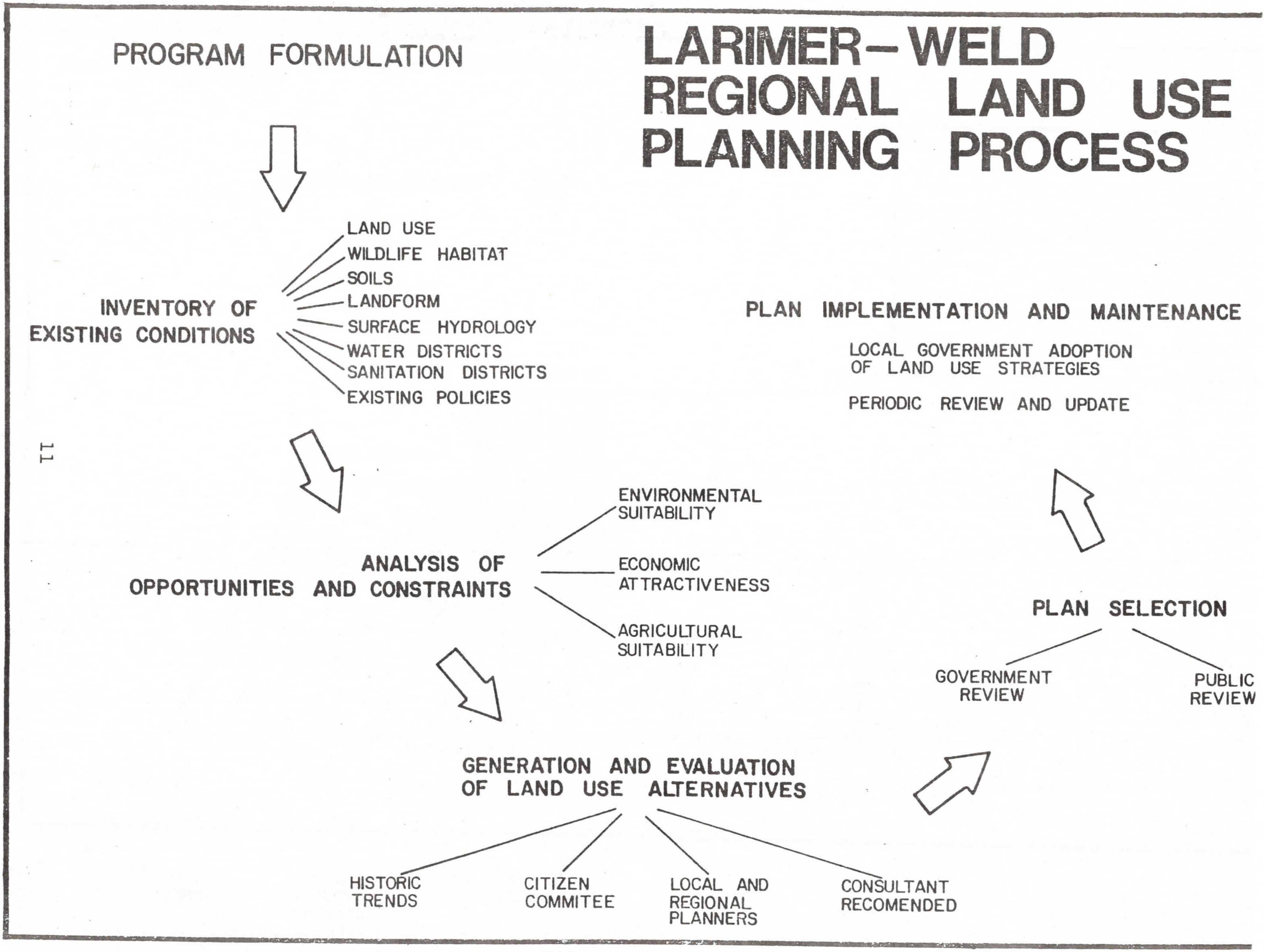

LARIMER-WELD REGIONAL LAND USE PLANNING PROCESS
PROGRAM FORMULATION
INVENTORY OF EXISTING CONDITIONS
LAND USE
WILDLIFE HABITAT
SOILS
LANDFORM
SURFACE HYDROLOGY
WATER DISTRICTS
SANITATION DISTRICTS
EXISTING POLICIES
ANALYSIS OF OPPORTUNITIES AND CONSTRAINTS
ENVIRONMENTAL SUITABILITY
ECONOMIC ATTRACTIVENESS
AGRICULTURAL SUITABILITY
GENERATION AND EVALUATION OF LAND USE ALTERNATIVES
HISTORIC TRENDS
CITIZEN COMMITEE
LOCAL AND REGIONAL PLANNERS
CONSULTANT RECOMENDED
PLAN SELECTION
GOVERNMENT REVIEW
PUBLIC REVIEW
PLAN IMPLEMENTATION AND MAINTENANCE
LOCAL GOVERNMENT ADOPTION OF LAND USE STRATEGIES
PERIODIC REVIEW AND UPDATE

FIG. 1.4-A

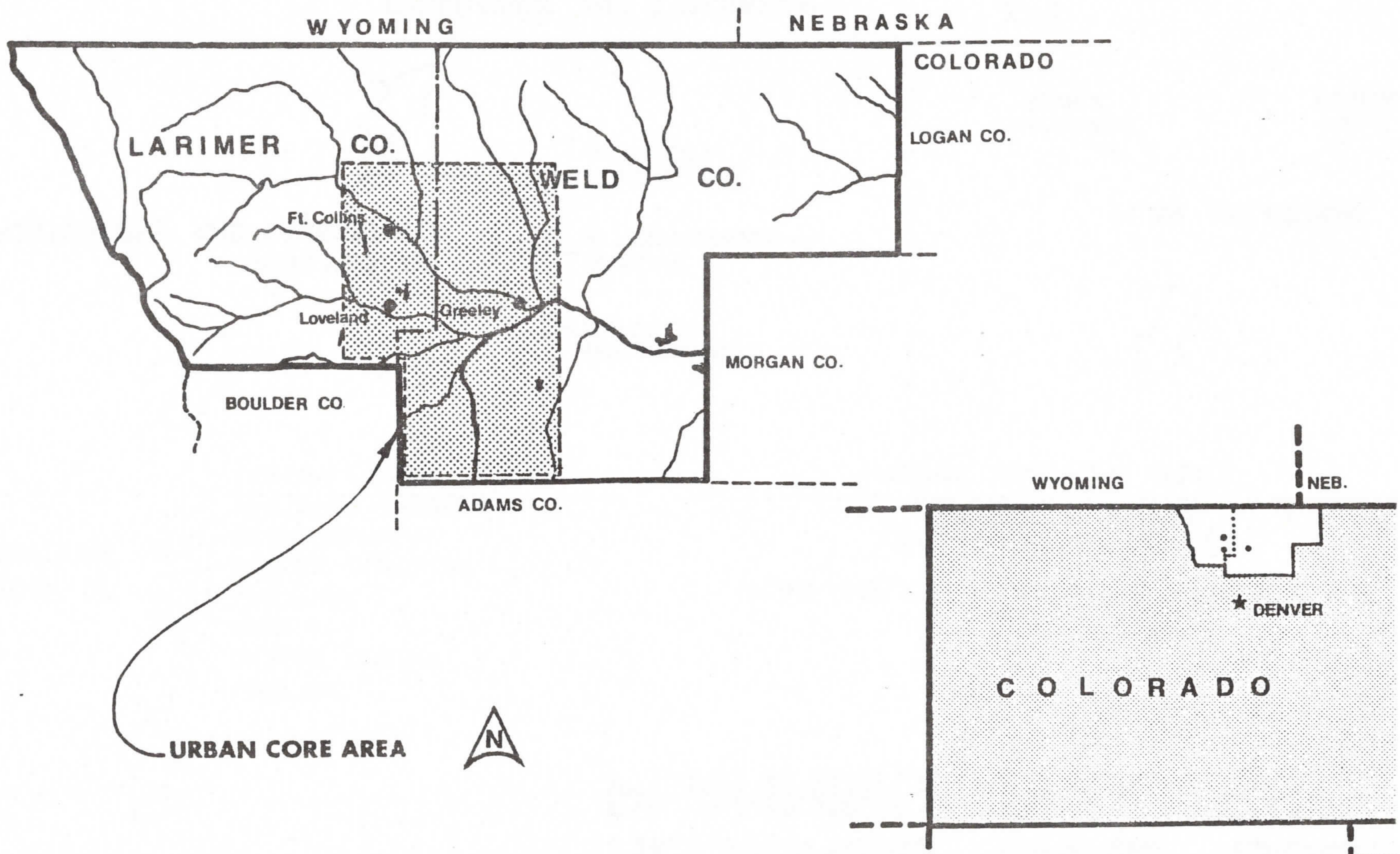


FIG. 1.4-B
LOCATION MAP - REGION 2

to the active involvement of this citizen's committee, the general public has had the opportunity to attend the committee meetings and review the material documented in this report at public information meetings. Formal public hearings will be held in the future to solicit additional input from the residents of Larimer and Weld Counties concerning the alternative land use concepts presented herein.

Chapter 2.0

CHAPTER 2.0

OVERVIEW OF THE LARIMER-WELD REGION

This chapter is intended as an inventory and description of the natural environment and man-influenced characteristics of the Larimer-Weld Planning Region. The following discussion is framed in the context of the issues which arise from the area's natural environmental setting and man's use of it.

The Larimer-Weld Region is a highly diverse land area of 6,618 square miles. The landscape, people, and economy combine to form many complex land use interactions. Man has been very influential in the development of the Larimer-Weld Region. But in his desire to settle the area, he has created new problems for which he must now seek solutions.

The descriptions included in the following sections are general and not intended to be a detailed treatment of the natural and man-made features of the area. For greater detail, the reader is directed to the references listed in the discussion and to the bibliography provided in Chapter 8.2 of this report for more detailed treatment of the topics discussed.

2.1 LOCATION AND LANDFORM

The Larimer-Weld Region is situated in the northern part of the State of Colorado, bordered on the north by the States of Wyoming and Nebraska, and on the west by the Continental Divide. All streams in the Region contribute to the Missouri River Basin system through the South Platte River in Colorado or the North Platte River in Wyoming. The South Platte River Basin, the Larimer-Weld Region, and a 2,000 square mile urban core area are indicated on Figure 2.1A. Within this Core Area are three major municipalities: Fort Collins, estimated population 60,600, Greeley, estimated population 53,500, and Loveland, estimated population 24,926 (Toups Corporation, 1975). The Denver metropolitan area is approximately 55 miles to the south of the urbanized central Core Area of the Region.

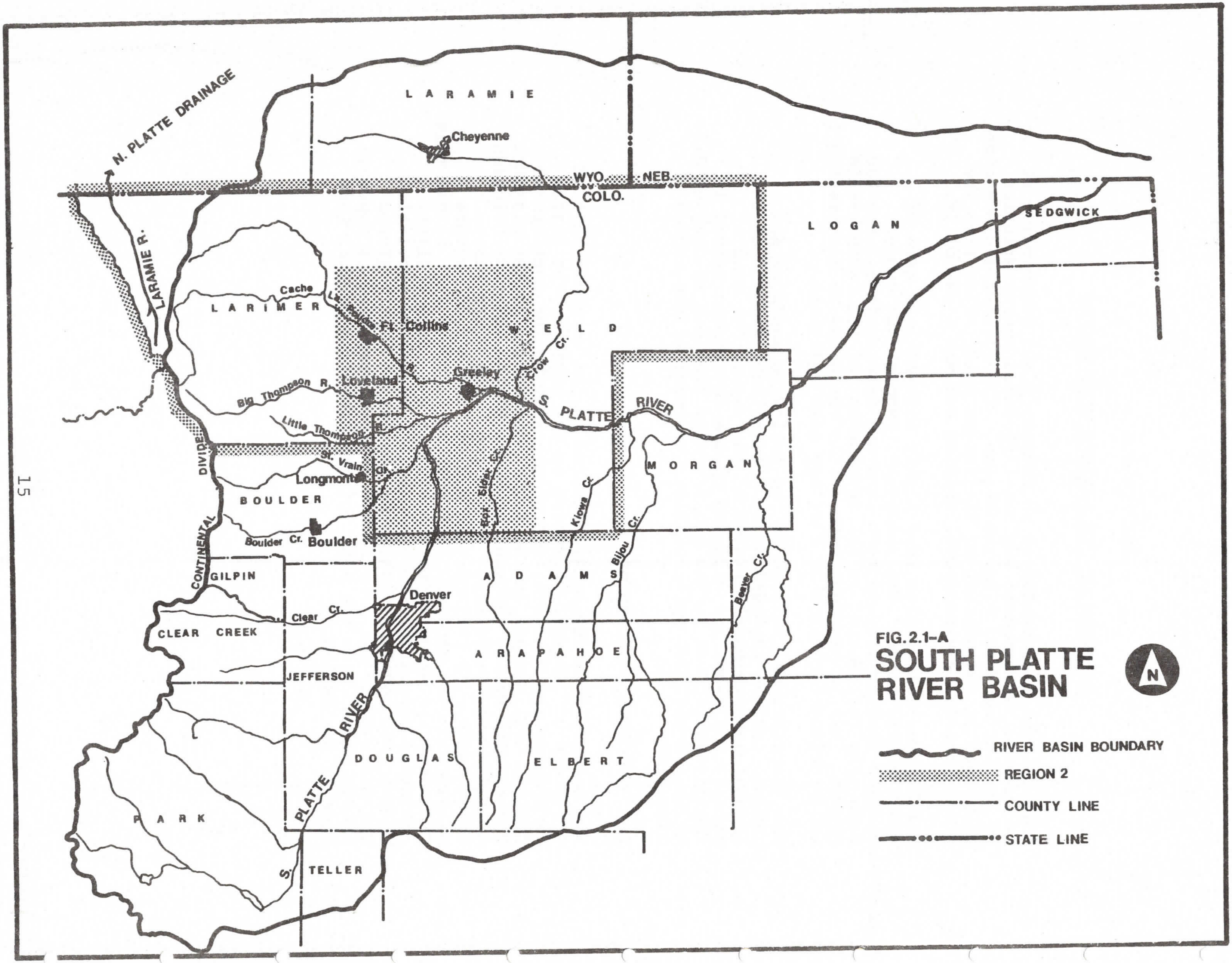


FIG. 2.1-A
SOUTH PLATTE RIVER BASIN

2.1.1 Land Ownership

Land ownership is a complex mix of privately- and publicly-owned parcels. The major publicly-owned lands are Roosevelt National Forest, Rocky Mountain National Park, and Pawnee National Grasslands. Generalized land ownership is summarized in Table 2.1 and illustrated in Figure 2.1-B.

TABLE 2.1 GENERALIZED LAND OWNERSHIP - LARIMER-WELD REGION (sq. mi.)

	Larimer	Percent	Weld	Percent	Region	Percent
Private	1,423.2	54.4	3,427.0	85.6	4,850.2	73.3
Federal (USFS, NPS, BR, BLM)	1,053.5	40.3	314.0	7.8	1,367.5	20.6
State (Public School, CSU, UNC, CDW)	122.3	4.7	260.5	6.5	382.8	5.8
County/Municipal	15.0	.6	2.5	.1	17.5	.3
Total	2,614.	100.	4,004.	100.	6,618.	100.

Source: U.S. Bureau of Census; Larimer County, 1977; Weld County, 1977.

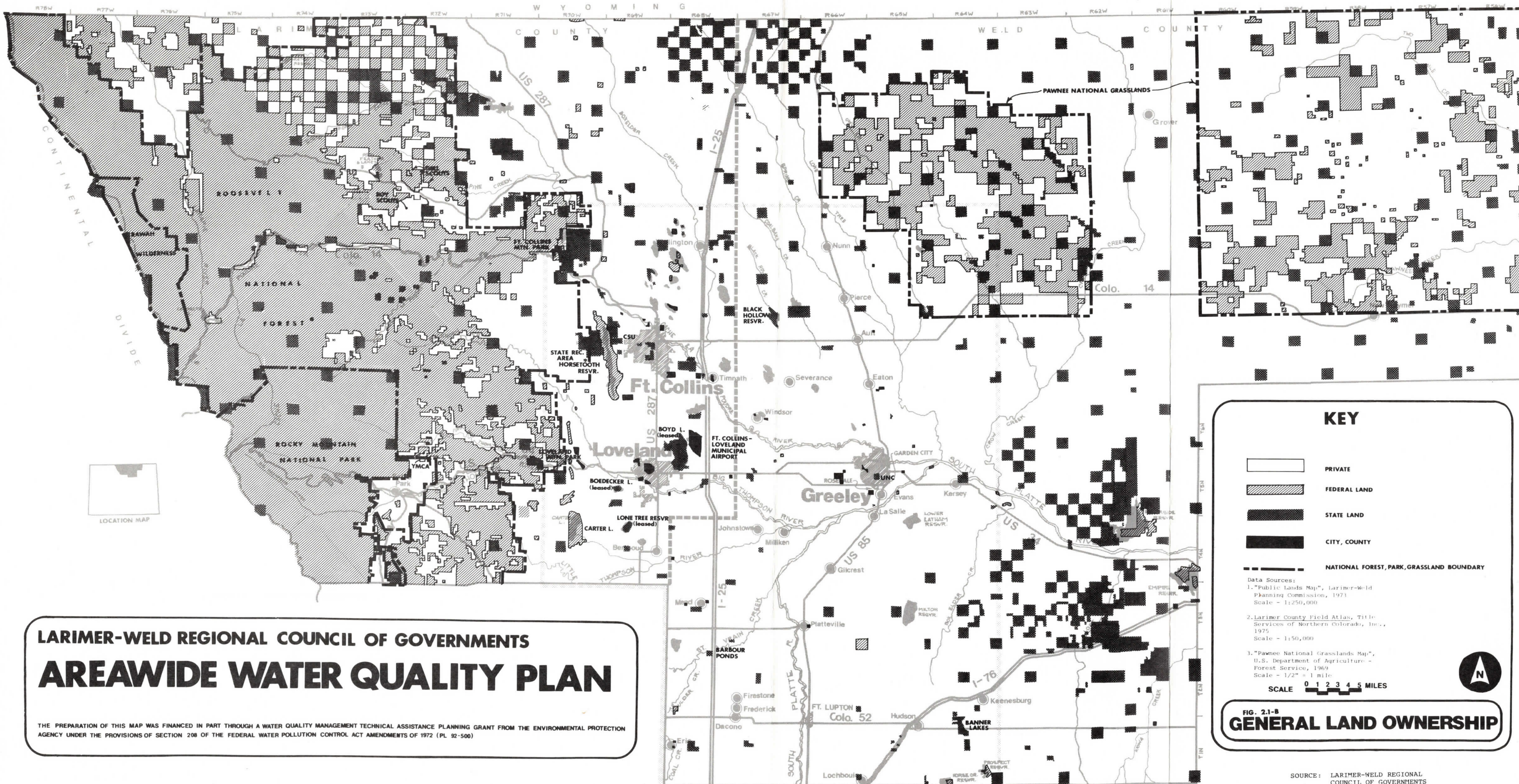
2.1.2 Landform Characteristics

The area is naturally divided into two topographic regions: the Great Plains and the Fron Range of the Southern Rocky Mountains. Locally, the topography may be broken down furtehr into three general landform types which will be referred to throughout the remainder of the report as mountains, foothills, and plains.

A careful assessment of topographic features gives important clues to describing other environmental characteristics and opportunities and constraints to man's use of the land. In particular, landforms may be analyzed using four descriptors of topography: relief, elevation, slope, and aspect. They provide information about environment influences and serve as indicators of engineering and environmental management problems.

Definitions of Landform Characteristics:

1. Relief refers to the difference in elevation between two points on a land surface.



LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A WATER QUALITY MANAGEMENT TECHNICAL ASSISTANCE PLANNING GRANT FROM THE ENVIRONMENTAL PROTECTION AGENCY UNDER THE PROVISIONS OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 (PL 92-500)

KEY

- PRIVATE
- FEDERAL LAND
- STATE LAND
- CITY, COUNTY
- NATIONAL FOREST, PARK, GRASSLAND BOUNDARY

Data Sources:
1. "Public Lands Map", Larimer-Weld Planning Commission, 1973. Scale - 1:250,000
2. Larimer County Field Atlas, Title Services of Northern Colorado, Inc., 1975. Scale - 1:50,000
3. "Pawnee National Grasslands Map", U.S. Department of Agriculture - Forest Service, 1969. Scale - 1/2" = 1 mile

SCALE 0 1 2 3 4 5 MILES

FIG. 2.1-B

GENERAL LAND OWNERSHIP

SOURCE: LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS 1977

2. Elevation is a quantitative way of expressing relief. It is a measure of vertical height above a mean datum of sea level. Generally in a given geographic location as elevation increases, growing seasons are shorter, temperatures are cooler, and ecosystems are more fragile; soils are shallower, are less developed, and have lower organic materials content; and precipitation is more frequent and occurs in greater quantities. These conditions hold true for most of the Region.

3. Slope is the change in vertical elevation over a given horizontal distance. It is normally measured in percent or degrees. Percent slope is computed by dividing the change in vertical elevation (rise) by the change in distance (run) and multiplying this fraction by 100.

$$\frac{\text{Rise (ft)}}{\text{Run (ft)}} \times 100 = \text{Percent Slope}$$

Slope is the single most important topographic factor in determining land use opportunities and constraints. Slope affects watershed runoff characteristics, soil erosion potential, soil and geologic material stability, the amount of sunlight incident upon a land surface, and many other things which in combination with other topographic characteristics or resource factors (geology, soils, vegetation, etc.) may help identify dollar costs and environmental trade-offs for various land uses.

Slope becomes a more important land use constraint as slope steepness increases. Slope limitations are relatively low on land areas with gentle slopes. But the problems of slope increase exponentially. Thus, the problems resulting from an incremental increase on a slope of 30 to 40 percent are much greater than a similar 10 percent increment from 15 to 25 percent.

4. Aspect is the orientation of a sloping land surface with respect to directional points of a compass. Generally in the Region, south-facing and west-facing slopes are warmer and drier than east- or north-facing slopes because they receive more direct sunlight. Aspect has very important effects on moisture regime, snow accumulation and retention, soil type, and vegetative cover.

A generalized cross-section of the region is shown in Figure 2.1-C Landform Perspective. It shows the wide variation in elevation, slope, and aspect of the Region. In the Larimer-Weld Region, the mountain landform is highly variable. In a general description, the aspect is predominantly to the east. Elevations range from over 14,000 feet down to about

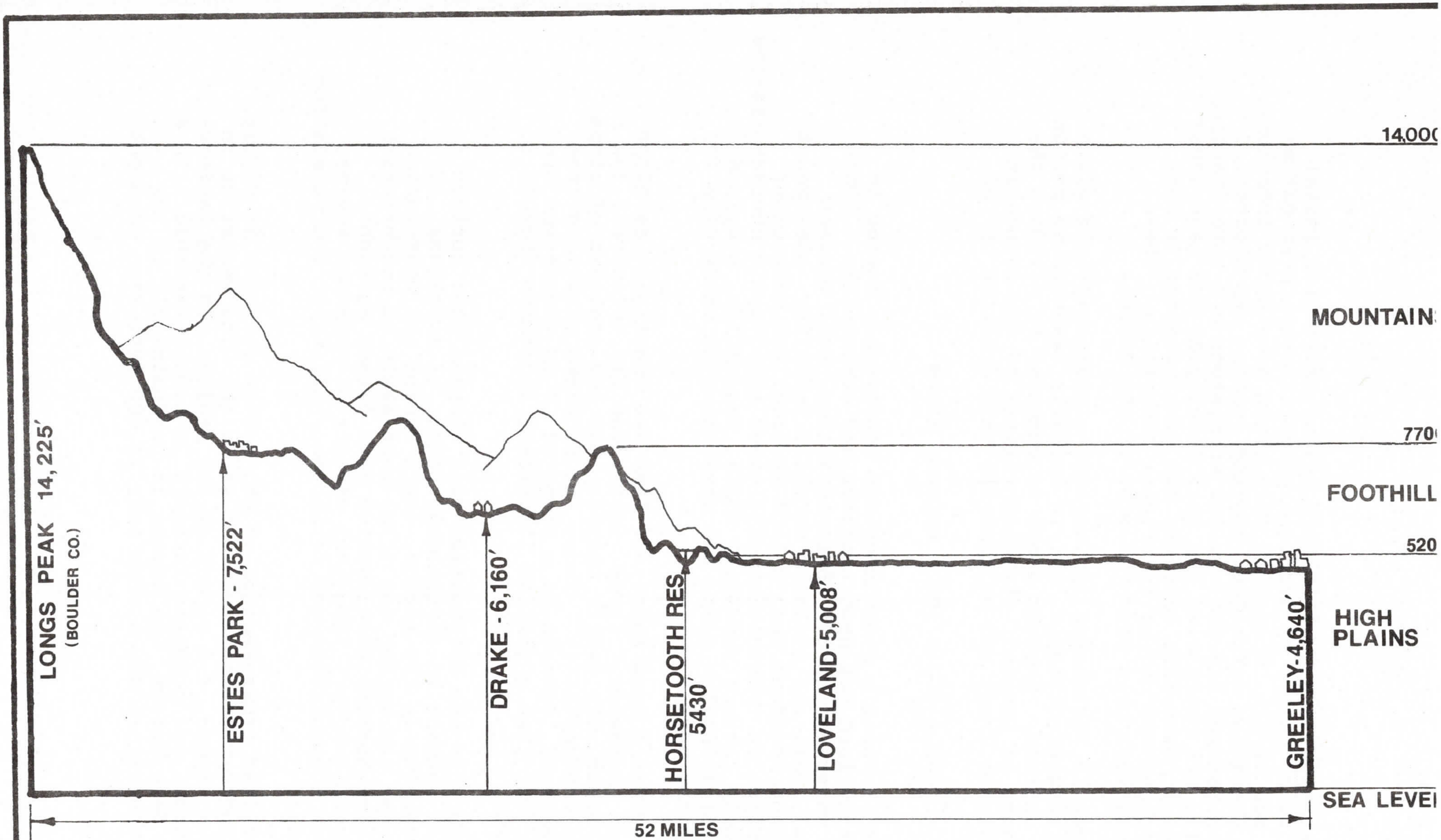


FIG. 2.1-C LAND FORM PERSPECTIVE

Cross Section Elevation

6,000 feet, in a gradually decreasing sequence moving from west to east. Drainage characteristics are well defined and valley side slopes exceeding 45 percent are common. This is particularly true in the conifer-forested higher elevations. Wide, high mountain valleys occur through much of the mountains, particularly in the immediate Estes Park area and in the northern part of the Region around Red Feather Lakes and Cherokee Park. Localized areas of gentle slopes between 5 and 20 percent may be present throughout the mountain park areas.

The foothills area occurs in the middle western section of the region. This area runs in a north-south direction along steeply inclined sedimentary sandstones and shale geologic formations which comprise the first series of hogback ridges in the Colorado Front Range mountains. The aspect is predominantly easterly with occasional gently sloping narrow agricultural valleys running in a north-south orientation near Masonville and Buckhorn Creek. Northwest of Loveland and surrounding Bellevue, northwest of Fort Collins, steep slopes abruptly rising from the plains, run the full length of the Core Area where the foothills interface the plains. Elevations range from about 5,400 feet at the interface to over 7,700 on some of the high promontories of the hogback ridges. Slopes in excess of 30 percent steepness are not uncommon and in many places slopes may exceed 45 percent at elevations above 6,000 feet.

The plains area landform covers the majority of the eastern three-fifths of the Region. Aspect is not pronounced, but it is highly variable. There appears to be a general southeasterly orientation of the land area in the northern plains tributary area to the South Platte River. The gently rolling hill character exhibits slope areas which may range from almost flat (0 to 3 percent) to about 15 percent.

The most obvious break in plains area landform continuity occurs in several scattered areas along the Cache La Poudre River south of Windsor and on the South Platte River north of Milliken. Located here are steeply sloping sandstone outcrops and breaks adjacent to the stream drainages. Slopes may frequently exceed 30 percent in these complex slope bank areas.

2.2 CLIMATOLOGY

Generally, climate in the Region varies with topography. With the exception of localized climatic changes in high mountain valleys or influences of large-scale weather patterns, weather conditions in the mountains, foothills, and plains are fairly uniform.

The high elevation mountain region has a rigorous climate with heavy snowfall and a short growing season. The precipitation varies with the elevation and exposure. Amounts in excess of 40 inches annually fall on the Continental Divide area that separates the watershed of the Cache La Poudre River, the Big Thompson River, and St. Vrain Creek from the Colorado River Basin. Summer temperatures in the mountains seldom exceed 90°F., and killing frost is apt to occur throughout the summer months in the highest elevations. The growing season in the lower mountain valleys extends approximately 115 days, from about the first week of June to the last week of September.

The climate of the foothills region is a transition from the mountains to the plains. Precipitation averages between 15 and 20 inches annually, with a smaller percentage of snow than found in the mountains. Both summer and winter temperatures are more moderate in the foothills than in either the plains or mountains.

Climatic conditions in the plains are characterized by low relative humidity, light rainfall, warm summers, cold winters, considerable wind, and large variation of precipitation from year to year. Near the foothills, the precipitation averages about 14-15 inches annually; this amount decreases eastward to a low of about 12 inches in the vicinity of Greeley, and increases to nearly 19 inches at the far eastern edge of the South Platte basin. Although most of the precipitation in the plains area falls in the form of rain from April through September, the distribution is often erratic, and prolonged dry spells occur during the growing season.

Figure 2.2-A, although not specifically adapted to individual local areas, gives a summary of regional climatic conditions. Figure 2.2-B shows precipitation for the Region. More specific data on a localized basis is available for individual weather stations throughout the Region.

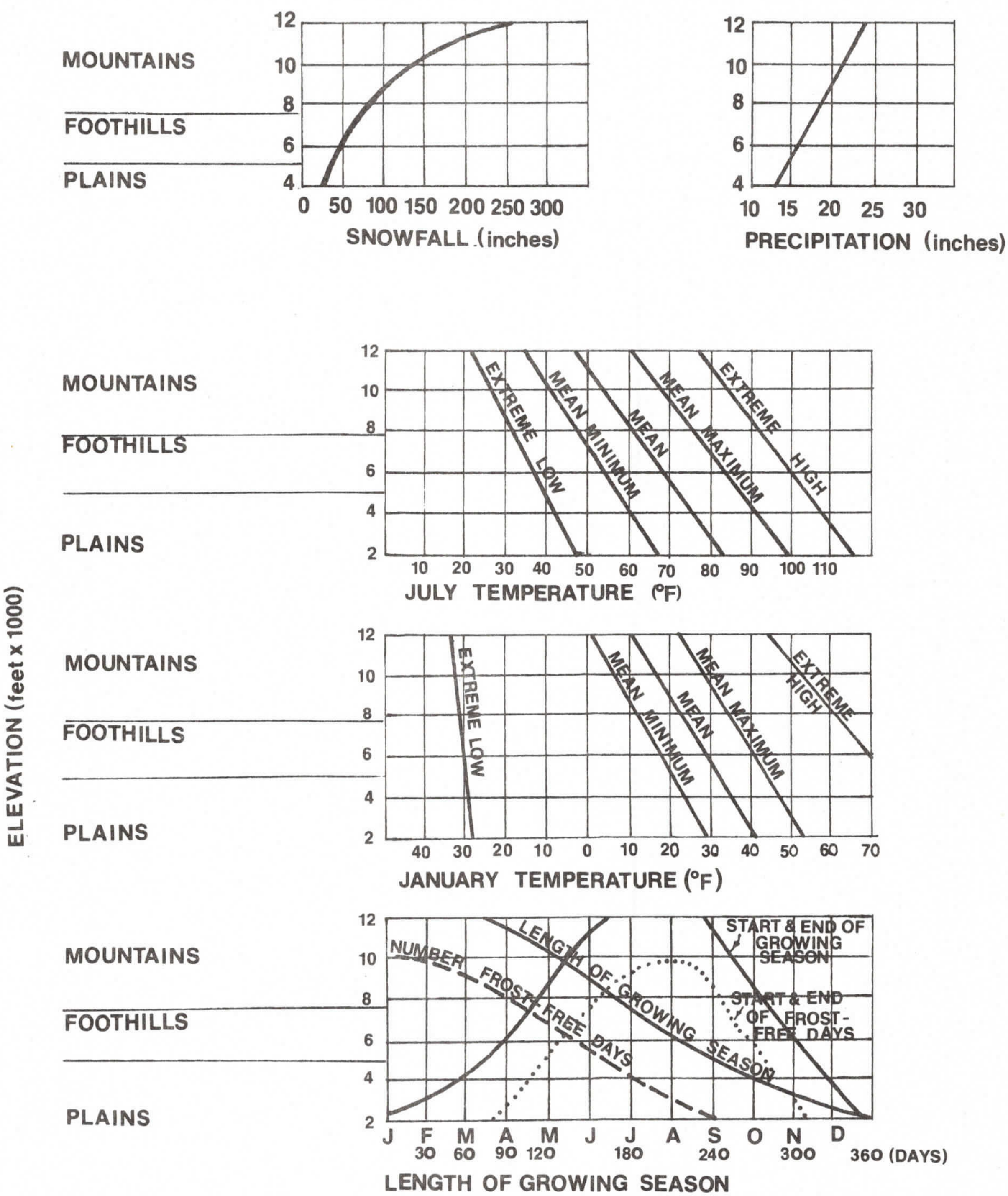
2.3 GEOLOGY

The generalized geologic setting of the Region may be described as a mass of Precambrian Era metamorphic and igneous rocks which form the core of the Rocky Mountains. Reclining against these are the oldest sedimentary formations. These sedimentary sandstones and shales, once horizontal, have been lifted and deformed by forces which made the Rocky Mountains. Thus, steeply inclined formations, which are called hogback ridges, stretch nearly all along the eastern edge of the Colorado Front Range.

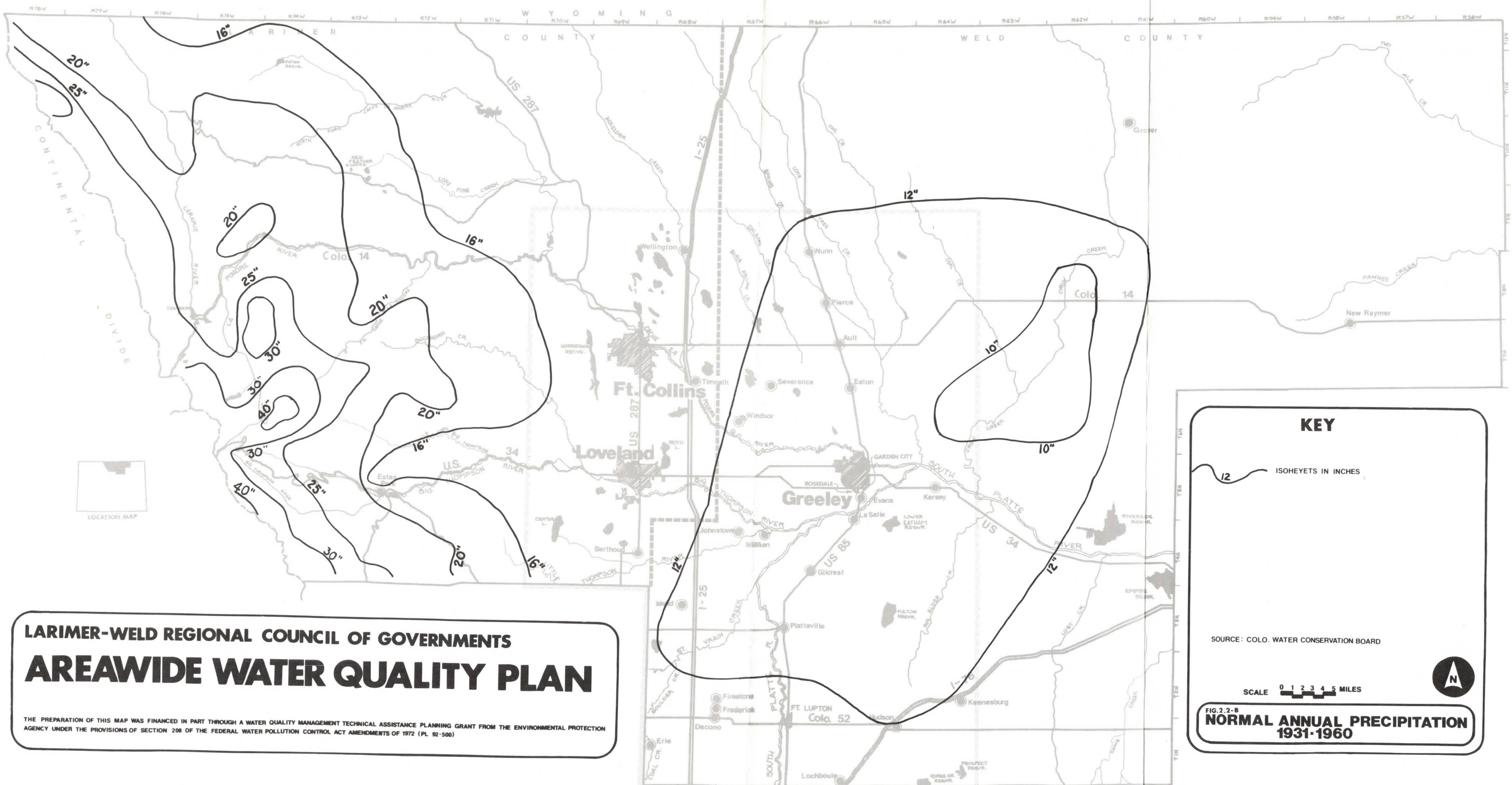
FIG. 2.2-A

GENERALIZED REGIONAL CLIMATES

EASTERN COLORADO



SOURCE: Adapted with modification from Baker, F.S., 1944. Mountain Climates of the Western United States, Ecological Monographs 14(2)



LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A WATER QUALITY MANAGEMENT TECHNICAL ASSISTANCE PLANNING GRANT FROM THE ENVIRONMENTAL PROTECTION AGENCY UNDER THE PROVISIONS OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 (PL 92-500)

FIG. 2.2-8
NORMAL ANNUAL PRECIPITATION 1931-1960

Some of the steeply inclined sedimentary formations extend deeply beneath the land surface and gradually flatten out to a horizontal position as they progress across the plains areas of Weld County. The age of sedimentary deposits decreases progressing outwardly within the Region. The natural processes of erosion have redeposited materials from the mountains and steeply inclined sedimentary areas to the less-steeply graded areas. These more recently deposited sand, silt, clay, and gravels are the source of the productive agricultural soils and subsurface aquifers.

The mountainous area in the western part of the Region is composed primarily of Precambrian Era igneous and metamorphic rock formations. These formations are generally in areas above 8,000 feet elevation. In locations where alpine glaciation has occurred extensively, there are shallow filled valleys of morainal deposits underlain by fractured igneous and metamorphic formations. Groundwater is very limited and irregular throughout the mountain areas (Schumm 1971).

Reclined against these Precambrian formations in the foothills area are sedimentary sandstones, shales, and limestones of the Paleozoic geologic age. These sedimantary deposits once laid in horizontal have been lifted and deformed by forces which formed the Rocky Mountains. These formations occur in a series of steeply sloping north-south parallel ridges and valleys.

The sandstone formations are possible aquifers, but they are limited because of the depth to adequate water supplies. The steep slope and nature of the bedding planes can create some hazards to land use when undercut or when loads are placed upon them. Sandstone, limestone, alabaster, and gypsum have been quarried in various locations along the foothills areas.

The interface of the foothills and plains area is covered by sedimentary formations of the Mesozoic Era. These rock formations in many places are overlain by younger Cenozoic Era formations. The Mesozoic formations are principally shales, some sandstones, and a few limestones. At the interface these uplifted geologic formations form steep hogback ridges. They are primarily steeply inclined sandstones and shales of the Cretaceous period. Progressing eastward out onto the plains area are the more recent Mesozoic formations which include most sandstone and shales. The more common formations which occur include the Pierre Shale, Foxhills Sandstone, and the Laramie formation. Overlaying these formations through much of the plains area are valley-fill deposits (recent water deposited gravels, silts, and clays), and pediment deposits. In the eastern portions of the Region, wind blown loess, sands, and pediment deposits are more frequently found.

The undifferentiated fill deposits which occur mostly in the floodplain areas support an extensive groundwater basin which provides water for many domestic irrigation wells. In some areas irrigation wells may yield as much as 2,000 gallons per minute (gpm). To a lesser extent, the finer textured valley-fill terrace deposits of arkosic gravels and sands are also important aquifer bearing formations of the Region (USGS 1972).

In eastern portions across the plains areas, wind blown sand deposits become more prevalent. These are usually not productive aquifers.

2.4 SOILS

The soil resources of the Region show a wide variation of physical and chemical characteristics. The agents which formed the soils, such as climate, wind, water, glacial ice, vegetative cover, and other biological influences have played varying roles through different parts of the Region. More detailed information about the soil resources is available from several sources (Heil et al 1976; USDA. SCS 1976 field office surveys).

In very general terms, the soils of the mountainous areas consist of very shallow to moderately deep, sloping, well-drained soils of stony coarse-to-medium texture. Depth to bedrock may be highly variable, but generally it is shallow. The parent geologic materials are largely granite, schists, and glacial deposits with sandstone at lower elevations.

At the base of the steep hillsides on which these mountain area soils are formed, there may be high terraces, alluvial fans, and benches which are comprised of more nearly level, moderately-deep soils of medium texture with high gravel content. These soils have developed largely from glacial till and outwashes.

The soils of the foothills area are also highly variable with the depth to bedrock shallow to moderately deep with rock outcrops appearing in some steeper areas. Parent geologic materials are largely sandstones with siltstones, limestones, and shales appearing in localized areas. Soil textures are somewhat finer. Gravel content and coarse materials may be of lesser extent than in the mountainous areas.

Soils of the transition zone or interface of the foothills and plains area are generally well-drained shallow medium-textured stony soils developing on sandstones and shales.

They form a discontinuous band which runs the entire length of Larimer County from the Wyoming state line to Boulder County.

In the plains area, soils are generally deeper and show greater signs of wind and water deposition from higher elevations. Soils of the floodplains, low terrains, and river bottoms are deeper and exhibit finer textures. In some cases, these soils are poorly drained and finer textured with underlying sand and gravels. They may be frequently flooded. Moving eastward away from the foothills, the soils show increased depth and greater predominance of wind deposited and wind-reworked origin. The soils of the west central part of Weld County are mainly deep level to moderately sloping, well-drained, medium to fine texture. These soils occur on upland alluvial fans and drainage ways.

In the northern parts of Weld County progressing eastward, deep well-drained sandy textured soils on moderate and gently rolling slopes occur. In the southern part of the Weld County area, excessively drained, deep soils on uplands and terraces are prevalent. In the far plains area, wind deposited materials on level to rolling uplands and terraces are predominate. These soils may frequently be shallow to bedrock of limey shales and sandstones.

2.5 HYDROLOGY

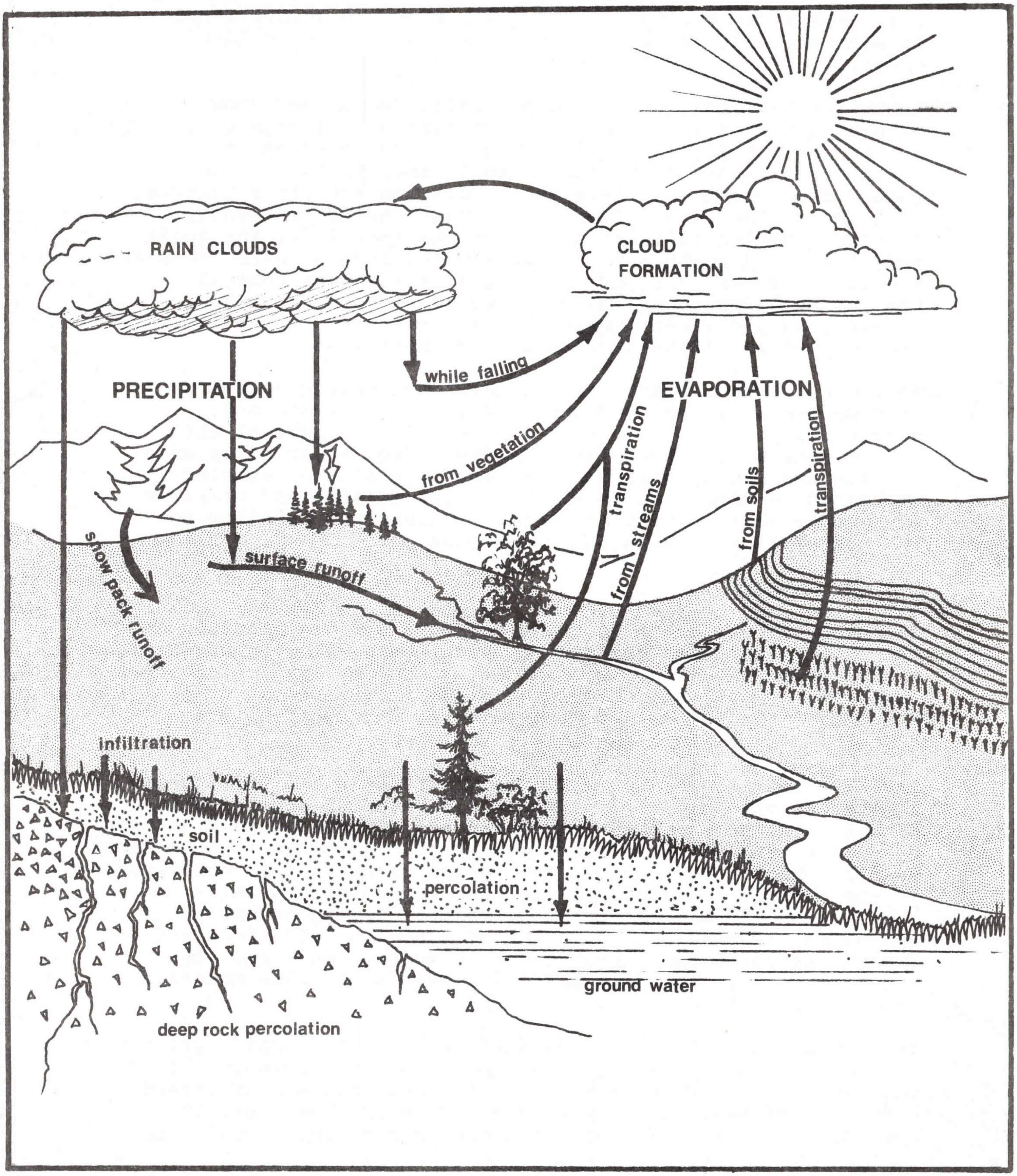
Hydrology is the study of the occurrence and distribution of water. It is a complex science which deals with the properties, distribution and circulation of water; on the surface of the land, in the soil and underlying geologic materials. A simplified diagram of the sources of water and its interaction in the hydrologic cycle is shown in Figure 2.5-A.

The hydrology of the South Platte River basin and tributaries in the Larimer-Weld Region is largely based on precipitation occurring as snow and on transbasin and transmountain diversion of waters from Colorado's western slope. As noted in a previous section, Figure 2.2-B shows the normal precipitation distribution in the region. Snowfall in the high mountains generally occurs from mid-November through March. Spring snowmelt begins in lower elevation ranges of 6,000 to 7,000 feet and progresses to higher elevations as temperatures rise. By mid-June to July the snow melt is occurring in high mountain areas of 11,000 to 14,000 feet.

Thin mountain soils, very few surface lakes and rapid spring snow melt afford little storage for water resources in the mountains of the Front Range. Historical analysis of stream flow amounts over the last 88 years reveals that about 70 percent of the annual runoff has occurred by July. Only the

FIG. 2.5-A

The Hydrological Cycle



snow remaining at high elevations contributes to stream flow of the major mountain tributaries and makes them perennial (year-round) streams (Bluestein 1975). The lowest flows in the major mountain rivers (Cache La Poudre, Big Thompson, and Little Thompson) occur during winter months from December through March when most of the water is bound as snow and ice in the high mountains. As a general rule, stream flow contributions from precipitation events are minimal except from infrequent high intensity storms usually occurring in summer.

Water contribution from the plains tributaries which drain the arid and semi-arid areas of Weld County is dependent upon intermittent runoff, and quantitatively is generally not important to the total water contribution of the South Platte River basin.

2.5.1 River Basins - Surface Hydrology

The major river basins and hydrologic sub-units of the region are illustrated in Figure 2.5-B. The following is a broad description of the six major river drainages in the region.

1. Laramie River Basin - The northwest corner of the region is drained by the Larimer River which flows northward to join the North Platte River in Wyoming. It is the only drainage in the region which does not directly connect with the South Platte River in Colorado. Land uses on the river drainage are confined mostly to low intensity irrigated agriculture, grazing, and low use open space. There is minimum access to the area over unsurfaced roads entering from the north through Wyoming, from the east through the Red Feather Lakes area, and from the south, through the Chambers Lake. Elevation ranges in the Laramie River basin are from 11,000 to 8,000 feet.

2. Cache La Poudre River Basin - The Cache La Poudre basin can be divided into an upper and lower drainage. The upper Cache La Poudre River drainage begins high in the Rocky Mountains west of Fort Collins. It flows in a south and easterly direction rapidly descending from the high mountainous areas where it joins the North Fork of the Cache La Poudre just above the community of Laporte. Land ownership on much of the upper slopes of the drainage is Federal and State. Principal land uses include grazing and forest harvesting. There are a number of overnight and day use picnic and campsite areas on the stream course and tributaries as well as numerous recreational residences lining the stream banks. The largest concentration of summer residences (and some year round homes) are near Rustic, Poudre Park, Crystal Lakes, and Red Feather Lakes.

The lower Cache La Poudre River drainage is defined as the river and its tributaries below the North Fork to the confluence with the South Platte River below Greeley. In this stretch, the river gradient lessens and begins to take on the characteristics of a plains stream as it emerges from the foothills. The river passes through three communities, Laporte, Fort Collins, and Greeley, as it makes its way to the South Platte River.

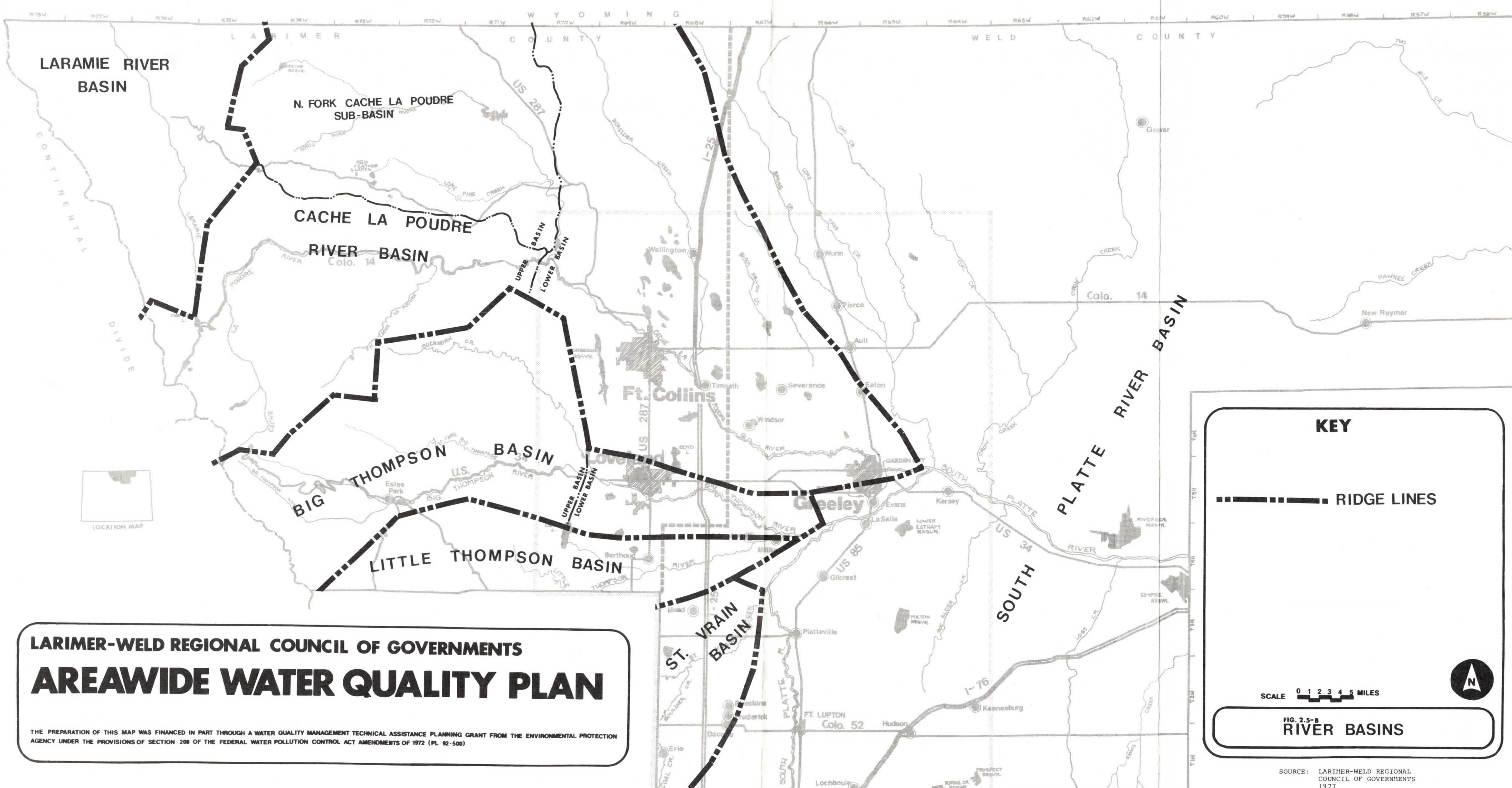
From a point just above the confluence with the North Fork (rivermile 61.9) to the confluence with the South Platte the Cache La Poudre has numerous domestic and irrigation ditch or canal diversions.

The natural hydrologic characteristics of the Cache La Poudre have been altered significantly by its many uses. Studies prepared for the 208 Water Quality Management Program have documented at least eleven points on the lower Cache La Poudre River where irrigation or municipal waste supply diversions may cause the river to temporarily dry up during portions of the year (Toups 1977a).

In the upper end of the lower drainage the cities of Fort Collins and Greeley receive domestic water supply from the Cache La Poudre and reservoir releases from the North Fork and Horsetooth Reservoir. This location marks the beginning of an area where complex water use and water quality relationships occur. In addition to being a source of irrigation water for tens of thousands of acres of agricultural lands, the Cache La Poudre is a receiving water for municipal and industrial waste waters and urban runoff in and around Fort Collins, Windsor, and Greeley. The river and adjacent riparian areas in the lower drainage also receive limited recreational use from fishermen, sportsmen, and nature seekers.

Annual peak flows on the Cache La Poudre River normally occur from May through September with about 70 percent occurring in June. Historically, most floods occur from intense rainfall in the basin. However, the upper portion of the basin accumulates a large snow pack during the winter and snowmelt runoff is considered a major floodwater contributor, especially when snowmelt is combined with heavy rains which could occur in May or June (US COE 1973).

According to U.S. Geological Survey records and historical accounts, flooding on the Cache La Poudre River has occurred infrequently in the lower reaches of the river with flows exceeding 21,000 cfs at the gaging station at the mouth of the River Canyon above Fort Collins.



KEY

RIDGE LINES

SCALE 0 1 2 3 4 5 MILES

FIG. 2.5-B
RIVER BASINS

SOURCE: LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS 1977

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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The river through Fort Collins begins to exceed channel capacity at 5,000 cfs. Peak discharge events of over 6,000 cfs have occurred in 1844, 1864, 1891, 1904, 1923, 1930, 1938, 1949, and 1976. Although the City of Fort Collins has not experienced flood danger in more than 45 years, the potential of flooding may increase as modification to the watershed and obstructions which alter flow in the channel occur. The factors affecting flooding and its impacts on the area may be found in other reports (See US COE 1973).

Flooding of the Cache La Poudre River near Greeley has occurred in 1864, 1876, 1884, 1904, 1917, 1923, 1947, 1949, 1951, and 1965 (U.S. COE 1974). It appears that Greeley and the community of Laporte, above Fort Collins are the most vulnerable to future flood damages. This conclusion is based on a brief review of floodplain information available on the Cache La Poudre River from the USGS gaging station just below the confluence of the Cache La Poudre with the North Fork down to the confluence with the South Platte River.

3. Boulder Creek-St. Vrain Creek Basin - The Boulder-St. Vrain Creek basin enters Weld County at the southeastern corner. Both the cities of Longmont and Boulder contribute treated municipal waste discharges to Boulder Creek-St. Vrain Creek. St. Vrain Creek joins the South Platte River approximately 4.5 miles northwest of Platteville. The Boulder-St. Vrain Creek basin exhibits a low gradient meandering plains stream character as it reaches the South Platte River. There are several points along the stream where diversions occur for irrigation purposes, significantly altering the natural stream characteristics and flow regine.

4. Little Thompson River Basin - The Little Thompson River has its source in the high mountain area in the southeastern corner of Rocky Mountain National Park near Long's Peak. It flows eastward out of the area through the Roosevelt National Forest. The stream gradient in the upper reaches is relatively steep. As the stream moves into the foothills area, it crosses from Larimer County into Boulder County and re-enters Larimer County just southwest of Berthoud. Water in this portion of the basin is diverted in ditches and canals for use on the irrigated agricultural lands which border the river. Land use in this area is primarily irrigated farmland.

5. Big Thompson River Basin - The Big Thompson River basin is located in the central southwestern portion of the study area. It has its source high in the mountains of Rocky Mountain National Park and drains approximately

one-fifth of the mountainous areas of Larimer County. The drainage basin upstream of the community of Cedar Cove is roughly 37 miles long and 18 miles wide at its widest point. The largest land area is on the north side of the drainage. The major tributaries are the North Fork of the Big Thompson which merges with the main stream at Drake and Buckhorn Creek which enters the stream about 5 miles west of Loveland.

From the generally wide open drainage in the upper part of the basin, the stream course constricts into a narrow cliff lined canyon in the middle and lower stretches. The drop in elevation throughout the canyon is pronounced. As the stream emerges from the canyon and is joined by Buckhorn Creek, the stream gradient lessens and the stream passes on to the wide alluvial irrigated agricultural valley on the south side of Loveland.

The Big Thompson River carries imported water from the Colorado Big Thompson Diversion project as well as native water. Western slope water from Grand Lake is transported through Alva B. Adams Tunnel and stored in Lake Estes for distribution to Carter Lake through Olympus tunnel. The remainder is carried by the Big Thompson River stream channel along with naturally occurring flows. From there, a portion of the combined flows are diverted for storage to other reservoirs or ditches and canals for immediate use. A more detailed account of the routing of Colorado Big Thompson project water is available in support materials (Toups 1977b).

A number of varying land uses occur on the Big Thompson from the headwaters in the mountains to confluence with the South Platte River on the Plains. In the mountain area, the Big Thompson is an important wildlife and recreational stream. It is a focal point for visitors to Rocky Mountain National Park and supports a quality cold water game fishery. As the river reaches the Estes Park area two municipal waste treatment plants discharge to the river. From Lake Estes down the canyon the stream has been used intensively as a recreational stream. However, the flood of July 31, 1976 has severely curtailed that use. A separate study on the Big Thompson Flood Area is being conducted (See Toups 1977c).

From the narrows at the Hansen Feeder Canal Tunnel the stream course begins to widen as it emerges from the foothills. From here to its confluence with the South Platte there are over 13 diversions for municipal and agricultural purposes. As the river reaches the lowlands around Loveland, land uses become more urbanized. The river receives some urban runoff from the southern portion of the City and is a receiving water for one municipal waste discharge and several industrial discharges including Great Western Sugar refinery. As the river leaves Loveland, it takes on the topical character of a shallow meandering plaines-type stream.

Flooding in the Big Thompson River basin is usually caused by intense rainfall events during spring and summer. Additional runoff from snow pack in the mountains may increase flood hazard in the spring months through June.

6. South Platte River Basin - The South Platte River enters the study area from the south in Weld County. It maintains a northerly course for about 18 miles, then begins to change to a northeasterly course where it is joined by the Big Thompson River. The South Platte is joined by the Cache La Poudre River near Greeley, where it again changes course to proceed out of the study area in an easterly direction. The South Platte, through Weld County, is a plains type stream.

   The drainage basin in the area which is not part of the Cache La Poudre, Big Thompson, or St. Vrain tributary systems is made up largely of small intermittent plains drainages which contribute small seasonal flows. The most important of these streams are Boxelder Creek in the southern part of Weld County and Lone Tree Creek in northern Weld County.

   Land use along the South Platte drainage is largely irrigated agricultural land; however, urban land uses are present along the river. Municipal waste discharges include Fort Lupton, Platteville, Hill N' Park Sanitation District, La Salle, Evans, Greeley, and Kersey. However, the greatest municipal and industrial impacts on water quality impacts on the River occur in the Denver area about five miles to the South.

   Historic flooding of the South Platte River in this stretch is evident from the nature of the topography and the seasonal flow variation which characterizes the stream. No detailed flood investigations have been completed for the South Platte River through Weld County. However, floodprone areas have been identified by the U.S. Geological Survey and large areas which have historically been inundated by flood activities have been delineated. (See Chapter 8.0 Appendices for areas covered.)

2.6 WATER RESOURCES

2.6.1 Present Uses of Water

Since the late 1800's, the South Platte River and its tributaries have changed from a natural drainage system to a highly complex water use and reuse system. The lower Cache La Poudre River drainage and the Colorado Big Thompson project have been acclaimed one of the most complex man-influenced hydrologic systems in the western United States. The natural hydrologic characteristics of the area have been modified by three basic water management actions: 1) storage in reservoirs; 2) import of water; 3) water use and reuse. The implementation of water management programs combined with the complex natural systems has added new opportunities and constraints to the hydrologic system.

1. Storage in Reservoirs - There are numerous storage reservoirs in the Region providing reserve water resources primarily for irrigation during the water-short periods of the year. The capacities of major storage reservoirs in the Region are presented in Table 2.6.1-A. Most of these reservoirs were constructed shortly after the turn of the century when mutual canal companies recognized the increased need for late summer irrigation water. There are over 75 reservoirs in the nine hydrologic sub-units in the Region with storage capacities of over 500 acre-feet. They provide much needed irrigation and municipal supply water and provide water-related recreation opportunities within the Region (see Toups 1977a for detailed quantitative analysis).

   The natural terrain of the Region has provided numerous reservoir sites for water impoundment at minimal cost. Natural ground depressions or basins overlying generally impervious geological materials were easily converted to reservoir areas by placement of earthen dams. The localized water resource development in the north Front Range of Colorado will verify this sophisticated modification in the water management system.

2. Import of Water - The Colorado-Big Thompson project is the largest transmountain water import measure in the study area and singly the largest import measure on the Colorado Front Range. It provides over 230,000 acre feet of West Slope water to the northern Front Range annually. Figure 2.6.1 shows the major sources and distribution of Colorado-Big Thompson water.

3. Water Use - As high quality water from the mountains moves eastward toward the Platte River in Nebraska, it may be used numerous times, with each use having a specific need for certain quality and quantity of water. Municipal, industrial, and agricultural water uses are considered to be the most

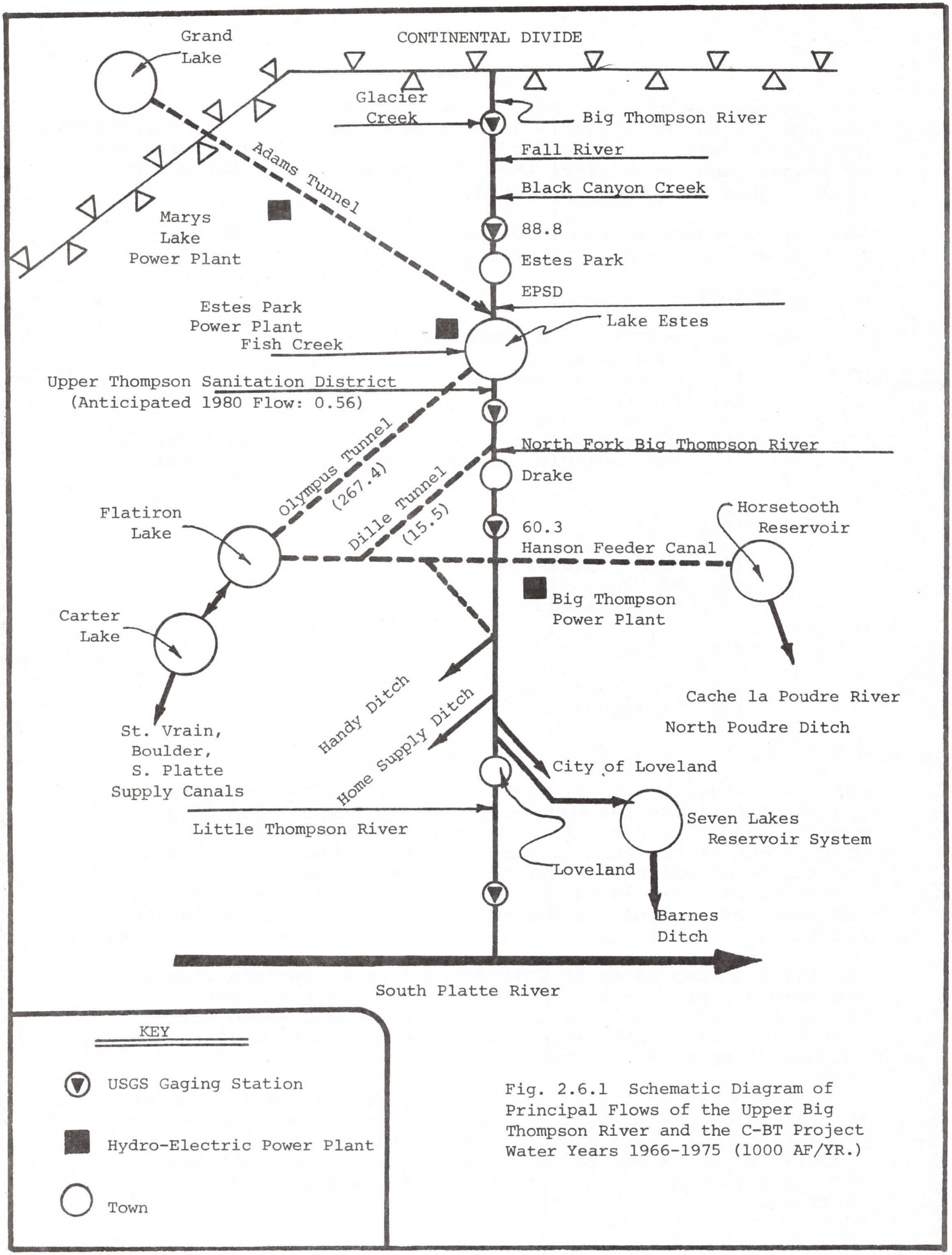


Fig. 2.6.1 Schematic Diagram of Principal Flows of the Upper Big Thompson River and the C-BT Project Water Years 1966-1975 (1000 AF/YR.)

consumptive and/or have the greatest impact on water quantity and quality in the Region. Other uses of water such as recreation, and fish or wildlife habitats historically have been considered of lesser importance since they are not water uses for which water rights have been appropriated.

The uses of water in the three general categories can be further broken down into subcategories as follows:

a. Municipal

(1) Household water consumption
(2) Lawn watering
(3) Commercial use
(4) Fire suppression
(5) Street cleaning
(6) Other associated urban use excluding industrial but including domestic consumption in rural areas

b. Industrial

(1) Food processing
(2) Manufacturing
(3) Miscellaneous

c. Agricultural

(1) Crop irrigation
(2) Livestock watering

2.6.2 Water Rights and Priorities

Long-term availability of water for agricultural, domestic, and industrial use has become a volatile issue. The large-scale transmountain and transbasin diversion of waters, which began at the turn of the century, augmented the timing and supply of water for agricultural use. However, few restrictions were placed on the intended water uses. But as irrigated agriculture became more intensified and population increased, greater demands have been placed on water resources.

The right to use water in Colorado and other western states has been a concern since the days of the early pioneers. The limited supplies of water led to conflicts among agricultural, mining, industrial, and domestic users with regard to their respective claims to the water.

In Colorado, water rights are property rights and are subject to use, sale, and transfer in the same manner as other property of the class known as usufructuary. A usufructuary property right is one in which the owner of the right has the right to use but not a right to the ownership of the water itself.

Under the Prior Appropriation Doctrine, a stream flowing by or through a piece of property has no bearing on the landowner's right to use water from the stream. The Prior Appropriation Doctrine gives the right to use that water to the person who has legally obtained the first use of that water. In Colorado, this is done by obtaining a permit from the State Engineer.

This permit gives the appropriator use of water obtained from natural sources and the continuing right to use the water regardless of the proximity of the intended use to the water source. The appropriator must put the water to a "beneficial" use within a reasonable period of time.

Under Prior Appropriation, use is governed by a priority system in which the "senior" water right (that which was granted first) will be satisfied before any "junior" rights, and he has the superior right to all the water necessary to fill his decrees before any junior rights can be met. The Senior Appropriator's right is specified as to time, place, and amount of water to be used. When water from the same source is used by several appropriators in succession, each is governed by the right of prior use.

In order to define and protect a right to use water, the owner must continue to use the water appropriated in the water right or lose it through abandonment.

2.6.3 Water Quality

Native water in the mountain areas of the Region is produced from rainfall and snowmelt which finds its way to streams through runoff, subsurface flow, or groundwater. Historically, water quality was a function of the type of parent geologic material, soils, and vegetation over which the water passed.

The past water quality of the South Platte River and tributaries in the region as a virgin stream has been postulated as good, with little differentiation in water quality between the mountain areas and the plains. The major influence to change in water quality in the plain's areas may have been directly or indirectly related to temperature changes of the water. The presence of warmer ambient air temperature and presence of suspended materials which could undergo some chemical reactions over the distance of flow in the River may have caused some changes. Other influences would have resulted from the water in the stream course picking up chemicals from the geologic materials over which it passed. (Bluestein 1975).

A current water quality assessment for the South Platte River has been completed in the Comprehensive Water Quality Management Plan prepared under Section 303(e) of the Federal Water Pollution Control Act Amendments of 1972 (FWPCA) for the State of Colorado (Toups 1974). The document includes an account of the water quality in the Region and the pollutant contributions of land uses on native and imported waters. Additional water quality analysis is being prepared as part of this investigation, and other work elements of the 208 Water Quality Management Planning process.

Table 2.6.3 shows the relative contribution of man related pollution sources in the region for four pollution indicators: BOD, nitrogen, suspended solids, and total dissolved solids (salinity).

In general, the water quality of the South Platte River basin in Larimer and Weld Counties is impacted mostly by agricultural water use and municipal sewage effluent discharges. The South Platte River as it enters Weld County from the south also shows significant influence from water use in the greater Denver urban area.

TABLE 2.6.3 DISTRIBUTION OF POLLUTANTS--LARIMER-WELD REGION

	PERCENT TO TOTAL POLLUTANT LOAD*			
WASTE SOURCE	BOD	SUSPENDED SOLIDS	TOTAL NITROGEN	TDS
Municipal	61	9	32	6
Industrial	15	9	15	2
Subtotal - Point Source	76	11	47	8
Irrigated Ag.	0	62	46	92
Feedlots	19	20	6	<1
Urban Runoff	4	7	<1	<1
Miscellaneous	1	<1	<1	<1
Subtotal - Non-Point Source	32	89	53	92
TOTAL	100	100	100	100

* Excludes natural background.

Toups Corporation 1977

2.6.3.1 Water Quality Impacts from Agricultural Activities

Agricultural activities are a major source of pollution in the study area in terms of their effects on surface and groundwater quality. The pollution generated from agriculture comes essentially from two sources: 1) irrigated cropland; 2) animal confinement facilities (see Toups 1974, 1977a for detailed discussion).

1. Irrigated Cropland - Pollution which occurs from irrigated cropland may result from erosion of topsoil layers by runoff; irrigation return flows which make their way back into the stream system; and deep percolation of leached irrigation waters through the soil to underlying water-tables or groundwater.

   The main pollutants which are contributed from croplands (irrigated and non-irrigated) are sediments, salinity, nitrates, phosphates, and pesticides. Erosion of soil from the land deposits sediment to streams and results in loss of valuable topsoil from agricultural lands. Some soil particles, such as clays, because of their physical and chemical properties, have the ability to attract plant nutrients such as phosphorus and pesticides. Through the erosion process, these things are also contributed to a stream as pollution.

   Salinity (total dissolved solids) is a function of the presence of mineral salts in a soil profile or subsurface geologic materials. These salts will dissolve in water applied to the soil during irrigation. Some of the salts will be carried off with water which reaches the stream as surface return flow, or passes through the soil and finds its way to groundwater, or moves laterally in the soil to a watercourse. Salinity buildup has adverse effects on the types of crops which may be grown and ultimately the yields which can be maintained. Salinity can significantly reduce crop production. Salinity as a pollutant is also important as a factor in domestic water supply because of taste and the effects which particular salts may have on corrosion damage to water systems.

   The primary source of nitrates in agricultural wastewater is from nitrogen fertilizers. Nitrogen is added in the form of ammonium nitrate (NH_2CONH_2) for the purpose of increasing crop yield. Because nitrogen in nitrate form is soluble in water, it is easily removed from the soil during water application and may contaminate groundwater or surface water supplies. Nitrogen as a contaminant of water is of concern for two reasons: 1) presence of nitrogen is a factor in stimulating growth of aquatic plants which may contribute to stream degradation; 2) nitrates in excess of 45 mg/l (10 mg/l nitrogen) appear to be the cause of methomoglobinemia to infants less than three months old. It is caused by the bacterial conversion of nitrate ions in water converted to nitrite. Nitrite then converts hemoglobin, the blood pigment which carries oxygen from the lungs to the tissues to methomoglobin. The altered pigment methomoglobin does not have the ability to carry oxygen and the physiological effect is oxygen deprivation or suffocation (Winston 1970).

Since many communities have municipal water supplies, which draw from wells in alluvial aquifers, which may receive nitrates from agricultural wastewater, the presence of accumulations of nitrogen is a concern to public health.

Phosphorus in agricultural wastewaters is the result of application of commercial fertilizers, usually in the form of ammonium phosphate. Unlike nitrogen, phosphorus is not readily soluble in water. Phosphorus is absorbed (attraction of the ion to the surface as a solid) by soil particles and usually remains in upper soil layers. It is removed from the land by erosion which displaces the soil particles on which the phosphorus is attached. Because of this characteristic, phosphorus poses little threat to groundwater.

Phosphorus, when in the presence of nitrates and organic carbon, can produce excessive growth of aquatic plants. This can cause eutrophic conditions in standing water or reservoirs and may lead to other water quality degradation.

Pesticides which include insecticides, herbicides, and fungicides are used on crops to control insects, pests, undesirable plants, and fungi to increase agricultural crop production. A wide variety of synthetic organic pesticides is used in the United States for these purposes. In many cases these chemicals may find their way into water supplies or food chains where, in sufficient concentrations, they can be toxic to human beings, fish, and wildlife. The monitoring and control of pesticide use in the Region is important to insure water quality.

2. Animal Confinement Facilities - Animal confinement facilities are areas which contain cattle, swine, sheep, or poultry in high concentrations. Wastes from confinement facilities produce a number of pollution problems which affect water quality. Pollution caused

by animals in confined areas includes nutrients (phosphorus and nitrogen), BOD, and fecal coliform and streptoccal bacteria. The basic problems of most nutrients have already been discussed in the narrative on irrigated agriculture. BOD is a measure of the strength of a waste in terms of the amount of oxygen needed to satisfy the biological requirement to stabilize the waste. Both BOD and bacterial indicators of waste are important for the protection of public health. Ammonia nitrogen, another feedlot waste product, can be toxic to aquatic life.

Pollutant characteristics are determinant on the breed of animal and the type and amount of feed which is consumed. For example, a feedlot steer will product about 7 to 10 times biochemical oxygen demand (BOD_5) materials and about 16 times the nitrogen load excreted by a human being.

Water pollution problems from animal confinement activities in the Larimer-Weld Region are described in more detail in a technical report available through the Council of Governments (Toups 1977d).

Statistical data indicates that between 835,000 and 950,000 fattened cattle are marketed in the Larimer-Weld region in any given year. The exact number fluctuates according to profitability of the livestock feeding industry. Feeders normally produce an average of about two pens of cattle each year.

Density of cattle on feed in Larimer and Weld Counties ranges from less than 100 to over 300 animals per acre of feedlot. Typical concentrations are in the 100 to 200 head range, with an average density of about 150 head per acre considered representative of confined feeding operations in the region.

More than 345,000 cattle, nearly 80 percent of the total number of cattle on feed at any one time in the two-county area, are known to be supported on feedlots equipped with conventional wastewater/runoff control facilities. Total feedlot area served by these controls is on the order of 2,200 acres.

Water quality impacts from animal confinement activities and use of their by-products comes from three basic sources: 1) Direct feedlot runoff; 2) percolation of corral or pen wastes; 3) manure or feedlot waste application to croplands. The nature of these problems and current states of concern are outlined in detail in the above referenced report.

2.6.3.2 Water Quality Impacts from Municipal Wastes

Point sources of wastewater within Larimer and Weld Counties include both municipal and industrial wastewater treatment facilities. There are currently 16 industrial and 30 municipal wastewater treatment facilities which have been granted state discharge permits. There are also an additional 13 municipal wastewater treatment facilities which are not currently required to have discharge permits because of the lack of significant discharges. Primary waste constituents from municipal and industrial sources include BOD, total dissolved solids, suspended solids, bacteria, nitrates, phosphates, and temperature. The major problems of these wastes as they affect pland animal life or otherwise impair water quality has previously been discussed.

In a basin-wide survey prepared by EPA in 1972 and reviewed by Bluestein and Hendricks in 1975, the relative contribution of municipal wastes by river sub-basins was analyzed. The most substantial contribution was from the South Platte River below Denver. Second, in terms of total flow contribution, was the Cache La Poudre River including discharges from Fort Collins and Greeley. Municipal drainage from the St. Vrain Creek was also substantial due to the municipal waste flow from the cities of Boulder and Longmont. The mix of contributing sources, in terms of magnitude of flow and quality of effluent, has undoubtedly changed due to population growth and waste treatment plant alterations. Table 2.6.3.2 presents the magnitude of municipal discharges in seven sections of the South Platte River basin. Additional detailed information on the contributions of municipal and industrial waste discharges in the region can be found in other Larimer-Weld 208 reports (Toups 1977).

During average flow of the South Platte River through the Denver gaging station (USGS 1972), the Metro Denver waste treatment plant effluent comprises approximately 50 percent of the flow. During months of low flow the discharge of effluent from the Metro Denver waste treatment plant may be as much as two times the river flow upstream of the outfall (Bluestein 1975).

2.6.3.3 Other Water Pollution Sources

As well as impacts from municipal, industrial, and agricultural pollution sources, waters of the region are affected by

TABLE 2.6.3.2 MAGNITUDE OF MUNICIPAL DISCHARGES IN SEVEN SECTIONS OF THE SOUTH PLATTE RIVER BASIN, 1971.

				BOD_5			Suspended Solids			Total Dissolved Solids		
	CMS	Flow MGD	Percent Total	Metric Tons/day	tons/day	Percent Total	Tons/day	Metric tons/day	Percent Total	Tons/day	Metric tons/day	Percent Total
So. Platte River (above Kersey RK380)	5.95	135.7[a]	73	19.2[b]	17.4	46	67.6[c]	61.3	74	371	337	69
Clear Creek Drainage (enters South Platte @RK500.6)	0.36	8.1	4	2.1	1.9	5	2.3	2.1	3	23.9	21.7	5
St. Vrain Drainage (enters South Platte @ RD434.5	0.70	16.0	9	3.1	2.8	9	2.7	2.4	3	38.1	34.6	7
Big Thompson Drainage (enters South Platte @ RD419.1)	0.175	4.0	2	1.0	0.9	2	1.2	1.1	1	10.1	9.2	2
Cache la Poudre Drainage (enters South Platte @ RK400.7)	0.70	16.0	9	10.1[f]	9.2	24	13.7[g]	12.4	15	34.8[h]	31.6	6
Minor Tributaries	0.035	0.8	1	0.2	0.2	1	0.4	0.4	1	2.3	2.1	1
So. Platte River (below Kersey RK380)	0.28	6.5	3	5.8	5.3	14	4.1	3.7	4	48.7	44.2	12
TOTAL	8.20	187.1	100	41.5	37.6	100	92.0	83.4	100	528.9	479.9	100

[a] Denver 86%. [b] Denver 78%. [c] Denver 88%. [d] Denver 83%.
[e] Greeley 44%. [f] Greeley 82%. [g] Greeley 76%. [h] Greeley 51%.

Source: Bluestein, M. and D. W. Hendricks, 1975. As extracted from U.S. EPA 1972 "Water Quality Investigations in the South Platte River Basin, Colorado 1971-72." National Field Investigation Center. Denver and Region VIII, Denver, Colorado.

silviculture (forest management operations), mining industry, and gravel operations; grazing and non-irrigated agricultural operations, improperly operated septic tank systems in rural and recreational areas; and urban runoff and construction and road building activities. A separate report deals with the sources and effects of these water pollution problems (Toups 1977).

2.7 VEGETATION

Vegetation as it relates to land use and urbanization serves many purposes. As a general rule, vegetation is a reflection of many interactions of the environment. It is often an indication of climate, moisture regime, soil, geology, and expected wildlife composition. The vegetative cover of the Larimer-Weld Region is diverse and ever-changing.

It has been argued by some ecologists that none of the original (pre-white settlement) vegetation exists in the plains and foothills areas of Colorado today (Moir 1971). Though it is hard to document this claim, it is evident that significant changes in vegetative cover have occurred as a result of settlement activities along the Front Range. Buffalo were replaced by cattle, and trees were used for cabins, railroad ties, and road construction. The biggest alteration on the Plains resulted from the conversion of plains grasslands to irrigated and non-irrigated farmland.

Vegetation of the mountainous areas is also constantly undergoing changes. Natural ecological changes resulting from insects, disease, succession, and fire have influenced the quantity and distribution of various plant species. Man, seeing the value of timber as a resource, has harvested forested areas and either left them to recover on their own or replanted areas with native or introduced species more suited to his needs.

There are 11 different general vegetative types which occur in the region. The most diverse distribution of these occurs in Larimer County because of the varied land forms and climatic conditions. Table 2.7-A lists the vegetative types of the region and their approximate elevation ranges.

TABLE 2.7-A GENERAL VEGETATIVE TYPES

Vegetation Type	Approximate Elevation Range
Alpine	11,000 - Above
Subalpine	8,500 - 12,000
Montane	6,000 - 8,500
Mountain Grassland	6,000 - 12,000
Pinyon-Juniper	5,000 - 8,000
Plains Grassland	4,000 - 6,000
Sage Brush	4,000 - 10,000
Sand Sage	4,000 - 6,000
Riparian Woodland	Below - 8,000
Disturbed	All Elevations

An inventory of native and non-commercially introduced plants occurring in Larimer and Weld Counties has been compiled for LWRCOG with the assistance of RAPIC (Rapid Access Plant Information Center) at Colorado State University. The inventory does not give geographical distribution of vegetative types, and vegetative ecosystem mapping and wildlife hazard mapping for some portions of Larimer County is available through the Colorado State Forest Service.

Plants known to be present in the region which occur on the threatened or endangered species list nationally and statewide have been indicated in Table 2.7-A.

2.8 WILDLIFE HABITAT

The wildlife resource is often difficult to quantify and evaluate in terms of its relative value to land use decisions. Man has limited knowledge about the interrelationships of ecosystems and the overall role which wildlife plays in nature. Resources have not been readily available for studying and inventorying wildlife in this perspective.

TABLE 2.7-B. THREATENED OR ENDANGERED PLANT SPECIES OF LARIMER-WELD REGION

VEGETATION TYPE	COMMON NAME	SCIENTIFIC NAME	ENDANGERED (1)	THREATENED (2)	MAXIMUM MINIMUM ELEVATIONS
Alpine	Alpine Black-headed Sedge	Carex, vernacula	unknown	Colorado	12,500 11,300
	Dwarf Rock Jasmine	Androsace, chamaejasme, carinata	Colorado	unknown	13,500 11,500
	Greenleaf Bluebells	Mertensia, viridis, cana	unknown	North America	13,000 8,800
	Halls Penstemon	Penstemon, hall II	Colorado	unknown	13,000 10,000
	Harbours Penstemon	Penstemon, harbour II	Colorado	unknown	13,000 11,500
	Rocky Mountain Columbine	Aquilegia saximontana	Colorado	unknown	12,000 10,000
	Spike Gilia	Ipomopsis, globularis	Colorado	unknown	14,000 12,000
	Unknown	Carex engelmannii	unknown	Colorado	12,000 11,000
	Unknown	Draba grayana	Colorado	unknown	13,000 11,500
	Unknown	Draba, lonchocarpa	Colorado	unknown	12,250 10,000

VEGETATION TYPE	COMMON NAME	SCIENTIFIC NAME	ENDANGERED[1]	THREATENED[2]	MAXIMUM MINIMUM ELEVATIONS
Alpine (cont.)	Unknown	Helictotrichon, hookeri	unknown	Colorado	12,000 11,000
	Unknown	Kobresia, sibirica	Colorado	unknown	13,370 11,800
	Unknown	Poa, patter-sonii, II	Colorado	unknown	12,800 3,658
	Unknown	Ranunculus, pygmaeus	Colorado	unknown	13,300 3,810
	Unknown	Senecio, am-plectens, holmii	Colorado	unknown	12,000 10,400
	Unknown	Senecio soldanella	Colorado	unknown	13,000 9,500
	Unknown	Senecio, taraxacoides	Colorado	unknown	13,000 11,000
Sub Alpine	Calypso	Calypso, bulbosa	Colorado	unknown	10,000 7,000
	Common bogbean	Menyanthes, trifoliata	unknown	Colorado	10,400 8,500
	Goldsaxifrage	Chrysosplenium, tetrandrum	unknown	Colorado	12,800 7,700
	Woodnymph	Moneses, uniflora	unknown	Colorado	11,500 8,500
	Unknown	Goodyera, oblongifolia	Colorado	unknown	10,700 6,000

VEGETATION TYPE	COMMON NAME	SCIENTIFIC NAME	ENDANGERED [1]	THREATENED [2]	MAXIMUM MINIMUM ELEVATIONS
Sub Alpine (cont.)	Unknown	Harbouria, trachypleura	Colorado	unknown	10,500 5,500
Montane	Rough fescue	Festuca, scabrella	Colorado	unknown	12,000 8,500
	Threeleaf lewisia	Lewisia, triphylla	unknown	Colorado	11,400 8,300
	Woodfern	Dryopteris, austriaca	Colorado	unknown	10,000 9,500
	Wood Lily	Lilium, philadel-phicum	unknown	Colorado	10,000 6,000
	Unknown	Cypripeduim, calceolus	Colorado	unknown	9,500 7,000
Mountain Grassland	Bluebells	Mertensia, humilis	Colorado	unknown	8,500 8,000
	Cushion coryphantha	Coryphantha, vivipara	Colorado	unknown	8,500 4,500
	Fennel gianthyssop	Agastache, foeniculum	unknown	Colorado	8,000 3,700
	Sedge	Carex, sprengelii	unknown	Colorado	7,700 5,400
	Unknown	Poa, patter-son II	Colorado	unknown	12,800 3,658
	Unknown	Potentilla rupincola	Colorado	unknown	7,500 7,000

VEGETATION TYPE	COMMON NAME	SCIENTIFIC NAME	ENDANDERED [1]	THREATENED [2]	MAXIMUM MINIMUM ELEVATION
Pinyon-Juniper	No Listings Noted				
Plains Grassland	Cryptantha	Cryptantha, celosioides	unknown	Colorado	5,000 5,000
	Mat Grama	Bouteloua, simplex	unknown	Colorado	8,800 8,800
	Western ironweed	Vernonia fasciculata	unknown	Colorado	4,900 3,700
Sagebrush	No Listings Noted				
Sandsage	No Listings Noted				
Disturbed	Bitter wintercress	Barbarea, vulgaris	Colorado	unknown	unknown
	Unknown	Solanum, James II	unknown	Colorado	7,500 6,000
Riparian	Sheathed pondweed	Potamogeton, vaginatus	Colorado	unknown	10,000 7,700
	Unknown	Senecio rapifolius	unknown	Colorado	8,500 7,800
Oakbrush	No Listings Noted				

(1) Species listed as endangered, North America, are those species listed in the Federal Register of 6/16/76 as being endangered in North America. Species listed as endangered, Colorado, are those species considered by local authorities to be endangered in Colorado. They may not be endangered elsewhere.

(2) Species listed as threatened, North America, are those species listed in the Smithsonian Report of 1975 (and amended by the Federal Register list of 6/16/76) as being threatened in North America. Species listed as threatened, Colorado, are those species considered by local authorities to be threatened in Colorado. They may not be threatened elsewhere.

However, information is available to support the need to study preservation of wildlife and wildlife habitats for input to land use decisions (see Nobe and Steinhoff 1973; Mammoth Lakes 1972; Lautenbach, et al 1974).

Wildlife are essential elements which should be considered in land use planning in the Region for three basic reasons: economy and recreation; aesthetics; and role in ecological processes.

2.8.1 Roles of Wildlife

The Region provides a recreation resource for residents and non-residents of Larimer and Weld counties who hunt, fish, photograph, or otherwise enjoy the presence of wildlife.

The mountains, foothills, and plains area of the Region provide substantial acreages of habitat for big and small game animals and fowl. Larimer County, having a major portion of the big game habitat, provides a recreation opportunity for hunters, fishermen, and viewers of wildlife. Well over 2,000 deer, elk, and antelope are harvested annually from the mountain, foothills, and plains areas of the Region. (Colorado Division of Wildlife 1975).

The northern part of the Front Range is a major nesting, resting, and feeding area for migratory birds, because of its geographic location, diversity of habitat, and food sources (natural and agricultural crops) and many acres of surface waters.

No attempt has been made to assess the economic contribution of recreation wildlife consumers in the Region. However, it is evident that numerous dollars are expended annually for the purchase of recreational equipment, food, and lodging by hunters, fishermen, birdwatchers, and photographers who observe or hunt wildlife on private or federally-owned lands in the Region.

The aesthetic values of wildlife are the hardest to quantify and yet may be the most precious to the individual who experiences the presence of wildlife. The fact that people go to the mountains or to a wildlife area less habited by other human beings and more by wild animals may serve to illustrate the aesthetic values of wildlife in the Region.

Nature is a complex series of interrelated phenomenon. Impacts to one part of an environmental system can affect other parts. Ecological balance plays an important role in maintaining species diversity and population levels. As an example, the bird population is a very important factor in keeping check on the population of insects. A disruption of the bird population of a particular species could have an adverse effect on the numbers and types of insects in an area. Wildlife in the Region also provides a biological indicator of the environmental quality. As more knowledge is gained about the factors which affect the environment, it may be possible to determine the environmental health of an area by the diversity of species and population levels which inhabit it.

2.8.2 Threatened or Endangered Species

Unlike man, wildlife cannot modify their environment to permit survival. Wildlife have basic requirements for survival: food, cover, water, and to a certain extent, freedom from harassment by man. This last requirement is a quality of life factor which varies for each species. Wildlife vary considerably in the amount of change which they can tolerate. Animals most susceptible to adverse effects of environmental change either have low breeding rates, require large territories to live in, or have special habitat requirements which they may compete for with other animals or man (Lautenbach, et al 1974).

Animals which are most susceptible or intolerant to change are large mammals, fur bearers, and birds of prey. Many of these animals have limited habitat for which they are suited and must adapt or be excluded from the area. As development and urbanization increases, increased problems of wildlife survival result. For these reasons, identification of potential conflict areas should be undertaken and possible buffer zones for wildlife protection established.

The Colorado State Nongame and Endangered Species Act of 1973 (CRS 33-8) has given the charge for protection and enhancement of species classified as threatened or endangered under the Act, to the Colorado Division of Wildlife.

As a part of the program to assist in the prevention of declining populations of these species, the Colorado Division of Wildlife has attempted to define some of the elements included as "essential habitat" requirements of individual species. Here "essential habitat" may be defined as the entire habitat or any portion thereof which is vital to the normal needs or survival of that species. The elements include:

1. Space for normal growth, movements, territorial behavior.

2. Nutritional requirements, such as food, water, or minerals.

3. Sites for breeding, reproduction, or rearing of offspring.

4. Cover or shelter.

5. Other defined biological, physical, or behavioral requirements (Colorado Division of Wildlife 1976).

The following material discusses those threatened and/or endangered species found in the study area. A summary of these species and their status is presented in Table 2.8.1.

1. Fishes

   a. Greenback Cutthroat Trout (*Salmo clarkii Stomias*)

   The only rare or endangered game fish species known to inhabit the Region is the Greenback Cutthroat trout (*Salmo clarkii stomias*). During the time the white man came to Colorado, the Greenback Cutthroat was the only classical game fish found in the South Platte and Arkansas River basin. A drastic decline in native Greenback Cutthroat populations occurred through a change in stream conditions resulting from development of irrigation diversions, mining, grazing, logging, other land uses, and introduction of non-native trout species. Because of the adverse conditions which hamper the existence of this trout species, there is circumstantial evidence to support a theory that the Greenback Cutthroat is the most susceptible of all western trouts to extinction (Behnke and Zarn 1976).

   Due to its extreme rareness, the Greenback Cutthroat has been listed as an endangered species by the U.S. Department of Interior under P.L. 93-205, the Endangered Species Act of 1973.

   There have been several attempts over the years to reintroduce the species to headwaters of the Big Thompson River in Rocky Mountain National Park (N.P.S. 1976) and Black Hollow Creek, a tributary to the Cache La Poudre River (Behnke and Zarn 1976). The limiting factor in reintroduction appears to be competition with other fish species, to the disadvantage of the Greenback Cutthroat. In order to accomplish a restoration effort, eradication of other competing species has been the prevalent technique employed.

TABLE 2.8.1 THREATENED AND ENDANGERED ANIMAL SPECIES OF LARIMER-WELD REGION

Common Name	Scientific Name	Status*
Fishes		
Greenback Cutthroat	Salmo clarkii stomias Cope	FE, SE
Johnny Darter	Eteostoma nigrum Rafinesque	SE
Birds		
White Pelican	Pelicanus erythrorhynchos	ST
Peregrine Falcon	Falco peregrinus anatum	FE, SE
Mammals		
Gray Wolf	Canus lupus	FE, SE
Grizzley Bear	Ursus arctos	SE, FT
Black-footed Ferret	Mustela nigripes	FE, SE
Wolverine	Gulo gulo L.	SE
River Otter	Lutra canadensis Schreber	SE

Species identified above appear on current Federal Register under the Threatened and Endangered Species Act of 1973, or the Colorado Division of Wildlife Management lists as authorized in the Colorado Nongame and Endangered Species Consent Act (1978 CRS 33-8).

Key to Status*

F - Federal
S - State

T - Threatened
E - Endangered

b. Johnny Darter (Etheostoma nigrum rafinesque)

The Johnny Darter is a small forage fish which historically inhabited portions of the South Platte River and tributaries. Recent studies of the 1960's have shown that the Johnny Darter may now be restricted to tributary streams of the South Platte River including selected portions of the Big Thompson River, Cache La Poudre River, St. Vrain Creek, Fossil Creek, Eaton Ditch, North Poudre Canal, and Reservoir #9 near Waverly. These are the only known habitats for this fish species in Colorado with the possible exception of tributaries to the Republican River drainage in eastern Colorado.

According to the Colorado Division of Wildlife, the elimination of Johnny Darter habitats has been the result of stream channelization, water regulation, siltation, and pollution from municipal and industrial sources (CDW 1976).

2. Birds

a. White Pelican (Pelicanus erythrorhynchos)

Prior to 1962, the White Pelican occurred only as a migrant and occasionally as a non-breeding summer resident. There is evidence to support the position that the White Pelican has at one time utilized most major reservoirs (over 600 surface acres) throughout the state. The only nesting colony for the White Pelican occurs on Riverside Reservoir in Weld County. The birds at Riverside feed on the other nearby reservoirs including Jackson Reservoir, Empire Reservoir, Lower Latham Reservoir, Milton Reservoir, and some others. Other migratory non-breeding White Pelicans utilize Fossil Creek Reservoir and Timnath Reservoir in Larimer County (CDW 1976).

Because of its nesting and feeding habits, the preservation of particular habitat acres is essential to the birds' continued existence. The Colorado Division of Wildlife is actively engaged in a program to preserve "essential" habitat through a land leasing and nest colony establishment program in the Region.

b. Peregrine Falcon (Falco peregrinus anatum)

This bird is a medium-sized falcon with a body length of 13-19 inches. The distribution of the Falco peregrinus anatum is universal across the northern two-thirds of the United States. However, it is rarely seen in the Eastern states in recent years.

The falcon's deadliest enemy is man. In past years, egg and skin collections reduced populations on a localized basis. In recent years the plight of the bird has been the result of the introduction of select pesticides to the environment causing, among other things, egg shell thinning and hampered reproduction. The Peregrine falcons are also shot by careless sportsmen. Human harassment and disturbance of eyries may inadvertantly cause peregrines to abandon nesting attempts. Some falcons are exceptionally sensitive to disturbance and will refuse to breed if humans have been anywhere near their eyries (Snow 1972).

The Peregrine falcon is known to inhabit and nest in two generalized areas in the mountainous portions of Larimer County, but they may also be present in other locations (CDW 1976).

3. Mammals

For practical purposes, the grizzley bear (Ursus arctos, the gray wolf (Canus lupus) and the wolverine (Gulo, gulo) can be considered extipated (population wiped out) from the Region and generally from the state. Their reintroduction to localized areas where habitat is suitable has not been actively pursued because of the large habitat areas required. Also because some of these mammals are predatory by nature, their diets may include certain domesticated or commercially-produced species, such as sheep and cattle. This condition has resulted in disfavorable reaction by some ranchers, farmers, mountain recreation home owners, and tourists. It is interesting to note that these species were present at self-sustaining population levels before man inhabited the area.

a. River Otter (Lutra canadensis Schreber)

River otter populations in past years declined due to the trapping of beaver (which occupy similar habitats) and water pollution largely caused by mining operations. After total extinction within the State, they have been introduced in recent years.

The population levels of river otter today are controlled by the availability of water of high quality and an abundant supply of fish, amphibians, and crustaceans.

Attempts have been made to reintroduce the river otter to selected stretches of major waterways in the state, including portions of the South Platte River (Colorado Division of Wildlife 1976). However, there have been no known attempts to reintroduce the species within the Larimer-Weld area.

b. Black Footed Ferret (*Mustela nigripes*)

Little is known about the black footed ferret except that its distribution is limited by the presence and abundance of the genus *Cynomys* (prairie dogs). While the historic distribution of the animal was equal to that of the prairie dog genus including much of the plains and foothills area of the Region, the ferret was not in abundance. It is not easily documented that the black footed ferret does or does not exist in Colorado at the present time. The most logical place to find them if they do exist today is around the Pawnee National Grasslands where habitat is suitable and unconfirmed sitings have been made (Snow 1972b).

2.9 FISHERIES

The rivers, streams, lakes, and reservoirs of the Region support a diversity of native and introduced fish species. The distribution of each fish species is a function of the ability of that particular fish to adapt to natural or man-caused aquatic conditions and compete with other inhabitants of a particular water body.

Table 2.9 is a list of introduced and native fishes of the South Platte River Basin in Larimer and Weld Counties. The historic geographic distribution of many of these species is difficult to document, because a comprehensive inventory by State and federal agencies of fish species for various drainages has not been a topic of great interest until very recently. This is especially true for streams and rivers. Some information for lakes and reservoirs is available.

All but one of the classical gamefish, such as the trouts (*Salmo*) and landlocked salmon (*Oncorhynchus*) found in the mountain Zone and in limited portions of the foothill and plains zones, are introduced fish species. Active stocking since the 1870's of these species and other introduced cold- and warm- water fishes by the Colorado Division of Wildlife and avid sports fishermen has greatly modified the original species composition.

FISHES OF THE SOUTH PLATTE RIVER BASIN
LARIMER-WELD REGION*

TABLE 2.9

COMMON NAME	SCIENTIFIC NAME	(1) GENERAL HABITAT	(2) NATIVE INTRODUCED	(3) NORMALLY G-TAKEN FOR FOOD B-CDW BAG LIMIT	(4) COMMENTS
Gizzard Shad	Dorosoma cepedianum	W	I	G,B	Abundant in Boyd Lake
Coho/Silver Salmon	Oncorhynchus kisutch	C	I	G,B	
Sockeye Salmon/Kokanee	Oncorhynchus nerka	C	I	G,B	
Mountain Whitefish	Prosopium williamsoni	C	I	G,B	Native to Colorado, introduced in limited areas of the Upper Poudre River
Cutthroat Trout	Salmo clarki	C	I	G,B	Introduced Hybrids
Greenback Cutthroat Trout	Salmo clarki stomias	C	N	G,B	Native, but reintroduced into Rocky Mountain Natl. Park and limited areas. Endangered.
Rainbow Trout	Salmo gairdneri	C	I	G,B	
Brown Trout	Salmo trutta	C	I	G,B	
Brook Trout	Salvelinus fontinalis	C	I	G,B	
Lake Trout/Mackinaw	Salvelinus namaycus	C	I	G,B	Selected reservoirs in Region

*Key to Species List provides information on code entries for columns (1)-(4).
Compiled from Bluestein, 1975; Li 1968; Colorado Division of Wildlife, 1977; R. Behnke, 1977, Colorado State University, Department of Zoology.

FISHES OF THE SOUTH PLATTE RIVER BASIN
LARIMER-WELD REGION* (CONT.)

COMMON NAME	SCIENTIFIC NAME	(1) GENERAL HABITAT	(2) NATIVE INTRODUCED	(3) NORMALLY G-TAKEN FOR FOOD B-CDW BAG LIMIT	(4) COMMENTS
Splake	Brook trout x Lake trout hybrid	C	I	G	
Artic Grayling	*Thymallus arcticus*	C	I	G	
Northern Pike	*Esox lucius*	C	I	G,B	
Stoneroller	*Campostoma anamalum*	W	N		
Lake Chub	*Couesius plumbeus*	W	N		Not known since 1903
Carp	*Cyprinus carpio*	W	I		Commonly taken for sport with bow and arrow.
Brassy Minnow	*Hybognathus hankinsoni*	W	N		
Plains Minnow, Northern	*Hybognathus placitus placitus*	W	N		Presence today doubtful
Golden Shiner, Western	*Notemigonus crysoleucas auratus*	W	I		
Common Shiner, Northern	*Notropis cornulus frontalis*	W	I		
River Shiner	*Notropis blennius*	W	N		
Big Mouth Shiner	*Notropis dorsalis*	W	N		
Red Shiner, Plains	*Notropis lutrensis lutrensis*	W	N		
Blacknose Shiner	*Notropis heterdepis*	W	N		
Northern Redbelly Dace	*Phoxinus eos*	W	N		Not known since 1903

FISHES OF THE SOUTH PLATTE RIVER BASIN
LARIMER-WELD REGION* (CONT.)

COMMON NAME	SCIENTIFIC NAME	(1) GENERAL HABITAT	(2) NATIVE INTRODUCED	(3) NORMALLY G-TAKEN FOR FOOD B-CDW BAG LIMIT	(4) COMMENTS
Fathead Minnow	_Pimephales promelas_	W	N		
Longnose Dace	_Rhinichthys catacractae_	W	N		
Suckemouth Minnow	_Phanacebius mirabilis_	W			
Creek Chub, Northern	_Semotilus atromaculatus atromaculatus_	W	N		
Longnose Sucker, Western	_Catostomus catostomus griseus_	W	N		
White Sucker, Western	_Catostomus commersoni suckley_	W	N		
Black Bullhead	_Ictalurus melas_	W	N	G,B	
Brown Bullhead, Northern	_Ictalurus nebulosus nebulosus_	W	I	G,B	
Channel Catfish	_Ictalurus punctatus_	W	N/I	G,B	Reintroduced
Plains Killifish	_Fundulus kansae_	W	N		
Plains Topminnow	_Fundulus sciadicus_	W	N		
Mosquito Fish/Western Gambusia	_Gambusia affinis affinis_	W	I		
Sacramento Perch	_Archoplites interruptus_	W	I	G	
Green Sunfish	_Lepomis cyanellus_	W	I	G	
Pumpkinseed	_Lepomis gibbosus_	W	I	G	

FISHES OF THE SOUTH PLATTE RIVER BASIN
LARIMER-WELD REGION* (CONT.)

COMMON NAME	SCIENTIFIC NAME	(1) GENERAL HABITAT	(2) NATIVE INTRODUCED	(3) NORMALLY G-TAKEN FOR FOOD B-CDW BAG LIMIT	(4) COMMENTS
Orange Spotted Sunfish	Lepomis humilis	W	N		
Smallmouth Bass, Northern	Micropterus dolomieui dolomieui	W	I	G,B	Common in Horsetooth Reservoir
Largemouth Bass, Northern	Micropterus salmoides salmoides	W	I	G,B	
White Crappie	Pomoxis annularis	W	I	G,B	
Black Crappie	Pomoxis nigromaculatus	W	I	G,B	
Iowa Darter	Etheostoma exile	W	I		
Orangethroat Darter	Etheostoma spectabile	W	N		Endangered
Johnny Darter, Central	Etheostoma nigrum nigrum	W	N		Endangered
Yellow Perch	Perca flavescens	W	I	G,B	
Walleye	Stizostedion vitreum vitreum	W	I	G,B	
Freshwater Drum	Aplodinotus grunniens	W	I	G,B	
Log Perch	Percina capredes	W	I		
Brook Stickleback	Culea inconstans	W	I		

KEY TO SPECIES LIST
FISHES OF THE SOUTH PLATTE RIVER BASIN
LARIMER-WELD REGION

COLUMN	EXPLANATION FOR CODING
(1)	C - Cold water - temperatures not exceeding 20°C W - Warm water - temperatures not exceeding 30°C
(2)	N - Native I - Introduced
(3)	G - Game and Food. Species most commonly taken by conventional angling means for food, including, but not limited to, any of the various fishes made a legal catch by specific state legislation. B - Species for which 1977 Colorado fishing regulations establish a bag or possession limit

The classification of fishes into one of the above categories does not preclude the value of such fishes as "sport fish." Where a sport fish may include numerous species taken for consumptive use, or otherwise enjoyed in a recreational experience.

Colorado State Statute defines sport fish in 1973 CRS 33-1-102(35). "Sport fish means all species of trout, char, grayling, salmon, walleye, northern pike, bass, crappie, bluegill, whitefish, catfish, perch, sunfish, drum, carp, sucker, shed, minnow, and such other species of fish that may be introduced or transplanted into this state for fishing or angling or are classified as sport fish by the Commission." (Colorado Wildlife Commission)

Much of the data available on the fisheries of the South Platte River is skeptical of the nature of the plains portion as a cold or warm water game fishery. Hiram Li (1968), in a thesis on the fishes of the basin, indicated that the pristine South Platte River basin did not support the diversity of species found in the remainder of the Missouri River basin, primarily because of ecological barriers related to the quantity of water in the system. Li postulated that before regulation of irrigation water through the year, the South Platte (and tributaries) was probably "torrential during spring runoff and virtually stagnant and intermittent during late summer." This flow alteration has definitely affected the fisheries of the foothill and plains areas. The composition of these fisheries was different because of stream flow variation and probably affected by the water quality, resulting from low flow conditions, i.e., temperature. The extent to which this may be an accurate assessment has not been well documented, and is a topic for further study.

2.10 RECREATION

The Larimer-Weld Region provides a wide diversity of passive and active recreation opportunities. Private, state and federal lands are available for many types of recreation. This area serves as a recreation resource for local residents and numerous visitors outside the Region and the State.

The demand for quality recreation experiences has increased dramatically over the last 15 years due to more free time, affluence, and greater mobility. An attempt on the part of local state and Federal administrators to keep abreast of recreation demands has met with limited success as a result of inadequate public financial support for land acquisition, development, and planning improvements of new and existing recreation areas.

Although the Larimer-Weld Region has about 6.3 percent of the total population of the South Platte River Basin in Colorado and Wyoming it contains 25.4 percent of the water recreation acres and 33.3 percent of the general recreation lands. In contrast, Denver County has roughly 30 percent of the population of the South Platte River Basin and only 1.0 percent of the water recreation acres and 0.2 percent of the recreation lands (BOR 1976).

Therefore, the Larimer-Weld Region is a recreation resource for much of Colorado's Front Range population and extensive out-of-state tourist populations who visit Roosevelt National Forest and Rocky Mountain National Park.

2.10.1 Larimer County and Municipalities

Larimer County makes a significant contribution to the availability of recreation opportunities in the area. The County administers such areas as Horsetooth Reservoir, Carter Lake, Flatiron Reservoir, and Pinewood Lake. The County is also in the process of developing the McMurray Natural area near Fort Collins, Shipley Natural Area near Loveland, and the Strauss Cabin Historical Site. In addition to those efforts, the Commissioners in March, 1975, instituted The Open Space and Outdoor Recreation Fund and Citizen's Advisory Board. In addition to those areas mentioned above as being developed, available funds are used for financial aid to the communities in the county to assist in developing their own recreational facilities.

Concern for future recreational opportunities and open space is noted in the preparation of the proposed Open Space and Outdoor Recreation Plan for Larimer County (Larimer County 1976) and a recreation needs survey prepared by the Recreation Resources Department at Colorado State University (Miller 1971). Community residents from urban and rural parts of Larimer County have continually expressed the need for more foot, horse, and bicycle trails, preservation of land around reservoirs, greenbelts for maintaining community identity, preservation of natural skyline features, and cooperative effort between the county and community for park improvement.

The Open Space Plan for the City of Fort Collins which is an element of the Comprehensive Plan lists a total of 584.9 acres in proposed or existing parks, 27.5 miles of proposed foot, bike, and horseback trails, and 1,008 acres of proposed and existing open space. The present park system consists of three community parks, City Park, Edora, and Lee Martinez (now under construction) with 11 smaller neighborhood or school parks, some of which are still to be developed. The neighborhood parks are specifically designed for the 8 to 20 age group and the activities to be provided are those suited to the neighborhood. Community Parks are being designed to serve the people of all age groups with a variety of recreational activities.

The City of Loveland also operates a system of community and neighborhood parks. The community parks are located near available bodies of water. Community parks have been developed adjacent to Lake Loveland, Rist-Benson Lake, Silver Lake, and on the Big Thompson River. Proposed community parks are also near water bodies. Centennial Trail is proposed to follow the Big thompson River from Namaqua Park, through Centennial Park, and the Shipley Natural Area to end in Barnes Park. However, this trail system is still in the planning stage.

In the Town of Estes Park, there are few, if any, points which do not have access to National Park, National Forest, or other open space within one half mile. The need to provide other recreational opportunities to its citizens and visitors is still apparent, however. In Estes Park the role of directing such activities as golf, tennis, or swimming is performed by the Rocky Mountain Metropolitan Recreation District. Many of the district's facilities are located in Stanley Park which is owned by the city. Other areas administered by the district include Mary's Lake, Lake Estes, and the East Portal Campground. The town has also acquired through subdivision regulations and as gifts some six and one half acres of neighborhood parks.

2.10.2 Weld County and Greeley

The recreation and open space responsibilities in Weld County are somewhat different than Larimer County. The State of Colorado operates three recreation areas, Barbour Ponds, Black Hollow Reservoir, and Seeley Lake, within the county. These efforts combined with the efforts of local communities as well as private organizations relegates the County to a basic role of preserving open space. The fields of crops and pastures allegedly provide the citizens of the county with scenic open space free of charge, and it is the policy of the county to encourage maintenance of agricultural lands through its comprehensive plan.

Weld County is a participant of the 1972 Pilot Public Access Program. This program is designed to test the feasibility of paying farm owners to open their land to public hunting, fishing, and riding. If successful, it is possible that more private lands can be opened for public recreation activities.

Greeley has a total of 401.5 acres of land devoted to existing parks and future parks development. The largest park is Island Grove, 85 acres. The city also maintains 14 neighborhood parks or playgrounds totaling some 110 acres. The city has an additional 153 acres in special use classification consisting of golf courses, museums, or other single function facilities.

Still in the planning stage is a proposed public open space area around the perimeter of the city. To be composed primarily of other Poudre and Platte River basins and such drainage ways as Ashcroft and Sheep Draw, these "linear parks" will contain in the neighborhood of 3,000 acres of land. This is to be developed in those areas which basically cannot be developed due to flood hazard. This same idea would be put to use in the inner city with a "linear park" paralleling the No. 3 ditch. The suggested linear park would consist of a trail system following No. 3 ditch through the city widening to provide needed recreation space in high density areas.

2.10.3 Rocky Mountain National Park

Rocky Mountain National Park provides recreational opportunities for visitors each year. In 1962 park visitation was about 1,774,000 and has increased to well over 2,854,000 in 1975. Future projections indicate that visitor use will likely exceed 3,500,000 by the year 2000.

Much of the visitor use period is concentrated in the peak summer months between June and September when nearly 80 percent of the total visitor count occurs. The present Park Master Plan adopted in January 1976, calls for minimal expansion of physical facilities within the park boundaries, control of privately owned concessions and elimination of "points of taking" water diversion of structures for distribution of waters to users outside the Park (USDI, NPS, 1976).

The net effect of increased recreation use of the Park while holding or reducing tourist support facilities once provided by concessions or the Park Service, now means greater impact to communities outside the Park boundaries. Estes Park would likely receive much of this impact as it is located at the only entrance from the east.

2.10.4 Roosevelt National Forest

Of 782,000 acres of the Roosevelt National Forest, nearly three-fourths of the area is within Larimer County. The Forest is managed under multiple-use concept whereby the forest resource provides wood, water, forage, wildlife, and recreation. In the recent past, recreation has been the major demand. Recreation visitor use has increased by over 65 percent in a five-year period from 1970 to 1975 when visitor day counts went from 1,123,000 to over 1,852,000. Projected increase for 1980 is expected to easily exceed 2,574,000 visitor days (USFS 1976). The increased use of Federally-owned forested lands has had significant impacts on the demand for overnight camping and picnic area sites, especially during the summer month weekend use period.

2.10.6 Larimer-Weld Region

Open space and recreational goals and objectives for the Region have been established. Recommendation areas of regional recreation interest have been identified. These recommendations and coordination guidelines attempt to encourage recreational development in areas other than individual municipal neighborhood parks and playgrounds or federally controlled areas. The guidelines are a tool to assist local jurisdictions in coordinating their open space areas. (See Larimer-Weld COG, 1973, 1974, 1976).

2.11 ARCHAEOLOGICAL AND HISTORIC SITES

The area is abundant with remnants of its rich historic past. Current efforts for identification of areas of archaeological and historic significance are being conducted by state institutions of higher learning, the Colorado Historical Society and the planning staffs of Larimer and Weld Counties. Inventories of sites discovered to date are available through these sources and are currently updated.

2.12 ECONOMY

Weld County is the richest agricultural county east of the Continental Divide (U.S. Bureau of Census 1964). It has been ranked consistently for many years among the top producing counties in the nation. The domination of agriculture in the Weld County economy is reflected in the importance of sugar beets, alfalfa, barley, and corn production for local and national markets. Weld County also ranks as one of the top counties in the nation for total number of cattle fed and value added in production (Foster 1968).

Although Larimer County's early economic development was also derived from agricultural sources, in more recent times the growth of economy has shifted to professional services, light manufacturing, wholesale and retail trade, education, and government.

Table 2.12-A represents the economy of the Region by aggregated employment sectors. The material presented here is the result of a descriptive summary of the Regional economy, based on an input/output analysis prepared for the Larimer-Weld COG by independent economic consultants (Gray, Huszar, and McKean 1976). Data is for a base year of 1974, therefore, the absolute numbers of employment and dollar sales are somewhat lower than expected 1977 conditions. However, the contributions to employment and sales by sector are reflective of the proportional mix of the economy.

TABLE 2.12A LARIMER-WELD REGION - SUMMARY OF INPUT-OUTPUT ANALYSIS, 1974

Sector	(1) 1974 Value of Sales ($1,000,000)	(2) 1974 Employment* (No. of Workers)	(3) 1974 Household Income by source ($1,000,000)	(4) Direct Plus[1/] Indirect Plus Induced Business Multiplier	(5) Direct[2/] Plus Indirect Plus Induced Employment Multiplier	(6) Direct[3/] Plus Indirect Plus Induced Income Multiplier
Livestock	477.64	7,165	35.94	1.673	.0308	0.136
Irr. Ag.	128.23	7,950	5.41	1.487	.0721	0.103
Dryland Ag.	17.48	559	0.94	1.686	.0453	0.147
Food Proc.	809.73	3,402	33.78	1.944	.0222	0.120
Mining	36.21	1,159	13.22	2.370	.0537	0.579
Electronics	406.56	6,884	75.24	1.452	.0226	0.313
Paper	2.70	133	0.80	1.801	.0588	0.369
Printing	10.70	645	4.86	1.980	.0698	0.534
Chem. & Petro.	5.11	100	0.56	1.323	.0243	0.149
Lumber	11.96	431	3.50	2.013	.0522	0.433
Misc. Mfg.	18.65	867	5.58	1.733	.0555	0.378
Utilities	177.42	2,531	24.75	1.332	.0171	0.171
Services	223.81	7,540	69.30	1.783	.0443	0.395
Trade	994.20	14,243	144.55	1.621	.0230	0.224
Education	180.86	17,905	103.91	2.154	.1115	0.675

1/ In dollars of business activity per dollar of output delivered to final demand.
2/ In numbers of workers per $1,000 of output delivered to final demand.
3/ In dollars of income generated per dollar of output delivered to final demand.

Data on employment include all workers, full and part time.

Source: Value of output, federal and state publications; employment and earnings, computer tapes produced by Colorado Department of Employment, multipliers, derived with input-output model for Larimer-Weld Regional COG.

The expansion of colleges, universities, and vocational schools in the past fifteen years have contributed to employment of educators, researchers, scientists, and support staff. These include the University of Northern Colorado (1960 to 1970), Colorado State University (1964 to 1972), Aims College (1967 to present), and the Larimer County Vocational Technical School (established in 1973).

The City of Fort Collins is also the location of important state and national governmental and research facilities. Included in Table 2.12-B are some of the more important contributors to state and Federal government employment.

TABLE 2.12-B MAJOR GOVERNMENT EMPLOYMENT CONTRIBUTORS STATE AND FEDERAL

U. S. Forest Service ---	Rocky Mountain Forest and Range Experiment Station
U.S. Forest Service ---	Forest Office, Arapaho/ Roosevelt National Forests
U.S. Forest Service ---	Watershed Systems Development Group/Computer Center
U.S. Dept. Agriculture-	Agricultural Research Service Economic Research Service
Colorado State Univ. --	Forest Service
Colorado State Univ. --	Cooperative Extension - Colorado State University
Colorado State Univ. --	Division of Wildlife, Regional Office

Within the last decade there has also been rapid growth in the electronics component and metals sector. Manufacture of health and scientific instruments, calculators, and photochemical processing are responsible for much of the new employment in the region. Technically-based industries whose products are small in bulk, but high in value are having a continuing importance.

The choice for such industry to locate here rather than in a larger metropolitan area is based on several factors. The region offers many attributes which technical industries seem to find attractive. Relatively inexpensive land availability for plant location or expansion, proximity to the goods and services of the Denver metropolitan area, adequate rail and highway transportation, and generally available support services from the larger municipalities of Fort Collins, Loveland, and Greeley

TABLE 2.13-A LARIMER COUNTY LOCAL POPULATION

	1930	1940	1950	1960	1970
LARIMER COUNTY	33,137	35,539	43,554	53,343	89,900
INCORPORATED AREAS					
Berthoud		811	867	1,014	1,446
Estes Park		944	1,617	1,175	1,616
Fort Collins	11,489	12,251	14,937	25,027	43,337
Loveland	5,506	6,145	6,773	9,734	16,220
Timnath		147	177	150	177
Wellington		465	541	532	691
SUBTOTAL	16,995	20,763	24,912	37,632	63,487
UNINCORPORATED AREAS					
Boxelder S.D.					
Red Feather/ Crystal Lakes					
South Fort Collins S.D.					
Spring Canyon S.D.					
Upper Big Thompson S.D.					
Other	16,142	14,776	18,642	15,711	26,413
SUBTOTAL	16,142	14.776	18,642	15,711	26,413
TOTAL	33,117	35,539	43.554	53.343	89,900

TABLE 2.13-A WELD COUNTY LOCAL POPULATION

	1930	1940	1950	1960	1970
WELD COUNTY	65,097	63,747	67,504	72,344	89,297
INCORPORATED AREAS					
Ault		761	866	799	841
Dacono		296	258	302	360
Eaton		1,322	1,276	1,267	1,389
Erie		1,019	937	875	1,090
Evans		792	862	1,453	2,570
Firestone		262	297	276	570
Fort Lupton		1,692	1,907	2,194	2,489
Frederick		652	599	595	696
Garden City		87	104	129	142
Gilcrest		352	429	357	382
Greeley	12,203	15,995	20,354	26,314	38,902
Grover		137	146	133	121
Hudson		295	365	430	518
Johnstown		961	897	976	1,191
Keenesburg		284	432	409	427
Keota		34	21	13	6
Kersey		268	304	378	474
LaSalle		755	797	1,070	1,227
Lochbuie					
Mead		191	186	192	195
Milliken		531	510	630	702
New Raymer		169	130	91	68
Nunn		190	182	228	269
Pierce		343	372	424	452
Platteville		561	570	582	683
Rosedale			57	70	66
Severance		138	108	70	59
Windsor		1,811	1,548	1,509	1,564
SUBTOTAL	12,203	29,898	34,514	41,766	57,453
Other	52,894	33,849	32,990	30,578	31,844
TOTAL	65,097	63,747	67,504	72,344	89,297

TABLE 2.13-B LARIMER-WELD REGION ETHNIC GROUP POPULATION ESTIMATES 1960 - 1976

		1960	1970	1975	1976
American Indian	*L	10	149	585	625
	W	57	163	440	445
Negro	L	86	280	468	750
	W	101	225	330	320
Oriental and Other	L	207	810	1,088	1,500
	W	738	1,184	880	1,700
Spanish	L	2,160	6,017	7,688	8,125
	W	8,831	13,752	18,590	19,055
All Other White	L	50,880	82,644	107,171	114,000
	W	62,617	73,973	89,760	90,000
TOTAL	L	53,343	89,900	117,000	125,000
	W	72,344	89,297	110,000	111,000
GRAND TOTAL		125,687	179,197	228,000	236,000

*L - Larimer County
W - Weld County

Note: Data for 1960 and 1970 are taken from publications of the U.S. Bureau of the Census. Data for 1975 and 1976 are estimated. Ethnic group school enrollments for 1970, 1971, 1974 and 1975 were used as a basis for the 1975 and 1976 estimates.

Source: Colorado Division of Planning. 1976. Ethnic Group Population of Colorado Counties, 1960-1976. Denver, CO.

are favorable location factors for industrial facilities. A casusal rural atmosphere, pleasing climate, and availability of varied cultural, scenic, and outdoor recreational opportunities contribute to a desirable human environment for prospective employees.

This combination of advantageous factors has led prominent technical industry to prefer the Region over other crowded areas of Colorado and the country which might offer better market and transportation advantages.

Economic growth scenarios discussed in support documents prepared for the Larimer-Weld COG describe future projections of the regional economy based on specified assumptions (Gray, Huszar, and McKean 1976).

2.13 POPULATION

Population is basically a function of employment opportunities, migration characteristics, and birth and death rates. More than any other factor, employment opportunities and in-migration influences population in the Larimer-Weld Region.

Table 2.13-A shows the population of the region and major population centers of the region from 1930 through 1970. For nearly all areas, the growth has been quite dramatic, in terms of percentage changes and absolute numbers, for the period from 1960 through 1970 to the present.

The causes for these changes may be attributed to several reasons. There is national evidence to support the position that large metropolitan areas of the country have been experiencing net loss of population to suburban areas in the last 5 to 10 years (U.S. Bureau of Census 1975). There is also evidence to suggest that Colorado is receiving in-migration from areas out of the state because of available jobs and education opportunities (for the period 1970 to 1975 80.5 percent of population increase in the region was from in-migration).

Demographic trends in nearly all communities are showing that many of the people coming into the region are locating in or near to the larger urbanizing areas to be close to jobs, schools, and services. This is reflected in the population increases for Fort Collins, Loveland, Greeley, and Windsor, as well as Fort Lupton and some of the smaller communities in southern Weld County which serve as bedroom communities for the Denver metropolitan area.

Population distribution in the Region is largely concentrated in the urbanizing areas of the Fort Collins, Loveland, Greeley Triangle. These cities, not including adjacent small incorporated areas or peripheral rural development areas, account for roughly 61 percent of the 1975 population of the Region. The urban population of the corporate areas of Loveland and Fort Collins accounts for over 71 percent of persons residing in Larimer County (See Table 2.13-B).

According to the Colorado Division of Planning in 1976, the proportional change of select minority ethnic groups has climbed at a greater rate than the total population for the period from 1960 through 1976 in both counties. This information is presented in Table 2.13-B. The accuracy and consistency of this information may be questionable, however, due to the method by which early information was collected in the 1960-1970 period.

2.14 LAND USE

Land use in the Region generally reflects the influences of geographic, environmental, and man-made features. Historically, agricultural and urbanizing land use development can be traced to several basic elements: availability of water supply, topography of the land, relative freedom from frequent flooding, acceptable climatic conditions, and proximity of transportation systems.

2.14.1 Land Use - Early Historic Development

Growth of the Larimer-Weld Region began as the result of a number of competing influences. The history of northern Colorado is rich with the stories of the early Indians, Spanish explorers, French fur traders, cowboys, and farmers who first came to settle. The past has left an indelible impression on the people and the land of this region. In what is now Weld County, French fur traders established a trail between Santa Fe, New Mexico, and Laramie, Wyoming, which is the path that U.S. Highway 85 still roughly travels.

Cattle grazing in the early to mid 1800's and development of irrigated agricultural lands in the last half of the 19th century illustrated the coming prominence of Weld County as a strong center for agricultural production. To supplement annual rainfall, the early agriculturalists constructed a complex system of reservoirs, canals, and ditches to irrigate the fertile alluvial soils of the area.

Urbanization of Weld County began along the path of U.S. Highway 85 and the Union Pacific Railroad. The result was a string of independent, small, agriculturally-based communities stretching from the Wyoming border to the southern Weld County line. As the area grew and the agricultural economy developed, more transportation for shipping agricultural products, people and supplies came about. The result was an interlacing system of railroads, U.S. highways, state highways, and county roads which is still used today.

Greeley became a focal point for marketing of farm crops and meat products as food processing and distribution became a prominent sector of the economy. From Greeley and surrounding communities food products were shipped, primarily by rail, to local and national markets.

Larimer County developed in a similar manner though agriculture played a less dominant role. As early settlement occurred in the Cache La Poudre and Big Thompson River valleys, the U.S. Government found the need to establish a military post for the protection of settlers. The site which was chosen was five miles east of the foothills and on the south bank of the Cache la Poudre River. It was called Camp Collins.

By 1867, with the big push to extend rail transportation northward into Wyoming, Fort Collins developed as a commercial center. The economic base of the area was agriculture. By 1877, the old Colorado Central (Colorado and Southern) Railroad completed a rail line to Fort Collins which was "important in the development of the most highly productive agricultural area of the world" (Taylor, 1909).

Similar descriptions of the Loveland, Timnath, Wellington and Berthoud areas attest to the importance which rail transportation, water, and irrigated agriculture played in the early urbanization of these areas (Taylor, et.al. 1909).

Land use in the Estes Park area developed because of tourism. In the early days, Joel Estes attempted to graze cattle in this high mountain valley surrounded by snowcapped peaks. His efforts failed, but the area soon became recognized as a vacation spot because of its proximity to what is now Rocky Mountain National Park. Since then, thousands of visitors have come to the area to enjoy the mountain scenery and attractions of the Rocky Mountain National Park. In more recent years, many of those who enjoyed the area as tourists have stayed. Some are artisans and craftsman who cater to the tourist crowds of summer. Others in greater numbers are retired persons who live in Estes Park all or part of the year.

The increasing visitor use of the Park and surrounding forest land, compounded by recent decisions for the Rocky Mountain Park Master Plan to limit concession services in the Park, will have land use impacts in the Estes Park area.

2.14.2 Land Use - Recent Trends

Land use in the last 10 to 15 years has been influenced largely by historic land use patterns, availability of water, development of transportation systems, and to a great extent, changing lifestyles. Recent decisions by large business, agribusiness, industry, and higher education to locate or expand have resulted in conversion of land to either direct or indirect urban use. As a result, location of new industrial and commercial complexes, residences, recreation areas, and transportation systems have consumed substantial acreages.

Growth all along the Colorado Front Range has increased dramatically over the last 20 years. Denver, as the focal point of that growth, has been a stimulas for an ever-increasing metropolitan area which could ultimately include much of the land area on the eastern edge of the Rocky Mountains. A linear area extending from Pueblo in the southern part of the state to north of Fort Collins has been an area of dramatic changes in land use.

The recent growth of the Larimer-Weld Region has created new awareness in the demand for conversion of rural land to urbanizing land uses. As indicated in a recent narrative included in the Larimer County Policy Plan, land consumption for rural residential use has increased substantially in recent years in total numbers. Land consumption has also increased because the density of rural residential units has decreased (Larimer County Planning Department 1977).

Changing lifestyles have been a key influence in land use conversion trends. More than any other single factor, the automobile has changed the patterns of urban growth. The auto has permitted the location of residences further from jobs, shopping, schools, and services. The result has been a dispersal of residential development which has consumed acreages that are not contiguous to existing urban centers.

Major industrial and commercial development, under most conditions, receives considerable review by local planning and zoning boards and local policy makers mainly because of size and potential impact to the economy and surrounding land uses. On the other hand, the day-to-day decisions for seemingly small residential developments in that same review process yielded the largest effect on historic consumption of the land for specific uses, particularly in the Core Area (McPhail 1972; Anderson). Continuation of such trends will significantly impact existing transportation systems, water and waste treatment needs, agricultural economy, social and health services, air pollution, and general overall rural characteristics of the Region.

2.15 TRANSPORTATION NETWORK

Larimer and Weld Counties are traversed by major north-south, east-west highways and rail transportation corridors. Early development of the area was influenced by its location at the edge of the mountain barrier and along the traditional route west that followed the South Platte River.

There are two major north-south corridors of rail transportation. The Colorado and Southern Railroad provides service by a line that originates in Wendover, Wyoming, and runs via Cheyenne, Fort Collins, Loveland, Longmont, and into Denver. Capacity of this line is severely limited by the paucity and shortness of passing tracks. Traffic on this route in 1975 was about four freight trains per day. The Union Pacific Railroad provides AMTRAK passenger and freight service from Cheyenne to Denver via Eaton, Greeley, Fort Lupton, and Brighton. This corridor has a very high capacity. There are a number of light duty branch lines which operate in the area between Fort Collins, Loveland, and Greeley for transportation of agricultural and commercial freight.

In the urbanizing area of the Front Range, the major north-south highway corridors are U.S. 287, U.S. I-25, and U.S. 85. Of these, I-25 operates as a freeway. The average daily traffic on I-25 ranges between 5,000 trips north of Fort Collins to 21,000 trips in the southern area of Weld County. U.S. 287 and U.S. 85 are termed "principal arterials." In the rural areas the average daily traffic ranges from about 2,000 trips to as many as 9,000 trips. In the urban areas of Loveland, Fort Collins, and Greeley, these arterials take on an urban character and handle traffic loads as high as 23,000 vehicles per day.

The major east-west highway corridor is U.S. 34 through Greeley, Loveland, Estes Park, and through Rocky Mountain National Park. Along much of its route in the foothills area, it takes on an expressway character. In the rural areas traffic is as high as 6,000 average daily trips. In the more urban areas the traffic handled is as high as 15,000 vehicles per day.

There are a number of other east-west highway corridors which serve as arterials in the Larimer-Weld Region. These are Colorado 52 through Fort Lupton, Colorado 66 through Platteville, Colorado 392 through Windsor, and Colorado 14 through Fort Collins and Ault. In 1974 traffic on these arterials was as high as 3,500 vehicles per day in the rural areas, while it approached 16,000 vehicles per day in some of the urban areas.

Likewise, violations of national standards for carbon monoxide were recorded in both cities. Several areas of the Air Quality Maintenance Area are in violation of the total suspended particulate standards.

Current analysis does not adequately explain the reasons for the oxidant violations in Fort Collins and Greeley; however, given the magnitude of the violations, it is logical that automobile traffic in the Front Range area is contributing a major portion of the photochemical oxidants. The automobile traffic from the Denver, Greeley, and Fort Collins areas is contributing to this problem. However, it is not known how much of each of these urban areas is contributing to the air quality problem in either Fort Collins or Greeley. Additionally, violations have been recorded in Windsor.

The carbon monoxide violations recorded in Fort Collins and Greeley are traffic related; therefore, the statewide implementation program will call for development of strategies for mitigation of the carbon monoxide problem.

The total suspended particulate National Ambient Air Quality Standard is being violated currently in this Air Quality Maintenance Area. In the Fort Collins area it was projected that the ambient particulate level would significantly increase over present levels until at least 1985. The maximum particulate concentrations occur in the urbanized part of the study area with the 1985 maximum developing in the vicinity of Colorado State University campus. The primary man-induced source contributors have been identified for the year 1985 as being dust and direct emissions from automobiles on paved streets; dust from unpaved roads; and emissions from fuel combustion. In the Greeley area it was projected that the ambient particulate levels would gradually increase over present levels until at least 1985. The maximum particulate concentrations occur in the east-southeast portion of the Greeley city area. The primary man-induced source contributors have been identified for the year 1985 as dust from unpaved roads and dust, sand and direct emissions from automobiles on paved streets. Minor contributions are noted from agricultural activities and emissions from fuel combustion.

The air quality problems in the Larimer-Weld Air Quality Maintenance Area are attributable to a number of natural and man-made factors. Among these are:

1. The location with reference to the Front Range mountains which create certain climatological conditions that can cause concentrations of pollutants to remain in one location for long periods of time;

2.16 AIR QUALITY

Clean air and unaltered visibility contribute to the health and overall environmental quality of the Region making it a desirable place for people to work, live, and play. In some areas, however, what was once pollution free air is now becoming degraded. Residential and industrial developments, automobile traffic, and agricultural and forestry practices can contribute dust, smoke, noxious gases, and other contaminants to the air in quantities which are harmful to life, property, vegetation, and wildlife, or reasonably interfere with the enjoyment of these things.

In general, the local climatic and elevational conditions present in a geographic location will determine air quality resulting from land uses. Local air temperature, winds, humidity, solar radiation, precipitation, air pressure, land form characteristics, and continental air movement will dictate what happens to air pollutants when they are introduced to the atmosphere.

At an elevation of 5,000 feet above sea level, the internal combustion engine of an automobile is much less efficient than at sea level. The engine uses more gasoline and introduces more pollutants to the atmosphere, particularly carbon monoxide, oxides of nitrogen and hydrocarbons. This combined with local climatic influences such as stagnating air movement conditions called inversions, can create severe automobile-related air quality conditions in the urbanizing areas of the Region.

High mountain valleys, lowlands, and areas abutting on the plains-foothills interface are particularly susceptible to inversion episodes. The grayish-orange haze over Greeley and Fort Collins on a calm winter or spring morning is readily available evidence of these conditions.

As a result of these pressing air quality problems which have resulted from land conversion and urbanization, a portion of the Region has been designated by the State as an Air Quality Maintenance Area (AQMA) under the Federal Clean Air Act of 1970. The boundaries of the North-Central Air Quality Maintenance Area (NCAQMA) correspond with the urbanizing Core Area (as defined in Chapter 3.0). The designation requires air quality planning to address total suspended particulates, carbon monoxide, and photochemical oxidants. It also requires that a statewide implementation plan include necessary regulatory measures to control levels of problem pollutants within the AQMA.

Limited air quality data points out violations of the photochemical oxidant standards in Fort Collins and Greeley.

2. The lack of an adequate through highway system which would reduce the pollutants produced by vehicular traffic without origins or destinations within the affected communities;

3. The lack of adequate alternative transportation systems within the affected communities;

4. The semi-arid nature of the Region which, along with frequent high winds in localized areas and large areas barren of ground vegetative cover, causes fugitive dust problems.

Since the air quality problems in the Larimer-Weld NCAQMA are transportation related, it is necessary that a sound land use and transportation planning program be undertaken in the Region. Predicted population increases will increase the potential for high carbon monoxide, photochemical oxidant, and total suspended particulate levels.

2.17 WATER AND SANITATION DISTRICTS

Throughout the region is a proliferation of special water and sanitation districts. These districts have been created under Colorado State Statute 1973 CRS 32-4 and have developed as a response to a need for water and sanitation services where existing entities could not or would not directly provide such services.

The formation of a special district is relatively simple both statutorily and administratively; special districts are in effect special purpose local governments with some of the same powers granted by the state to general purpose local government, such as counties. Among the powers of special purpose governments are the authority to manage, contract, operate, and maintain needed facilities; acquire and dispose of water rights, personal property, and treatment works and facilities; fix water and sewer rates, and levy taxes as well as borrow money; incur indebtedness; and issue bonds. A more detailed discussion of special districts, their functions, and powers may be found in other reports prepared in the 208 Water Quality Planning process (See Briscoe, Maphis, Murray, and Lamont 1977 a, b).

Special districts, because they are formed to solve a special water or sewer need, do not engage in issues beyond the scope of their articles of formation. Special districts do not have land use powers. Such powers rest with local government.

There are over 40 water and/or sanitation districts in the region. A listing of these entities serving the urban core area may be found in Chapter 3.5.7 Information on general existing service areas and locations of facilities are available at the Larimer-Weld Regional Council of Governments offices.

Chapter 3.0

CHAPTER 3.0

LAND USE OPPORTUNITIES, CONSTRAINTS, AND SUITABILITY ANALYSES

Land use patterns result from the interaction of economic, social, environmental, and political factors in the Region. This Chapter discusses the general determinants of land use patterns and then describes the process used to identify the physical potential of parcels of land in the Region to accommodate a particular land use. The discussion of this process, commonly referred to as land use suitability analysis, is followed by a brief discussion relating suitability analyses to land use planning. The remainder of this Chapter discusses the land use suitability analysis that was conducted for the Region.

3.1 GENERAL DETERMINANTS OF LAND USE PATTERNS

The physical presence of economic and environmental resources on a unit of land creates an attraction or "opportunity" for certain land uses and a detraction or "constraint" to other uses. These resources generally relate to the physical characteristics of a particular unit of land and are, therefore, ameniable to spatial land use analyses such as suitability analyses. Social-attitudinal and political factors also act to encourage or discourage land uses. However, these factors usually are not included in spatial land use analyses because they deal with social and political aspects which are subject to change and frequently cannot be directly related to particular units of land.

3.1.1 Economic

The availability of a resource for which there is a demand or which can be utilized to create a demand, acts an an economic determinant of land use patterns. Areas with sewer and water systems, highways and railroads, and public services and facilities are economic attractors of urban development. When demand for urban uses exist, developers will seek out areas with such services in preference to those without them. In a similar manner, prime soils, water availability, and transport and processing facilities, are economic resources which attract agricultural land development.

As certain resources are economic attractors of land use, others are disincentives. Historically, increases in land valuation accompanied by similar increases in property taxation have acted to remove many lands from agricultural production. These increases are generally the result of pressure to use the land for a use that has a higher economic return than agriculture. Frequently the pressures are anticipatory and there is a lag between the value and tax increase and the realities of demand and development. Consequently, the cost of maintaining the land in agricultural use becomes decreasingly viable and the land often is vacated.

3.1.2 Environmental

Land use patterns are influenced by natural resources, by the attractiveness or amenities created by the mere presence of a resource, by the physical constraints certain resources can impose, and by the ecological constraints imposed by other resources. The environmental character or amenity of an area can be an attractor of growth. For example, the Region's setting at the base of the Rocky Mountains with areas exhibiting open-rural characteristics and clean air has attracted industries and populations seeking relief from the problems traditionally found in urban environments. However, such attributes, or "resources" can be disrupted severely without careful management. When this occurs, the disrupted resource can be a disincentive or deterent.

Certain environmental resources impose physical constraints on land uses. Areas subject to floods or landslides, or those exhibiting severe slope impose constraints for most urban and suburban uses. In certain cases these constraints can be reduced by engineering mitigation measures into development proposals. For example, a constraint imposed by a unit of land located in a floodprone area could be minimized by incorporating floodproofing techniques into the design of structures to be built in that area.

The ecological characteristics of an area can also influence the pattern of land uses. Certain wildlife and vegetative habitats are very sensitive to the presence of man. Introduction of urban or suburban uses into such areas could threaten continuance of the species. The presence of such resources impose constraints on urban land uses, but provide opportunities for open space or resource management area uses.

3.1.3 Social-Attitudinal

Often, land use patterns are influenced by expressions of residents concerning preferred types and density of use. In the public forum, residents are afforded the opportunity to support, oppose, or suggest revisions to land use patterns proposed by other residents or public agencies. These expressions occasionally conflict with economic or environmental realities. Regardless of these realities, community emotional biases are often sufficiently strong to sway the decision process and act as a land use determinant.

3.1.4 Governmental Policy

Governmental policies are the mechanisms which ultimately affect the pattern of land utilization. Policies are adopted to reflect and preserve the preferred values of the electorate. Local agencies, cities, and counties implement land use policies through the establishment of general plans and zoning ordinances and granting of subdivision approvals and building permits. General plans and zoning ordinances are designed to guide subdivision approvals and the granting of building permits by designating conditions and uses for specific geographic areas. This is not to imply that these guidelines are absolutes, variances are frequently granted at the discretion of the local agencies. Although the responsibility for land utilization lies at the city and county level, it is influenced by the actions of other governmental entities. (Refer to discussion in Chapter 1.0: Introduction.)

3.1.5 Land Use Conflicts

Ideally, after analyzing all the land use determinants, a parcel of land would clearly be best used for one particular use. However, this ideal situation rarely occurs. Frequently the analysis of the land use determinants indicates that an area could accommodate a number of land uses ranging from natural open space to urban development. As an example, an area adjacent to existing urban uses and transportation facilities, with water and sewer service, and with Class I agricultural soils could easily accommodate either urban or agricultural uses.

One of the purposes of a land use plan and planning process is to anticipate where land could be used for more than one use and provide guidance to decision makers concerning the most appropriate use of that area considering economic, environmental, and social and political factors. The planning process should identify where conflicting land uses could occur. This information is then transmitted to those agencies responsible for making land use decisions, planning and zoning boards, and commissions and county commissioners for resolution of the conflict. Such decisions usually occur in a public forum providing the community residents an opportunity to influence the decision process. Objectivity in the decision process is enhanced by an accurate understanding of the resources necessary to the support of and impacts incurred by the alternative uses. This understanding is developed by fully analyzing the land use determinants.

In the absence of a land use plan such determinations would be influenced by market values; the use or potential use providing the landowner with the greatest economic return would probably be selected. However, market decisions are frequently shortsighted and ignore social benefits or costs that could result if the land were used in a different manner than mandated by the market.

The remainder of this Chapter discusses the process used to analyze the physical conditions in the Region and how they could influence land use patterns and land use planning.

3.2 OVERVIEW OF SUITABILITY ANALYSIS

Land use suitability analyses spatially evaluate the resources of an area and identify their effect on the ability of a particular parcel of land to accommodate various land uses. Suitability analyses are spatial analyses in that they evaluate the effect the physical characteristics of a particular area have on the use of that area. This information provides decision makers and residents with knowledge regarding economic and environmental resources which act as attractors of and detriments to land utilization.

Suitability analyses can be conducted from two prospectives:

1. The attractiveness of a unit of land for a class of land use, thus acting as an incentive for utilization. Attraction can be measured economically (inferring a monetary benefit to the user) and functionally (the ability of the land to accommodate a use).

2. The hazards or sensitivity of a unit of land for a class of land use, thus acting as a disincentive for utilization.

Five tasks generally comprise the analysis of land use suitabilities. These include definition of land uses for which the resource suitabilities will be assessed, identification of the geographically disposed resources which may influence the selected land uses, collection of pertinent data, construction of a computer data bank, and suitability modeling for each land use.

The first step of the suitability analysis is to identify the land uses or aggregation of uses that will be evaluated. Depending on the purpose of the analysis, either general or specific land uses might be selected. General land uses include urban, rural, agricultural, or open space. Specific land uses include high density residential, community commercial, neighborhood recreation, etc.

For each land use, general or specific, a set of resources and conditions (opportunities and constraints) exist that contribute to the suitability of the land to accommodate that use. The number of such resources are extensive, however, generally only a limited number are consequential in their impact. For example, the presences of wildlife habitats have some effect on the sensitivity of an area to development, but only the presence of a rare or endangered species may be considered of sufficient importance to include in the suitability analysis.

The second step in any suitability analysis is to identify those resources which are potentially of major consequence in influencing land utilization. It should be noted that since land suitability is a spatial evaluation, only those resources which can be geographically described can be considered.

The next step in the process is to collect data describing the location, quantity, and quality of those resources judged to be significant determinants of land use. Frequently much of the required data is available through previous studies and only needs to be compiled into a consistent data bank for the area to be evaluated.

Storage of the data collected in a computerized data bank can facilitate the manipulation of the usually diverse and extensive information collected for suitability analyses. However, depending on the complexity of the evaluation and the resources available, it may not be efficient to set up a computerized data bank.

The final task in a suitability analysis is to develop the land use suitability models and generate a series of maps which reflect the suitability of areas to accommodate selected land uses. The usefulness of a computerized data bank lies in its ability to rapidly manipulate the data and generate suitability maps based on varying assumptions as to the significance of a particular resource.

A suitability model is basically a systematic weighting scheme applied to the resources considered to be significant land use determinants. The weighting scheme is developed to either reflect the attractiveness of a unit of land for a class of land use or the hazard or sensitivity of a unit of land for a class of land use. A suitability model developed to reflect the attractiveness of a unit of land would assign high values to those resources creating the greatest attraction and a low value to those resources creating the lowest attraction. For example, sewer service areas would be assigned a high value and nonsewered service areas a low value. The output of the suitability process is a series of maps displaying the relative measure of suitability of geographic areas with respect to the weighting scheme developed.

3.3 RELATIONSHIP OF SUITABILITY ANALYSES TO LAND USE PLANNING

Suitability analyses and resultant suitability maps are tools to improve the land use planning process. The maps, in and of themselves, do not constitute a plan. Rather, they display the relative suitability, either attractiveness or sensitivity, of geographical areas to accommodate defined land uses. Definition of a unit of land as less suitable than another does not imply that it should not be utilized. It serves as an indicator that a particular factor or group of factors are present which make the site less attractive or more sensitive for a defined land use. Knowledge of these factors assists planning agencies in designating the best development and conservation areas. This information also enables the decision making body to specify the expenditures which must be incurred to heighten a particular area's suitability and judge that the benefit to be derived from using that land is sufficient relative to the cost. This permits a clear understanding of the trade-offs necessary to attain general community goals and objectives. An example is the acceptance of urban development in an area of prime agricultural soil to facilitate a concentrated pattern of land use, thus lessening vehicle miles traveled, air pollution, and noise.

3.4 LARIMER-WELD SUITABILITY ANALYSIS

To facilitate the land use planning process a land use suitability analysis was conducted for the Region. Although determining the appropriate land use pattern for the entire Region is of concern, the suitability analysis concentrated on the Core Area, as defined in Chapter 1.0. The suitability analysis followed the five steps outlined and discussed in Section 3.2 of this Chapter. Figure 3.4 illustrates the suitability process conducted for the Region. Numbers within the task blocks refer to data categories and suitability maps discussed in this section 3.5 and 3.6.

From the perspective of attraction, two classes of use emerged as the major competitors for land in the Core Area:

1. Urban and suburban land uses, including residential (generally, at densities in excess of one dwelling unit per three acres), commercial (retail and office), industrial, institutional (educational, health, governmental administrative, etc.), active recreational, and supporting systems (circulation and energy transmission corridors, airports, etc.);

FIGURE 3.4

SUITABILITY ANALYSIS SEQUENCE AND INTERRELATIONSHIPS

1	2	3	4	5
Identification of Suitability Land Uses	Identification of Pertinent Data Systems	Data Collection	Construction of a Computer Data Bank	Suitability Modeling
			3.5.1 Slope/Landform	
			3.5.2 Soils	
			3.5.2.1 Agricultural Capability	
			3.5.2.2 Septic Tank Limitations	3.6.2.1 Environmental Sensitivity/ Hazard
		Existing Maps and Documentation	3.5.2.3 Erosion Hazards	3.2.2.2 Urbanization Suitability Low Irrigated Agriculture; 3.6.2.2 Urbanization Suitability Low Irrigated Agriculture Sanitation Service
Urbanization	Natural Resources	Aerial Photo Interpretation	3.5.2.4 Building Site Soil Constraints	
Agricultural Production		Field Surveys	3.5.3 Surface Hydrology	3.6.2.2 Urbanization Suitability High Irrigated Agriculture; 3.6.2.2 Urbanization Suitability High Irrigated Agriculture Sanitation Service
Open Space/ Management	Economic Resources		3.5.4 Wildlife Habitat	
			3.5.5 Land Use	3.6.2.3 Agriculture Production Suitability
			3.5.5.1 Urban Land Use	
			3.5.5.2 Non-Urban Land Use	
			3.5.6 Transportation and Transmission	
			3.5.7 Sanitation Systems	

2. <u>Agricultural production</u>, including irrigated and non-irrigated lands producing crops for human consumption and for livestock feeding.

Historically a center for agricultural production, the Core Area has experienced one of the highest rates of population growth in the United States in recent years. To accommodate the influx of population, considerable acreage in agricultural production adjacent to the three major urban centers (Fort Collins, Greeley, and Loveland) has been converted to urban and suburban uses. These areas have proved to be more economically attractive for urban uses than agriculture. In other areas of the Region, particularly to the southeast and to the east of the Core Area, agricultural production has proved to be more economically attractive than the rangeland or vacant land which it replaced.

When an environmental resource exhibits a significant hazard to urban uses or incurs an unacceptable level of disruption by the introduction of man, two options are available: 1) mitigation; or 2) avoidance. Mitigation actions are exercised to eliminate or control an environmental hazard or conditions which contribute to the resource sensitivity. Construction of channels to convey flood waters, retaining walls to stabilize hillsides, and removal of combustible vegetation adjacent to residences are representative of the measures which may be used to eliminate or lessen a hazard. Restrictions on grading, reductions in residential densities, and required connections to sanitation treatment systems are representative of actions to lessen or "manage" environmentally sensitive systems.

When mitigation actions cannot be successfully implemented or are considered to be too costly relative to the potential benefit, an appropriate course of action would be to avoid urban uses in the hazardous or sensitive area. Such action does not necessarily infer the prohibition of all use. Flood plains are often used as community greenbelts for recreational activities or for extractive industries.

Three evaluations of land use suitability were conducted, addressing the issues raised above:

1. The economic attractiveness for urban and suburban development;

2. The attractiveness for agricultural production;

3. The environmental hazards or sensitivities to urban and suburban development (or "attractiveness" for resource management and open space).

The following is a discussion of those resources ascertained to be of consequence in determining land use suitability for each of these issues and the rationale for their selection.

3.4.1 Economic Attractiveness for Development

Determinant Resources

1. Existing Urban Land Uses - The availability of or accessibility to public services (water, sewer, health, police and fire protection, educational, etc.); newly developed urban uses tend to locate in close proximity to existing urban areas.

2. Nonurban Land Uses - As growth occurs, land not in urban use but adjacent to them, will be subject to escalating pressure for development. Particularly "vulnerable" are vacant and platted lands.

3. Transportation and Transmission Systems - Historically, transportation systems have been one of the principal determinants of land use patterns. Highways provide access among uses: residence to employment, to shopping, to recreation, to entertainment, etc. Generally, the greater the capacity and accessibility of the circulation system, the greater the resultant urban development. U.S. Highway 287, with its recent commercial and residential activity reflects the correlation. This does not imply that highways, in and of themselves, create growth. Rather, highways act as a magnet for growth occurring in an area. Commercial uses (automobile and truck service stations, restaurants, and motels) at the interchanges of interstate systems and major highway intersections in the Region, also, reflect the economic incentives for development related with transportation systems.

4. Sanitation Service Areas and Districts - Areas with available or planned sanitation service act to attract growth that occurs within the Region. Though a developer must compensate a sanitation district for connection and treatment and assume the capital costs of sewer linkage, these costs are substantially lower than would be incurred to form a new district and construct new facilities.

Initially, the availability of water was judged to be a significant factor in shaping the pattern of urban land uses. However, review of existing and proposed water service areas and districts indicate that water districts cover most of the Core Area. Thus, water service does not particularly enhance or detract from the suitability of any area for urban or suburban development. The total amount of water available to the Region for domestic use could restrict the Regional growth rate if adequate supplies are not available. Growth could require more water than is available or could be developed. If this water were not made available, growth could be curtailed unless water designated for agricultural uses were converted to domestic use.

3.4.2 Attractiveness for Agricultural Production

Determinant Resources

1. Soil Type - Soils are classified by the United States Department of Agriculture Soil Conservation Service according to their capability for sustained production of crops and the potential risk of soil damage. Areas characterized by the presence of soils in the Class I-IV levels are particularly attractive for agricultural production. At lesser levels, measures to enrich the productivity of the soil need to be undertaken to facilitate successful crop production.

2. Existing Nonurban Land Use - Lands currently in agricultural production, vacant land and that in a non-intensive use display a capability for crop production, assuming the presence of suitable soils.

Water availability had initially been considered an important determinant of the pattern of agricultural production. However, since the distribution of irrigation water is controlled by water rights and laws, it was determined that the market would generally be able to provide for the provision of water to areas suitable for agricultural uses. This is valid as long as the total amount of water available for agricultural uses is not reduced.

3.4.3 Environmental Hazards and Sensitivities to Urban Development (or Attractiveness for Resource Management and Open Space).

Determinant Resources

1. Wildlife and Vegetative Habitats - Within the Core Area there are a number of rare and endangered, and extremely sensitive, wildlife and vegetative habitats that could be irreversibly impacted by the introduction of urban and suburban uses.

2. Surface Hydrology - Surface hydrology may impact land utilization in several respects; first, areas subject to flooding can constitute a hazard to life and property; secondly, water bodies and lands immediately adjacent

to them often are a critical habitat for bird and wildlife species (the Pelican breeding grounds at Milton Reservoir and the Boyd Lake Recreational Area are representative); and lastly, intrusion of urban uses into stream beds and water bodies requires extensive and costly construction operations.

3. Soils - Soils in the Core Area have been classified by the Soil Conservation Service (SCS) of the United States Department of Agriculture and interpreted according to their capability to support physical land use development. Three characteristics which may influence the development of urban and suburban uses include:

   a. Building Site Soil Constraints - Soils have been classified according to their ability to support foundations in an undisturbed state. Areas classified as "severe" exhibit conditions which are difficult and extremely costly to overcome, if at all. In areas classified as "moderate," foundations can be designed to withstand soil problems.

   b. Erosion Hazard - Soils have been classified according to their susceptibility to erode due to the action of wind and/or water. Areas classified as "severe" exhibit conditions which are difficult and extremely costly to overcome. Engineering solutions are available and cost-effective for those areas classified as "moderate."

   c. Septic Tank Limitations - Soils have been classified according to their limitations for the use of septic tanks for sewage treatment and disposal. Areas classified as "severe" exhibit conditions that are difficult to overcome and extremely costly. Installation of septic tanks in these areas could seriously pollute groundwater and/or surface water, adversely impacting vegetative cover and wildlife. Development of urban uses in these areas usually necessitates the construction of a sanitation treatment system. Areas with "moderate" limitations have problems that normally can be overcome by engineering design and proper site planning.

4. Slope - As a general rule, as slope increases the potential for development of urban and suburban uses decreases. In a similar manner, as the size of the site required for a use increases, the greater the constraint of slope. Housing requiring minimum contact with the surface can be developed on relatively steep

slopes. A manufacturing facility, on the other hand, requires uniform surficial contact. Thus, grading is necessary in sloped areas to provide a flat pad.

3.5 Larimer-Weld Data Base

For each resource judged to be a significant determinant of land use suitability, data describing its location, quantity, and quality was compiled and incorporated into a computerized data bank. Original data sources included black and white aerial photographs, existing maps and reports, and interviews with county and city planners, representatives of special use districts, and State of Colorado agencies. Extensive field reconnaissance and original research was not conducted.

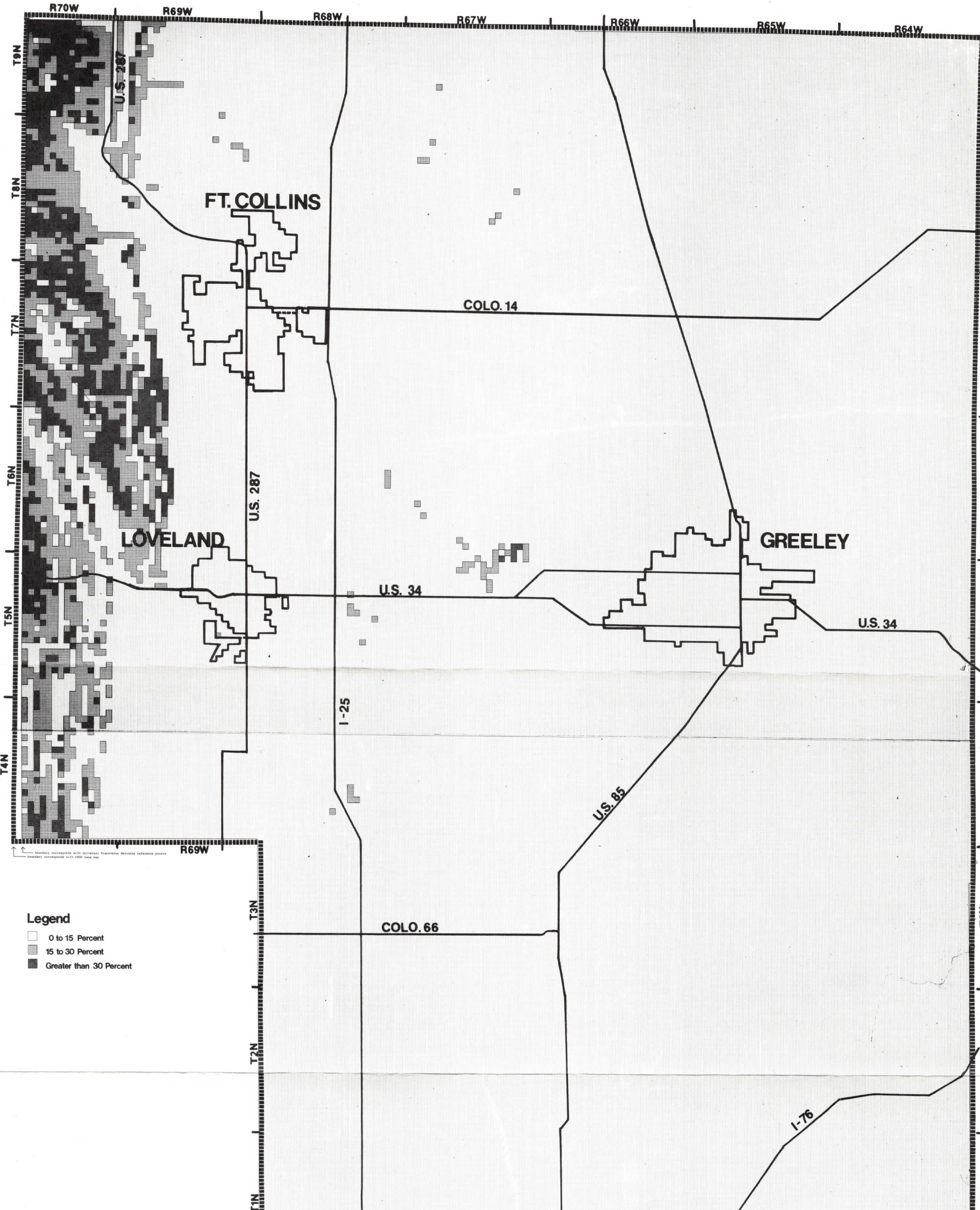
This data bank should be considered preliminary in that it focuses only on those geographically-disposed resources (resources which can be directly related to a specific unit of land) which were judged to be most significant in determining land use suitability. It is not an exhaustive compilation or evaluation of all economic, social, environmental and political resources acting in the Region. Rather, it is intended to provide a sufficient base of information to complete the suitability analyses and guide the formulation and testing of alternative land use strategies.

3.5.1 Landform and Slope

Figure 3.5.1 illustrates the basic landforms which characterize the Core Area. Generally, the area consists of the rugged foothills of the Rocky Mountains in the west, from which the plains gently slope to the east.

Running in a north-south direction, the foothills comprise steeply inclined sandstone and shale formations which constitute the first series of hogback ridges in the Front Range. The aspect is predominantly easterly, interrupted by occasional narrow valleys running in a north-south orientation near Masonville and Buckhorn Creek. As the foothills meet the plains there is on abrupt change of slope. This is true along the full length of the western edge of the Core Area. Elevations range from approximately 5,400 feet at the base of the foothills to over 7,600 feet on some of the high promontories of the hogback ridges. Slopes in excess of 30 percent are not uncommon and in many places exceed 45 percent.

Most of the Core Area consists of gently rolling plains extending from the base of the foothills. Aspect is highly variable, although there appears to be a general southeasterly orientation of the land area in the northern plains tributary area to the South Platte River. The gently rolling character



Slope

FIG. 3.5.1

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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consistently ranges from almost flat (0 to 3 percent) to less than 15 percent.

The uniform pattern of the plains is broken by scattered areas of steep slope along the Cache La Poudre River, south of Windsor, and the South Platte River, north of Milliken. Steeply sloping sandstone outcrops and breaks occur in the drainage areas of these rivers. Slopes may exceed 30 percent in these riverbank areas.

In the Core Area, approximately 93.7 percent (1,123,800 acres) falls within a 0 to 15 percent slope classification; 3.8 percent (45,520 acres) in a 15 to 30 percent classification; and 2.5 percent (30,400 acres) exceed 30 percent.

3.5.2 Soils

Detailed soils surveys for much of the Core Area have been prepared by the SCS. The surveys identified over 150 soil types for the Region. Through a standard classification system and interpretive analysis in use by the SCS, soils have been interpreted for their capabilities and suitabilities for certain selected uses. The interpretive groupings consider the following factors:

1. Depth to bedrock or thickness of material
2. Slope
3. Depth to water table
4. Salinity or alkalinity
5. Flooding
6. Frost action
7. Presence of stones or coarse materials
8. Permeability
9. Shrink-swell of soil due to presence of certain clay materials
10. Texture
11. Layering of soil and subsoil

For the Core Area four soils interpretive maps have been prepared. These are:

1. Agricultural Capability
2. Septic Tank Limitations
3. Erosion Hazard
4. Building Site Soil Constraints

The following summarizes these maps and discusses the occurrence of the conditions in the Core Area:

3.5.2.1 Agricultural Capability

According to the SCS, "In this classification (agricultural capability) the farmable soils are grouped according to their potentialities and limitations for sustained production of the common cultivated crops that do not require specialized site conditioning or site treatment. Nonarable soils (soils unsuitable for longtime sustained use for cultivated crops) are grouped according to their potentialities and limitations for production of permanent vegetation and according to their risks of soil damage if mismanaged." [USDA-SCS 1971].

Agricultural capability ratings only reflect the general capability of the land and do not consider the import of water, treatment of soils, accessibility to processing facilities and the market, contiguity of farmland, economic demands, specific management requirements, etc. Determination as to whether or not a parcel of land will be placed into agricultural production must account for these other factors.

Soils have been disaggregated into nine capability classes. The risks of soil damage or limitations in agricultural productivity become progressively greater from Class I to Class IX. Generally, Classes I-IV are capable of producing common cultivated field crops and pasture plants. Soils in Classes V-VII are best suited to use of adapted native plant species. Lands included in Class VIII and IX are not capable of supporting crops, grasses or trees without major reclamation.

The following discussion describes each agricultural capability class. These descriptions are extracted directly from <u>Land Capability Classification Agricultural Handbook #210.</u> [USDA-SCS 1937].

> "<u>Class I</u>: Soils in Class I have few limitations that restrict their use."
>
> "Soils in this class are suited to a wide range of plants and may be used safely for cultivated crops, pasture, range, woodland, and wildlife. The soils are nearly level and erosion hazard (wind and water) is low. They are deep, generally well drained, and easily worked. They hold water well and are either fairly well supplied with plant nutrients or highly responsive to inputs of fertilizer."
>
> "The soils in Class I are not subject to damaging overflow. They are productive and suited to intensive cropping."
>
> "Soils may be placed in Class I if the limitation of an arid climate has been removed by relatively permanent irrigation works. Such irrigated soils (or soils potentially useful under irrigation) are nearly level, have deep rooting zones, have favorable permeability

and water-holding capacity, and are easily maintained in good tilth. Some of the soils may require initial conditioning including leveling to the desired grade, leaching of a slight accumulation of soluble salts, or lowering of the seasonal water table. Where limitations due to salts, water table, overflow, or erosion are likely to recur, the soils are regarded as subject to permanent natural limitations and are not included in Class I."

"Soils that are wet and have slowly permeable subsoils are not placed in Class I. Some kinds of soil in Class I may be drained as an improvement measure for increased production and ease of operation."

"Soils in Class I that are used for crops need ordinary management practices to maintain productivity--both soil fertility and soil structure. Such practices may include the use of one or more of the following: fertilizers and lime, cover and green-manure crops, conservation of crop residues and animal manures, and sequences of adapted crops."

"Class II: Soils in Class II have some limitations that reduce the choice of plants or require moderate conservation practices."

"Soils in Class II require careful soil management, including conservation practices, to prevent deterioration or to improve air and water relations when soils are cultivated. The limitations are few and the practices are easy to apply. The soils may be used for cultivated crops, pasture, range, woodland, or wildlife food and cover."

"Limitations of soils in Class II may include singly or in combination the effects of: 1) gentle slopes; 2) moderate susceptibility to wind or water erosion or moderate adverse effects of past erosion; 3) less than ideal soil depth; 4) somewhat unfavorable soil structure and workability; 5) slight to moderate salinity or sodium easily corrected but likely to recur; 6) occasional damaging overflow; 7) wetness correctable by drainage but existing permanently as a moderate limitation; 8) slight climatic limitations on soil use and management."

"The soils in this class provide the farm operator less latitude in the choice of either crops or management practices than soils in Class I. They may also require special soil-conserving cropping systems, soil conservation practices, water-control devices, or tillage methods when used for cultivated crops. For example, deep soils of this class with gentle slopes subject to moderate erosion when cultivated may need one of the following practices or some combination of two or more: terracing, stripcropping, contour tillage, crop rotation that include grasses and legumes, vegetated water disposal areas, cover or green-manure crops, stubble mulching, fertilizers, manure, and lime. The exact combinations of practices vary from place to place, depending on the characteristics of the soil, the local climate, and the farming system."

"Class III: Soils in Class III have more restrictions than those in Class II and when used for cultivated crops the conservation practices are usually more difficult to apply and to maintain. They may be used for cultivated crops, pasture, woodland, range, or wildlife food and cover."

"Limitations of soils in Class III restrict the amount of clean cultivation; timing of planting, tillage, and harvesting; choice of crops; or some combination of these limitations. The limitations may result from the effects of one or more of the following: 1) moderatly steep slopes; 2) high susceptibility to water or wind erosion or severe adverse effects of past erosion; 3) frequent overflow accompanied by some crop damage; 4) very slow permeability of the subsoil; 5) wetness or some continuing waterlogging after drainage; 6) shallow depths to bedrock, hardpan, fragipan, or claypan that limit the rooting zone and the water storage; 7) low moisture-holding capacity; 8) low fertility not easily corrected; 9) moderate salinity or sodium; 10) moderate climatic limitations."

"When cultivated, many of the wet, slowly permeable but nearly level soils in Class III require drainage and a cropping system that maintains or improves the structure and tilth of the soil. To prevent puddling and improve permeability it is commonly necessary to supply organic material to such soils and to avoid working them when they are wet. In some irrigated areas, part of the soils in Class III have limited use because of high water table, slow permeability, and the hazard of salt or sodic accumulation. Each distinctive kind of soil in Class III has one or more alternative combinations of use and practices required for safe use, but the number of practical alternatives for average farmers is less than that for soils in Class II."

"Class IV: The restrictions in use for soils in Class IV are greater than those in Class III and the choice of plants is more limited. When these soils are cultivated, more careful management is required and conservation practices are more difficult to apply and maintain. Soils in Class IV may be used for crops, pasture, woodland, range, or wildlife food and cover."

"Soils in Class IV may be well suited to only two or three of the common crops or the harvest produced may be low in relation to inputs over a long period of time. Use for cultivated crops is limited as a result of the effects of one or more permanent features such as: 1) steep slopes; 2) severe susceptibility to water or wind erosion; 3) severe effects of past erosion; 4) shallow soils; 5) low moisture-holding capacity; 6) frequent overflows accompanied by severe crop damage; 7) excessive wetness with continuing hazard of waterlogging after drainage; 8) severe salinity or sodium; 9) moderately adverse climate."

"In sub-humid and semi-arid areas, soils in Class IV may produce good yields of adapted cultivated crops during years of above average rainfall; low yields during years of average rainfall; and failures during years of below average rainfall. During the low rainfall years the soil must be protected even though there can be little or no expectancy of a marketable crop. Special treatments and practices to prevent soil blowing, conserve moisture, and maintain soil productivity are required. Sometimes crops must be planted or emergency tillage used for the primary purpose of maintaining the soil during years of low rainfall. These treatments must be applied more frequently or more intensively than on soils in Class III."

"Class V: Soils in Class V have little or no erosion hazard but have other limitations impractical to remove that limit their use largely to pasture, range, woodland, or wildlife food and cover."

"Soils in Class V have limitations that restrict the kind of plants that can be grown and that prevent normal tillage of cultivated crops. They are nearly level but some are wet, are frequently overflowed by streams, are stony, have climatic limitations, or have some combination of these limitations. Examples of Class V are: 1) soils of the bottom lands subject to frequent overflow that prevents the normal production of cultivated crops; 2) nearly level soils with a growing season that prevents the normal production of cultivated crops; 3) level or nearly level stony or rocky soils; 4) ponded areas where drainage for cultivated crops is not feasible but where soils are suitable for grasses or trees. Because of these limitations, cultivation of the common crops is not feasible but pastures can be improved and benefits from proper management can be expected."

"Class VI: Soils in Class VI have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover."

"Physical conditions of soils placed in Class VI are such that it is practical to apply range or pasture improvements, if needed, such as seeding, liming, fertilizing, and water control with contour furrows, drainage ditches, diversions, or water spreaders. Soils in Class VI have continuing limitations that cannot be corrected, such as: 1) steep slope; 2) severe erosion hazard; 3) effects of past erosion; 4) stoniness; 5) shallow rooting zone; 6) excessive wetness or overflow; 7) low-moisture capacity; 8) salinity or sodium; 9) severe climate. Because of one or more of these limitations, these soils are not generally suited to cultivated crops. But they may be used for pasture, range woodland, or wildlife cover or for some combination of these."

"Some soils in Class VI can be safely used for the common crops provided unusually intensive management is used. Some of the soils in this class are also adapted to special crops such as sodded orchards, blueberries, or the like, requiring soil conditions unlike those demanded by the common crops. Depending upon soil features and local climate the soils may be well or poorly suited to woodlands."

"Class VII: Soils in Class VII have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife."

"Physical conditions of soils in Class VII are such that it is impractical to apply such pasture or range improvements as seeding, liming, fertilizing, and water control with contour furrows, ditches, diversions, or water spreaders. Soil restrictions are more severe than those in Class VI because of one or more continuing limitations that cannot be corrected, such as: 1) very steep slopes; 2) erosion; 3) shallow soil; 4) stones; 5) wet soil; 6) salts or sodium; 7) unfavorable climate; 8) other limitations that make them unsuited to common cultivated crops. They can be used safely for grazing, woodland, wildlife food and cover, or for some combination of these under proper management."

"Depending upon the soil characteristics and local climate, soils in this class may be well or poorly suited to woodland. They are not suited to any of the common cultivated crops; in unusual instances, some soils in this class may be used for special crops under unusual management practices. Some areas of Class VII may need seeding or planting to protect the soil and to prevent damage to adjoining areas."

"<u>Class VIII</u>: Soils and land forms in Class VIII have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife, or water supply or to aesthetic purposes."

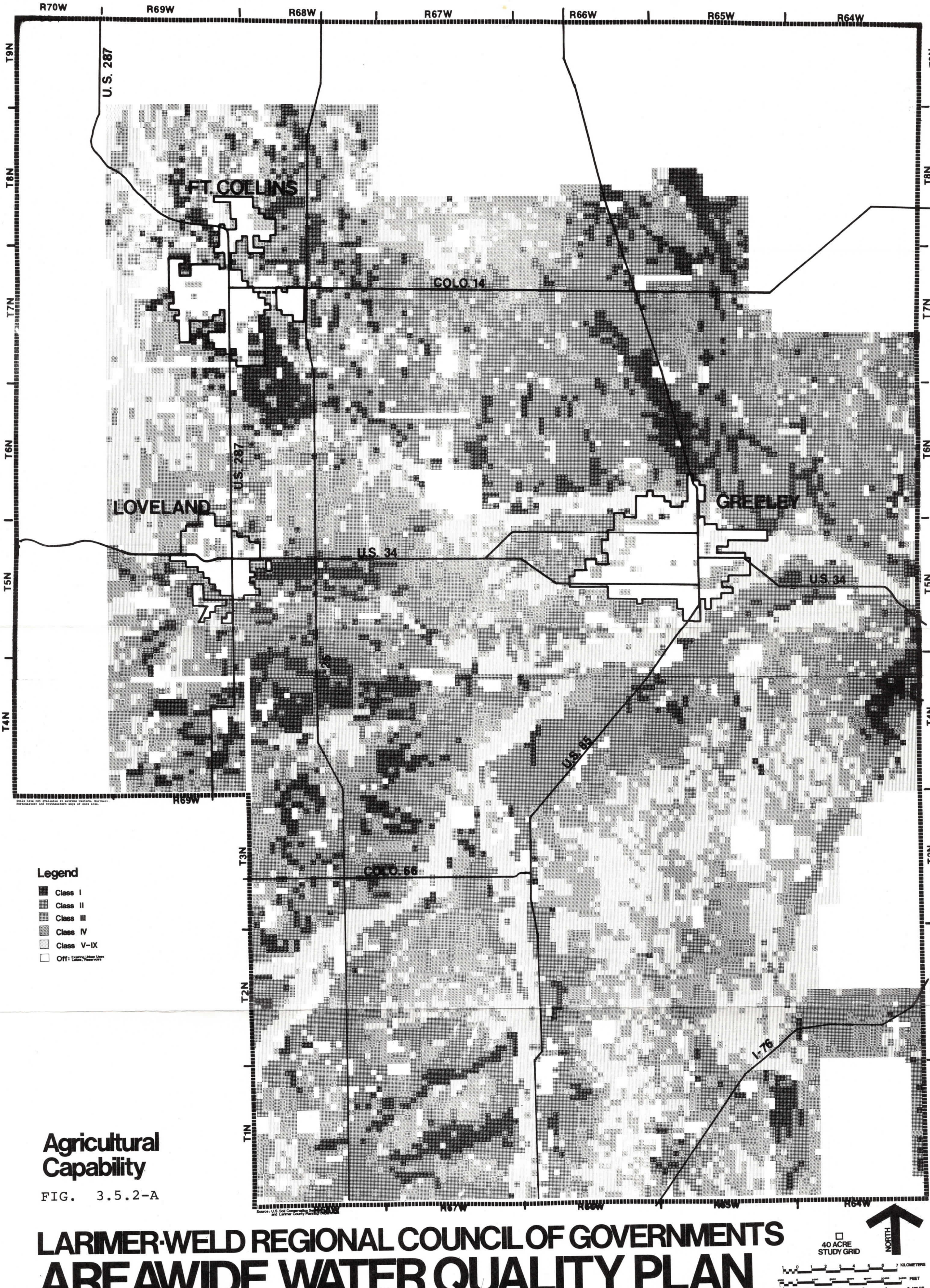
"Limitations that cannot be corrected may result from the effects of one or more of the following: 1) erosion or erosion hazard; 2) severe climate; 3) wet soil; 4) stones; 5) low-moisture capacity; 6) salinity or sodium."

"<u>Class IX</u>: Badlands, rock outcrop, sandy beaches, river wash, mine tailings, and other nearly barren lands are included in Class IX. It may be necessary to give protection and management for plant growth to soils and landforms in Class IX in order to protect other more valuable soils, to control water, or for wildlife or esthetic reasons."

In analyzing agricultural capability five capability classifications have been distinguished: 1) Class I; 2) Class II; 3) Class III; 4) Class IV; 5) Class V-VIII. Figure 3.5.2.1 illustrates the occurrence of these categories in the Core Area.

In reviewing the Agricultural Capability Map (Figure 3.5.2A), it should be noted that baseline soils data was unavailable for the extreme western, northern, and southeastern portions of the Core Area. This accounts for 26.4 percent of the Core Area, or 317,200 acres, and graphically has been left blank. Also excluded are areas currently in urban development, 59,520 acres or 5 percent of the Core Area.

Review of the map reveals that 10.7 percent (88,000 acres) of the Core Area, for which data was available, contains Class I soils. However, 30 percent (247,080 acres) of the area contains Class II soils. Thus slightly less than one half of the developable Core Area displays a high level of agricultural capability. Generally, these areas are found: 1) to the immediate southeast, east and northeast of the Fort Collins and Terry Lakes area; 2) to the south, southeast, and east of Loveland; 3) in a vast expansion northwest, north, and northeast of Greeley; 4) along the south and



Agricultural Capability

FIG. 3.5.2-A

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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eastern banks of the South Platte river; 5) in the triangular land areas created by the confluence of the St. Vrain and South Platte rivers, and St. Vrain and Big Thompson rivers; 6) north of the Cache La Poudre River. Much of the land area between the Big Thompson and Cache La Poudre rivers falls within a Class III or IV soil classification. Overall, 36.9 percent of the area (303,920 acres) are so classified.

Lands displaying low levels of agricultural capability (Classes V-IX) account for 22.4 percent, or 184,000 acres, of the developable Core Area lands. Most of these lands are found at the extreme western edge of the Core Area, the foothills of the Rocky Mountains, and in a large area east and south of the South Platte river.

Table 3.5.2A summarizes the acres within each soil classification in the Core Area.

TABLE 3.5.2A AGRICULTURAL CAPABILITY

Classification	Acreage	Percentage Available Land	Percentage Total Core Area
Class I	88,000	10.7	
Class II	247,080	30.0	
Class III	138,400	16.8	
Class IV	165,520	20.1	
Class V-IX	184,000	22.4	
Class I-IX	823,000	100.0	65.6
No Data	317,200		26.4
Urban	59,520		5.0
Total	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate

3.5.2.2 Septic Tank Limitations

Septic tank limitations are based on the ability of a particular soil type to safely accept and treat sanitary wastes with a septic tank absorption field. The latter is a subsurface tile system laid in such a way as to distribute the wastes uniformly to the subsoil. The principal concern is the ability of soil materials on which the waste is disposed to absorb the liquid within an adequate time period to permit the natural biological processes of the soil to purify the wastes. Insufficient processing results in contamination of surface, subsurface, and/or ground water.

Factors evaluated in determining septic tank limitations include: 1) slope; 2) permeability of subsoil and substratum; 3) depth to consolidated rock or other impervious layers; 4) flooding; 5) seasonal and annual groundwater table. Based on these factors, areas are classified as "low," "moderate," or "severe" in constraining the implementations of septic tanks.

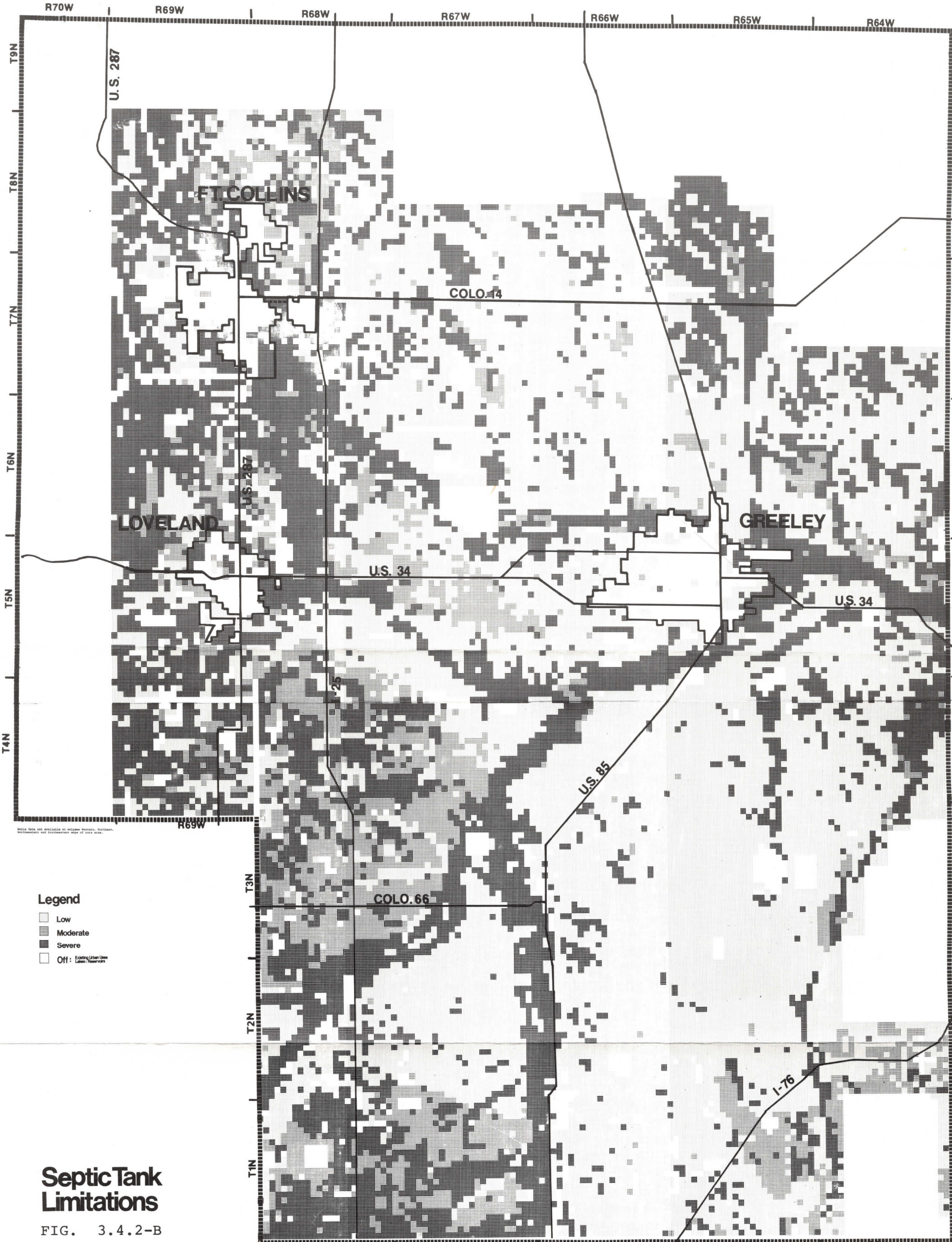
Areas with low septic tank limitations have none or slight soil limitations that can be readily and economically overcome. Areas with moderate limitations have problems that can normally be overcome with proper planning, careful design, and average management. Areas with severe limitations experience problems that are difficult and extremely costly to overcome, if possible at all. Generally, above average design, planning, and management would be required to safely use septic tanks in areas with severe limitations.

Figure 3.5.2B illustrates the limitations on septic tank use in the Core Area. As in the previous map, it should be noted that no baseline soils data was available for 312,080 acres, or 26 percent of the area, and 59,520 acres of existing urban use, or 5 percent of the area, is excluded.

Review of this map reveals that a large percentage of the area, 33.7 percent (278,680 acres) displays severe limitations for septic tank use. Significantly, much of the land in the Larimer County portion of the Core Area is so characterized. In general, the greater the proximity to the Rocky Mountains, the greater the severity of the limitations. Areas immediately surrounding the communities of Fort Collins, Loveland, and Berthoud are uniformly restrictive. Consequently, development in these areas would necessitate a sanitation collection and treatment system. All hillside areas, particularly attractive for residential use, exhibit severe limitations.

Proceeding eastward, the frequency of land displaying severe limitations dissipates, excepting the flood plains of the Cache La Poudre, Big Thompson, South Platte and St. Vrain rivers. Other large areas of severe limitation are found in the southwest, between Erie and the South Platte river, and to the northeast of Pierce, Ault, and Eaton.

Moderate levels of septic tank limitations account for 11.9 percent (98,920 acres) of the Core Area. Principally, these lands are found in the triangular area between the confluence of the Big Thompson and St. Vrain rivers.



Septic Tank Limitations

FIG. 3.4.2-B

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AREAWIDE WATER QUALITY PLAN

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40 ACRE STUDY GRID

NORTH

SCALE 1:48,000

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Approximately 54.4 percent (450,520 acres) of the Core Area displays a low level of limitations for the use of septic tanks. Most of this is found in Weld County, outside flood-prone areas.

Table 3.5.2B summarizes the acreage found in each septic tank limitation classification.

TABLE 3.5.2B SEPTIC TANK LIMITATIONS

Classification	Acreage	Percentage Available Land	Percentage Total Core Area
Severe	278,680	33.7	
Moderate	98,920	11.9	
Low	450,520	54.4	
Low, Moderate & Severe	828,120	100.0	69.0
No Data	312,080		26.0
Urban	59,520		5.0
Total	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate.

3.5.2.3 Erosion Hazards

The erosion hazard ratings of "low," "moderate," and "severe" are assigned by the SCS to each soil type based on the susceptibility of that particular soil to erode due to wind or water forces. Factors evaluated in determining erosion hazard include: 1) soil characteristics (density, plasticity, texture, etc.); 2) slope; 3) wetness; 4) content of stones and rocks.

Areas characterized by a low level of hazard exhibit minor problems that can be readily and economically overcome. Areas with moderate hazard have problems that can normally be overcome with proper planning, careful design, and average management. Areas with severe hazards experience problems that are difficult and extremely costly to overcome, if possible at all. Generally, above average design, planning, and management would be required to safely develop in areas of severe hazard.

Figure 3.5.2C illustrates potential areas of erosion hazard in the Core Area. Again, areas in which no baseline data was available or are currently developed were excluded from the map. Streams are also deleted from this map.

Review of the map reveals a very small percentage of the area, 8.9 percent (6,840 acres), displaying severe erosion hazards. Generally, these are randomly scattered. One concentration exists in the foothills northwest of Loveland, south of Horsetooth Reservoir.

A larger area, 21.5 percent (165,440 acres), displays a moderate level of erosion hazard. Generally, these areas are found throughout the western and southern portions of the Core Area. However, no one area dominates the pattern, as they are scattered rather uniformly, broken by areas of low hazard.

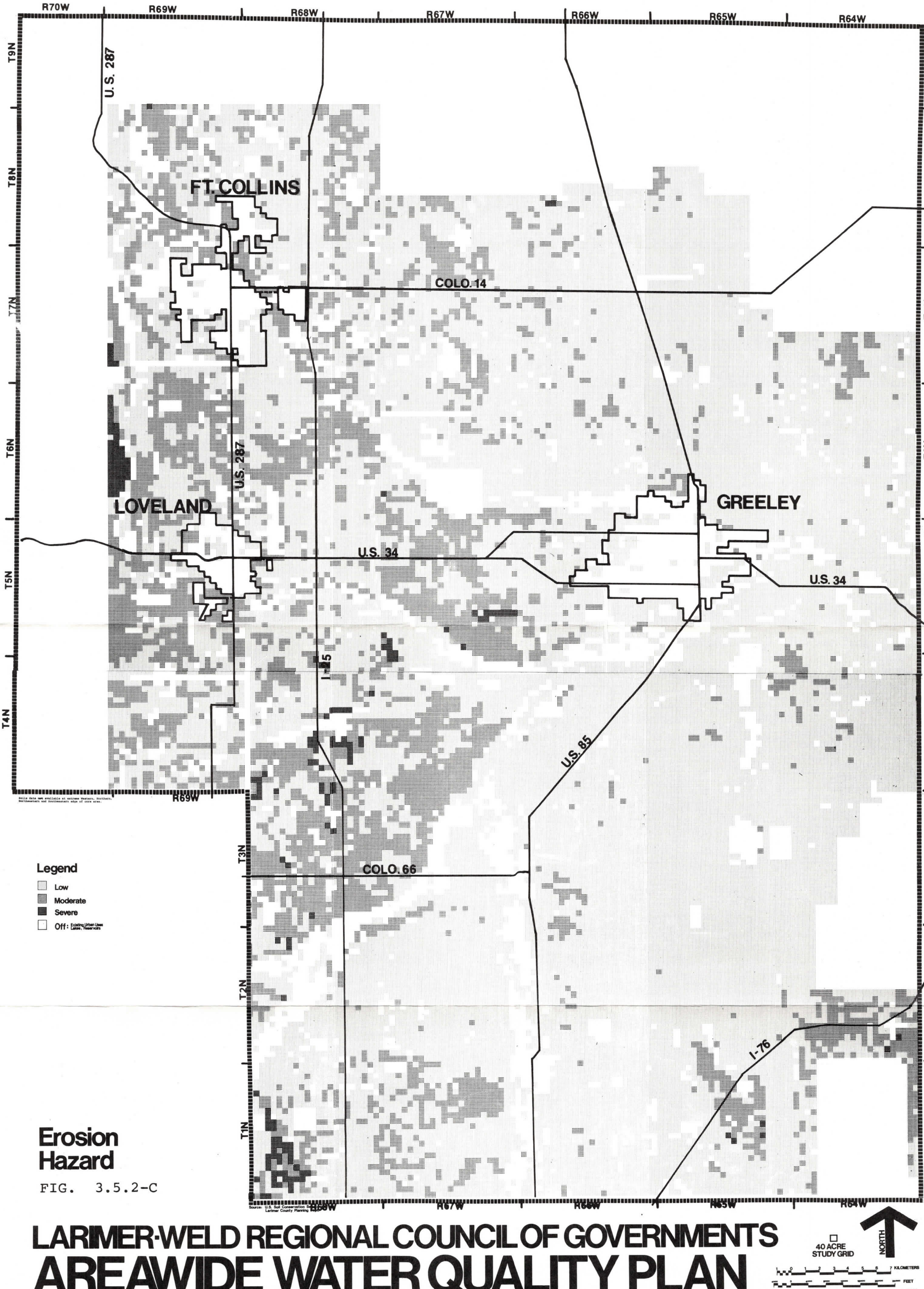
Overall, the Core Area is characterized by a low level of erosion hazard. Approximately 77.6 percent of the land, 597,240 acres, exhibits little hazard, particularly vast areas to the northeast, east, and southeast.

Table 3.5.2C summarizes the acreage found in each erosion hazard classification.

TABLE 3.5.2C EROSION HAZARD

Classification	Acreage	Percentage Available Land	Percentage Total Core Area
Severe	6,840	8.9	
Moderate	165,440	21.5	
Low	597,240	77.6	
Low, Moderate & Severe	769,240	100.0	64.1
No Data	326,840		27.2
Urban	59,520		5.0
Streams	44,120		3.7
Total	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate.



Erosion Hazard

FIG. 3.5.2-C

Source: U.S. Soil Conservation Service
Larimer County Planning Dept.

LARIMER·WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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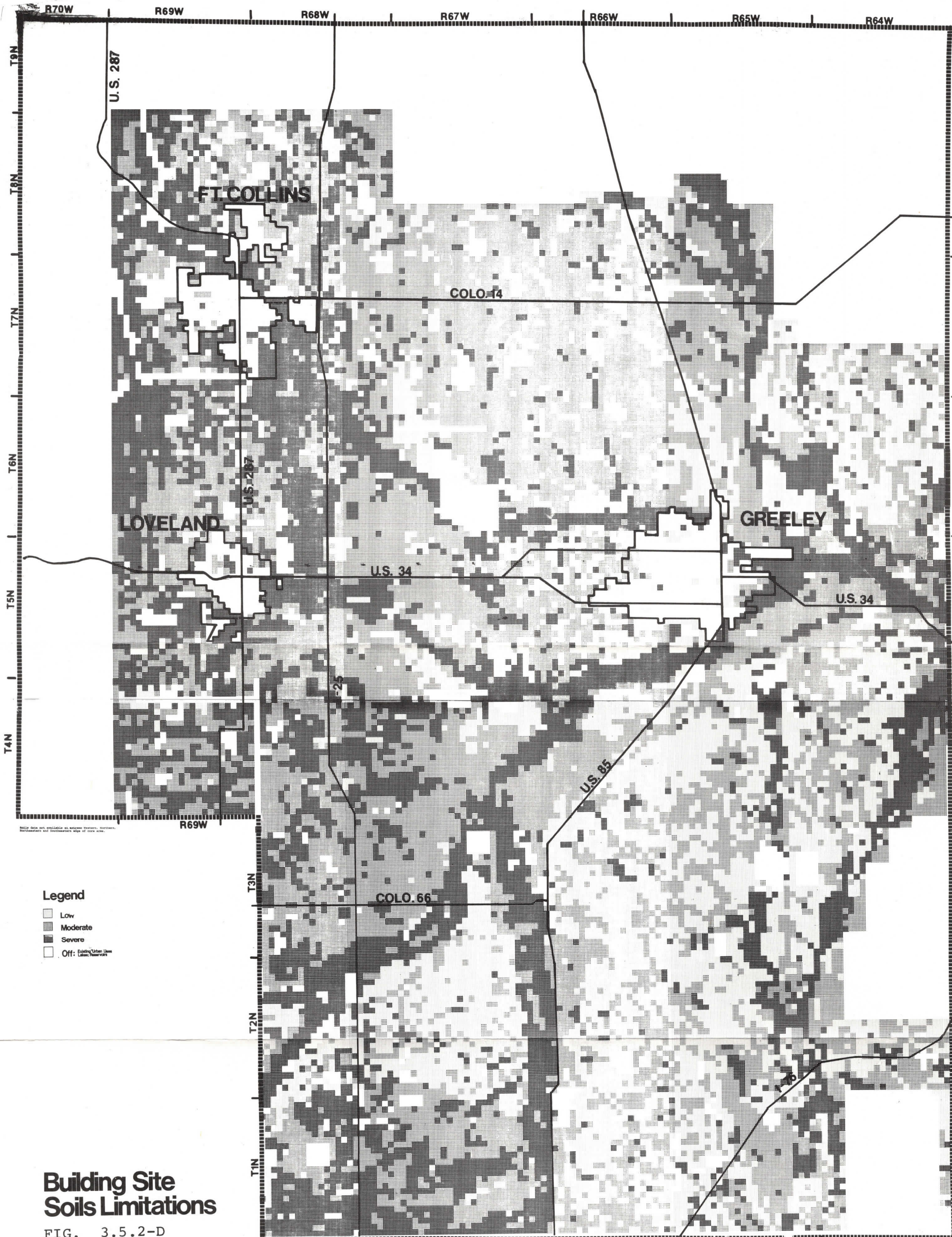
3.5.2.4 Building Site Soil Constraints

The SCS has assigned ratings of "low," "moderate," and "severe" to each soil type based on its limitations to support foundations of buildings in an undisturbed state. The features that are generally considered in these ratings are those that relate to the capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties affecting the capacity to support load include: 1) wetness; 2) susceptibility to flooding; 3) density; 4) plasticity; 5) texture; 6) shrink-swell potential. Those that affect excavation are: 1) wetness 2) slope; 3) depth to bedrock; 4) content of stones and rocks. Areas characterized by a low level of constraint exhibit minor problems that can be readily and economically overcome. Areas with moderate constraints have problems that can normally be overcome with proper planning, careful design, and average management. Areas with severe constraints experience problems that are difficult and extremely costly to overcome, if possible at all. Generally, above average design, planning, and management would be required to safely develop in areas of severe constraint.

Figure 3.5.2D illustrates building site soil constraints in the Core Area. Areas without baseline soils data and those lands currently in urban development are excluded from the map.

Review of the map reveals that extensive areas are classified as severely constrained for building. Included is approximately 31.2 percent of the Core Area, or 258,720 acres. These lands are scattered throughout the two-county area, with a greater concentration and intensification in Larimer County. Of the many areas exhibiting this characteristic, those of significance include: 1) lands immediately surrounding Fort Collins and, to a lesser extent, Loveland; 2) a large area to the northwest and southeast of Fort Collins; 3) a corridor extending from southeast Fort Collins, along and west of Interstate 25, east of Boyd Lake, to the Big Thompson River; 4) the floodplains of the Cache La Poudre, Big Thompson, South Platte, and St. Vrain rivers; and Boulder Creek; 5) the foothills of the Front Range of the Rocky Mountains; 6) scattered areas along U.S. Highway 287; 7) lands immediately east of Erie; 8) lands on the periphery of Berthoud. Excluding the floodplains, many of these lands are potential high growth areas. Thus, in development attention must be directed at this constraint.

Displaying moderate constraints on building development is 43.9 percent of the available land, or 363,800 acres. These lands are scattered throughout the Core Area, with large areas evident: 1) to the north of the Cache La Poudre River



Building Site Soils Limitations

FIG. 3.5.2-D

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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40 ACRE STUDY GRID

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and Greeley; 2) defined by I-25, the Cache La Poudre and Big Thompson rivers, and Greeley; 3) in the triangle created by the confluence of the Big Thompson and St. Vrain rivers.

Approximately 24.8 percent of the available land, or 205,600 acres, exhibits low level of building site soil constraint. Most of these lands are found to the southeast and east of the St. Vrain and South Platte rivers. Though these areas display the highest suitability for construction due to soils, a very small percentage of the Region's growth has occurred here.

Table 3.5.2D summarizes the acreage within each building site soil constraint classification.

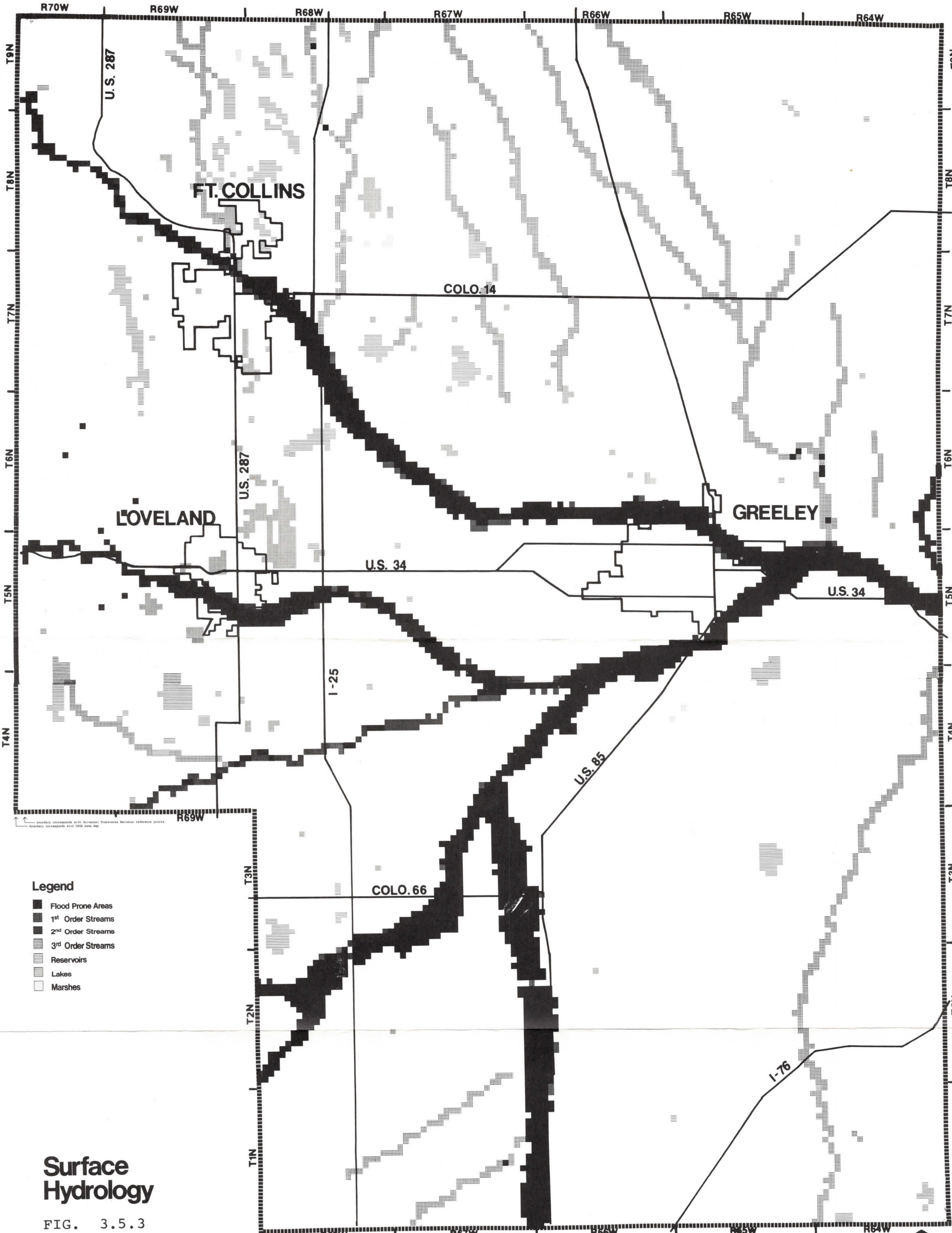
TABLE 3.5.2D BUILDING SITE SOIL CONSTRAINTS

Classification	Acreage	Percentage Available Land	Percentage Total Core Area
Severe	258,720	31.2	
Moderate	363,800	43.9	
Low	205,600	24.8	
Low, Moderate & Severe	828,120	100.0	69.0
No Data	312,080		26.0
Urban	59,520		5.0
Total	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate.

3.5.3 Surface Hydrology

Throughout the Core Area are numerous rivers, streams, lakes, ponds, reservoirs, and marshes. Figure 3.5.3 illustrates these resources. Much of the eastern slope of the Front Range of the Rocky Mountains and the plains drain into the South Platte River basin. The South Platte flows northward from the Rockies of central Colorado into the Core Area, past Fort Lupton and Platteville. Slightly north of Platteville, the river turns northeasterly, flowing along the



Surface Hydrology

FIG. 3.5.3

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

The preparation of this map was financed in part through a Water Quality Management Technical Assistance Planning Grant from the Environmental Protection Agency under the provisions of Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500).

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40 ACRE STUDY GRID

NORTH

KILOMETERS FEET MILES

SCALE 1:48,000

southern edge of Greeley. From Greeley, it extends east to its eventual confluence with the North Platte River in Nebraska.

Major tributaries (first order streams) of the South Platte are the Cache La Poudre Big Thompson, St. Vrain rivers and Boulder Creek. Draining the northwestern portion of the Core Area, the Cache La Poudre extends from the Rocky Mountains southeasterly, south of Laporte, along the northern limit of Fort Collins, south of Windsor, and north of Greeley. Its confluence with the South Platte forms the eastern limit of Greeley.

The Big Thompson River traverses the central portion of the Core Area, extending easterly from the highly constricted "Narrows" in the foothills of the Rockies, along the southern boundary of Loveland, north of Milliken and Johnstown to its confluence with the South Platte River. It drains approximately 20 percent of the mountainous areas of Larimer County.

At the southeastern corner of the Core Area, Boulder Creek and St. Vrain River enter Weld County. From their confluence, the St. Vrain flows northeasterly to the South Platte River, northwest of Platteville.

From the southwest, near Berthoud, the Little Thompson River (a second order stream) extends northeasterly. It drains into the Big Thompson immediately north of Milliken and east of Johnstown.

Other smaller perennial and seasonal streams drain the plains areas in an intricate, branching pattern. These ultimately drain into the South Platte and its major tributaries.

Much of the natural drainage pattern has been altered due to the construction of canals and ditches for agricultural irrigation. Throughout the plains area, these canals intercept natural runoff and surface flow in the rivers. During the summer months, diversion of water into the canals is occasionally sufficient to drain the river and stream beds.

Much of the flow of the major mountain tributaries is attributable to the snowpack at the higher elevations of the Rocky Mountains. As a general rule, plains stream flow contributions from precipitation are minimal, except from infrequent high intensity storms. Water contribution from the plains tributaries which drain arid and semi-arid areas exhibit intermittent runoff and, quantitatively, are insignificant to the total water contribution of the South Platte River basin.

Localized thunderstorms occasionally cause heavy runoff in the mountains and when concentrated, flash flooding. Extremely large storms can cause serious flooding along major watercourses, as evident by the flooding of the Big Thompson River in 1976. Floodprone areas occur along all major and secondary watercourses in the area. Such areas are designated as lands in which there is one chance in one hundred of being inundated by floods in any given year. Floodprone areas encompass 63,120 acres within the Core Area.

Scattered throughout the area are numerous lakes, ponds, and reservoirs. Most of these serve as a source of water for agricultural use, and some for domestic use. Among these are:

1. Horsetooth Reservoir, to the west of Fort Collins, serving as a storage facility for waters diverted from the west slope of the Rockies;

2. Carter Lake Reservoir, to the southwest of Loveland and west of Berthoud, also a storage facility for diverted water;

3. A cluster of lakes and reservoirs north of Fort Collins (Terry Lake, Windsor Reservoir, Douglas Lake, Bee Lake, et al);

4. Lake Loveland;

5. Boyd Lake, to the east of Loveland, a wildlife and recreational area;

6. Milton Reservoir, approximately nine miles east of Platteville, the breeding grounds of the "endangered" White Pelicans;

7. Lower Latham Reservoir, northeast of Timnath; and Windsor Reservoir, north of Windsor.

These are representative of the 75 reservoirs in the Region and the numerous natural lakes and ponds. There are approximately 23,520 surface acres of lakes and reservoirs in the Core Area.

Table 3.5.3 summarizes the areas of surface water and flood plains in the Core Area.

TABLE 3.5.3 SURFACE HYDROLOGY

Classification	Acreage	Percentage of Core Area
Floodplain	68,120	
First Order Streams	5,560	
Second Order Streams	3,440	
Third Order Streams	35,120	
Reservoirs	15,640	
Lakes	7,880	
Marshes	400	
Total	136,160	11.4

Source: Toups Corporation, Quinton-Redgate.

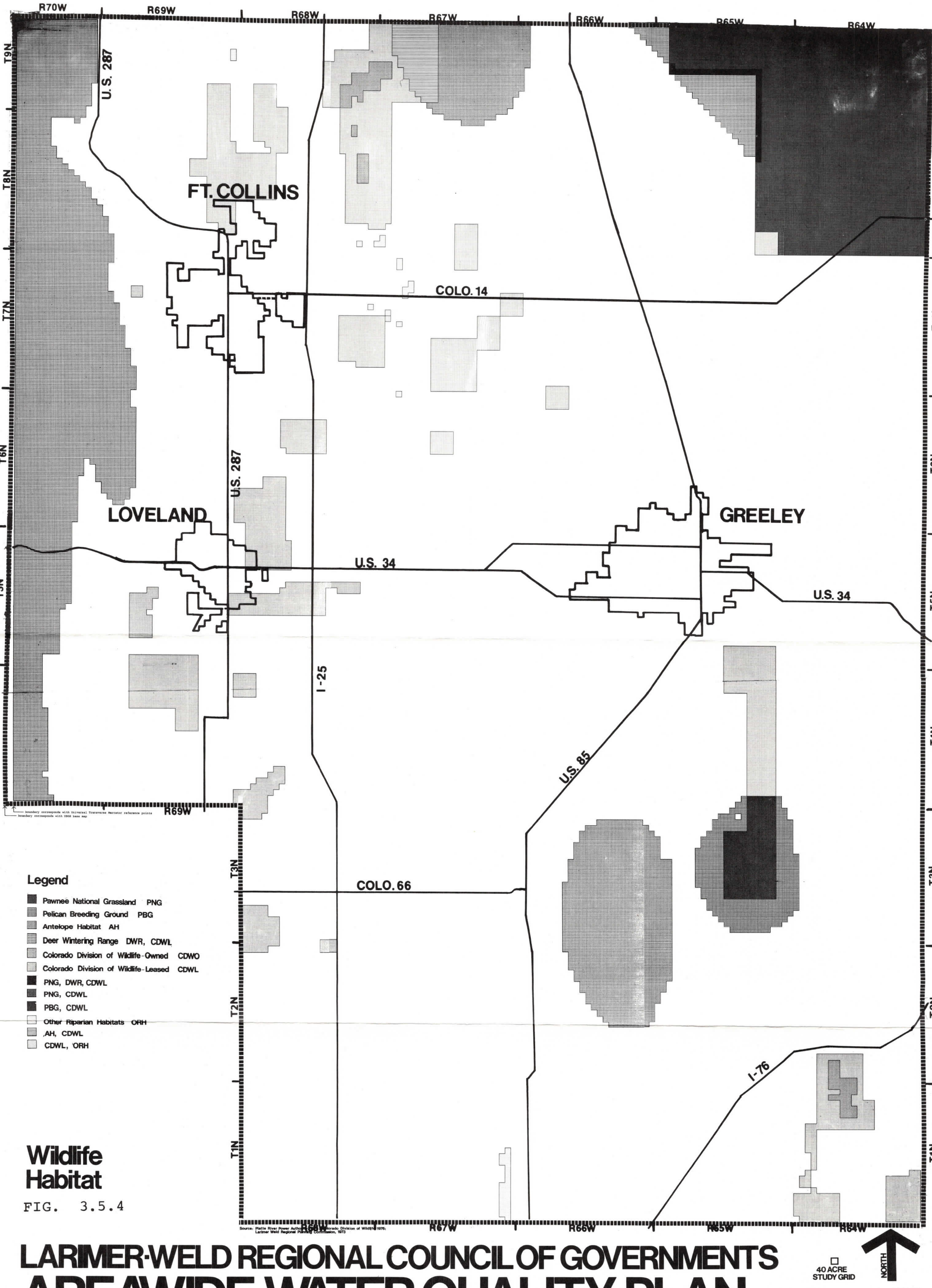
3.5.4 Wildlife Habitat

Throughout the Core Area an abundance and diversity of wildlife is found. Their presence contributes to the unique environmental character which has attracted significant population growth. With its wildlife, the area has become a regional center of hunting, fishing, and wildlife observation. The mountains and plains provide a rich habitat for big and small game animals and fowl. According to the Colorado Division of Wildlife, well over 2,000 deer, elk, and antelope are harvested annually in the area. The streams, rivers, and lakes support a diversity of native and introduced fish species. These waters and the abundant aquatic and terrestrial vegetation constitute a major nesting, resting, and feeding area for migratory birds.

To ensure the continuing usefulness of these habitats for recreation and preservation of rare, endangered and protected species, critical wildlife habitats have been identified in the Core Area. Figure 3.5.4 illustrates the location of these habitats. Significant among these are:

1. The extensive habitat of the White Pelican, classified as a threatened species, found around Milton Reservoir (to the east of Platteville) and Lower Latham Reservoir (to the east of La Salle);

2. The floodplains of the South Platte River, east of Greeley, supporting a very large population of wintering Bald Eagles, a protected species;



Wildlife Habitat

FIG. 3.5.4

Source: Platte River Power Authority; Colorado Division of Wildlife 1976; Larimer Weld Regional Planning Commission, 1973

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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3. The Pawnee National Grasslands, northeast of the Core Area, a diverse grassland habitat containing antelope, deer, and other species;

4. The Boyd Lake State Recreation Area (east of Loveland) and Wellington Wildlife Area (east and southeast of Wellington), extensively developed by the Colorado Division of Wildlife to enhance the diversity of wildlife;

5. The extensive antelope ranges in the areas northeast of Wellington and northwest of Nunn, and east of Platteville and west of Milton Reservoir;

6. The deer wintering ranges and hunting areas in the foothills of the Rocky Mountains and the Pawnee National Grasslands;

7. The Black Hollow Reservoir and Windsor Reservoir hunting and fishing areas, north of Windsor;

8. The Banner Lakes Wildlife Area, a hunting area southeast of Hudson;

9. The Barbour Ponds State Recreation Area, west of Mead.

The Colorado Division of Wildlife owns or leases for public use a significant amount of land and water surface in the Core Area. One of the principal responsibilities of the Division is to plan for and manage lands to meet the demand for hunting and fishing. Many of the areas listed above, and others scattered throughout the Core Area, are leased for waterfowl, pheasant, dove, and rabbit hunting.

Of the Core Area, approximately 21.1 percent, or 253,280 acres, are classified as critical wildlife habitats. Lands owned or leased by the Colorado Division of Wildlife constitute 13.2 percent of the Area's critical habitats. Table 3.5.4 summarizes the acreage of significant habitats and those leased or owned by the Division of Wildlife.

TABLE 3.5.4 WILDLIFE HABITAT

Classification	Acreage	Percentage of Core Area
Pawnee National Grasslands (PNG)	52,280	
PNG, Deer Range, CDW Leased	1,280	
PNG, CDW Leased	160	
Pelican Breeding Grounds (PBG)	8,160	
PBG, CDW Leased	5,520	
Deer Range, CDW Leased	77,120	
Antelope Range	33,120	
Antelope Range, CDW Leased	3,640	
CDW Owned	3,160	
CDW Leased	67,280	
Riparian	1,520	
Riparian, CDW Leased	40	
Total	253,280	21.1

Source: Toups Corporation, Quinton-Redgate.

3.5.5 Land Use

As discussed in Chapter 2.0, the Region has historically been a center of agricultural and cattle production. In Weld County, the pattern of land use was influenced by the corridors (railroad and highway) established to transport farm and beef products to the marketplace. Along these routes, communities developed as food processing and resident service centers. In Larimer County, the catalyst was the establishment, on the south bank of the Cache La Poudre River, of a military post for the protection of settlers (Camp Collins). Subsequently, development of a railroad line north to Wyoming and south to Denver was an impetus for the establishment of communities along its length. Ultimately, east-west highways were developed to link the two north-south corridors. To a lesser extent, communities have emerged along these routes. This network of railroads and highways has constituted the structural framework on which communities have continued to develop.

During recent years, the Region has experienced one of the highest rates of growth in the United States. Significant expansion has occurred in the principal urban and suburban communities and along the major transportation corridors.

To clearly understand the pattern of land utilization as it exists in the Core Area, urban land uses have been differentiated from other classes of use. Consequently, two maps illustrating existing land use have been prepared.

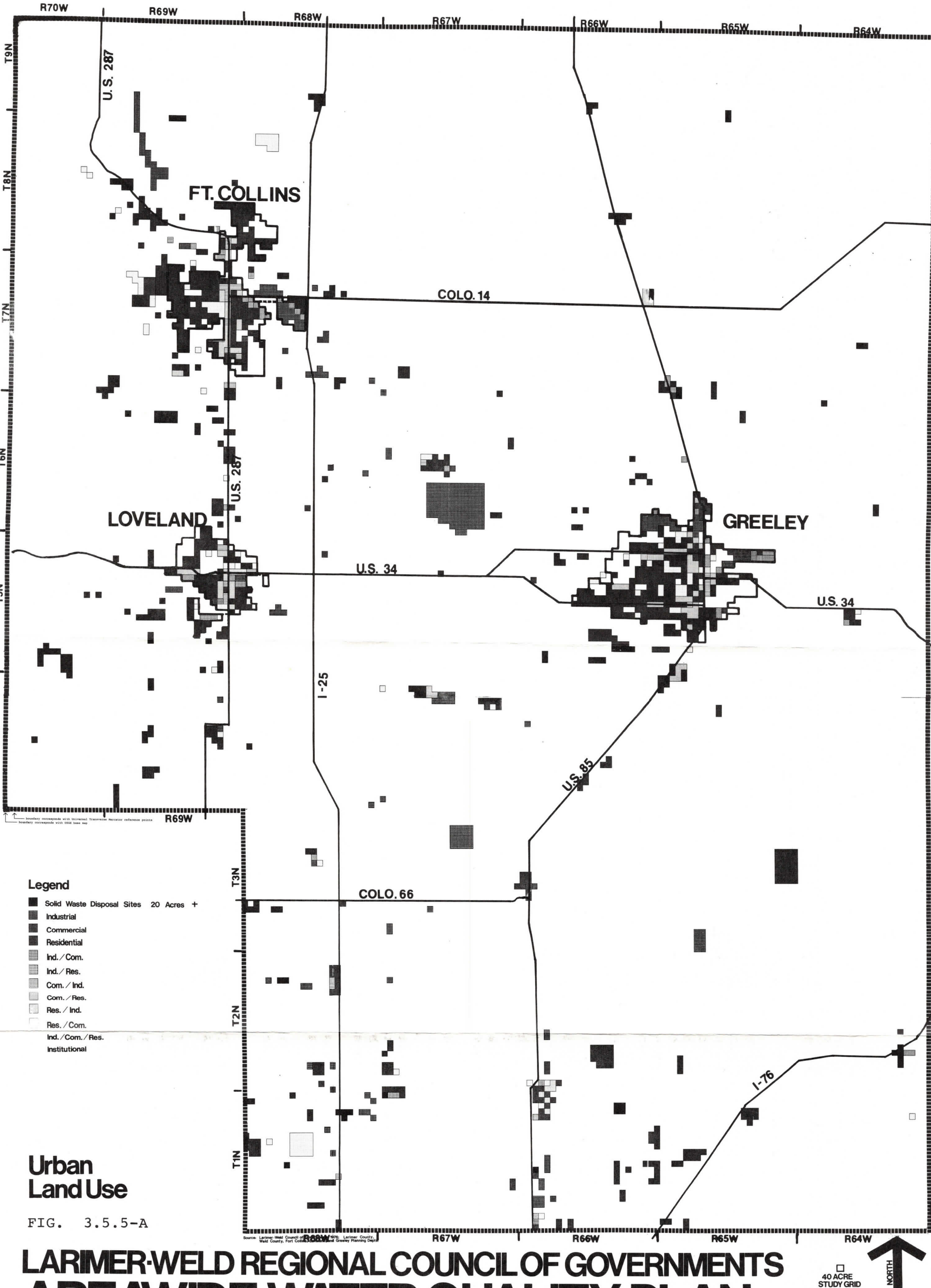
3.5.5.1 Urban Land Use

Figure 3.5.5A illustrates the pattern of urban land uses as they exist. Three major communities are found in the Core Area; Fort Collins, Loveland, and Greeley. Geometrically, they form the points of a triangle. Fort Collins, the northwest point, is generally located on the south bank of the Cache La Poudre River and flanks U.S. Highway 287. Loveland, the southwest point, is located on the north bank of the Big Thompson River and also flanks U.S. Highway 287. The eastern point, Greeley, is formed by the confluence of the Cache La Poudre and South Platte rivers.

Fort Collins is the largest of the three communities and has experienced the most significant rate of growth. The oldest portion of the community is located on the south bank of the river. At the river intersection with the north-south regional arterial, U.S. Highway 287, is located the "downtown" commercial center. Deterioration in recent years, attributable to the outward growth of the community, has prompted a program for the area's redevelopment. Extending southeast along the bank of the river are industrial uses with a mixture of residential and commercial areas immediately adjacent. A major industrial center is located along Colorado Highway 14 to the northeast of the river. To the west of U.S. Highway 287 is a complex of City, Larimer County, and Federal Government administrative facilities and office commercial uses surrounded by residential. A major activity center around which the community has developed is Colorado State University. Defined, generally by U.S. Highway 287 on the east, Shields on the west, Laurel on the north, and Prospect on the south, it has influenced the types of land use which have developed on its periphery. Reflecting this are the student-oriented commercial uses along Elizabeth Street, west of CSU, and smaller developments along U.S. Highway 287.

Recent development in Fort Collins has seen a significant expansion of commercial uses along U.S. Highway 287 south of Prospect Avenue. These are characterized as a mix of fast-food establishments, subregional shopping centers, automobile dealerships, banks and savings and loans, and small convenience goods stores. In effect, a continuous strip of commercial use extending approximately to Harmony Road has emerged.

Further south, on U.S. Highway 287, outside of the city limits, scattered commercial and residential development extends to the northern limits of Loveland.



Urban Land Use

FIG. 3.5.5-A

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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NORTH

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SCALE 1:48,000

Residential and supporting commercial and institutional uses have extended outward in all directions from Fort Collins. Principal growth areas have been in the southeast, the west, and north of the Cache La Poudre, around the lakes. Development of the Foothills Shopping Center, southeast of Drake Avenue and U.S. Highway 287 and Hewlett-Packard on Harmony Road, near Interstate 25, will act as significant catalysts of future growth in these areas.

Loveland, the smallest of the three urban centers, has developed principally between the Big Thompson River and around Lake Loveland. Loveland has historically been a retirement community. However, recent decisions by industries, such as Hewlett-Packard and Teledyne Water Pik, to locate in Loveland are changing the character of the City. The older commercial center of Loveland is located along U.S. Highway 287 north of its intersection with the Big Thompson River. Industrial uses have developed along the north bank, and in some cases within, the flood plain of the river. Older residential areas surround the commercial and industrial uses.

Recent commercial activity has been influenced by the two principal arterials passing through Loveland. As in Fort Collins, commercial uses have extended north along U.S. Highway 287. The development has been limited to smaller commercial uses, fast food establishments, savings and loans and banks and convenience goods stores. Insufficient population exists for a major commercial center, though a smaller complex is being developed at U.S. Highway 287 and 29th Street. Additionally, commercial uses have developed along U.S. Highway 34, the principal access route to Rocky Mountain National Park and Estes Park. Much of this has occurred subsequent to the completion of I-25. Many of the establishments cater specifically to the needs of the tourist population.

Corresponding with recent commercial developments, there has been a significant shift of residential development to the northwest, north, and northeast. Residences and their supporting commercial and institutional uses now surround Lake Loveland and have extended eastward toward the Boyd Lake recreational area.

Though outside the city limits, Boedecker and Buckingham Lakes have acted as an attraction of recent residential development. This, coupled by other recent developments south of the Big Thompson, suggest continuing development in the southwest. Currently development toward the east, along U.S. Highway 34, is limited. Exceptions include the dog track and commercial facilities at the I-25 interchange. Northeast of Boyd Lake, the Loveland-Fort Collins Airport provides commuter service to Denver.

Greeley developed as a colony community, along the Union Pacific Railroad, at the confluence of Cache La Poudre and South Platte rivers, midway between Denver and Cheyenne. As the waters of these rivers were diverted for agricultural production, food processing industries developed adjacent to the railroad and were surrounded by commercial and residential uses. A teacher's college, the University of Northern Colorado, was established in the southern portion of the community. These uses constitute a north-south corridor extending along the Union Pacific Railroad, from First Street to, approximately, Sixteenth Street. This corridor, coupled with the physical limitations of the Cache La Poudre and South Platte rivers and the development of U.S. Highway 85 parallel to the railroad, constitute the structure for the pattern of land uses found today.

The "downtown" commercial area of Greeley is located in a strip along Eighth Avenue, from First Street to Sixteenth Street. Immediately adjacent to this area is the center of city and Weld County administrative facilities, bounded by Sixth and Ninth Streets, and Eleventh and Ninth Avenues. Office-commercial uses are also found here. At the southern terminus of the commercial strip is the University of Northern Colorado, a "J"-shaped area generally defined by Sixteenth Street, Eighth Avenue, Twenty-fourth Street, Seventeenth Avenue, Twentieth Street, and Tenth Avenue. At the northern terminus of and flanking the commercial strip are industrial uses. Those to the east have direct access to the railroad. Additionally, a large industrial area flanks the railroad in the south; bounded by U.S. Highway 85, a diagonal extending from Twentieth Street in the northeast to Twenty-fourth Street in the southwest, and the freeway extension of Eighth Avenue. A major regional shopping center was recently developed in the area north of U.S. Highway 34 and west of the freeway extension of Eighth Avenue.

Within the Union Pacific-U.S. Highway 85 corridor are a number of areas with mixtures of somewhat incompatible land uses. In the long-term, significant blighted conditions may emerge unless corrective action is exercised. Urban renewal programs are ongoing with this and other blightable areas of Greeley.

Almost all of Greeley's residental and supporting commercial and institutional development extends west from the north-south corridor. The west has provided the least resistence to urban growth. These areas, in agricultural production, do not represent the physical constraints of the rivers to the north and south, nor the psychological and public service disadvantages of the east. Strip commercial uses (fast-food establishments, restaurants, automotive sales, and convenience goods stores) have developed along Ninth and Tenth Streets, the principal east-west connectors to U.S. Highway 34 and I-25.

Along and within the Cache La Poudre River have developed a number of non-agricultural industrial uses. One of the largest is a sand and gravel operation, northwest of Island Grove Park. To the east of U.S. Highway 85 is Weld County Municipal Airport, around which a number of smaller industrial facilities have been developed.

Within the center of the triangular land area defined by the three urban communities is an extensive area recently acquired by Eastman Kodak and zoned for industrial and scientific use. Southeast of Windsor and partially within the Cache La Poudre River floodplain, the area is almost as large as the existing urbanized area of Loveland. The northeastern portion of the site has been developed and is operational. Its location provides the opportunity to draw on the labor pool of the three urban areas and is a potentially significant attractor of local growth. The town of Windsor is the closest urban area to the Kodak facility. Due to lack of housing opportunities and poor availability of public services Windsor did not initially receive a high growth impact due to Kodak's location. However, continued expansion of the Kodak facility coupled with improved facilities in Windsor will result in significant expansion of Windsor.

Throughout the Core Area are numerous smaller communities located along the principal north-south and east-west highways and railroads. Most are located along U.S. Highway 287 (La-porte and Berthoud), U.S. Highway 85 (Nunn, Pierce, Ault, Eaton, Evans, La Salle, Gilcrest, Platteville and Fort Lupton), Colorado Highway 60 (Johnstown and Milliken), and U.S. Interstate 76 (Lochbuie, Hudson, and Keenesburg). Others include, Wellington (along I-25), Mead (west of I-25), Erie (the eastern extension of the Boulder County community), Timnath (east of I-25), and Kersey (on U.S. Highway 34). Three communities, Firestone, Frederick and Dacono are located in close proximity to one another and are trending towards convergence. They are located immediately east of I-25.

Most of these communities are agricultural service areas. Generally, they are characterized by a clustering of residential units, convenience commercial uses, schools and limited public service facilities, and parks. Occasionally, a food processing facility or other small industrial uses will be found.

Other isolated pockets of use are scattered throughout the Core Area. Often, they are industries whose location is determined by the presence of a resource necessary to their production. The oil extraction and processing activities in the southern portions of the area and the mining operations northwest of Fort Collins are representative. The St. Vrain Nuclear Power Plant is located at the confluence of St. Vrain and the South Platte rivers to facilitate use of the available water and maintain physical isolation from the area's communities. In a number of areas, residential tracts have been developed to capitalize on certain unique environmental characteristics. Development on the north shore of Carter Lake Reservoir, on the south and eastern shores of Horsetooth Reservoir, and east of Milton Reservoir are representative. At major intersections of major highways, automotive and truck service stations, restuarants, motels, and other highway-oriented commercial uses are found.

Table 3.5.5A summarizes the acreage of the Core Area currently developed for urban land uses.

TABLE 3.5.5A EXISTING URBAN LAND USES

Classification	Acreage	Percentage of Urban Uses	Percentage of Core Area
Residential	33,040	55.5	
Commercial	3,080	5.2	
Industrial	9,840	16.5	
Institutional	4,200	7.1	
Solid Waste Disposal Site	1,480	2.5	
Residential/Commercial[a]	4,000	6.7	
Residential/Industrial[a]	1,120	1.9	
Commercial/Residential[a]	1,240	2.1	
Commercial/Industrial[a]	280	0.5	
Industrial/Residential[a]	640	1.1	
Industrial/Commercial[a]	280	0.5	
Industrial/Commercial/ Residential[a]	320	0.5	
Total	59,520	100.0	5.0

[a] Uses are listed according to their dominance in a grid cell.

Source: Toups Corporation, Quinton-Redgate.

3.5.5.2 Nonurban Land Use

Figure 3.5.5B illustrates the occurrence of nonurban land uses. Reflecting the historical tradition of the area's land use, irrigated and nonirrigated lands clearly dominate. Accounting for 49.1 percent of the nonurban areas (559,400 acres) irrigated agricultural lands extend eastward from the foothills of the Rocky Mountains in a general triangular pattern. The northeastern edge of the triangle, extends from an area approximately six miles east of Wellington, along an east-west line north of Highway 14, northeasterly to Pierce, and southeasterly to a point east of Galeton. The southeastern boundary is defined by a line parallel to the eastern and southeastern bank of the South Platte River.

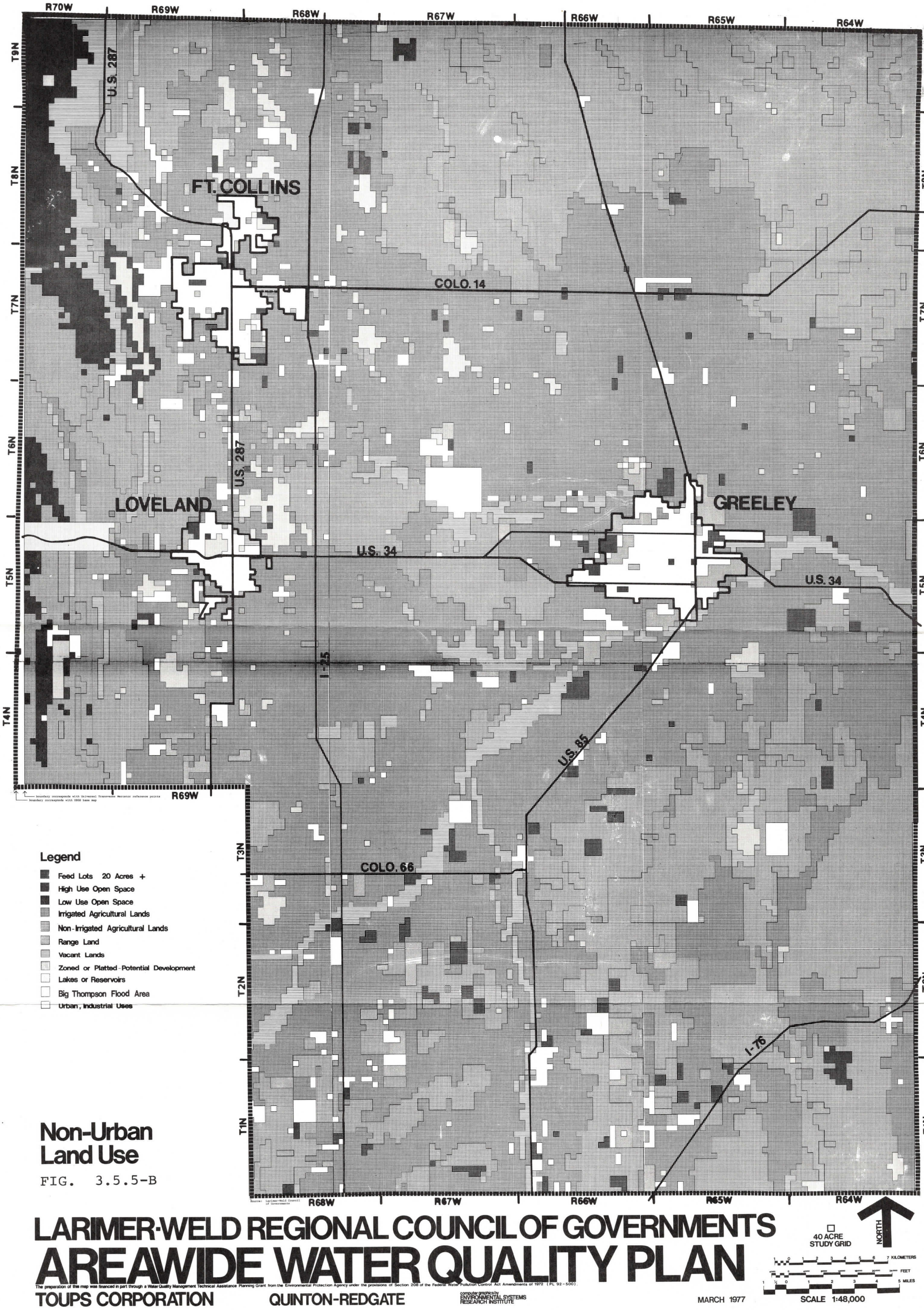
The triangular area is bisected from the west by an expanse of nonirrigated agricultural lands, north of the Big Thompson and south of the Cache La Poudre rivers. Other nonirrigated lands occur along the foothills of the Rocky Mountains, in the northern portion of the central Core Area, and in large areas scattered throughout the southeast. Nonirrigated agricultural lands occupy 24 percent of the nonurban areas (274,160 acres).

Rangeland is the third largest nonurban land use in the Core Area. Principally, these lands are located in the northeast (the Pawnee National Grasslands), the southeast, and in the southwest and west (the foothills and valleys of the Rocky Mountains). Approximately 14.3 percent of nonurban lands (163,400 acres) are used as rangeland.

It should be noted that certain areas have been removed from agricultural production to accommodate development of urban uses, while other areas not previously irrigated or used as rangeland have been converted to agricultural use. This later shift has primarily impacted the eastern and southeastern portions of the Core Area. Review of the map reveals "bands" of irrigated agricultural use within larger rangeland areas. This is particularly evident in the areas surrounding Milton Reservoir.

Numerous feedlots are scattered throughout the Core Area. Principally, these are found in the southern and eastern sectors, particularly along the South Platte and St. Vrain rivers, and surrounding Greeley.

Along the western edge of the Core Area, the foothills of the Rockies constitute a significant area of low use open space. Opportunities for camping, hiking, picnicking, as well as hunting and fishing are available. Extending east from the mouth of the Big Thompson Canyon, an area has been designated for special study as to its appropriate use, due to the July 31, 1976 flood.



Non-Urban Land Use

FIG. 3.5.5-B

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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High use, or active open spaces are scattered throughout the Core Area. Generally, these are developed recreational areas, including golf courses, community parks, campgrounds, and boating and water skiing. These are found within and adjacent to the area's urban communities and along the perimeter of Horsetooth Reservoir and portions of Carter Lake Reservoir.

Approximately 1.4 percent of the nonurban lands (16,520 acres) has been zoned or platted for urban use. Most of these lands occur on the immediate periphery of existing urban and rural communities. A small number are scattered apart from existing communities.

By definition, lands which are vacant currently have no use. Included are riverbeds, flatland areas between the ridges of the foothills of the Rocky Mountains, and a number of sensitive wildlife habitats around lakes, ponds, and reservoirs. Vacant lands account for 4.6 percent of the nonurban lands (52,440 acres) of the Core Area.

Table 3.5.5B summarizes the acreage of nonurban land by type, currently existing in the Core Area.

TABLE 3.5.5B EXISTING NONURBAN LAND USES

Classification	Acreage	Percentage of Nonurban Uses	Percentage of Core Area
Irrigated Agriculture	559,400	49.1	
Nonirrigated Agriculture	274,160	24.0	
Rangeland	163,400	14.3	
High Use Open Space	7,760	0.7	
Low Use Open Space	27,520	2.4	
Feedlots (20 acres+)	12,240	1.1	
Water Bodies	23,480	2.1	
Vacant	52,440	4.6	
Zoned or Platted	16,520	1.4	
Big Thompson Study Area	3,240	0.3	
Total	1,140,160	100.0	95.0

Source: Toups Corporation, Quinton-Redgate.

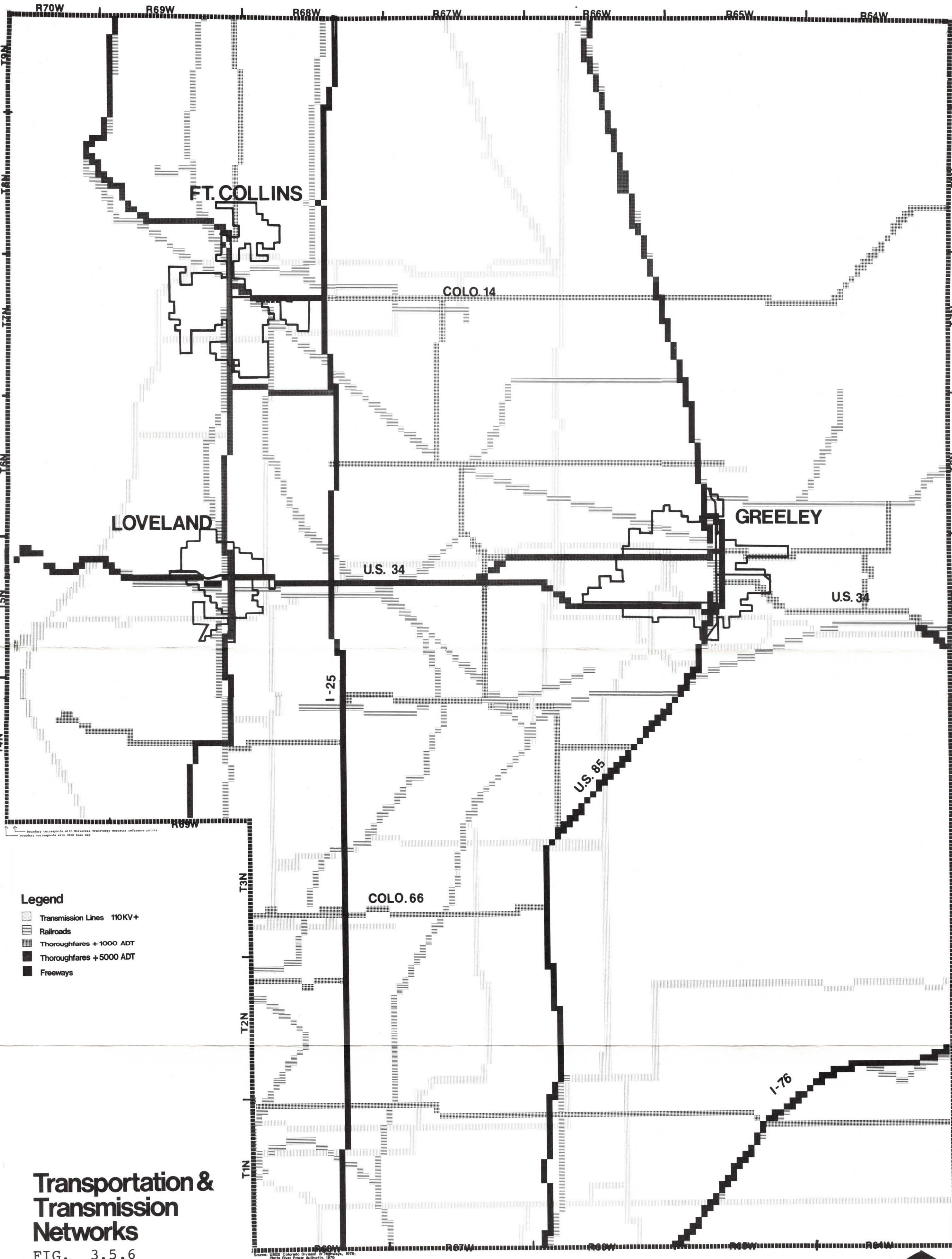
3.5.6 Transportation and Transmission Networks

Major north-south and east-west highways, rail transportation corridors, and an intricate network of transmission systems traverse the Core Area. These provide for the movement of people, goods, and energy. As discussed, the prevailing pattern of land use was determined by the routing of these systems. Figure 3.5.6 illustrates the location of these systems in the Core Area.

Early transportation development was influenced by the physical barrier imposed by the Rocky Mountains in the west and the Core Area's location on the traditional route west that followed the South Platte River. Two major north-south railroad corridors were developed. In the western portions of the area, the Colorado and Southern Railroad established a line originating in Wendover, Wyoming, running via Cheyenne, Fort Collins, Loveland, Longmont, into Denver. The Union Pacific Railroad established a line linking Cheyenne and Denver, via Eaton, Greeley, Fort Lupton, and Brighton. Earlier, these lines provided access of agricultural products and beef to markets in Denver and the east. Currently, the Colorado and Southern line is severely limited by the scarcity and shortness of passing tracks. In 1975, approximately four freight trains per day used this route. On the other hand, the Union Pacific route has a very high capacity and currently provides Amtrak passenger and frequent freight service. Additionally, a number of light-duty trains operate on branch lines between Fort Collins, Loveland, and Greeley for predominantly agricultural use.

Major north-south highway corridors in the Core Area include U.S. Highway 287, U.S. Interstate Highway 25, and U.S. Highway 85. U.S. Highway 287 runs parallel to the Rocky Mountains from Denver, through Longmont, Berthoud, Loveland, Fort Collins, and northwest to Laramie, Wyoming. U.S. Highway 85 originates in Denver and passes through the eastern Core Area, including Fort Lupton, Platteville, Gilcrest, La Salle, Evans, Greeley, Eaton, Ault, Pierce, and Nunn, to Cheyenne, Wyoming. I-25 was constructed as a major north-south corridor for the western United States, linking Las Cruces, New Mexico (via Santa Fe, Pueblo, Colorado Springs, Denver, and Cheyenne) with Casper, Wyoming.

The average daily traffic on I-25 ranges between 5,000 trips north of Fort Collins to 21,000 trips in the southern area of Weld County. U.S. Highway 287 and U.S. Highway 85 are classified as "principal arterials." the rural areas the average daily traffic ranges from about 2,000 trips to as many as 9,000 trips. In the urban areas of Fort Collins, Loveland, and Greeley, these arterials assume an urban character and handle traffic loads as high as 23,000 vehicles per day.



Transportation & Transmission Networks

FIG. 3.5.6

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

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U.S. Highway 34 is the principal east-west corridor through the Core Area. Originating in Nebraska, it extends west through Greeley, Loveland, and Estes Park, to the western border of Rocky Mountain National Park. Principally, the arterial functions in two capacities: 1) as a linkage between Loveland and Greeley; 2) to provide access from I-25 to Rocky Mountain National Park. Much of its route takes on an expressway character. In the rural areas traffic is as high as 6,000 average daily trips. In the more urban areas the traffic accommodated ranges to 15,000 vehicles per day.

There are a number of other east-west highway corridors in the Core Area. These include Colorado Highway 52, extending from Boulder County, through Dacono, Fort Lupton, and Hudson; Colorado Highway 66, extending from Boulder County to Platteville; Colorado Highway 392, extending through Windsor, linking I-25 and U.S. 85; and Colorado Highway 14, connecting Fort Collins and Ault. Traffic counts on these arterials in 1974 were as high as 3,500 vehicles per day in the rural areas, while approaching 16,000 vehicles per day in some of the urban areas.

An extensive network of energy transmission lines exists in the Core Area. All lines of 110 kilovolts or greater capacity, including several lines at 230 kV and the 345 kV Hayden-Ault line are depicted on the map. The only generation facility within the area is the Fort St. Vrain nuclear power plant. It is located northwest of Platteville, at the confluence of the Saint Vrain and South Platte rivers. Major substations serving the area are located approximately four miles west of Ault and in Greeley (the Weld substation).

3.5.7 Sanitation and Water Service

The Core Area is served by an assortment of special sanitation districts, combination water and sanitation districts, and municipally owned districts. These districts are largely coincident with existing urban and rural communities. Their present service areas correspond to areas of existing development and those likely to be developed in the immediate future. It should be noted that a number of districts propose service in areas outside existing urban and rural concentrations. Development in these areas could alter the prevailing pattern of land use development.

Sanitation districts servicing the Core Area include:

a. In the immediate Fort Collins Area:

(1) City of Fort Collins Water and Sewer Department;
(2) Boxelder Sanitation District;

(3) Cherry Hills Sanitation District;
(4) Mountain View Sanitation District;
(5) North Fort Collins Sanitation District;
(6) Laporte Water and Sanitation District.

b. In the immediate Loveland area:

(1) City of Loveland Water and Sewer Department;
(2) North Loveland Sanitation District;
(3) Horseshoe Lake Sanitation District.

c. In the U.S. Highway 287 corridor:

(1) South Fort Collins Sanitation District;
(2) South Loveland Sanitation District;
(3) City of Berthoud Sanitation Department.

d. In the immediate Greeley area:

(1) City of Greeley Sanitation Department;
(2) Hill and Park Sanitation District;
(3) Evans Sanitation District.

e. The rural communities and general Core Area:

(1) Spring Canyon Sanitation District;
(2) Tri-Area Sanitation District;
(3) Wellington Sanitation District;
(4) Timnath Sanitation District;
(5) Nunn Sanitation District;
(6) Pierce Sanitation District;
(7) Ault Sanitation District;
(8) Eaton Sanitation District;
(9) Severance Sanitation District;
(10) Windsor Sanitation District;
(11) Kersey Sanitation District;
(12) La Salle Sanitation District;
(13) Milliken Sanitation District;
(14) Johnstown Sanitation District;
(15) Gilcrest Sanitation District;
(16) Platteville Sanitation District;
(17) Mead Sanitation District;
(18) Fort Lupton Sanitation District;
(19) Hudson Sanitation District;
(20) Keenesburg Sanitation District;
(21) Erie Sanitation District.

The use of water in the Core Area can be classified according to three categories: 1) municipal; 2) industrial; 3) agricultural. Water as a recreational opportunity and a habitat for fish and wildlife, historically, has assumed a secondary role to these three principal uses. The delivery and allocation of water to these uses is the responsibility, in much of the Core Area, of the Northern Colorado Water Conservancy District. For domestic and industrial use, a multiplicity of local municipal and special water districts contract to the Conservancy District for an allotment appropriate to their defined needs. In a similar manner, numerous local irrigation districts and companies contract with the Conservancy District for water for agricultural use. To convey the water to the users, a complex network of natural watercourses, canals, ditches, and storage reservoirs are found throughout the area. Additionally, facilities diverting water from tbe western slope of the Rocky Mountains have been constructed.

Lands within the Core Area outside the Northern Colorado Conservancy District include:

1. An area in the north-central Core; defined in the west by the Larimer and Weld County boundary, an irregular line in the south approximately 4 miles north of Colorado 14 extending to a point immediately south of Nunn, and in the east by the Pawnee National Grasslands.

2. In the northeast; the Pawnee National Grasslands.

3. A large area of the southeast; defined by a line parallel to and ranging from 5 to 8 miles east and southeast of the St. Vrain and South Platte rivers, beyond their confluence.

In general, this area is coincident with the irrigated agricultural lands depicted on the Existing Nonurban Land Use Map (Figure 3.5.7). It is indicative of the almost universal accessibility to water conveyance systems in the Core Area. However, it should not necessarily be interpreted as an indication of a boundless and unlimited resource of water for urban and agricultural uses. Severe years of drought and lessening reservoirs of water, could significantly impact consumption. The area is and, as urban growth continues, will be dependent on transportation of water from outside sources.

3.5.8 Construction of the Computerized Data Bank

The storage of information is achieved by overlaying a grid, a series of equally spaced lines forming a mesh, onto the base data and encoding all information according to its location on the grid. The individual cells defined by the grid became common repositories for data and represent specific geographic areas. The entire grid is representative of a map of the Core Area. A 40-acre grid cell, or an area 1,320 feet by 1,320 feet, has been utilized. Its size was selected to reflect the level of detail of data necessary for a regional analysis (i.e., the differentiation of major categories of land use, rather than site-specific delineations), as well as allowing a manageable number of cells for analysis (approximately 30,000 cells for the Core Area).

In keying the grid to the base information, the Universal Transverse Mercator (UTM) system has been utilized. This system delineates coordinates on a global basis and are defined on all USGS maps.

Coding of each data variable involved placing a blank grid overlay on the source data map and registering it with the coordinate system. Once registered, the source data map, visible through the transparent overlay, can be encoded, using a numeric code to identify each data subcategory. As an example: for the category of "slope," subcategories of 0-15 percent may be assigned as a code "1," 16-30 percent assigned a code "2," and in excess of 30 percent assigned a code "3."

As a general rule, a code was assigned to the grid cell, if the data subcategory occurred in at least 50 percent of the cell. Exceptions to this rule include:

1. Urban Land Use: subcategories were assigned if they covered at least 30 percent of the cell; when a number of urban uses occur in a cell, they were assigned a "composite use" label, with the dominant use listed first.

2. Transportation and Transmission Systems: any cell through which a system passes was encoded.

3. Surface Hydrology: any cell through which a stream passes is indicated.

After the map has been encoded, it is keypunched onto computer cards for processing and verified for accuracy.

The data was output using an electrostatic printer. (Baseline soil classifications were used for four interpretative maps and not output, nor was the sewer service area and district data.) Unlike the familiar high speed character printer, which overprints alpha-numeric symbols to create density characters, the electrostatic printer produces patterns composed of a series of microdots. The graphic image is considerably more effective in displaying a gray tone scale, facilitating a clear differentiation among data subcategories. (The maps contained in the preceding section are computer generated.)

3.6 LARIMER-WELD SUITABILITY MODELS

As stated in the introductory comments to this Chapter, the goal of the suitability process is the establishment of an index of land use appropriateness. Three indices (or issues) of suitability have been evaluated: economic attractiveness for urbanization; attractiveness for agricultural production; and environmental sensitivity and hazard for urbanization. The output is in the form of maps displaying the relative measure of suitability of geographic areas with respect to these three issues.

The computer modeling technique utilized for the suitability analysis maps the many variables present on a selected parcel of land and combines the data from several maps in a controlled weighted procedure. Two types of procedures have been conducted to develop the weighting schemes for the defined suitability issues. One involves the use of a matrix to outline the relative importance of each resource according to the suitability issue and at the same time, comparatively rank the importance of one resource versus all others. On the "x," or vertical axis, each resource category is listed. On the "y," or horizontal axis, each resource category is assigned to a cell according to its importance relative to all other resources in influencing the suitability issue. Those exhibiting the greatest influence are assigned a "10;" those exhibiting the least influence are assigned a "1." If a subcategory <u>absolutely</u> prohibits the use, it is classified as "Off." "0" is utilized in special cases, irrelevant to this analysis.

Subsequently, the computer scans each grid cell for the presence of the resources. For each cell, the computer searches for the highest value present. This number represents the suitability level to be displayed. This weighting procedure has been utilized for the assessments of: 1) economic attractiveness for urbanization and; 2) environmental sensitivity and hazard for urbanization.

To assess the Core Area's attractiveness for agricultural production, a second weighting procedure was followed. It established a "logic" model which identified the conditions which must be present for each level of suitability. In structuring the model, it initially defines those conditions under which the use is absolutely prohibited. In sequence, it then identifies all the conditions which must be present to exhibit the highest level of suitability; if those conditions are not present, it identifies the factors necessary to the next lower level of suitability. This pattern is followed until the conditions contributing to the lowest level of suitability are defined.

Unlike the multi-variable matrix, the logic model does not necessarily infer that a highest (level "10") or lowest (level "1") suitability will occur. A level "10" and "1" is always assigned in a multi-variable matrix to reflect the relative, rather than absolute, ranking of data subcategories. In the logic model, the conditions necessary to the highest or lowest level of suitability may not be present.

To produce the suitability map, the computer searches each cell for the factors necessary for each level of suitability. As the appropriate composite of variables are found, the relevant suitability classification is assigned and printed.

3.6.1 Suitability Analysis Process

Figure 3.6.1 illustrates the steps conducted in the process of analyzing land use suitabilities in the Core Area.

The value weighting process incorporated the expertise and local knowledge of the consultant staff and the city, county, and regional planners of the two county area. Participating consultant staff exhibit expertise in urban and environmental planning, policy planning, biological sciences, civil engineering, and socio-economics. This coupled with the diverse expertise and knowledge of the local planners, constituted a broad base from which the varying perspectives encouraged objectivity and tempered emergence of a particular bias in the value-setting process.

Utilizing multi-variable weighting matrices to assess the economic attraction, environmental hazards, and sensitivities for urbanization, the following procedure was conducted:

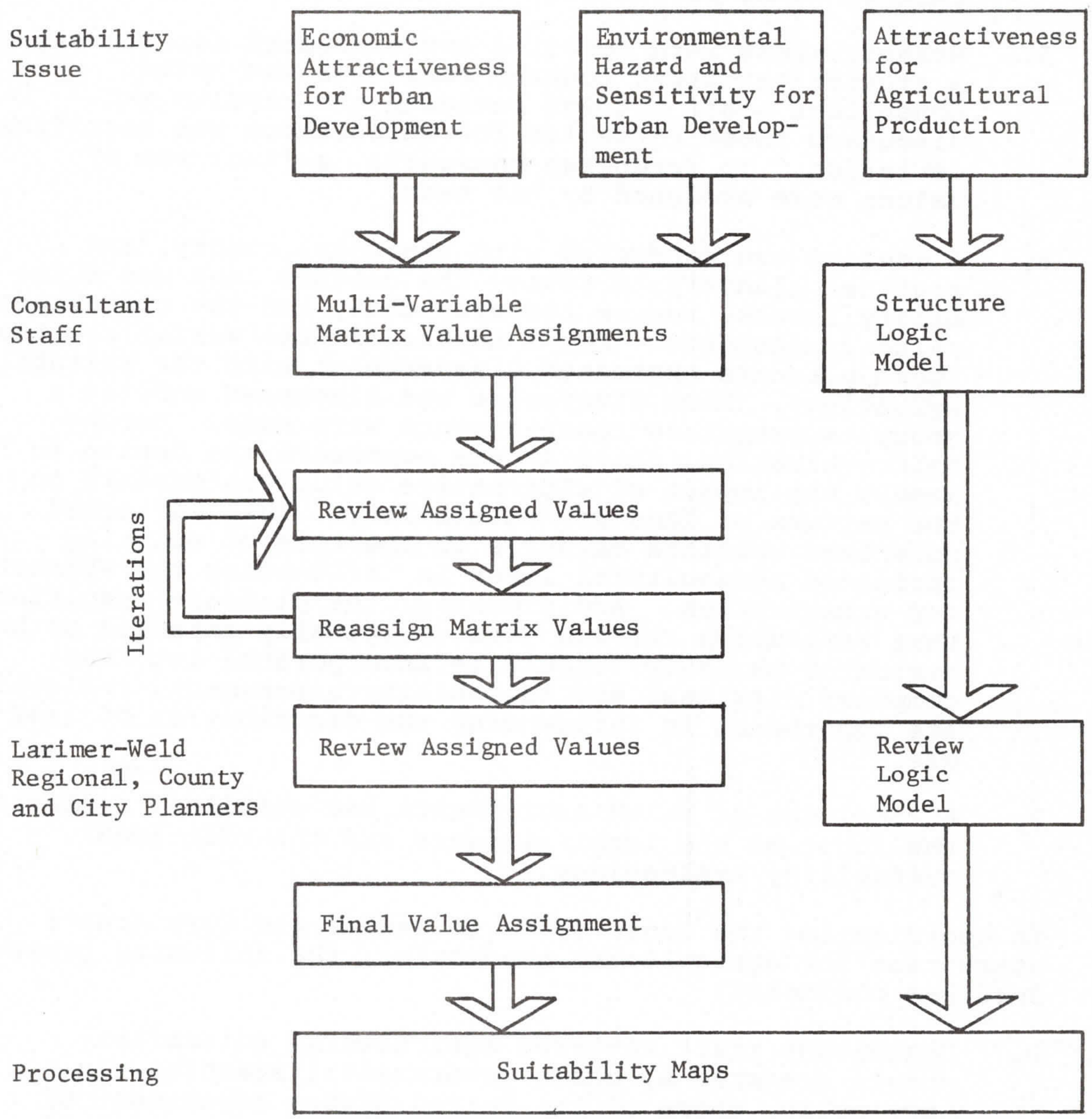
1. A discussion session to review baseline and interpretive data and suitability issues was conducted by the consultant team. This provided the opportunity for clarification and a common understanding of the systems which may influence land use decisions and the principal issues in the Core Area.

2. Each consultant team member anonymously assigned values utilizing the multi-variable matrices for the two suitability issues.

3. Value assignments were compiled and evaluated for their convergence. A discussion session was conducted to review the assignments and address those data variables for which there was significant divergence. Each participant was given the opportunity to express his reasoning for the values assigned.

FIGURE 3.6.1

SUITABILITY ASSESSMENT PROCESS



4. Subsequently, each staff member anonymously reassigned the values. The participant had the opportunity to change his value, based on insight gleaned from the discussion session, or retain his original assignments. The intent of the iteration was to allow convergence to form in areas of previous disagreement.

5. Reassignments were compiled and evaluated for convergence. A statistical trend towards consensus was noted. Consultant staff met and reviewed the results and discussed those variables for which there was significant deviation. To establish consensus, a final set of values were assigned by the team.

6. A meeting was conducted with the city, county, and regional planners to review the defined land use suitability issues, review resource data, and the consultant value assignments. For a number of data variables, the local planners expressed disagreement with the suitability weightings. Each divergence was discussed and, as a group, appropriate reassignments were made. During this evaluation, the planners expressed the desire to assess the impact of alternative value assignments on the pattern of land use suitability. This reflected polarized opinions relative to the role of existing irrigated agricultural lands in influencing the attraction for urbanization. Additionally, the planners specified that sanitation service data (originally intended to be evaluated manually) should be incorporated into the computer data base and suitability assessment, reflecting its importance in influencing the distribution of land use.

7. A final set of value assignments was compiled, reflecting the input of the local planners and the additional suitability evaluations.

In coordinating the logic model to assess the Core Area's attraction for agricultural production, the following procedure was conducted:

1. Consultant staff reviewed agricultural suitability models prepared by other governmental agencies, in particular, those of the United States Department of Agriculture. The review focused on the identification of the determinants of crop production and their interrelationships.

2. A logic model defining the natural and physical resources necessary for each level of agricultural suitability was constructed and reviewed by all consultant staff.

3. A meeting was conducted with the regional, county, and city planners to review the model. Agreement was expressed with its content.

3.6.2 <u>The Suitability Models</u>

The following summarizes the evaluations of land use suitability of the Core Area:

3.6.2.1 Environmental Hazards and Sensitivity for Urbanization (Attractiveness for Resource Conservation and Open Space).

Figure 3.6.2A represents the suitability model for urbanization as measured by environmental hazard and sensitivity. The higher the value assigned to the resource subcategory, the more suitable, less hazardous or sensitive, the system is for urbanization. Resources assigned the lowest value ("1"), represent those which are most sensitive and hazardous for urbanization, though they do not infer that prohibition is necessary. Only those resources assigned an "Off" value prohibit urbanization. This value has been assigned only to those resources which are unavailable for development, either by legal or physical constraint. The evaluation focuses on the presence of a resource within the 40-acre grid cell. Developmental actions in immediately adjacent grid cells were considered to exhibit little or no direct impact on the environmental system. This reflects the generalized locational character of the data.

Resources judged to be unavailable for urban development due to legal constraints include the Pawnee National Grasslands and the lands owned by the Colorado Division of Wildlife. Those judged unavailable due to the physical constraint they impose (ie., are unbuildable) include streams, lakes, and reservoirs.

Of the wildlife habitats present in the Core Area, the Pelican breeding grounds and lands leased by the Colorado Division of Wildlife were assessed to be extremely sensitive to urban development. Habitat modification would result in significant harm to the threatened species present. Marshes represent a rich habitat for birds and other wildlife, thus were considered as very sensitive to urban uses. Antelope, riparian, and deer habitats were judged to be moderately sensitive. Other wildlife habitats are characterized as minimally sensitive due to the abundance and adaptability of the species present.

Areas subject to flooding are considered extremely hazardous, to life and property, thus are unsuitable for urban uses (excluding certain extractive industries). Marshes, as a

FIGURE 3.6.2-A.

NOTES	MAP TITLE: ENVIRONMENTAL SENSITIVITY AND HAZARD FOR URBANIZATION	NUMERICAL IMPORTANCE OF DATA VARIABLE AND SUB-CLASSIFICATION											
NOTES	DATA VARIABLE	10	9	8	7	6	5	4	3	2	1	0	OFF
	WILDLIFE HABITAT	Other				Deer		Ante-ope Rip.	Marsh		Pelican CDW Lease		Pawned CDW/Owned
	SURFACE HYDROLOGY	Other					Marsh				Flood Prone Areas		Streams Lakes Reservoirs
	BUILDING SITE SOILS CONSTRAINTS	Low	Mod			Severe							
	EROSION HAZARD	Low	Mod			Severe							
	SEPTIC TANK LIMITATIONS	Low		Mod			Severe						
	SLOPE	0-15%				15-30%					30%+		

hydrologic system, exhibit a moderate constraint on development. Construction costs would be higher than other areas due to the drainage, grading, vegetation removal, and filling required for development.

Slopes in excess of 30 percent were judged to be highly constraining, those of 15 to 30 percent moderately constraining, and 0 to 15 percent minimally constraining on the development of urban and suburban uses. Most classes of urban use require large flat pads. To provide a pad in sloped areas, extensive grading and earth stabilization is necessary. Generally, increases in slope incur a commensurate increase in the cost of construction. Among urban uses, the least affected is residential. Occasionally, units are constructed on very steep terrain. However, this is the exception, as costs for construction of the unit and provision of access and utilities are considerably higher, thus limiting the potential market.

Severe building site soils constraints, erosion hazards, and septic tank limitations exhibit a moderate suitability for urban uses. Such areas display characteristics for which construction solutions are possible, but costly. Radical foundation design, soil stabilization, and/or construction of sanitation treatment systems are necessary for development. Areas subject to moderate or low levels of soil, erosion, or septic tank limitations are considered as highly suitable for urbanization. This is attributable to the opportunity to readily correct any problems which exist by proper engineering design and site planning.

3.6.2.2 Economic Attractiveness for Urban and Suburban Uses.

Four models were prepared to illustrate the suitability of the Core Area for urbanization as measured by the economic attractiveness of the areas resources. These variations provide the opportunity to assess the impacts of alternative weightings of the importance on development exhibited by a number of resources. Variables to which alternative suitability weights were assigned include irrigated agricultural lands and sanitation systems. These models include:

1. Attractiveness for Urbanization 1: Low Irrigated Agricultural Rating.

   Figure 3.6.2B represents the suitability model for urbanization as measured by economic attractiveness, assuming a <u>low</u> suitability rating for irrigated lands in agricultural production. The higher the value assigned to the resource, the more suitable, or greater attraction, the system exhibits for urbanization.

FIGURE 3.6.2-B.

	MAP TITLE ATTRACTION FOR URBANIZATION 1: LOW AG. RATING	NUMERICAL IMPORTANCE OF DATA VARIABLE AND SUB-CLASSIFICATION											
NOTES	DATA VARIABLE	10	9	8	7	6	5	4	3	2	1	0	OFF
	URBAN USES (RES., CML. INDUSTRY & INST. ONLY)	¼ mi.		½ mi.		3/4mi.		1 mi.			1-2mi.		
	EXISTING LAND USES (URBAN & NONURBAN)	Platted Land		Vacant				Range-land		Non Irr/Ag	Irrig Ag.		Res. Cml. Ind.
													Inst. Feedlot Hi-use O.S.
													Lo-use O.S. Solid Waste Surface Water
	THOROUGH FARES 5000ADT+		¼ mi.				½ mi.				½-1mi.		
	FREEWAYS					¼ mi.			½ mi.		½-1 mi.		
	THOROUGH FARES 1000ADT+							¼ mi.			¼-½ mi.		
	RAILROAD LINES					¼ mi.					¼-½ mi.		
	EXISTING CIRCULATION/ TRANSPORTATION SYSTEMS												Freeways Thorough 5000
													Thorough 100C Railroad Transmission

Resources assigned the lowest value ("1") represent the least attraction for urban development. Those resources classified as "Off" are unavailable for further urban and suburban development due to the presence of existing urban uses. The evaluation views attraction, or suitability, from two perspectives: one focuses on the influence of a resource present within a 40-acre grid cell; the second examines the impact of a resource on adjacent grid cells.

Due to their physical presence, areas of existing urban and suburban land uses and circulation and transmission systems are considered unavailable for further urban development. This does not infer that "infilling" or "recycling" of urban areas will, or should not occur. Rather it focuses the primary objective of suitability mapping on the evaluation of those lands not currently developed for urban uses. Specific subcategories, excluded from development, include existing residential, commercial, industrial, feedlots, high use open space, low use open space, solid waste disposal sites, freeways, thoroughfares, railroads, and transmission networks. Additionally, surface waters are classified as unbuildable.

In general, the greater the proximity to existing urban land uses and their services, the greater the economic attractiveness for urban development. Areas within one-quarter mile of existing urban uses (residential, commercial, industrial, and institutional) were considered to exhibit the greatest attraction for further development. Almost of equal significance are those areas within one-quarter mile of thoroughfares carrying in excess of 5,000 vehicles per day and one-half mile of existing urban areas. A moderate attraction for urban development is displayed by these areas within one mile of existing urban areas, one-half mile of thoroughfares carrying in excess of 1,000 vehicles per day, and railroads. Displaying the least attraction for urban development are those areas at distances greater than one mile from existing urban land use, one-half mile of thoroughfares carrying in excess of 5,000 vehicles per day and freeways, and one-fourth mile of thoroughfares carrying in excess of 1,000 vehicles per day and railroad lines. Freeway interchanges are significant attractors of commercial use, as is evident at the interchanges of I-25 and U.S. Highway 34 and Colorado 14. However, an "interchange" classification was not encoded into the data base.

Of the lands which are undeveloped in the Core Area, platted lands, regardless of location, display an attraction equivalent to that of areas within a quarter mile of existing urban uses. Vacant lands, also exhibit a high level of suitability. Rangeland and lands utilized for non-irrigated crop production were judged to display a low level of suitability for urbanization due to the importance of maintaining uses vital to the counties' food production. Irrigated agricultural lands were considered the least suitable for future urban development due to their role as a source of fodder for cattle, hence, an important component in the national food market.

2. Attractiveness for Urbanization 2: High Irrigated Agricultural Rating.

Figure 3.6.2C represents the suitability model for urbanization as measured by the economic attractiveness of the physical and natural resources, assuming a high suitability rating for agricultural production. This model is identical to the preceding in its rankings of determinant resources, except that it views irrigated lands in agricultural production as a significant attractor of urban development. This philosophy reflects the viewpoint that the availability of water for irrigated lands, also necessary for urban development, would act as a significant inducement. Such lands would be considerably more attractive than those without water.

This variation enables a ready understanding of the potential impact of restricting irrigated agricultural lands from urban development and the significance of water in shaping the urban pattern.

3. Attractiveness for Urbanization 3: Low Irrigated Agricultural Rating; with Sanitation Service.

Figure 3.6.2D represents the suitability model for urbanization as measured by the economic attractiveness of the Core Area's resources, assuming a low suitability rating for irrigated agricultural lands, and incorporating information regarding the availability of sanitation service. This model introduces ranking for existing and planned sanitation service areas while reflecting identical ranking of the relative importance of area resources for urbanization as the first Suitability Attraction Model (assigning a classification of "least suitable" for irrigated agricultural land.

Exhibiting the highest attraction for urban development are those areas within one-quarter mile of existing and planned to 1980 sanitation service. Economically such areas offer a clear advantage to a developer, affording him the opportunity to link into existing facilities rather than requiring construction of costly trunk

FIGURE 3.6.2-C.

NOTES	MAP TITLE ATTRACTION FOR URBANIZATION 2: HIGH AG. RATING DATA VARIABLE	NUMERICAL IMPORTANCE OF DATA VARIABLE AND SUB-CLASSIFICATION 10	9	8	7	6	5	4	3	2	1	0	OFF
	URBAN USES (RES. CML. INDUSTRY & INST. ONLY)	¼ mi.		½ mi.		3/4 mi		1 mi.			1-2mi.		
	EXISTING LAND USES (URBAN & NONURBAN)	Platted Land		Vacant				Range-land		Non-Irr/Ag			Res. Cml. Ind.
													Inst. Feedlot Hi-Use O.S.
													Lo-Use O.S. Solid Waste Surface Water
	THOROUGH FARES 5000 ADT+		¼ mi.				½ mi.				½-1mi.		
	FREEWAYS					¼ mi.			½ mi.		½-1mi.		
	THOROUGH FARES 1000 ADT+												
	RAILROAD LINES					¼ mi.					¼-½ mi.		
	EXISTING CIRCULATION/ TRANSMISSION SYSTEMS												Freeways Thorough 5000
													Thorough 1000 Railroad Transmission

FIGURE 3.6.2-D.

MAP TITLE
ATTRACTION FOR URBANIZATION 3: LOW AG. RATING WITH SANITATION

NUMERICAL IMPORTANCE OF DATA VARIABLE AND SUB-CLASSIFICATION

NOTES	DATA VARIABLE	10	9	8	7	6	5	4	3	2	1	0	OFF
	URBAN USES (RES. CML. INDUSTRY & INST. ONLY	¼ mi.		½ mi.		3/4mi.		1 mi.			1-2 mi		
	EXISTING LAND USES (URBAN & NONURBAN	Platted Land		Vacant				Range-land		Non-Irr/Ag	Irrig. Ag.		Res. Cml. Ind.
													Inst. Feedlot Hi-Use O.S.
													Lo-Use O.S. Solid Waste Surface Wate
	THOROUGH FARES 5000 ADT+		¼ mi.				½ mi.				½-1 mi		
	FREEWAYS					¼ mi.			½ mi.		½-1 mi		
	THOROUGH FARES 1000 ADT+							¼ mi.			¼-½ mi		
	RAILROAD LINES					¼ mi.							
	EXISTING CIRCULATION/ TRANSMISSION SYSTEMS												Freeways Thorough 500
													Thorough 100 Railroad Transmission
	SEWER DISTRICT												
	Present to 1980	¼ mi.		½ mi.		3/4mi.		1 mi.					
	1980 - 1985		¼ mi.		½ mi.		3/4mi.		1 mi.				
	1985 - 1990				¼ mi.		½ mi.		3/4 mi.		1 mi.		
	District					In							

lines and treatment systems. Almost as attractive are those locations within one-quarter mile of areas planned for service during the 1980 to 1985 period.

As the scheduled implementation period occurs in later years, the less influence it has on attracting urban development. This is attributable to the lack of certainty of implementation the later service is scheduled and the perceived ability to change sanitation plans. Representative of this, areas within one-quarter mile of locations programmed for service for the 1985 to 1990 period display only a moderate level of attraction for urbanization. Also, displaying a moderate level of attraction are those locations within three-quarters of a mile of existing and planned to 1985 service, one-half mile of areas planned to 1990, and within a sanitation district, but without planned service. Displaying the least economic attraction are those areas in excess of one mile from existing or planned service.

4. Attractiveness for Urbanization 4: High Irrigated Agricultural Rating; with Sanitation Service.

Figure 3.6.2E represents the suitability model for urbanization as measured by the economic attractiveness of the Core Area resources, assuming a high suitability rating for irrigated agricultural lands, and incorporating information regarding the availability of sanitation service. This model is identical to the preceding in its rankings of determinant resources, except that it views irrigated lands in agricultural production as a significant attractor of urban development. Like the Suitability Attraction Model 2, this philosophy reflects the viewpoint that the availability of water for irrigated lands, also necessary for urban development, would act as a significant inducement. Such lands would be considerably more attractive than those without water.

Again, this variation enables an understanding of the potential impact of restricting irrigated agricultural lands from urban development, the magnitude of land available for development if no limits are considered, and the significance of water in shaping the urban pattern.

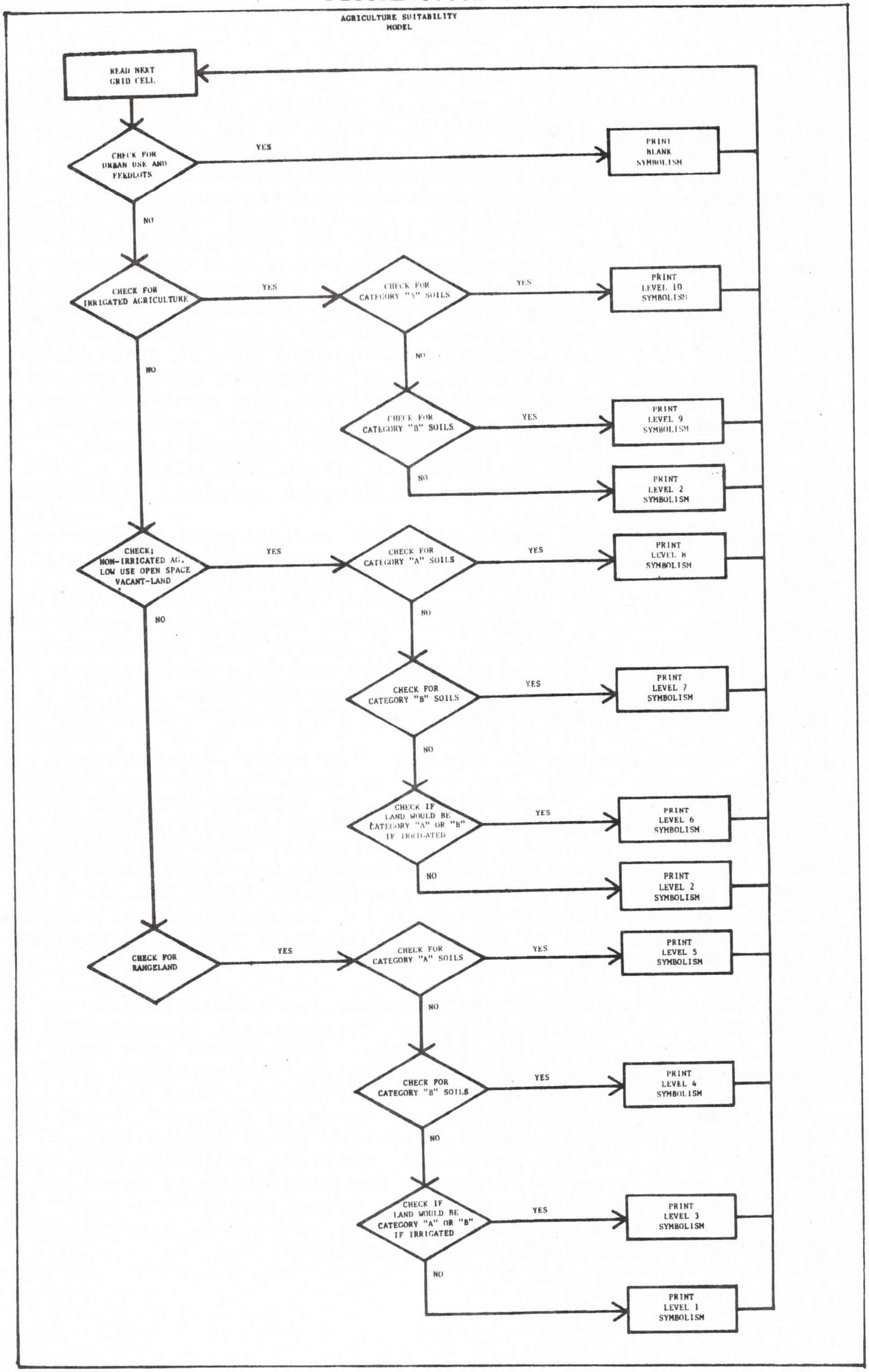
3.6.2.3 Attractiveness for Agricultural Production

Figure 3.6.2F represents the logic model constructed to display the suitability (attractiveness) of the resources in the Core Area for agricultural production. The higher the

FIGURE 3.6.2-E.

	MAP TITLE ATTRACTION FOR URBANIZATION 4: HIGH AG. RATING WITH SANITATION	NUMERICAL IMPORTANCE OF DATA VARIABLE AND SUB-CLASSIFICATION											
NOTES	DATA VARIABLE	10	9	8	7	6	5	4	3	2	1	0	OFF
	URBAN USES (RES. CML. INDUSTRY & INST. ONLY)	¼ mi.		½ mi.		3/4mi.		1 mi.			1-2mi.		
	EXISTING LAND USES	Platted Land/ Irr/Ag		Vacant				Range-land		Non Irr/Ag			Res. Cml. Ind.
													Inst. Feedlot Hi-Use O.S.
													Lo-Use O.S. Solid Waste Surface Water
	THOROUGH FARES 5000 ADT+		¼ mi.				½ mi.				½-1mi		
	FREEWAYS					¼ mi.			½ mi.		½-1mi		
	THOROUGH FARES 1000 ADT+							¼ mi.			¼-½mi		
	RAILROAD LINES					¼ mi.					¼-½mi		
	EXISTING CIRCULATION/ TRANSMISSION SYSTEMS												Freeways Thorough 5000
													Thorough 1000 Railroad Transmission
	SEWER DISTRICT												
	Present to 1980	¼ mi.		½ mi.		3/4mi		1 mi.					
	1980 - 1985		¼ mi.		½ mi.		3/4mi.		1 mi.				
	1985 - 1990				¼ mi.		½ mi.		3/4mi.		1 mi.		
	District					In							

FIGURE 3.6.2-F


AGRICULTURE SUITABILITY MODEL
READ NEXT GRID CELL
CHECK FOR URBAN USE AND FEEDLOTS
YES
NO
PRINT BLANK SYMBOLISM
CHECK FOR IRRIGATED AGRICULTURE
CHECK FOR CATEGORY "A" SOILS
PRINT LEVEL 10 SYMBOLISM
CHECK FOR CATEGORY "B" SOILS
PRINT LEVEL 9 SYMBOLISM
PRINT LEVEL 2 SYMBOLISM
CHECK; NON-IRRIGATED AG. LOW USE OPEN SPACE VACANT-LAND
PRINT LEVEL 8 SYMBOLISM
PRINT LEVEL 7 SYMBOLISM
CHECK IF LAND WOULD BE CATEGORY "A" OR "B" IF IRRIGATED
PRINT LEVEL 6 SYMBOLISM
CHECK FOR RANGELAND
PRINT LEVEL 5 SYMBOLISM
PRINT LEVEL 4 SYMBOLISM
PRINT LEVEL 3 SYMBOLISM
PRINT LEVEL 1 SYMBOLISM

value assigned (stated in terms of "levels") to an area, the more suitable, or attractive, that area is for agricultural production. Conversely, areas assigned the lowest value ("1"), represent those considered to be least suitable. Those areas assigned blank symbolism are restricted from agricultural production. This value has been assigned only to those areas which are unavailable for development due to the physical presence of another long-term land use. The evaluation focuses on the presence of a resource within the 40-acre grid cell. For the suitability evaluation, development actions in immediately adjacent grid cells were considered to exhibit little or no influence on agricultural activities. In reality this may not be true, as fragmented parcelization and limitation of access may adversely impact continued crop production. However, it is the intent of this analysis to focus only on soil type, water availability, and type of present use to assess agricultural suitability within a cell, regardless of economic viability on physical practicality.

Resources considered unavailable for agricultural production include urban land uses (residential, commercial, industrial, institutional, high-use open space, solid waste disposal sites, and feedlots) and water bodies (streams, lakes, and reservoirs). These areas are unusable or committed to a nonagricultural use in excess of 25 years. The agricultural suitability model initially searches all grid cells in the Core Area for these uses. If found, no symbolism will be printed, thus excluding these cells from further analysis.

As the second step in the process, the model searches the nonurban land use file for those cells within which irrigated agriculture occurs. When present, the program searches the soils classification file for Class I or II soils (defined as Category "A" and Class III or IV soils, defined as Category "B". The presence of the former constitutes the highest level of suitability for attraction (level "10") and the latter the next highest (level "9"). If irrigated agricultural lands occur in areas of Class V to IX soil, they are assigned a very low suitability (level "2").

Next, the model searches the nonurban land use file for those cells in which nonirrigated agriculture, low-use open space, and vacant land may be found. When these uses are present, the program searches the soils classification file for Class I or II, or Class III or IV soils. When the former occurs, a high suitability value is assigned (level "8") and the latter, a moderately-high value (level "7"). If Class V to IX soils are found, they are evaluated according to their ability to be raised to the Class I to IV level if irrigated. A moderate suitability value (level "6") is assigned when this is possible. When it is not, a very low suitability value (level "2") is assigned.

In its final iteration, the computer searches the non-urban data file for cells within which rangeland is found. When this use if found, the program searches for Class I or II, or III or IV soils. When the former occurs, a moderate (level "5") suitability is assigned, and for the latter, a moderately low (level "4") value. If Class V to IX soils are found, they are evaluated according to their ability to be raised to the Class I to IV level if irrigated. A moderately low suitability value (level "3") is assigned when this is possible. When it is not, the cell is classified as the least suitable for agricultural production (level "1").

3.6.3 The Suitability Maps

Application of the models of land suitability to the baseline data results in a series of maps displaying the relative appropriateness areas to accommodate urban, open space, and agricultural uses. As stated, suitability maps do not constitute plans, nor are they absolute. Rather they serve as an index expressing the existing suitability of a geographic unit, in this case a 40-acre grid cell, for a definite use vis a vis all other similar geographic units. This information serves as a "red flag" or "warning system" that there is present a particular factor or group of factors which make an area unsuitable for the defined land use. In many cases, deficiencies can be corrected, e.g.. providing sanitation service when none is available, channelizing and controlling water flows in floodprone areas, or providing water for agricultural production. By identifying the factor(s) which lessen suitability, the community may judge whether there are sufficient benefits to be derived from a potential use to warrant implementation of measures to mitigate a problem, or accept the risk. Thus, the suitability maps are an informational tool, enabling the decision-maker and the public to better understand the trade-offs which may be necessary in accommodating a proposed land use.

Suitability for land use development, as measured by a set of given determinants, is displayed in eleven levels of graphic symbolism. Whenever a unit of land is absolutely unavailable for use, blank symbolism is used. Only in this case are mitigating, or corrective actions deemed impossible or inappropriate.

A range of ten graphic patterns are used to represent the suitabilities of areas available for development. For maps displaying the attraction for urban land uses and agricultural production, dense (or dark) patterns are used for the high values assigned to the resource determinants. Conversely, low density, or very "light", patterns are assigned to low values. For the environmental sensitivity and hazards map a reverse symbolism is used. Dense graphic patterns have been assigned to the lower values (representing low levels of suitability, a high hazard and sensitivity) and light patterns to the high values.

The land use suitability maps for the Core Area include:

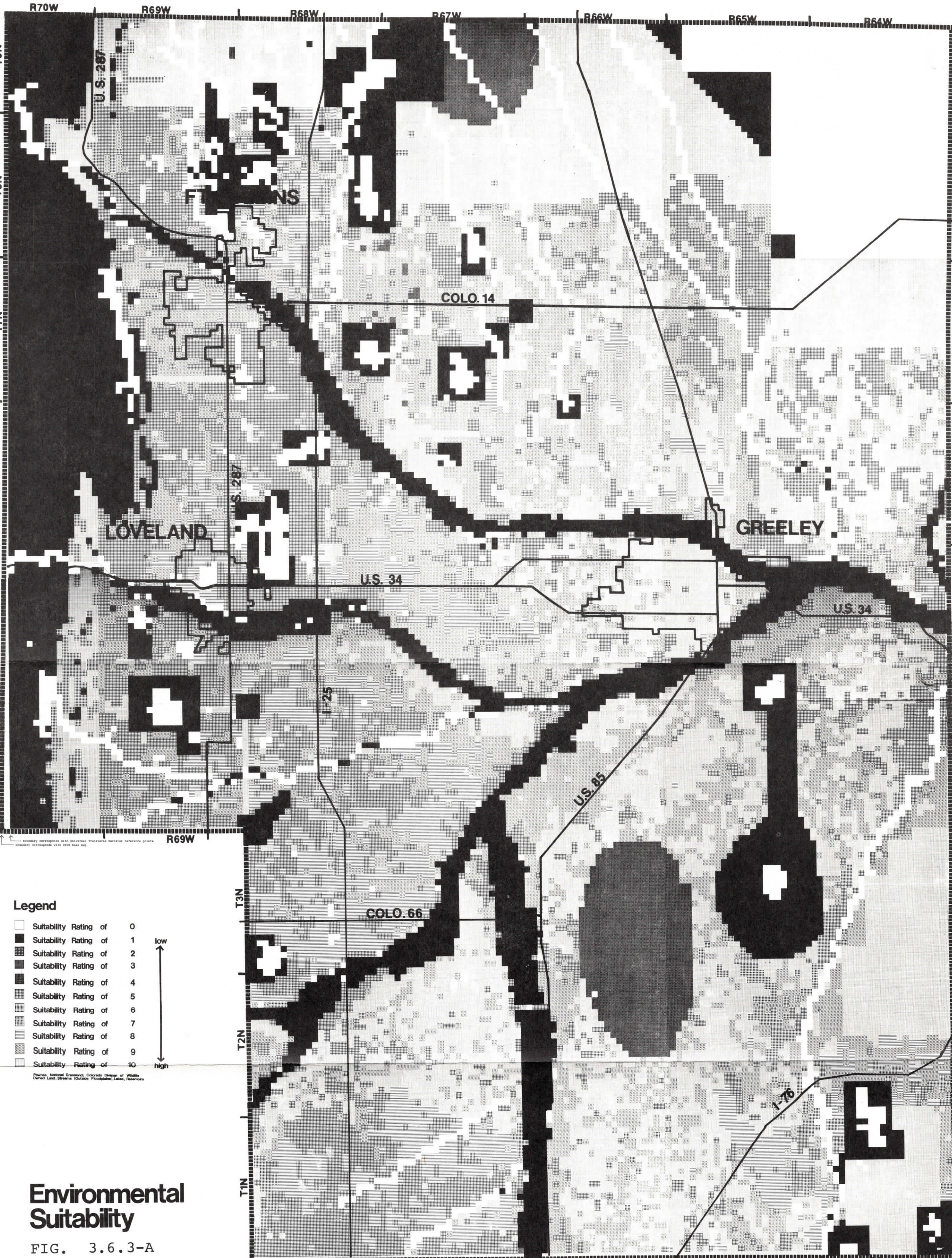
3.6.3.1 Environmental Hazard and Sensitivity for Urbanization (Attractiveness for Resource Conservation and Open Space).

Figure 3.6.3A displays the suitability of the Core Area to accommodate urban and suburban development as measured by sensitivities and hazards of the environmental resources. Conversely, this map depicts those areas appropriate for designation as open space or resource management and control. As stated above, the dark symbology represents the resources most hazardous or most sensitive to urban uses.

At the northeast corner of the Core Area, the Pawnee National Grassland, a significant wildlife and vegetative habitat, is excluded from urban development. Other smaller parcels of land owned by the Colorado Division of Wildlife scattered throughout the area are also excluded. The numerous lakes, ponds, reservoirs, and streams in the area are unbuildable, thus unsuitable for development.

Posing the most significant hazard to development are the floodprone areas of the Cache La Poudre, Big Thompson, South Platte and Saint Vrain rivers and Boulder Creek. To draw from an available source of water, urban and rural communities in the Core Area developed along their banks. As the major centers grow, pressures for expansion into the floodplain can be anticipated. The recent Big Thompson flood demonstrates the significant threat which exists in these areas. A limited number of urban uses are compatible with floodplains, in particular extractive industries such as sand and gravel. However, for most uses the flood area constitutes a serious hazard and should be avoided. An additional concern is that marshes, a rich vegetative and wildlife habitat, are often found along the banks of areas subject to flooding. These are extremely sensitive to the introduction of man and are unsuitable for development.

The Front Range of the Rocky Mountains, at the western edge of the Core Area, with their precipitous slopes are considered minimally suitable for urban development. Construction on the steep slopes in this area often necessitate the use of dynamite to blast for foundations. Additionally, the severe slopes make the provision of public services and utilities difficult, at best. Environmentally, they constitute a unique geologic and visual resource.



Environmental Suitability

FIG. 3.6.3-A

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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MARCH 1977

40 ACRE STUDY GRID

NORTH

KILOMETERS

FEET

MILES

SCALE 1:48,000

Breeding grounds for the White Pelican are found around Milton and Lower Latham Reservoirs, east of La Salle and Platteville. This bird has been designated by Colorado Division of Wildlife as a threatened species and consequently is adversely threatened by the introduction of urban or suburban uses. Due to this, the areas surrounding the reservoirs, as well as a connecting corridor are considered unsuitable for urban development.

Around many of the lakes in the Core Area unique vegetative and wildlife habitats are found. The Colorado Division of Wildlife has designated these as critical habitat buffer zones and, in some cases, hunting preserves in which man's activities should be limited. Representative of the many present are the Boyd Lake Recreation Area, Wellington Wildlife Area, Severance Wildlife Area, Rocky Ridge Reservoir, Black Hollow Reservoir, Big Thompson Ponds, Barbour Ponds Recreation Area, Lone Tree Reservoir, Boedecker Reservoir, and Banner Lakes Wildlife Areas. Review of the map indicates a very low level of suitability for these areas. Additionally, those lands leased by the Colorado Division of Wildlife have been designated as equally sensitive.

Northeast of Wellington and immediately east of Platteville are two of the remaining Antelope Ranges in the Core Area. Presently, the habitat is severely fragmented. Further disturbance may permanently destroy its value as a resource. Consequently, it is considered very sensitive to urban development.

Much of the remaining area is classified as moderately to minimally sensitive or hazardous to urban and suburban development. Variation in suitability levels here is accounted for by the impact of soil type on development. In general, engineering design and proper siting can remedy problems which occur in these areas.

Of the Core Area, 10.2 percent (122,260 acres), is considered unavailable for urban development due to the presence of an environmentally hazardous or sensitive resources; 17.6 percent (211,680 acres) is extremely hazardous or sensitive; and 50 percent displays little or no hazard or sensitivity. It should be noted that lands currently in urban development have not been excluded from this analysis. Table 3.6.3A summarizes the distribution of suitability levels.

TABLE 3.6.3A ENVIRONMENTAL SUITABILITY FOR URBANIZATION

Suitability Level	Acres	Percentage of Core Area
10 High	305,880	25.5
9	211,920	17.7
8	81,080	6.8
7	-	-
6	33,400	2.8
5	200,800	16.7
4	32,700	2.7
3	-	-
2	-	-
1 Low	211,680	17.6
Restricted	122,260	10.2
TOTAL	1,199,720	100.0

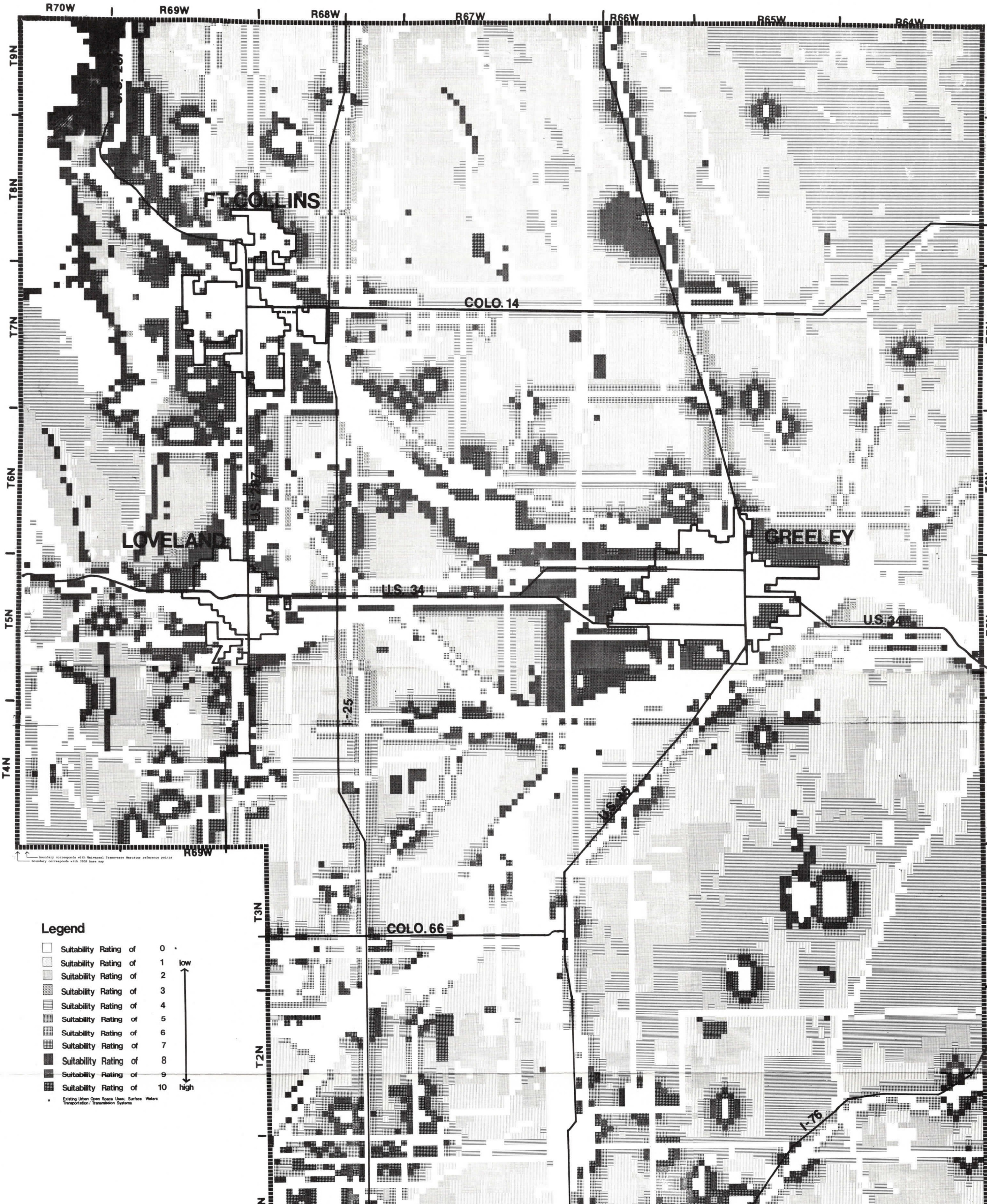
Source: Toups Corporation, Quinton-Redgate, and Environmental Systems Research Institute

3.6.3.2 Economic Attractiveness for Urban and Suburban Uses.

1. Attractiveness for Urbanization 1: Low Irrigated Agricultural Rating.

Figure 3.6.3B displays the suitability of the Core Area to accommodate urbanization as measured by the economic attractiveness of its resources, assuming a low suitability rating for irrigated lands in agricultural production. The denser and darker the pattern, the greater the suitability for development.

Areas of existing urban and suburban use (residential, commercial, industrial, institutional, feedlots, high and low use open space, and solid waste disposal), water bodies (lakes, streams, reservoirs), floodprone areas, and circulation and transmission corridors (freeways, thoroughfares, railroads, and transmission lines) are considered unavailable for further urban development. As previously stated, this does not infer that "infilling" or "recycling" should not occur in developed areas. Rather it focuses the evaluation on



Legend

Suitability Rating of	0 *	
Suitability Rating of	1	low
Suitability Rating of	2	
Suitability Rating of	3	
Suitability Rating of	4	
Suitability Rating of	5	
Suitability Rating of	6	
Suitability Rating of	7	
Suitability Rating of	8	
Suitability Rating of	9	
Suitability Rating of	10	high

* Existing Urban Open Space Uses; Surface Waters Transportation / Transmission Systems

Urban Suitability
(low rating for ag. lands)

FIG. 3.6.3-B

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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MARCH 1977

40 ACRE STUDY GRID

NORTH

1 0 1 2 3 4 5 6 7 KILOMETERS

4000 0 4000 8000 12000 16000 20000 24000 FEET

1 ½ 0 1 2 3 4 5 MILES

SCALE 1:48,000

suitability of undeveloped lands. Approximately 28.9 percent of the Core Area, or 346,600 acres, is excluded from consideration. Of this total only 59,520 acres, or 5 percent of the Core Area are developed in urban and suburban use.

Displaying a high level of attraction for urban uses are: 1) areas in direct proximity to the urban and rural communities and major thoroughfares (Colorado Highway 14 and U.S. Highways 287, 34, and 76); 2) areas along the base of the Front Range (immediately west of Fort Collins). The availability and adjacency of public services and utilities reduce potential development costs to be borne by the developer and community, resulting in the high level of attraction.

Extending outward from these community centers and circulation corridors are clusters of land displaying characteristics highly attractive for urbanization. Often, these are lands which have been platted, but not developed, or are adjacent to isolated parcels of existing development. These are found: 1) to the northwest of Fort Collins; 2) to the southwest of Fort Collins; 3) along U.S. Highway 287 between Berthoud and Fort Collins; 4) to the west and southwest of Loveland; 5) to the northeast of Timnath; 6) an area surrounding Windsor and the Kodak property; 7) in an area encompassing Firestone, Frederick, Dacono, and East Erie; 8) to the west of Greeley; 9) to the southwest of Evans and Greeley along the South Platte River; 10) an area southwest of Hudson, north of U.S. Interstate Highway 76. Other highly suitable areas are scattered throughout the Core Area. In these areas, significant development is unlikely due to their lack of access and distance from major services. Much of the remainder of the Core Area, principally lands in agricultural production, display a very low level of suitability for urban or suburban development.

Of the land available for urban development in the Core Area (853,120 acres), 15.6 percent (131, 920 acres) exhibits those characteristics which make it highly attractive for urban or suburban development. Conversely, 47.2 percent (402,600 acres) exhibits those characteristics which make it highly unattractive for development. Table 3.6.3B summarizes the distribution of suitability levels.

TABLE 3.6.3B SUITABILITY FOR URBANIZATION 1: (LOW IRRIGATED AGRICULTURAL RATING)

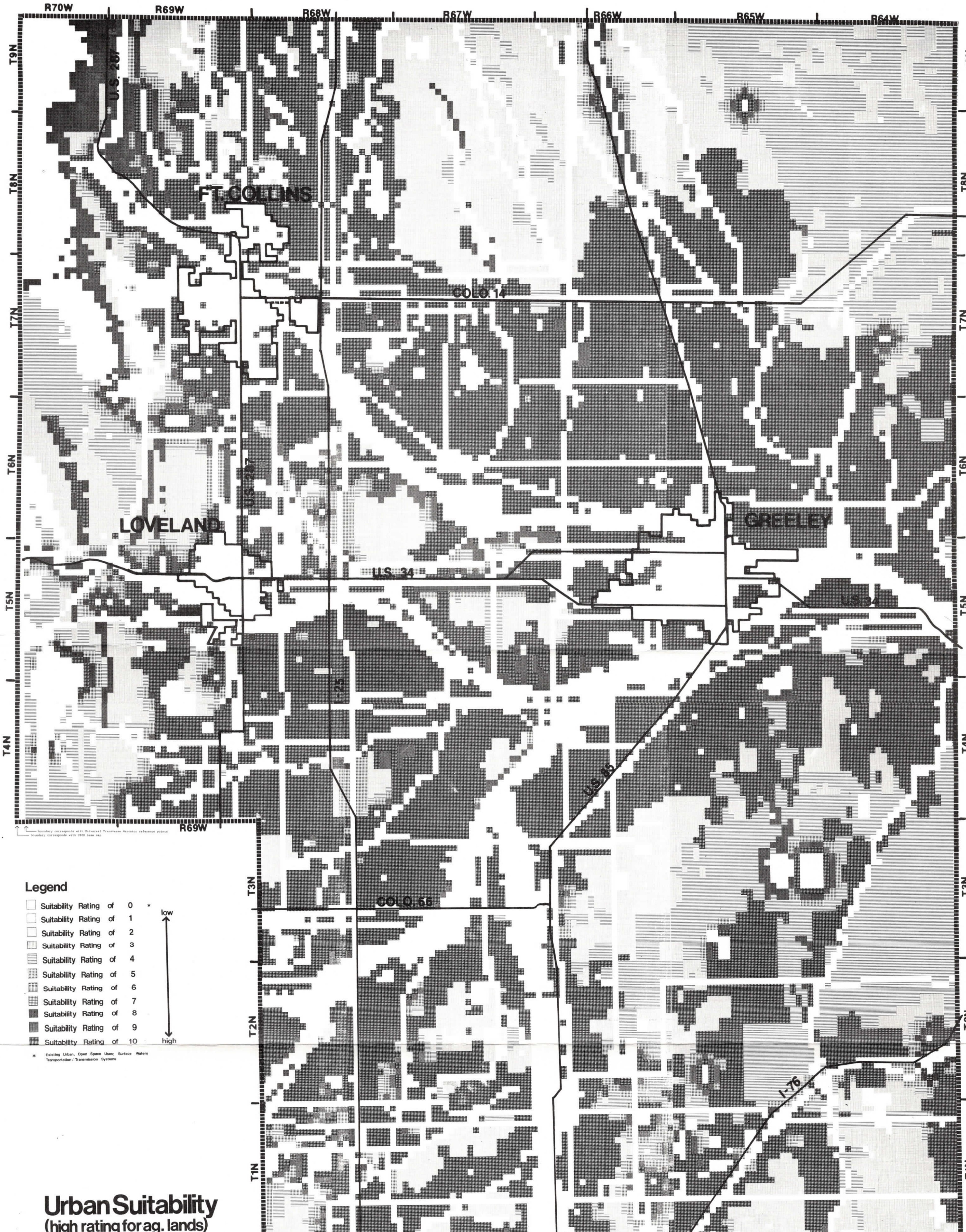
Suitability Level	Acres	Percentage of Developable Area	Percentage of Core Area
10 High	50,080	6.0	
9	12,800	1.5	
8	69,040	8.1	
7	-	-	
6	99,920	11.7	
5	7,560	0.9	
4	211,080	24.7	
3	-	-	
2	167,920	19.7	
1 Low	234,720	27.5	
TOTAL	853,120	100.0	71.1
Restricted	346,600		28.9
TOTAL	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate, Environmental Systems Research Institute

2. Attractiveness for Urbanization 2: High Irrigated Agricultural Rating.

Figure 3.6.3C displays the suitability of the Core Area to accommodate urbanization as measured by the economic attractiveness of its resources, assuming a high suitability rating for irrigated lands in agricultural production. The symbology utilized is the same as the previous map, i.e. the denser the pattern the higher the suitability.

This map varies from the preceding only in one respect, in addition to the areas discussed, all irrigated lands currently in agricultural production are judged to display a high economic attraction for urban and suburban development.



Urban Suitability
(high rating for ag. lands)

FIG. 3.6.3-C

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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40 ACRE STUDY GRID

NORTH

KILOMETERS
FEET
MILES

SCALE 1:48,000

Comparatively reviewing the two maps, the impact is readily apparent. Vast acreage in the Core Area previously considered as minimally attractive now displays a high attraction. Whereas only 15.6 percent of the developable land displayed a high suitability in the first evaluation, 57.7 percent (or 492,760 acres) exhibits a high economic attraction when irrigated lands are considered attractive.

Extending easterly from the Rocky Mountains, the pattern of additional land suitable for urban development generally flanks the major rivers. These include: 1) areas north of and parallel to the Cache La Poudre River; 2) in the triangle defined by the Big Thompson, St. Vrain, and the South Platte rivers; 3) areas parallel to the south side of the South Platte River, northeast of Platteville.

Areas likely to be subject to significant development pressure during the next 25 years, still displaying relatively low levels of suitability for urban development include lands: 1) west of U.S. Highway 287 between Loveland and Fort Collins (due to the lack of services and present dryland farming); 2) directly east of Boyd Lakes, north of U.S. Highway 34, west of the Kodak site; 3) south of U.S. Highway 34, north of Milliken, and west of Greeley; 4) immediately north of Berthoud, east of Lone Tree Reservoir; 5) east of Platteville.

Other lands less likely to experience significant pressure for development displaying low levels of urban attraction include: 1) a vast area in the northeast including the Pawnee National Grassland and the area between Wellington and Nunn; 2) areas to the southeast between U.S. Highways 85 and 80; 3) the Front Range of the Rocky Mountains at the western edge of the Core Area.

Of the lands available for urban development, 52.5 percent (447,960 acres) display those characteristics which result in the highest level of economic attractiveness for urban and suburban development. Conversely, only 19.7 percent (168,760 acres) is highly unattractive for development. Table 3.6.3C summarizes the distribution of suitability levels.

TABLE 3.6.3C SUITABILITY FOR URBANIZATION 2: (HIGH IRRIGATED AGRICULTURAL RATING)

Suitability Level	Acres	Percentage of Developable Area	Percentage of Core Area
10 High	447,960	52.3	
9	6,080	0.7	
8	38,720	4.5	
7	-	-	
6	27,080	3.2	
5	5,040	0.6	
4	159,480	18.7	
3	-	-	
2	167,920	19.6	
1 Low	840	0.1	
TOTAL	853,120	100.0	71.1
Restricted	346,600		28.9
TOTAL	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate, Environmental Systems Research Institute

3. Attractiveness for Urbanization 3: Low Irrigated Agricultural Rating; with Sanitation Service

Figure 3.6.3D displays the suitability of the Core Area to accommodate urbanization as measured by the economic attractiveness of its resources, assuming a low suitability rating for irrigated agricultural lands, and incorporating information regarding the availability of sanitation service. Again, suitability is displayed in a range of graphic patterns, from light (for low levels of attraction), to dark (representing high levels of attraction).

This map closely resembles the first suitability map in its pattern of attractiveness for urbanization. It differs only in its depiction of lands with existing or planned sanitation service as highly suitable for urban development. Close examination of the maps reveals a reinforcement and slight outward expansion of the patterns established in the first map. Additional

Urban Suitability
including sanitation systems
(low rating for ag. lands)

FIG. 3.6.3-D

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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highly attractive lands are found: 1) on the immediate periphery of Loveland; 2) along U.S. Highway 287; 3) to the northwest, west, southwest, and southeast of Fort Collins; 4) in the vicinity of the Fort Collins-Loveland airport; 5) to the west and southwest of Greeley (along the South Platte River); 6) in the Tri-City area; 7) west of Pierce. Most of these lands are programmed for sanitation service implementation to the year 1985.

Of the land available, approximately 17.9 percent (152,700 acres) display those characteristics which make it highly attractive for urban or suburban development. This is an increase of 20,780 acres, or 2.3 percent of the available land, attributable to the economic inducement of sanitation service. Conversely, 46.3 percent (395,000 acres) is highly unattractive for development. Table 3.6.3D summarizes the distribution of suitability levels.

TABLE 3.6.3D SUITABILITY FOR URBANIZATION 3: LOW IRRIGATED AGRICULTURAL RATING; WITH SANITATION SERVICE

Suitability Level	Acres	Percentage of Developable Area	Percentage of Core Area
10 High	56,920	6.7	
9	19,600	2.3	
8	76,200	8.9	
7	2,960	0.4	
6	93,720	11.0	
5	8,200	1.0	
4	200,520	23.5	
3	10,320	1.2	
2	177,840	20.9	
1 Low	206,840	24.3	
TOTAL	853,100	100.0	71.1
Restricted	346,600		28.9
TOTAL	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate, Environmental Systems Research Institute.

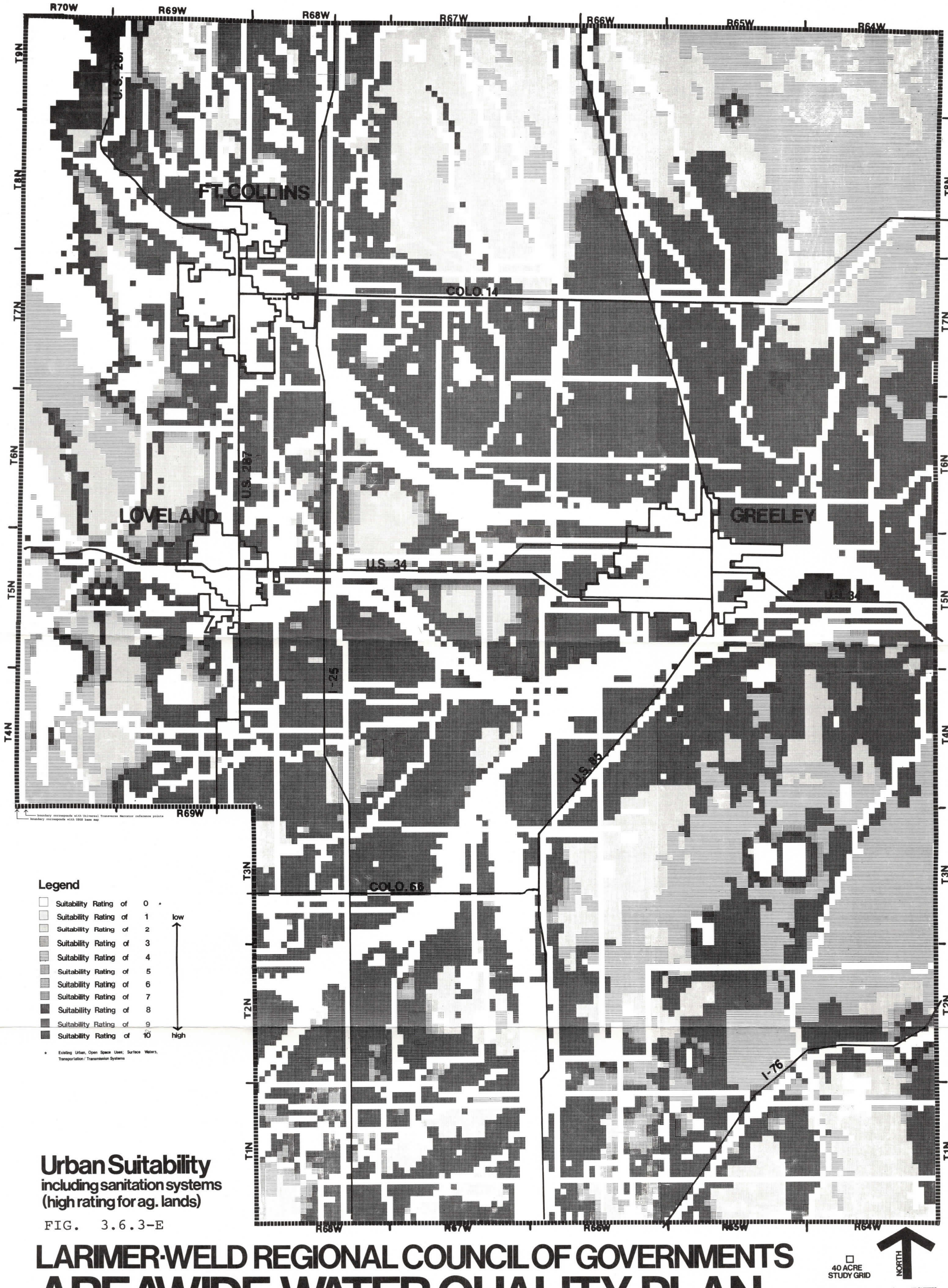
4. Attractiveness for Urbanization 4: High Irrigated Agricultural Rating; with Sanitation Service

Figure 3.6.3E displays the suitability of the Core Area to accommodate urbanization as measured by the economic attractiveness of its resources, assuming a high suitability rating for irrigated lands in agricultural production, and incorporating information regarding the availability of sanitation service. As in the preceding three maps, the darker and denser the graphic image, the greater the suitability for urban development.

This map is almost identical to that displaying urban suitabilities with a high attraction for irrigated agricultural lands without sanitation service (Urbanization Suitability 2). Close evaluation reveals additional highly suitable lands: 1) to the northwest of Loveland; 2) in the vicinity of Fort Collins-Loveland airport; 3) to the west of Greeley.

Overall, inclusion of existing and planned sanitation service areas only minimally affects the pattern and magnitude urban suitability due to the overlaps of these areas with irrigated agricultural lands. The reservoir of highly attractive land increases by only 6,800 acres (to 499,560 acres), or 0.8 percent of the total available land. Correspondingly, the highly unattractive resource of land is reduced by 5,200 acres (to 163,500 acres) or 0.5 percent of the total.

As was evident in the maps displaying the suitability for urbanization without sanitation service, the magnitude and overall pattern of suitability is radically impacted by the consideration of irrigated agricultural lands as attractive for urban development. Vast acreages previously displaying minimal development attraction, is highly attractive under this assumption. Of the land available, 58.5 percent (499,560 acres) exhibits a high attraction for urban and suburban uses, as opposed to 17.9 percent if irrigated agricultural lands are considered unsuitable. Only 19.2 percent (163,520 acres) exhibit a low level of economic attraction. Table 3.6.3E summarizes the distribution of urban suitability levels.



Urban Suitability
including sanitation systems
(high rating for ag. lands)

FIG. 3.6.3-E

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN

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TABLE 3.6.3E SUITABILITY FOR URBANIZATION 4: HIGH IRRIGATED AGRICULTURAL RATING; WITH SANITATION SERVICE

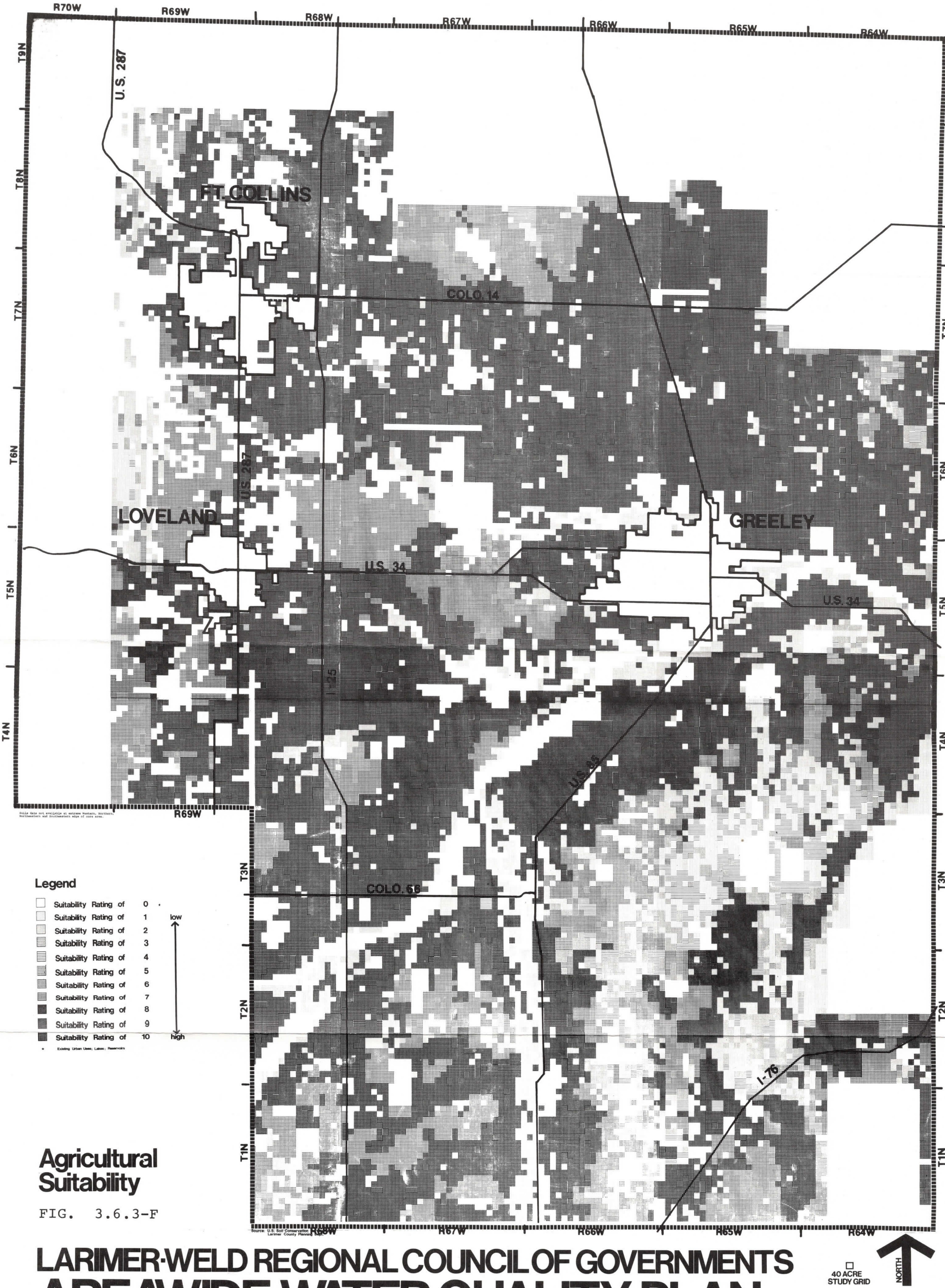
Suitability Level	Acres	Percentage of Developable Area	Percentage of Core Area
10 High	450,240	52.8	
9	8,000	0.9	
8	41,320	4.8	
7	480	0.1	
6	25,640	3.0	
5	4,320	0.5	
4	159,200	18.7	
3	1,600	0.2	
2	161,200	18.9	
1 Low	760	0.1	
TOTAL	853,100	100.0	71.1
Restricted	346,600		28.9
TOTAL	1,199,720		100.0

Source: Toups Corporation, Quinton-Redgate, Environmental Systems Research Institute.

3.6.3.3 Attractiveness for Agricultural Production

Figure 3.6.3-F displays the suitability to accommodate agricultural production. As in the preceding maps, the darker the graphic pattern, the higher the level of suitability. Unlike the preceding maps, large acreages in the extreme west, north, and southeast portions of the Core Area are not accounted for in the suitability evaluation, due to the unavailability of baseline soils data. These omissions encompass 368,840 acres, or approximately 30.7 percent of the Core Area.

Within the field of data, existing urban and suburban land uses (residential, commercial, industrial, institutional, high use open space, feedlots, and solid waste disposal), and water bodies (lakes, streams, reservoirs) are considered unavailable for agricultural production. Approximately 8.6 percent of the Core Area, or 103,000 acres, is excluded from



Agricultural Suitability

FIG. 3.6.3-F

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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consideration due to the presence of these resources. Transmission corridors have not been excluded, as crop production is permitted in such areas. Transportation corridors have not been displayed to facilitate an understanding of the continuity and locational groupings of productive lands.

Review of the map, reveals that vast lands within the Core Area display a very high level of attractiveness for agricultural production. Approximately, 65.6 percent of the available land exhibits characteristics placing it within the two highest levels of agricultural suitability. However, only 11 percent of these soils are rated Class I, all others fall within Classes II, III, and IV, and are presently irrigated. Comparing this suitability map with the agricultural soils classification map (Figure 3.5.2A), it is clearly evident that vast acreages are being farmed without the presence of "prime" soil.

Extending easterly from the Rocky Mountains and adjacent to the principal river corridors, are vast areas of land highly suitable for agricultural production. For generations the Cache La Poudre, Big Thompson, St. Vrain, Boulder, and South Platte rivers have provided a source of water for crop production. Supplying water to the productive soils, numerous ditch companies have been formed to divert the water from the rivers. This accounts for the proximity of lands exhibiting high suitability to the rivers.

Large areas of highly suitable agricultural land are present: 1) adjacent to and north of the Cache La Poudre River; 2) in the triangle formed by the confluence of the Big Thompson and St. Vrain rivers; 3) flanking the St. Vrain and South Platte rivers from the south of the Core Area to their confluence; 4) and along the eastern and southern banks of the South Platte River. In most cases, highly productive agricultural lands are found on the periphery of urban and rural communities.

A large area displaying a moderate level of suitability is located between the Cache La Poudre and Big Thompson rivers. Generally, it extends east fom the Rockies, between Fort Collins and Loveland, south of Windsor, to the western extremeties of Greeley. Currently, much of this area is used for dryland farming. As water is unavailable, the area displays a relatively lower level of suitability. South and east of the South Platte River is a vast area displaying moderate and low levels of suitability for agricultural production. Presently, this area is used as rangeland and for dryland farming. In a number of pockets within the area, the use of center-pivot sprinklers has been introduced to increase agricultural production.

Of the lands available for agricultural production, 65.6 percent (477,960 acres) display a high level of attraction, due to the presence of irrigation. Approximately 18.1 percent (132,000 acres) display a moderately high level due to ongoing in dryland farming. At the low end of the scale, 13.4 percent (97,480 acres) display a very low suitability for agricultural production, even assuming the introduction of water. Table 3.6.3F summarizes the distribution of agricultural production suitability levels.

TABLE 3.6.3F SUITABILITY FOR AGRICULTURAL PRODUCTION

Suitability Level	Acres	Percentage of Available Land	Percentage of The Core Area
10 High	335,000	46.0	
9	142,960	19.6	
8	40	0.0	
7	101,240	13.9	
6	30,760	4.2	
5	40	0.0	
4	20,360	2.8	
3	15,960	2.2	
2	56,600	7.8	
1 Low	24,920	3.4	
TOTAL	727,880	100.0	60.7
Restricted	103,000		8.6
No Baseline Data	368,840		30.7
TOTAL	1,199,700		100.0

Source: Toups Corporation, Quinton-Redgate, Environmental Systems Research Institute.

Chapter 4.0

CHAPTER 4.0

LAND USE ALTERNATIVES

To permit a detailed evaluation of the impacts of urban land use patterns on the quality of the Region's water resources, and a general evaluation of the impacts on environmental, economic, and sociocultural resources, four land use alternatives were developed for the Core Area. The alternatives focused on the Core Area because approximately 90 percent of the Region's existing population is found within this area and by the year 2000, 95 percent of the Region's population is expected to live in this area.

Alternative A, reflecting the land use patterns expected to result if the existing trends in land use decisions continue throughout the planning period, was prepared by the consultant. Alternatives B and C were developed by the Citizen's Committee. Alternative D was developed by members of the city, county, and regional planning staffs. The land use alternatives discussed in this Chapter reflect land use patterns for the year 2000 and are based on consistent population projections and associated land use demands. As described in more detail below, a land use allocation gaming technique was used to develop Alternatives B, C, and D. This technique was developed to provide the Citizen's Committee and the professional planners with a tool that would enable them to allocate projected regional land uses within the major urban communities and those unincorporated areas expected to experience extensive growth pressures. This technique is not ameniable to the allocation of land uses to the smaller communities in the Region, although in some cases such allocations were made. Therefore, land use Alternatives B, C, and D best reflect alternative land use patterns for the major urban areas and not for the smaller communities. The consultant was not so constrained in the development of Alternative A. Here, as described in more detail below, the consultant evaluated past land use decisions made by the county and city decision makers and then allocated land uses to each community and the unincorporated urbanizing areas.

As stated, consistent population projections and associated land use demands were used to develop the land use alternatives discussed in this Chapter. Regional population projections and land use demands were calculated and used as control totals for the number of people and amount of land use that each alternative was to reflect. Population projections and/or land use demands for the subregional areas (counties, cities, towns, etc.) were not used during the development of these land use alternatives. This resulted in divergent land use alternatives and raised critical issues as to the most desirable regional land use pattern. If subregional projections had been incorporated into the generation of land use alternatives, the resultant land use patterns would only have reflected different allocations within the subregional areas.

The following sections discuss the regional population projections, land use demands, and land use alternatives. Chapter 5.0 provides an evaluation of the land use alternatives.

4.1 REGIONAL POPULATION PROJECTIONS

As the basis for land use planning, water quality, transportation, and air quality planning, the Larimer-Weld Council of Governments (LWCOG) has developed regional population projections. These projections were developed in close coordination and with the assistance of the Colorado Division of Planning, which is the agency authorized by the State of Colorado by Statute CRS(1973)24-32-204 to prepare the "official projections" for the state planning regions. The regional projections developed by the LWCOG will be formally reviewed and possibly amended by the Division of Planning prior to their distribution as the official population projections for Region 2 which encompasses Larimer and Weld Counties. Although these projections should be considered preliminary in nature, they are adequate for regional land use planning purposes. Any changes in the projections could be reflected by revising the target year of the plan. An increase in the projected population level would shorten the planning time frame while a decrease in the projected population would extend the time frame. Changes in the projections would have the greatest effect on the major urban areas and would not significantly effect projections for other areas.

The regional population projections and the procedures used to derive them are not based on implied or adopted local or state policies designed to manage growth within the Region. They are based on the best available locally derived projections of the trends in economic activity within the Region. The social, economic, and environmental costs and consequences of the regional projections will be evaluated through the water quality, transportation, land use, and air quality planning activities of the LWCOG. Based on an explicit base of information from these evaluations, appropriate agencies within the Region will consider strategies to minimize negative effects and best utilize the economical and environmental resources.

To ensure that the population projections are as accurate and up-to-date as possible, the population projections will be updated on an annual basis. The LWCOG has developed a computerized Input/Output (I/O) model of the regional economy that provides a tool to accomplish this annual update. The I/O model also provides the mechanism whereby locally derived information pertaining to economic activities within the Region can be incorporated into the population projection process. A detailed report, describing the I/O model, its applicability, and results, is available from the LWCOG [Gray, Huszar, McKean 1976].

Table 4.1 portrays the population projections used in the land use planning process. As indicated, the population of the Region is expected to more than double by the year 2000 reaching a level of 506,000 over the 1975 estimated level of 239,200.

TABLE 4.1 POPULATION PROJECTIONS FOR LARIMER-WELD REGION [a]

1970[b]	1975	1980	1985	1990	1995	2000
179,197	239,200	296,600	347,900	401,800	451,600	506,000

[a] LWCOG 1977.
[b] U.S. Bureau of Census.
[c] Local Planning Departments.

4.2 REGIONAL LAND USE DEMANDS

In order to prepare the land use alternatives it was necessary to identify the land use demands associated with the population projections discussed above. To meet the needs of the projected population, lands will be converted from other uses to residential, commercial, industrial, institutional, and recreational open space uses. The magnitude of additional land that will be required by the projected year 2000 population is defined in the following discussion of each of these uses.

Due to the regional orientation of this study, there has been no attempt to quantify the replacement or recycling of structures or uses likely to become physically or functionally obsolete during the ensuing 25 years. Likewise, there is no evaluation of the adequacy of the existing base of land uses to meet the needs of the existing populations. Such investigations are more logically the purview of specific planning efforts at the community and subregional level.

4.2.1 Residential Demand

Projections of future regional residential land use demands are based on family size and prevailing average residential densities. Basic assumptions underlying residential demand forecasts include:

1. An average family size of 3.1 people. This figure is consistent with the average family size in the Region based on 1970 census information indicating average family size of 2.95 in Larimer County and 3.19 in Weld County.

2. An average residential density of 2.8 dwelling units per acre. This figure reflects an average of residential densities of the urban areas where development is occurring at 3.3 units per acre and higher and rural and suburban areas where existing densities are approximately 1 unit per acre. This density also accounts for the infilling of vacant lands, the intensification, and recycling of older community areas, and an increasing market for multiple units.

As indicated in Table 4.2.1 the projected demand for additional residential use during the 1975 to 2000 period is 30,370 acres.

TABLE 4.2.1 REGIONAL RESIDENTIAL LAND USE DEMANDS [a]

Area	Population Increase	Average Family Size	Additional Dwelling Unit Demand	Average Density	Additional Acreage Demand
Region	266,800	3.1	86,500	2.8	30,370

[a] Toups Corporation and Quinton-Redgate 1977.

4.2.2 Commercial Demand

Commercial development is a function of employment and population growth in the Region and surrounding areas. Unlike other land uses, there is not a linear correlation between population size and commercial development. As population density and discretionary income increase, the ratio of supportable commercial activity increases. Only at certain thresholds, or market support levels, can certain types of commerce be considered viable. For example, a regional shopping center, containing two or three major department stores and miscellaneous clothing and goods stores, is dependent on a market of approximately 150,000 residents.

In general, commercial activity is a geometric function of the level of employment and population. The larger the community (or market), the greater the diversity of commercial types. For example, unique types of commercial uses catering the highly specialized clientele (rare jewelry stores, exotic foodstuffs, etc.) often can be found in a large metropolitan area, like Denver, but not Fort Collins or Greeley. Additionally, major corporate offices often seek larger urban centers for the proximity they offer to similar companies. In the Core Area, the location of a number of major electronics industries, Kodak and Hewlett-Packard, may act as an inducement for commercial uses which would not normally be attracted to the area.

To project the commercial acreage to be demanded in the Region by the year 2000, the following process was conducted:

1. Tabulation of the number of additional commercial employees forecast by the Input-Output Model [Gray, Huszar, McKean 1976].

2. Specification of a ratio of acreage per employee; and

3. Calculation of acreage demanded utilizing that ratio.

Commercial land use demands include services, trade (household, food sales, drugs apparel, restaurant, hardware, fuel stations, transport dealers, other), and finance, insurance, and real estate. Additional commercial employee forecasts are summarized in Table 4.2.2-A.

TABLE 4.2.2-A ESTIMATED ADDITIONAL COMMERCIAL EMPLOYEES 1975-2000 [a]

Commercial Sector	1975 Employees	2000 Employees	Employee Growth
TOTAL	24,380	29,325	4,945

[a] Toups Corporation, Quinton-Redgate 1977.

Excluding nonlabor intensive commercial activities (the Fort Collins - Loveland airport, the Greeley airport, uses associated with the CSU agricultural station) and vacant lands within commercial strips and centers, a ratio of approximately 14.6 employees per acre prevails in the Region. Table 4.2.2-B indicates the derivation of this ratio.

TABLE 4.2.2-B 1975 ESTIMATED COMMERCIAL EMPLOYEE/ACRE RATIO [a]

1975 Total Commercial [b] Sector Employees	1975 Commercial Lands in the Core Area	1975 Employee/Acre Ratio
24,380	3,080 [c]	
	1,050 [d]	
	4,130 acres	
	(800) nonlabor intensive acres	
	3,300 acres	
	(1,665) 50% vacancy [e]	
	1,665 acres	
		14.6

[a] Toups Corporation, Quinton-Redgate 1977.
[b] Input-Output Model.
[c] Computer existing land use data file; cells with commercial use predominant, with at least 30% of the cell occupied.
[d] Computer existing land use data file; cells containing a mix of land use, other uses dominant; estimate of commercial percentage.
[e] Estimate of percentage of 40 acre data cells without commercial use.

It is anticipated that there will be infilling of vacant lands and diversification of commercial type will occur between now and the year 2000. According to the Urban Land Institute, areas similar to the Core Area experience commercial employee per acre ratios of 18:1. Based on this and the projected level of growth, it is assumed that a ratio of 15 employees per acre can be anticipated by the year 2000 in the Region. Based on this assumption a demand of 330 additional commercial acres will occur. Table 4.2.2-C summarizes the commercial land use demand forecast.

TABLE 4.2.2-C FORECAST OF ADDITIONAL COMMERCIAL ACREAGE 1975-2000 [a]

Commercial Sector	Employee Growth	Employees per acre	Additional Acreage Required
Total	4,945	15	330

[a] Toups Corporation, Quinton-Redgate 1977.

4.2.3 Industrial Demand

Demand for industrial land use functions in much the same manner as that for commercial. There is not a straight-line correlation between population and the total of industrial acreage required. As population density increases, the diversity of industrial type and the employee per acre ratio will vary. Historically, nonlabor intensive industries, such as agricultural production and livestock, accounted for the bulk of the Region's employment. Mineral and sand and gravel extraction, developing in later years, require large sites with relatively few employees. The recent introduction of the electronics industry, particularly Kodak and Hewlett-Packard, brought to the Region its labor-intensive activities. The majority of the projected industrial growth is expected in labor-intensive industries [Gray, Huszar, McKean 1976] It can be reasonably expected that the employee per acre ratio will increase significantly.

To project the industrial acreage to be demanded in the Region by the year 2000, the following process was conducted:

1. Tabulation of the additional employees forecast in labor-intensive industries by the Input-Output Model;

2. Specification of a ratio of industrial employees per acre;

3. Calculation of the acreage demand, utilizing that ratio.

Industrial land use demands include the following industrial uses: food processing, electronics, paper, printing, and miscellaneous manufacturing. Though some growth is forecast in the nonlabor intensive industries (livestock, irrigated agriculture, and lumber), these uses will generally occur outside urban and suburban communities at the location of the resource, and are not calculated as a part of urban industrial demand. Additional employees forecast for labor-intensive industrial sectors of the Region are summarized in Table 4.2.3-A.

TABLE 4.2.3-A ESTIMATED ADDITIONAL INDUSTRIAL EMPLOYEES (LABOR-INTENSIVE INDUSTRIES) 1975-2000 [a]

Industrial Sector	1975 Employees	2000 Employees	Employee Growth
Total	11,931	36,337	24,406

[a] Toups Corporation, Quinton-Redgate 1977.

Excluding nonlabor intensive industrial activities (extractive mining, petroleum and chemicals, and lumber) and vacant lands within industrial centers, a ratio of approximately 4.6 employees per acre prevails in the Region. The derivation of this ratio is specified in Table 4.2.3-B.

TABLE 4.2.3-B 1975 ESTIMATED INDUSTRIAL EMPLOYEE/ACRE RATIO [a]

1975 Total Labor Intensive Industrial Employees [b]	1975 Industrial Lands In the Core Area		1975 Employee/Acre Ratio
11,931	9,840	[c]	
	300	[d]	
	10,140	acres	
	(5,000)	nonlabor intensive industrial acres	
	5,140	acres	
	(2,570)	50 percent vacancy [e]	
	2,570	acres	
			4.6

[a] Toups Corporation, Quinton-Redgate 1977.
[b] Input-Output Model.
[c] Computer existing land use data file; cells with industrial use predominant; with at least 30 percent of the cell occupied.
[d] Computer existing land use data file; cells containing a mix of land use, other uses dominant; estimate of industrial percentage.
[e] Estimate of percentage of 40 acre data cells without industrial use.

As stated, it is anticipated that industrial infilling and diversification of industrial type will appreciably raise the ratio of employees per acre. Consistent with the Urban Land Institute's analyses of areas of similar land use and growth trends, and the experience of the consultant, a ratio of 10.0 employees per acre is projected for the labor-intensive industries in the Region. Based on this, a demand of 2,440 additional industrial acres is forecast. Table 4.2.3-C summarizes this forecast.

TABLE 4.2.3-C FORECAST OF ADDITIONAL LABOR-INTENSIVE INDUSTRIAL ACREAGE 1975-2000 [a]

Industrial Sector	Employee Growth	Employees per acre	Additional Acreage Required
Total	24,406	10	2,440

[a] Toups Corporation, Quinton-Redgate 1977.

4.2.4 Institutional Demand

Institutional land uses are defined to include educational facilities, public utilities, health facilities, libraries, museums, police and fire, public administrative facilities, and other governmental entities. Forecasts of the Input-Output Model indicate significant growth in insitutional employment; considerably in excess of a 1:1 ratio with population growth. Traditionally, governmental services escalate at a geometric rate as population levels increase. This, coupled with significant expansion of university-related research and development activities, account for the majority of growth in the institutional sector.

To project the institutional acreage to be demanded in the Region by the year 2000, the following process was conducted:

1. Tabulation of the additional employees forecast in the institutional sectors of the Input-Output Model;

2. Specification of a ratio of institutional employees per acre;

3. Calculation of the acreage demand, utilizing that ratio.

Additional institutional employees forecast are summarized in Table 4.2.4-A.

TABLE 4.2.4-A ESTIMATED ADDITIONAL INSTITUTIONAL EMPLOYEES 1975-2000 [a]

Institutional Sector	1975 Employees	2000 Employees	Employee Growth
Total	29,665	111,832	82,169

[a] Toups Corporation, Quinton-Redgate 1977.

Excluding undeveloped lands within institutional centers, in 1975 a ratio of 14.1 institutional employees per acre existed in the Region. Table 4.2.4-B indicates the derivation of this ratio.

TABLE 4.2.4-B 1975 ESTIMATED INSTITUTIONAL EMPLOYEE/ACRE RATIO [a]

1975 Total Institutional Employees [b]	1975 Institutional Lands In the Core Area	1975 Employee/Acre Ratio
29,665	4,200 [c] acres (2,100) [d] 50 percent vacancy 2,100 acres	14.1

[a] Toups Corporation, Quinton-Redgate 1977.
[b] Input-Output Model.
[c] Computer existing land use data file; cells with institutional use predominant; with at least 30 percent of the cell occupied.
[d] Estimate of percentage of 40 acre data cells without institutional use.

As in the cases of industrial and commerical land uses, extensive infilling and intensification of institutional land uses can be expected to the year 2000. Diversification of the types of institutional uses found in the Region and the concentration of uses to offer great efficiencies in the provision of public services will appreciably raise the ratio of employees per acre. Consistent with the Urban Land Institute's analyses of similar character and patterns of growth, and the experience of the consultant, a ratio of

30.0 employees per acre is used for projections of institutional demand in the Region. Based on this a demand of 2,740 additional institutional acres is forecast. Table 4.2.4-C summarizes this forecast.

TABLE 4.2.4-C FORECAST OF ADDITIONAL INSTITUTIONAL ACREAGE 1975-2000 [a]

Institutional Sector	Employee Growth	Employees per acre	Additional Acreage Required
Total	82,169	30	2,740

[a] Toups Corporation, Quinton-Redgate 1977.

4.2.5 Community Recreation

Standards for the provisions of active and passive recreational open spaces vary according to the density of land use, physical character of the area, characteristics of the population, and the proximity to major regional open spaces. In dense urban environments characterized by multiple dwelling units without outdoor recreational space and inaccessibility to major regional recreational opportunities, the ratio of land per capita provided for local and community parks is quite large. On the other hand, in relatively low density, rural environments, in close proximity to major region recreational areas as is the case of the Region, the minimum per capita requirements are considerably lower.

Forecasts of future neighborhood and community recreational open space demands is related solely to the minimum acreage necessary to support the additional population. It does not account for current surplus which exists in the Region. To project the acreage of neighborhood and community parks necessary to support population growth in the Region to the year 2000, the following process was conducted:

1. Tabulation of the additional population forecast for the region;

2. Specification of a ratio of neighborhood and community park acreage per capita;

3. Calculation of the acreage demand, utilizing that ratio.

Neighborhood parks denote any area of land set aside and improved specifically as a high activity area; the primary use being for active play by children centrally located to the residences and within walking distance of the housing it is intended to serve. Those recreational facilities associated with a neighborhood park generally include a tot lot, playground apparatus, athletic field, limited barbeque and picnic facilities, and other uses deemed appropriate on the basis of neighborhood need. Community parks usually serve several neighborhoods, providing outdoor and indoor facilities to meet a much wider range of recreational interests. Often facilities will include swimming pools, tennis courts, baseball, football, and soccer fields, picnic areas, as well as museums, cultural centers, and youth centers.

Consistent with the standards of the National Recreation and Parks Association, a ratio of 2.5 acres per 1,000 residents for neighborhood parks and 2.5 acres per 1,000 residents for community parks is utilized to forecast local recreational demands. Based on this, a demand of 680 acres of neighborhood and 680 acres of community park are forecast. Table 4.2.5 summarizes this projection.

TABLE 4.2.5 MINIMUM NEIGHBORHOOD AND COMMUNITY PARK REQUIREMENTS FOR ADDITIONAL POPULATION: 1975-2000 [a]

Population Increase	Park Type	Acreage/ Population	Minimum Acreage Required
268,100	Neighborhood	2.5/1,000	680
	Community	2.5/1,000	680
	Total		1,360

[a] Toups Corporation, Quinton-Redgate 1977.

4.2.6 Summary of Land Use Demand: 1975-2000

Table 4.2.6 summarizes the projected land use demands for the year 2000 for the Region. These land use demands were used to develop the land use alternatives as described in the following sections.

TABLE 4.2.6 SUMMARY LAND USE DEMAND FORECAST: 1975-2000 [a]

Land Use	1975 Estimated Acreage	Additional Acreage	Year 2000 Total Acreage
Residential	33,040	30,370	63,410
Commercial	1,665	329	1,995
Industrial	2,570	2,440	5,010
Institutional	2,100	2,740	4,840
Local Recreation	--	1,360	1,360[b]
Total	39,375	37,070	76,615[b]

[a] Toups Corporation, Quinton-Redgate.
[b] Does not include existing recreational acreages.

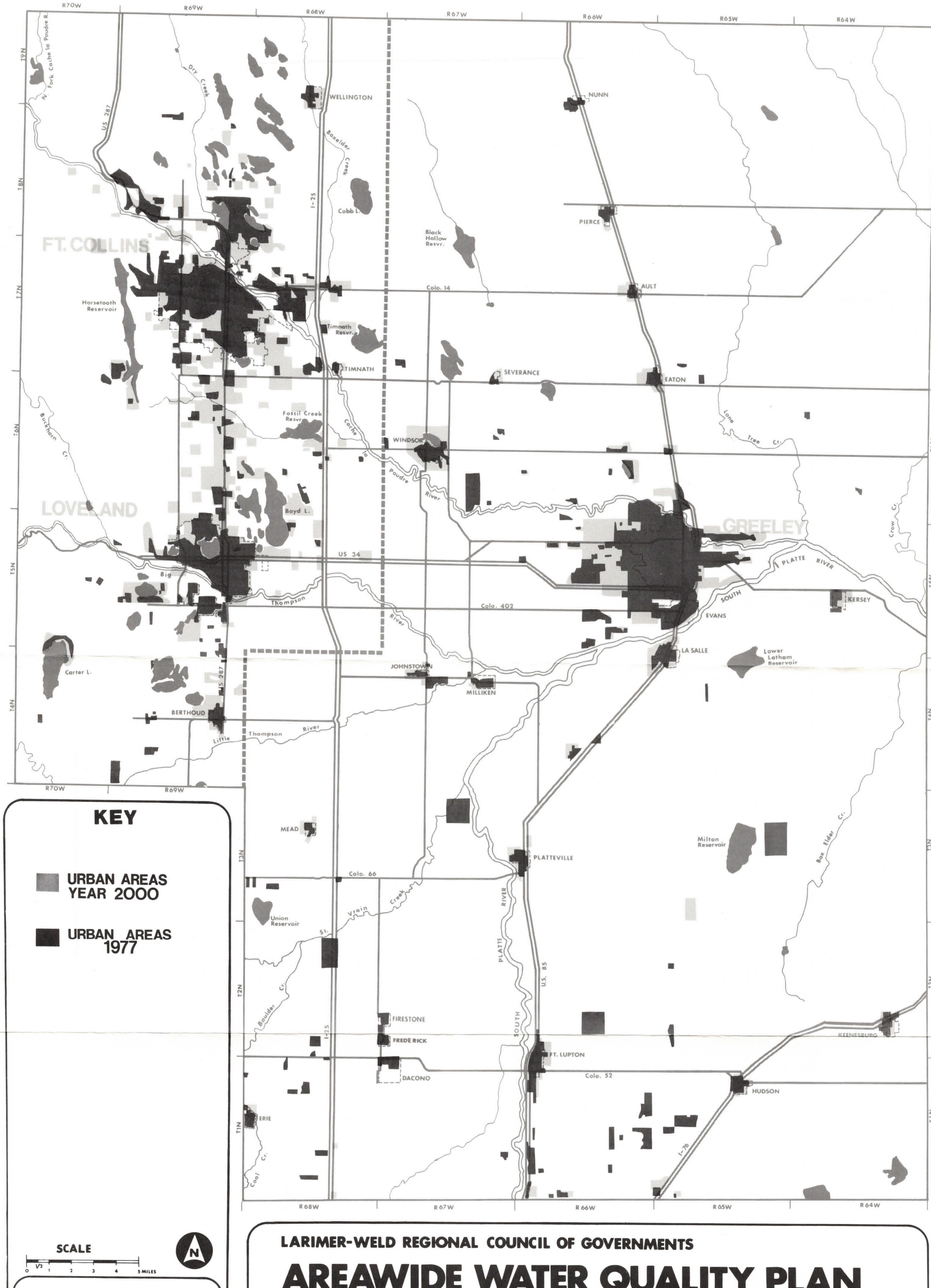
4.3 ALTERNATIVE A: TRENDS

An important aspect of regional land use planning was an understanding of how city and county land use decisions have shaped the land use patterns and what future land use patterns could occur if these trends in land use decisions continue. Therefore a land use alternative was developed by the consultant reflecting a projection of trends in land use decisions and patterns. Figure 4.3 indicates the Trends Alternative. Figure 4.3 is a generalized map combining all urban land use categories into a generic urban category. A detached map reflecting the allocation of the land uses described in Section 4.2 is available for review at the LWCOG.

4.3.1 Plan Derivation

Within the Region two county governments and in excess of 30 municipal governments are involved in land use decisions. In order to develop a regional plan based on projections of trends in land use decisions, past decisions and resultant land use patterns were analyzed. The results of these analyses provided an insight into the regional land development practices.

Within Weld County, land use decisions have been generally consistent with the comprehensive plan adopted in 1973 [Weld County 1973]. Therefore, as past trends in the land use



Alternative A
Historic Trends

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A WATER QUALITY MANAGEMENT TECHNICAL ASSISTANCE PLANNING GRANT FROM THE ENVIRONMENTAL PROTECTION AGENCY UNDER THE PROVISIONS OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT OF 1972 (PL 92-500)

Fig. 4.3

March, 1977

patterns generally reflect Weld County policies, this land use alternative is based on the guidelines in the Weld County Comprehensive Plan. The Weld County Comprehensive Plan is essentially based on two major policies. First, prime agricultural land should be retained for agricultural use. Second, new development should be encouraged to locate within or immediately adjacent to existing communities, but only to the extent the towns desire the growth.

The situation in Larimer County was complicated by the fact that most land use decisions were made without the assistance of guidelines offered by a comprehensive plan. Even though Larimer County and the City of Fort Collins are in the process of developing comprehensive plans as of June 1977, Loveland was the only city in the county with an adopted comprehensive plan. Therefore, land use decisions have been based on unwritten or unadopted policies in the portions of Larimer County outside of Loveland. A review of the approval of rezoning applications and subdivisions indicated that development outside of the municipal boundaries was occurring in a dispersed manner. Although some growth was occurring immediately adjacent to the existing urban areas, subdivisions were also approved along U.S. Highway 287 between Loveland and Fort Collins; in the foothills areas both north and south of Horsetooth Reservoir; in the area to the northeast of Fort Collins around Terry Lake; around Boyd Lake northeast of Loveland; on Colorado Highway 14 east of Interstate 25; and in other areas separated from the existing urban areas. The cities of Fort Collins and Loveland attempted to confine their growth within their existing boundaries. However, development occurred in the unincorporated areas of the County immediately adjacent to the cities and they, in turn, extended their boundaries to include these areas. As a result between 1950 and 1975 the geographical size of Fort Collins increased five-fold. However, many areas within the city limits remained undeveloped [Fort Collins Planning Department 1976]. Loveland and its adjacent unincorporated areas experienced similar growth patterns.

Projections of land use patterns in Larimer County following the trends outlined above were difficult to derive, at best, since there were no policies or guidelines to follow and previous land use decisions had been essentially made on a parcel by parcel basis. To develop this land use alternative, two assumptions were made:

1. All privately owned lands were available for development without constraints as to location.

2. Growth would occur in and around areas that attract urbanization including areas in close proximity to major employment centers existing and potential public service areas, areas adjacent to transportation networks, and scenic areas.

Based on these assumptions land uses reflecting the land use demands defined in Section 4.2 were then dispersed throughout the county.

It is also important to note that land use decisions in both Larimer and Weld Counties have been made without knowledge of land use suitabilities as discussed and defined in Chapter 3.0. Therefore, this land use alternative did not consider this information.

4.3.2 Plan Description

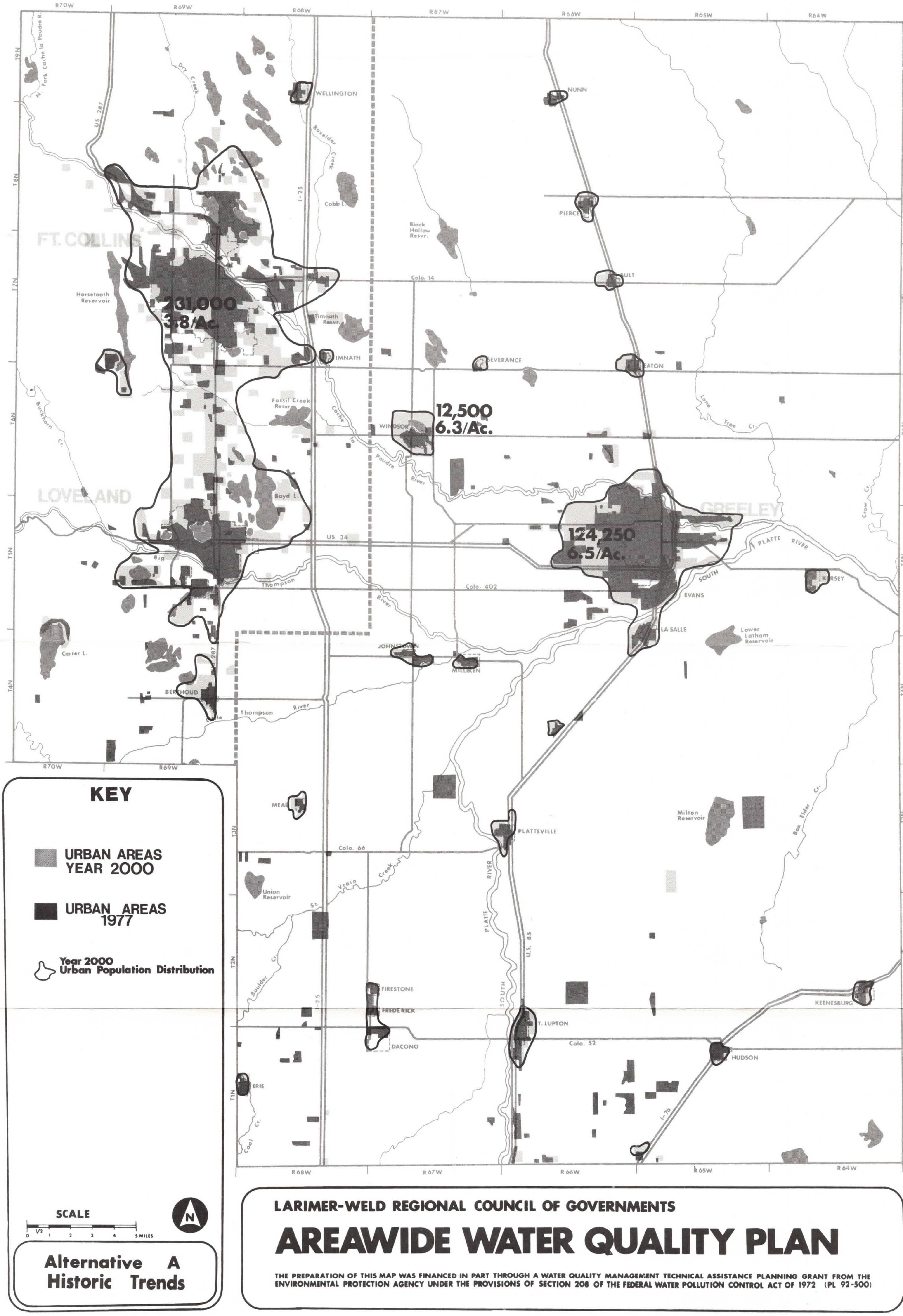
Figure 4.3 suggests that if the trends in land use decisions and resultant land use patterns continue, by the year 2000 the land use patterns in Larimer County will differ greatly from those in Weld County. Growth within Weld County would be concentrated in and around existing communities while growth within Larimer County would be scattered throughout the county and much of the presently undeveloped land within Loveland and Fort Collins would remain vacant. Figure 4.3.2 indicates the conceptualized boundaries of the major urban areas associated with Alterntive A and suggests the year 2000 population levels and average population density within each area. The conceptualized urban areas are those areas where urban and suburban type of residential, commercial, and industrial development would be accommodated. Where these areas overlap presently undeveloped areas or areas with a rural character, significant changes would occur in the community characteristics. Table 4.3.2 presents a summary of the population densities for the major urban areas associated with Alternative A.

Within Weld County, the Greeley urban area, including Greeley, Evans, Garden City and La Salle, would attract the majority of the countywide growth. This growth would be heavily concentrated within and immediately adjacent to the existing developed areas. The undeveloped land between Business Route 34 and U.S. 34 would be developed to an area approximately 4.0 miles east of the downtown area. Multifamily residential development would locate in a large area north of Business Route 34, a smaller area south of Business Route 34 adjacent to the golf course, a small area just west of the downtown area, and an area just east of the University of Northern Colorado. As a result of this land use pattern the population density of the Greeley urban area would increase by 48 percent, reaching a density of 6.5 people per acre by the year 2000 (Table 4.3.2).

TABLE 4.3.2 POPULATION DENSITY OF MAJOR URBAN AREAS FOR LAND USE ALTERNATIVE A [a]

Area	Existing 1975 Acreage [b]	1975 Population [c]	1975 Population Density (People/acre)	2000 Acreage	2000 Population	2000 Population Density (People/acre)	Percentage Change in Density
Larimer County							
Fort Collins-Loveland Area	19,500	89,326	4.6	59,400	231,000	3.8	-17
Fort Collins		60,600			112,200		
Loveland		24,926			64,400		
Boulder, S.D.		1,500			7,400		
S.F.C., S.D.		1,500			47,000		
		800					
Weld County							
Greeley Area	13,134	57,932	4.4	19,000	124,250	6.5	+48
Greeley		53,500			109,700		
Garden City		197			250		
Evans		3,455			9,400		
La Salle		780			4,900		
Windsor	800	2,426	3.0	2,000	12,500	6.3	+110

[a] Toups Corporation, 1977.
[b] LWCOG.
[c] Local Planning Departments.



LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A WATER QUALITY MANAGEMENT TECHNICAL ASSISTANCE PLANNING GRANT FROM THE ENVIRONMENTAL PROTECTION AGENCY UNDER THE PROVISIONS OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT OF 1972 (PL 92-500)

FIG. 4.3.2

March, 1977

The other major growth area within Weld County is the town of Windsor. As mentioned, Kodak, one of the Region's biggest employers is located in Windsor. The Kodak industrial complex is located to the southeast of the community and presently covers approximately 25 percent of the land owned by Kodak. Growth of the Windsor area would generally occur to the southeast, north, and west. By the year 2000 the population density of Windsor will increase by 110 percent, reaching a density of 6.3 people per acre. Such an increase in density will help the city efficiently provide public services to its future residents.

The towns of Firestone, Frederick, and Dacona, commonly referred to as the Tri-Area, and Fort Lupton would also experience significant growth by the year 2000. The Tri-Area would become graphically and possibly politically linked while the Fort Lupton area would grow in a northerly and easterly direction. Development in these communities and in the other smaller communities in Weld County would occur within the undeveloped portions or on lands immediately adjacent to the developed areas.

As portrayed on Figure 4.3, a projection of the historic trends in land use divisions in Larimer County would result in a scatttered or dispersed land use pattern. Much of the presently undeveloped lands between Loveland and Fort Collins would be developed for residential uses. Extensive development would also occur along the south shore of Horsetooth Reservoir, around the northern and eastern shore of Carter Lake, and entirely around Bodecker Lake. Much of the presently undeveloped land within Loveland and Fort Collins would remain vacant while the cities would have to extend their boundaries to capture enough growth to pay for existing and planned public facilities. As a result of such defensive annexations the population densities of Fort Collins and Loveland would decrease by 10 percent and 24 percent, respectively (Table 4.3.2). Such decreases compounded by relatively low existing population densities for urban areas would result in unnecessarily high costs and inefficient provision of public services.

The scattered development pattern would result in substantial development in the corridor between Loveland and Fort Collins, where as many people as presently live in Loveland would live by the year 2000. Such extensive development of this area could result in pressure to establish a new community between the major urban areas of Larimer County. If such a community were estabished in this area with the land use pattern depicted on Figure 4.3 significant problems would be created in providing the residents public services.

The difference in the land use patterns that would result, if historic trends in land use decisions continue, reflect to a certain extent the differing problems facing the two counties. The majority of the small communities in Weld County are dependent on the agricultural activities in their immediate vicinity and would effectively "cut their own throat" by allowing development to extend into agricultural lands. Growth of Greeley and Windsor will be tied very closely to expansion of industry within the city and would not benefit through scattered development which isolates employees residence from place of work. On the other hand, due to the close proximity of Loveland and Fort Collins and ease of accessibility between the two cities many people live in one city and work in the other. New employment centers are developing along the southern boundary of Fort Collins, Hewlett-Packard on Harmony Road near I-25, and the northern boundary of Loveland, new commercial shopping centers on the east side of U.S. 287, increasing the ease of living and working in different communities. These facts are resulting in ever increasing land values in the area between Loveland and Fort Collins which is forcing farmers to sell their land to potential developers just to pay their taxes. Many lands have been taken out of agricultural production as a result of such sales and are lying vacant awaiting conversion to urban uses at some point in the future. Only through the adoption of a sound land use strategy, guiding growth toward existing communities and infilling of vacant lands within existing communities and providing incentive for continued agricultural activities in the area between Loveland and Fort Collins, could the trends be reversed in Larimer County.

4.4 ALTERNATIVES B AND C: CITIZEN'S COMMITTEE

Figures 4.4-A and 4.4-B portray the land use alternatives developed by the Citizen's Committee. Figures 4.4-A and 4.4-B are generalized maps based on detailed maps available for review at the LWCOG.

4.4.1 Plan Derivation

The Citizen's Committee formed at the outset of the planning process reviewed the goals and objectives of and requirements for land use planning. At the first meeting of the Citizen's Committee the proposed planning process was discussed including the manner that the Committee's input would be incorporated into the process. As the data was compiled, it was reviewed with the Committee so they would have a better understanding of the regional conditions. The results of the suitability analyses were carefully reviewed with the Committee so they would also understand the opportunities and constraints for development. The next step was for the Committee to review

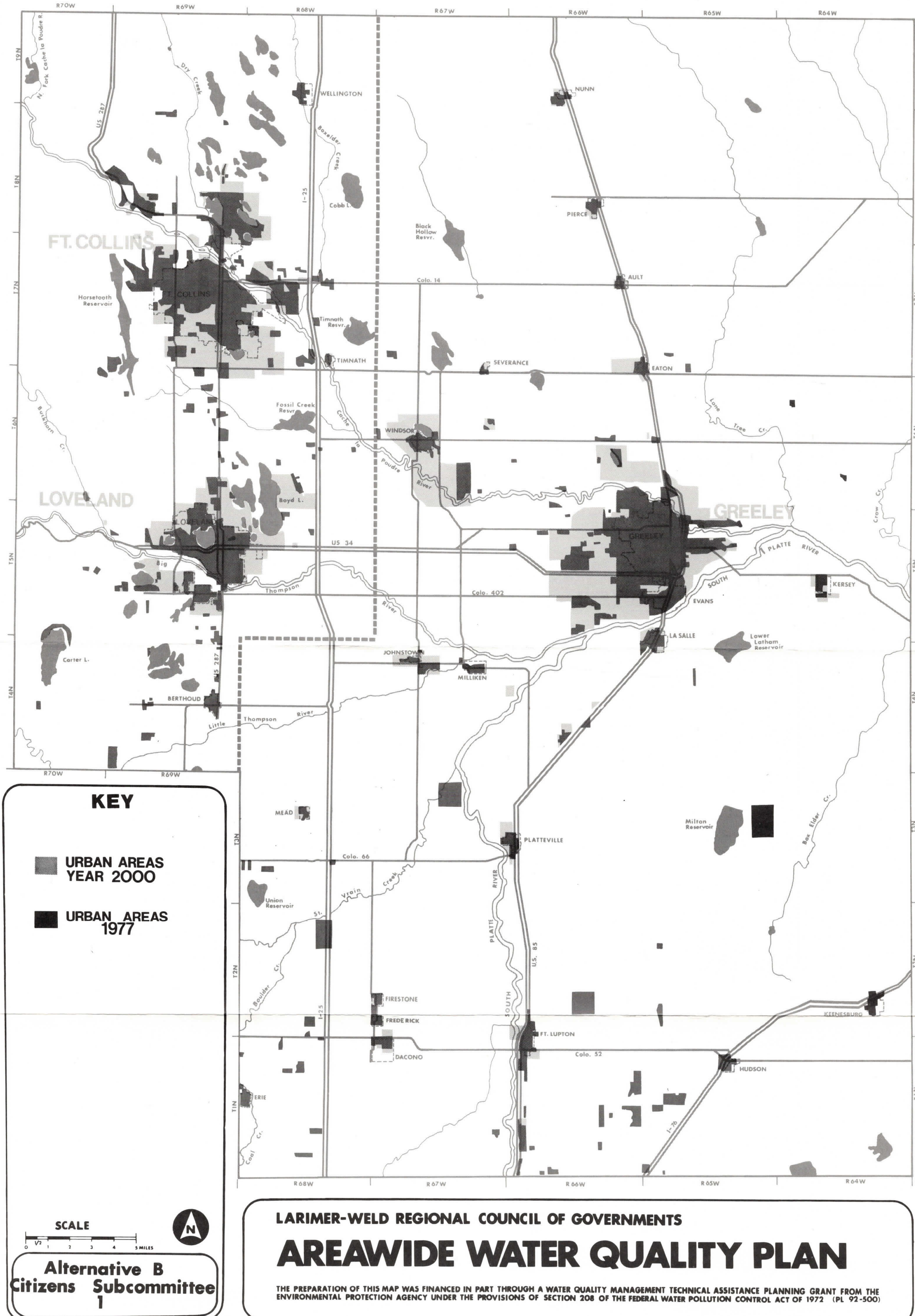
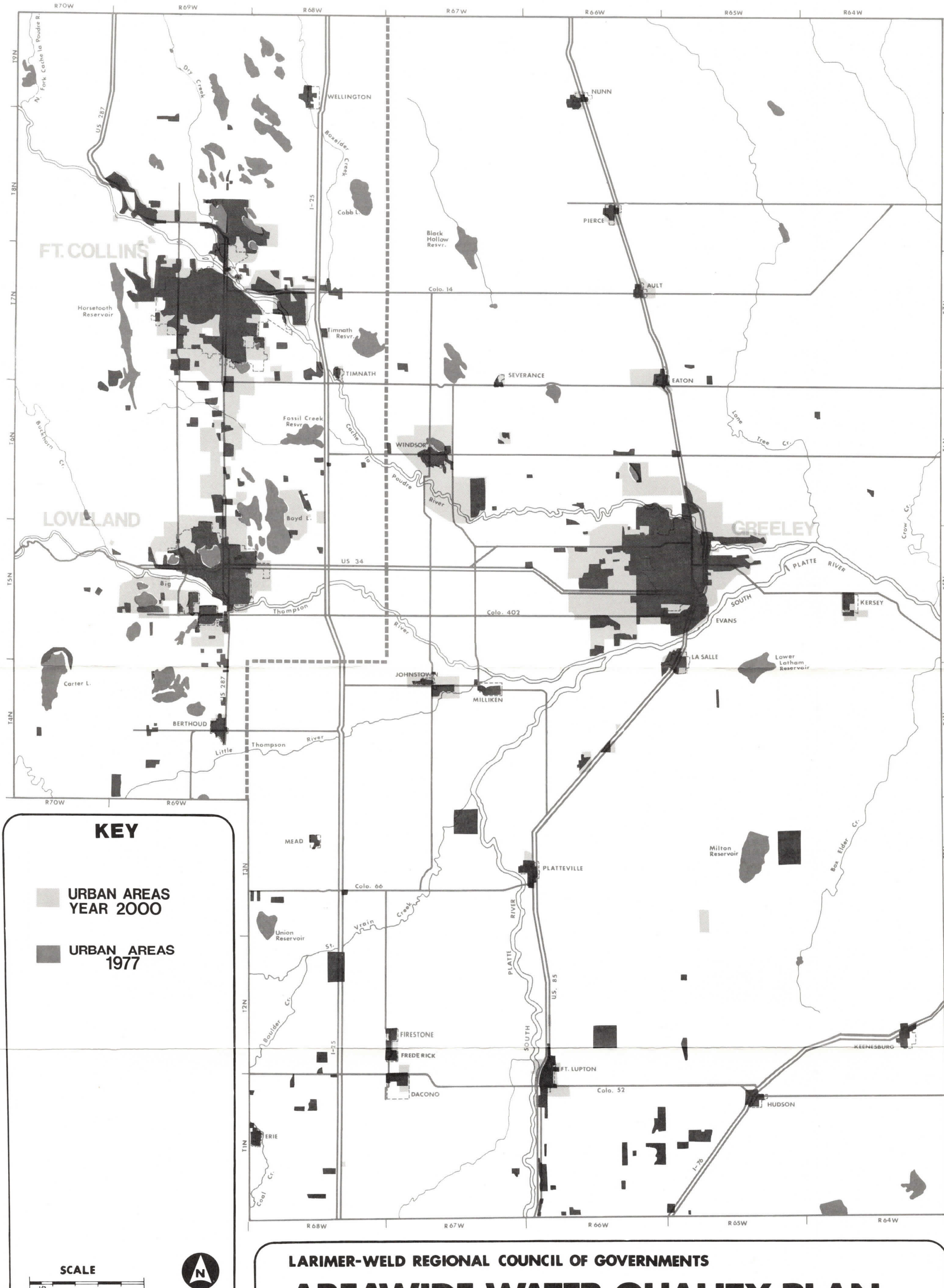


Fig. 4.4-A

March, 1977



Alternative C
Citizens Subcommittee
2

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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Fig. 4.4-B

March, 1977

the regional population projections and to gain an understanding of how much land would be required to accommodate the anticipated increase in population.

The Committee was then ready to develop alternatives. The first step of this process was to have each member of the Committee prepare a map indicating their ideas as to the location of future development for the year 2000. Each Committee member was given a base map of the Core Area and asked to indicate the following information:

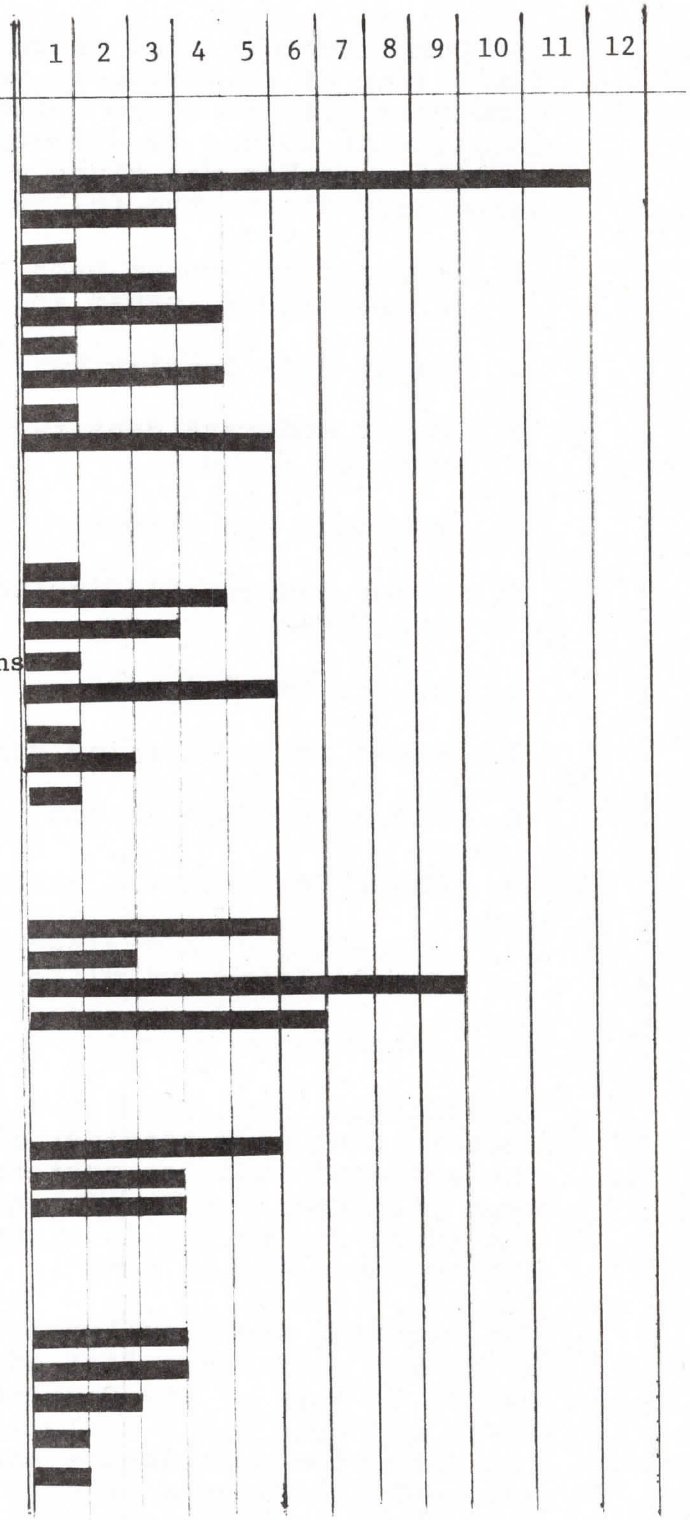
1. Boundaries around each community depicting the extent of additional urban and suburban development.
2. Major high density residential areas.
3. Major moderate density (single-family detached) residential areas.
4. Regional and community commercial areas.
5. Major industrial (including agricultural processing facilities) areas.
6. Agricultural lands.
7. Areas for open-range grazing.
8. Major north-south and east-west highways.
9. Major recreational areas.
10. Areas to be maintained as open space. (As examples: flood plains, wildlife habitat areas).
11. Other major uses.

In addition, each Committee member was asked to list the factors that were considered most important in designating the selected land use pattern. Once the individual maps had been prepared, the Committee members presented their maps and ideas for future development to the rest of the committee and to the planning staff.

The planning staff analyzed the Committee members' maps and ideas and prepared a list of 29 concepts that were expressed by one or more of the Committee members. Table 4.4.1 presents these concepts and a scale indicating how many members of the Committee expressed a particular concept. The Committee reviewed the results of this analysis and then divided into two subcommittees to participate in a land use gaming exercise.

TABLE 4.4.1

Larimer-Weld 208 Advisory Land Use and Population Committee
Land Use Concepts: Frequency of Response



Growth Pattern

1. Around existing communities
2. Link Ft. Collins and Loveland
3. North-south limited to 287
4. In areas of existing systems
5. Commercial along major highways
6. Extensive area; non-concentrated
7. Infill existing communities
8. Adhere to existing plans and zoning
9. Intensify/revitalize community cores

Specific Areas

10. Urban expansion north of Ft. Collins
11. Link Tri-towns
12. Develop Greeley-Ft. Collins ridge
13. Residential: lakes north of Ft. Collins
14. Centralized airport
15. New town: northwest of Ft. Collins
16. Centralized regional industrial
17. Major eastward expansion of Erie

Environmental Sensitivities/Hazards

18. Preserve Wildlife areas
19. Preserve National Grassland
20. Avoid major floodprone areas
21. Minimize devel. of prime agri. soils

Open Space

22. Along major streams
23. Around lakes
24. In urban areas

General

25. Balance community development
26. Preserve existing lifestyle/rural
27. Neighborhood concept
28. Ability to mine
29. Mass transit corridors

Each subcommittee was given a base map and a number of plastic chips representing residential, commercial, industrial, institutional and urban recreation land uses. (Each chip represented fifty acres of land use. The total number of chips within each land use category was based on the land use demands as discussed in Section 4.2. As a group the subcommittee allocated the land uses throughout the Core Area. The only constraint placed on these subcommittees was the amount of land use that had to be allocated.

The planning staff then analyzed the results of the subcommittee allocations in terms of the concepts that the committee members had expressed previously and the results of the land use suitability analysis. Five issues were identified where conflict existed between the subcommittee allocations and the expressed land use concepts or the suitability analysis. The following is a list of the issues identified by this analysis.

1. Development allocated in floodprone areas.

2. Development allocated in areas without water available from municipal or agricultural sources.

3. Development allocated to riparian wildlife habitat areas.

4. Development allocated on Class I and II agricultural soils.

5. Development allocated in dispersed and concentrated patterns.

Each of these issues was presented to the committee for review and to develop a policy that would resolve the conflict and provide guidance for the development of a citizen's committee land use alternative. On the issue of concentration versus dispersion, the committee was split with half the committee desiring a concentrated development pattern throughout the Region and the other half desiring concentration in Weld County but a more dispersed pattern in Larimer County. Consequently two policies were formulated by the Citizen's Committee for this issue. The following are the policies developed by the Citizen's Committee and were used to prepare the two citizen land use alternatives (Alternatives B and C).

Issue 1: Development in Floodprone Areas

Policy 1: Floodprone areas should be used for open-space, recreation, mining, or low risk development. Other development should only be allowed if structural improvements are completed to eliminate the risk of a flood.

Issue 2: Development in Areas Without Water

Policy 2: Development should be allowed in these areas only if the developer is willing to pay the full cost of providing an adequate water supply to the area.

Issue 3: Development in Riparian Wildlife Habitat Areas

Policy 3: Public acquisition of habitat areas should be encouraged; however, if acquisition is not possible or economical, development should be allowed to occur.

Issue 4: Development in Class I and II Agricultural Soils

Policy 4: Preservation of Class I and II agricultural lands should be encouraged; however, to avoid sporadic development, limited development of such land should be allowed adjacent to existing communities.

Issue 5: Development Allocated in Dispersed and Concentrated Patterns

Policy 5: Development should occur within and immediately adjacent to existing communities.

Policy 6: Within Weld County, development should occur within and immediately adjacent to existing communities and along the U.S. Highway 287 corridor between Loveland and Fort Collins.

4.4.2 Plan Description (Alternative B: Citizen's Subcommittee Group 1)

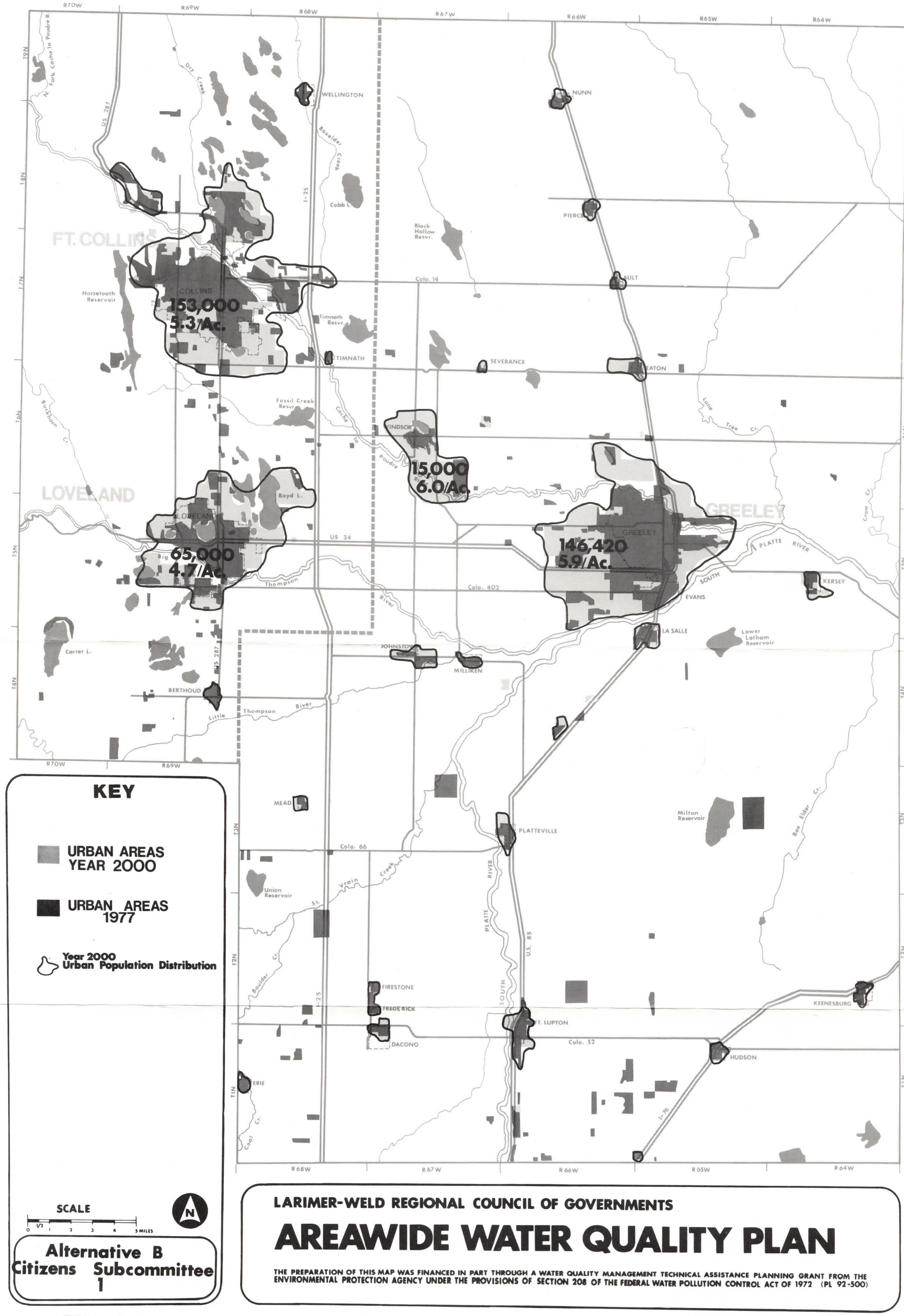
Figure 4.4-A portrays the land use pattern developed by the Citizen's Subcommittee Group 1. This group followed Policy 5 of only allowing new development to occur within and immediately adjacent to existing communities. Figure 4.4-A portrays growth occurring primarily within and adjacent to the existing urban areas of Loveland, Fort Collins, and Greeley. Growth in these areas account for 85 percent of the growth allocated within the Core Area. By including the growth allocated to Windsor, nearly 90 percent of the growth is accounted for. Table 4.4.2 and Figure 4.4.2 present a summary of the population densities for major urban areas associated with Alternative B.

Within Weld County, Alternative B suggests that the Greeley urban area would attract 30 percent more growth than the historic trends (Alternative A) suggests. This additional development would occur primarily in the western and southwestern portions of the City of Greeley. Residential growth would also occur north of the Cache la Poudre River extending

TABLE 4.4.2 POPULATION DENSITY OF MAJOR URBAN AREAS FOR LAND USE ALTERNATIVE B [a]

Area	Existing 1975 Acreage [b]	1975 Population [c]	1975 Population Density (People/acre)	2000 Acreage	2000 Population	2000 Population Density (People/acre)	Percentage Change in Density
Larimer County							
Fort Collins Area	13,500	63,600	4.7	29,000	153,000	5.3	+13
Fort Collins		60,600			150,000		
Boulder		1,500			1,500		
S.F.C., S.D.		1,500			1,500		
Loveland Area		24,926	4.2	1,3800	65,000	4.7	+12
Weld County							
Greeley Area	13,134	57,932	4.4	24,700	146,420	5.9	+34
Greeley		53,500			140,000		
Garden City		197			250		
Evans		3,455			4,500		
La Salle		780			1,670		
Windsor	800	2,426	3.0	2,500	15,000	6.0	+100

[a] Toups Corporation, 1977.
[b] LWCOG.
[c] Local Planning Departments.



LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

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FIG. 4.4.2

March, 1977

east of U.S. Highway 85 for approximately 2.0 miles and north of the river approximately 1.0 mile. Table 4.4.2 indicates that as a result of the policy of developing within and adjacent to existing communities the population density of the Greeley urban area would increase by 34 percent. This increase in density was also accomplished by the designation of two major high density residential areas. One area is located south of Business Route 34, approximately 0.5 mile west of U.S. Highway 85. A major new industrial area is designated along the north bank of the South Platte River, just south of the confluence of the South Platte and Cache La Poudre rivers. Expansion of commercial areas in the downtown area, near the regional shopping center, and west along Business Route 34 is also suggested by Alternative B. Alternative B designates 30 percent more land for development in the Greeley area than Alternative A; however, only 18 percent more people are accommodated within this area.

Alternative B also suggests extensive development of the Windsor area resulting in a 100 percent increase in population density. Growth would occur primarily towards the north, south, and west. High density residential uses are suggested to the south, adjacent to the property owned by Kodak and to the northeast around the northern and eastern shore of Windsor Lake. Expansion of existing commercial activities in the downtown area is also suggested.

Within Larimer County, Alternative B portrays all new development occurring within or adjacent to the major urban areas of Loveland and Fort Collins. As a result the population density of Loveland and Fort Collins would increase by 12 percent and 15 percent, respectively. Growth in the Fort Collins area would occur in a northeasterly direction around the lakes in this area, and in a southern direction generally as far as Harmony Road. Vacant lands within the existing community would be infilled contributing to the increase in population density. A major new high density residential area is suggested west of U.S. Highway 287 and north of Harmony Road approximately 1.0 mile. Expansion of the existing commercial activities along U.S. Highway 287 are suggested as far south as Harmony Road, creating a commercial strip from Harmony Road to the northern edge of town. Alternative B suggests a 35 percent increase in the population over the level suggested by Alternative A for Fort Collins; however, this increased population is accommodated with only a seven percent increase in land area.

Expansion of the Loveland area is suggested in all directions, with the most extensive growth occurring in the north, south, and west. Residential development in this area is suggested. New residential areas are suggested 1.0 mile north of 29th Street between Wilson and Taft Avenue and 2.0 miles north of 29th Street between Taft Avenue and an area 0.5 miles east of U.S. Highway 287. Expansion to the south would occur approximately 1.0 mile south of Colorado Highway 402 between U.S. Highway 287 and Taft Avenue and between the Big Thompson River and Colorado Highway 402 approximately 2.5 miles west of Taft Avenue. Although the anticipated population level for Loveland is approximately the same as Alternative A, the land area required to support the population is approximately 45 percent less.

As indicated, the land use gaming technique used to develop Alternative B was not designed to allocate growth to the small communities within the Region. The technique required the allocation of land uses in 50-acre units and some of the town only had 100 to 200 acres of total developed area. In light of this, the Subcommittee only allocated growth to those communities with which they were familiar. Growth was not allocated to the following communities: Berthoud, Timnath, Wellington, Erie, Evans, Garden City, Hudson, Keenesburg, Kersey, La Salle, Lochbuie, Mead, Milliken, and Severence.

The Committee members acknowledged that growth in any of these areas would reduce the growth they had allocated to the major urban areas, but felt that such necessary reallocations would be minor in consequence and did not alter their commitment to containing growth within existing communities. This means that although the towns of Berthoud, Timnath and Wellington might attract some of the growth allocated to Loveland and Fort Collins, growth of the unincorporated areas, other than those immediately adjacent to and therefore ultimately part of the existing cities, should not be allowed.

4.4.3 Plan Description (Alternative C: Citizen's Subcommittee Group 2)

Figure 4.4-B portrays the year 2000 land use allocations developed by the Citizen's Subcommittee Group 2. This group followed the same policies for land use allocation as did Group 1 for Weld County. Therefore, the land use patterns (Figures 4.4-A and 4.4-B) for the communities in Weld County are identical. However, this group followed a different policy for land use allocation in Larimer County. In addition to concentrating growth around existing communities they also concentrated growth along the corridor between Loveland and Fort Collins. The result of following this policy was an allocation of approximately 23,300 people and 5,000 acres of residential and commercial uses to the area between Loveland and Fort Collins and an associated allocation of less people and land uses to the cities of Loveland and Fort

Collins than Group 1 allocated. Table 4.4.3 and Figure 4.4.3 summarize the population densities for the major urban areas associated with Alternative C.

Although less people were allocated to the Loveland area than in Alternative B, more land was required to accommodate the year 2000 population. The reason for this was that this Subcommittee did not suggest the expansion of existing on the development of new high density residential areas. Additional land, beyond that designated on Alternative B, designated for residential uses is located to the west of Bodecker Lake and south of Colorado Highway 402 west of U.S. Highway 287. This less concentrated development pattern would actually result in a decrease in the population density of the Loveland area over existing densities.

Alternative C suggests a land use pattern for Fort Collins almost identical to the pattern suggested by Alternative B in terms of area covered. However, the amount of people accommodated in this area is approximately 13 percent less than Alternative B results in a population density lower than Alternative's B, but still an increase over existing densities. This situation results from the lack of infilling of vacant lands within developed areas. Although development of Fort Collins is suggested as far south as Harmony Road, major areas between Drake and Harmony Roads would remain vacant.

Development within the area between Loveland and Fort Collins would occur along the east and west sides of U.S. Highway 287 extending approximately 1.0 mile west and 0.5 mile east. Minor extension of the existing commercial areas is also suggested in this area. The level of development in this area would result in the establishment of a new urban area equal to the Loveland today. Assurance of adequate public services and facilities to this area would rest with Larimer County unless the residents of the area choose to incorporate.

For the same reasons as stated in Section 4.4.2 the members of this Citizen's Subcommittee did not allocate growth to the following areas: Berthoud, Timnath, Wellington, Erie, Evans, Garden City, Hudson, Keenesburg, Kersey, La Salle, Lochbuie, Mead, Milliken and Severance.

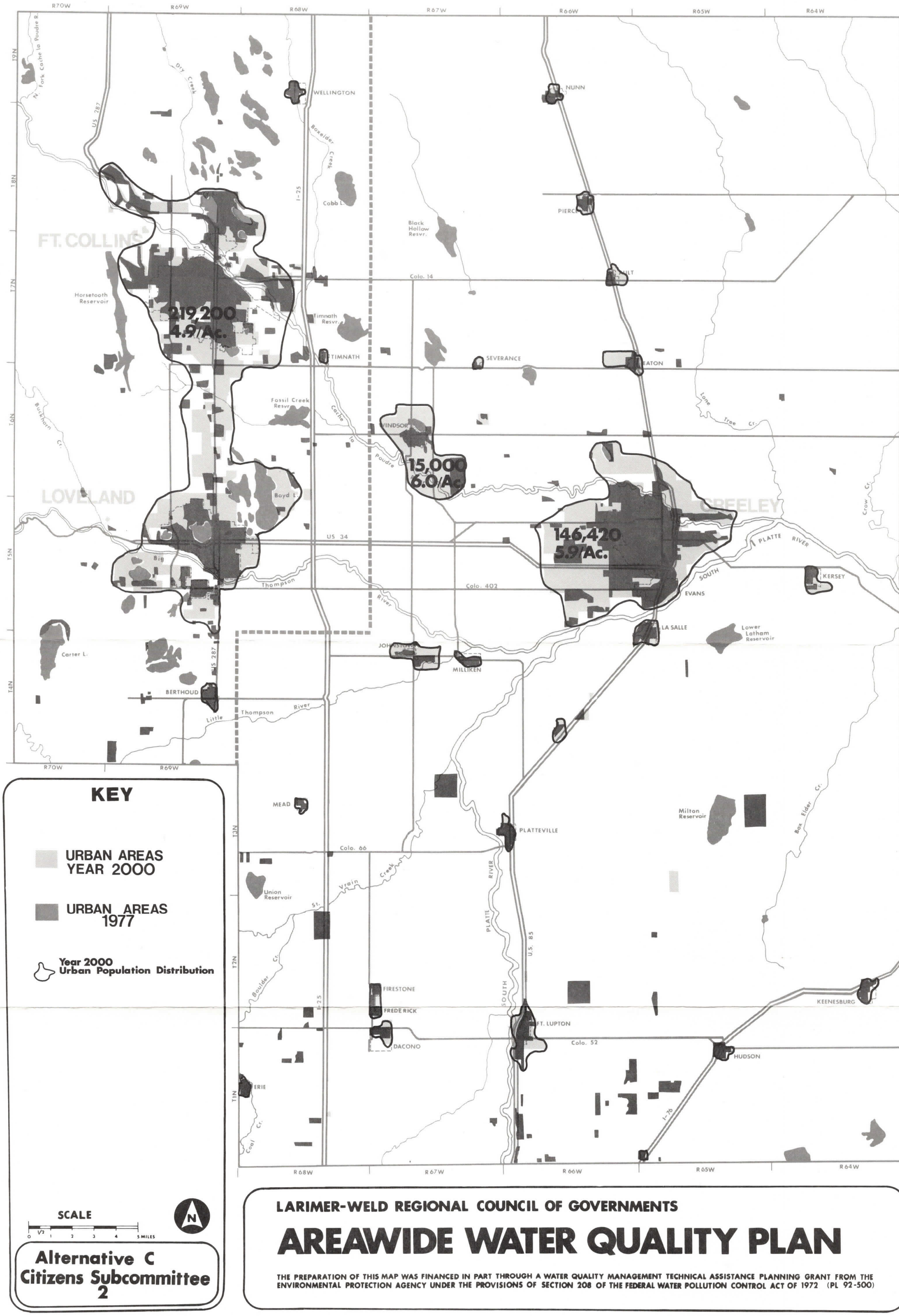
4.5 ALTERNATIVE D: REGIONAL AND LOCAL PLANNERS

To incorporate the existing plans and policies of the local governments into the regional planning process, members of the local and regional planning staffs worked together to develop a land use alternative. Figure 4.5 portrays this alternative.

TABLE 4.4.3 POPULATION DENSITY OF MAJOR URBAN AREAS FOR LAND USE ALTERNATIVE C [a]

Area	Existing 1975 Acreage[b]	1975 Population[c]	1975 Population Density (People/acre)	2000 Acreage	2000 Population	2000 Population Density (People/acre)	Percentage Change in Density
Larimer County							
Fort Collins-Loveland Area	19,500	89,326	4.6	45,100	219,200	4.9	+7
Fort Collins		60,600			134,700		
Loveland		24,926			60,000		
Boxelder, S.D.		1,500			1,500		
S.F.C., S.D.		1,500			23,000		
Weld County							
Greeley Area	13,134	57,932	4.4	24,700	146,420	5.9	+34
Greeley		53,500			140,000		
Garden City		197			250		
Evans		3,455			4,500		
La Salle		780			1,670		
Windsor	800	2,426	3.0	2,500	15,000	6.0	+100

[a] Toups Corporation, 1977.
[b] LWCOG.
[c] Local Planning Departments.



LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

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FIG. 4.4.3

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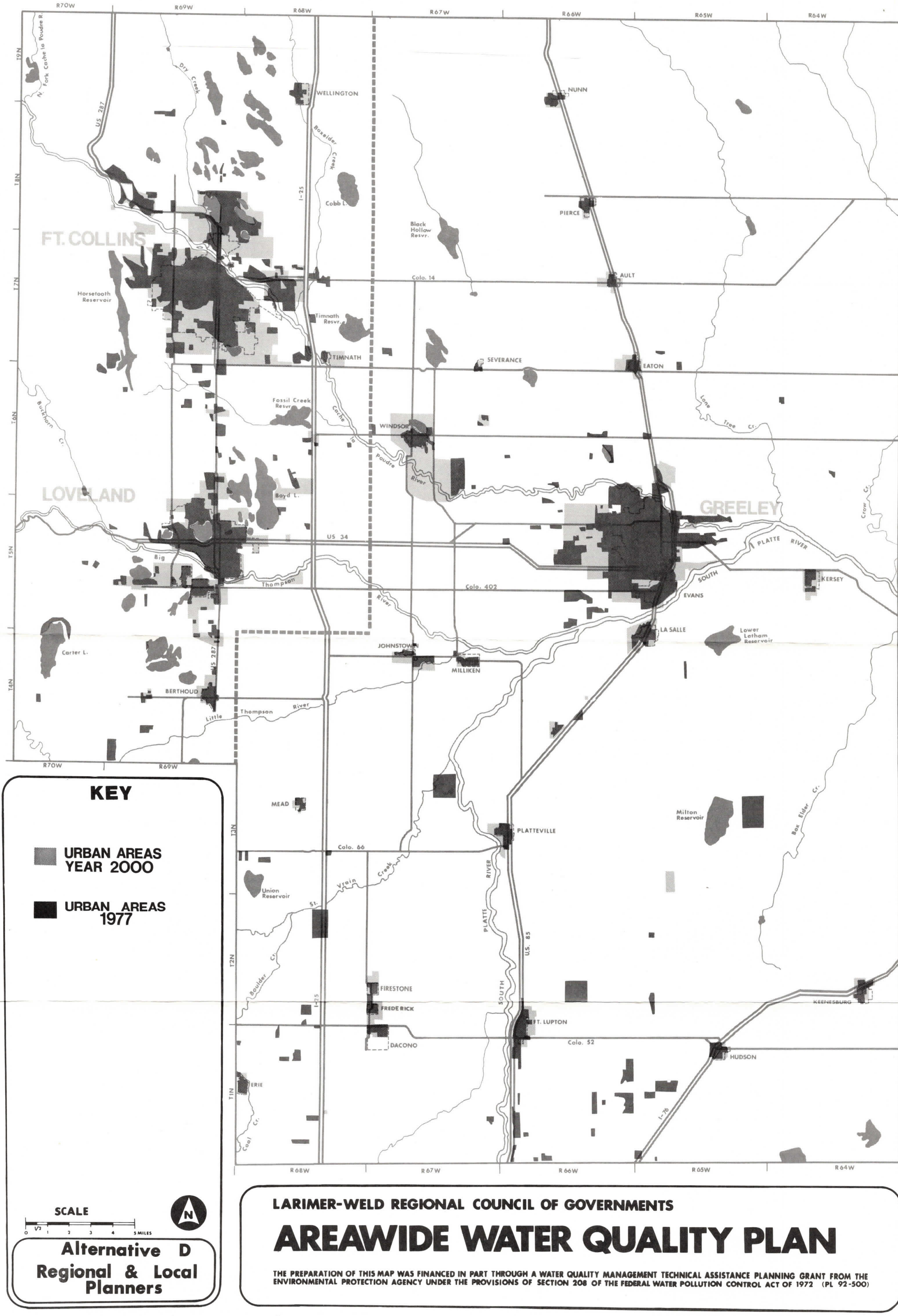

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Fig. 4.5

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4.5.1 Plan Derivation

A technique similar to the one used by the Citizen's Committee was used to derive this alternative. Members of the planning departments of Larimer County, Weld County, Loveland, Fort Collins, Greeley, and Windsor met for an all day working session and used the land use gaming technique described in Section 4.4.1 to develop their land use alternative. Since the Weld County planning staff is responsible for preparing plans for the small towns within that county, those areas were also represented in the development of this alternative. The planners were asked to use their professional judgements and existing plans and/or policies as guides for their land use allocations. The following areas have adopted comprehensive plans that were generally incorporated into this alternative: Loveland, Greeley, Platteville, Pierce, Ault, Erie, La Salle, Fort Lupton, Windsor and Weld County. The Weld County Comprehensive Plan does not include a land use map but only includes policies to guide development. These policies, as identified in Section 4.3, were used as guidelines in allocating development throughout the County. The areas that do not have adopted plans or policies to guide growth include: Fort Collins, Berthoud, Timnath, Eaton, Evans, Garden City, Gilcrest, Hudson, Johnstown, Keenesburg, Kersey, Lochbuie, Mead, Milliken, Nunn, Severance, Dacono, Firestone, Frederick and Larimer County. In these areas the planners were asked to allocate land uses based on their professional judgments and their knowledge of the physical, social, and political environments.

4.5.2 Plan Description

Figure 4.5 portrays the year 2000 land use allocations developed by the local and regional planners. Table 4.5.2 and Figure 4.5.2 summarize the population densities of the major urban areas associated with this alternative. Since the technique used to develop this plan was a land use allocation procedure, the population levels reflected in Table 4.5.2 do not necessarily reflect the official population projections of each community.

The growth patterns portrayed in this alternative for all of Weld County are the same as those reflected in Alternative A and discussed in Section 4.4.2. This is the case because the land use decisions in Weld County, including those within the City of Greeley, have closely followed the adopted comprehensive plans.

The land area of the City of Loveland is suggested to slightly more than double by the year 2000; however, Alternative D anticipates a more than tripling of Loveland's population resulting in an increase in population density of 60 percent.

TABLE 4.5.2 POPULATION DENSITY OF MAJOR URBAN AREAS FOR LAND USE ALTERNATIVE D [a]

Area	Existing 1975 Acreage [b]	1975 Population [c]	1975 Population Density (People/acre)	2000 Acreage	2000 Population	2000 Population Density (People/acre)	Percentage Change in Density
Larimer County							
Fort Collins Area	13,500	63,600	4.7	29,700	176,300	5.9	+26
Fort Collins		60,600			167,300		
Boulder, S.D.		1,500			4,500		
S.F.C., S.D.		1,500			4,500		
Loveland Area	6,000	24,926	4.2	12,200	81,300	6.7	+60
Weld County							
Greeley Area	13,134	57,932	4.4	19,000	124,250	6.5	+48
Greeley		53,500			109,700		
Garden City		197			250		
Evans		3,455			9,400		
La Salle		780			4,900		
Windsor	800	2,426	3.0	2,000	12,500	6.3	+110

[a] Toups Corporation, 1977.
[b] LWCOG.
[c] Local Planning Departments.

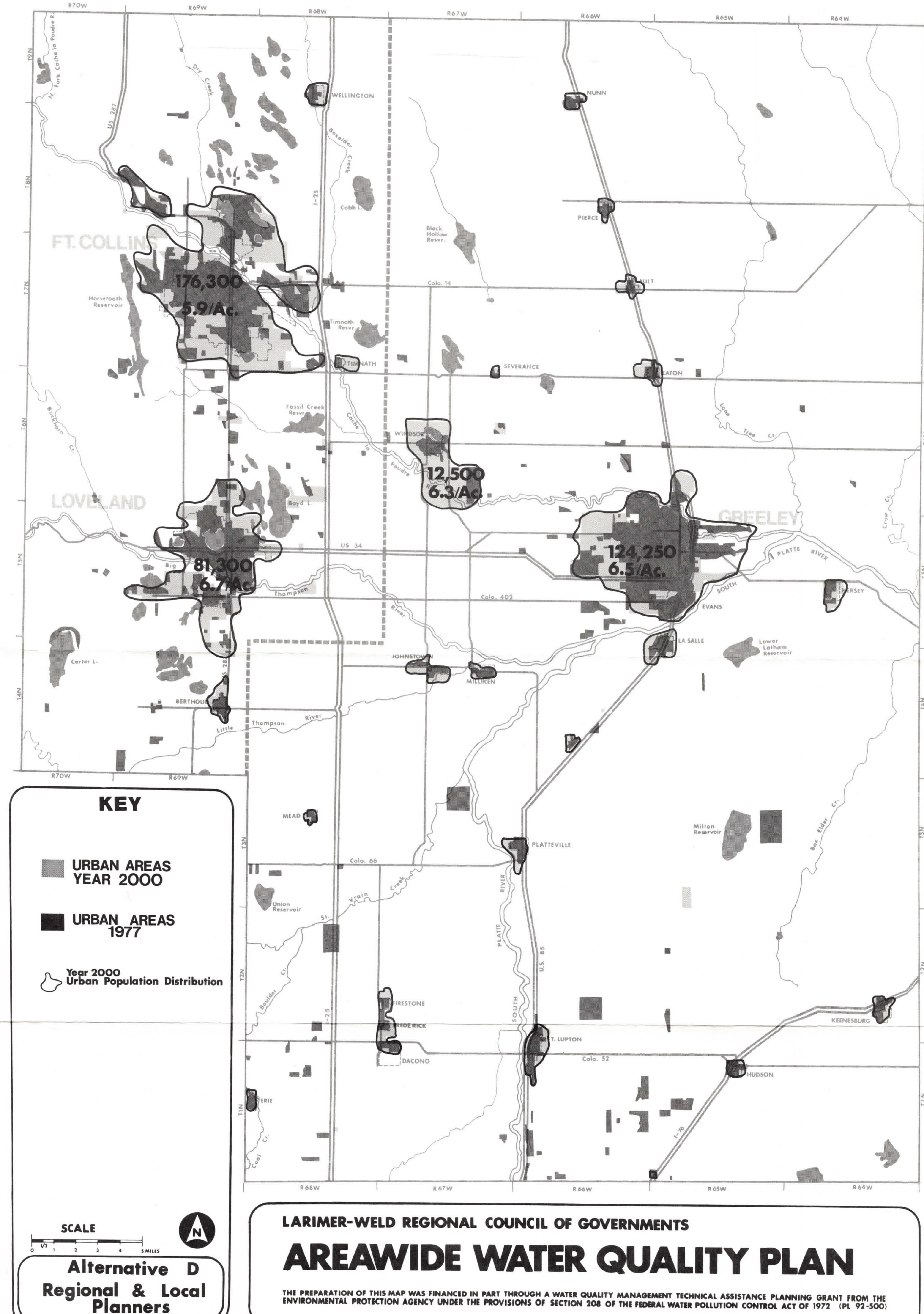

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FIG. 4.5.2

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This is made possible through the designation of six high density residential areas. The largest area would be located approximately 0.5 mile north of 29th Street between Wilson and Taft Avenues. Another large area would be located north of Colorado Highway 14, west of Wilson Avenue. Other areas would be located west of U.S. Highway 287 and south of Colorado Highway 402, south of U.S. Highway 34 between Taft Avenue and U.S. Highway 287, two areas east of U.S. Highway 287 and north of 29th Street, and west of U.S. Highway 287 north of 29th Street. Residential uses would be concentrated throughout Loveland extending approximately 0.5 mile west of Wilson Avenue, 2.0 miles west of Taft Avenue along Colorado Highway 402 and along the southern shore of Bodecker Lake, 2.0 miles south along U.S. Highway 287 below Colorado Highway 402 and approximately 1.0 mile west and 2.0 miles north along U.S. Highway 287 above 29th Street and approximately 1.0 mile east and west.

The land use pattern for the Fort Collins urban area closely aligns the pattern designated on Alternative B; however, the population accommodated within this area is approximately 10 percent higher than the population anticipated in Alternative B. As a result, Alternative D portrays the highest population density of all the land use alternatives for the Fort Collins area. As in Loveland, this is accomplished by suggesting the establishment of several major high density residential areas. The largest area is located east of Shields Avenue extending approximately 1.0 mile north of the Cache La Poudre River. Another major area would be located east of Overland Trail and north of Vine Drive. Additional high density residential areas are suggested north of Vine Drive 0.5 mile east and west of Shields Avenue, east of Overland Trail and south of Mulberry Street and two areas south of Prospect Road between Overland Trail and Taft Hill Road.

Alternative D suggests only minimal expansion of residential development between Loveland and Fort Collins, limited to expansion of existing developed areas.

Chapter 5.0

CHAPTER 5.0

EVALUATION OF LAND USE ALTERNATIVES

The diversity of land use alternatives presented in Chapter 4.0 reflects the ability of the Region's resources to accommodate varying land uses and differing opinions as to the land use pattern that would result in most efficient use and management of these resources. To evaluate the differences between the land use alternatives, evaluation criteria were developed. These criteria were designed to provide for evaluation of land use, environmental, and economic aspects of each alternative and to facilitate the development of a land use strategy that would result in efficient utilization and management of the Region's resources. This chapter discusses the land use issues that were used to define the evaluation criteria and then presents an evaluation of each land use alternative based on the defined criteria. This evaluation is presented in a matrix form to enable rapid comparison of the differences between the alternatives.

5.1 LAND USE ISSUES

As the basis for the development of criteria to evaluate the land use alternatives, eleven land use issues relating to regional land use patterns were defined. These issues emerged from:

1. Evaluation of the land use suitability analyses.
2. Citizens' preferences for land use developments as expressed in land use Alternatives B and C.
3. Preferences of local planners for land use development as expressed in land use Alternative D.
4. Adopted policies of local governmental agencies and special use districts;
5. Conflicts among land use suitabilities, defined land use preferences, and adopted policies.

Principal land use issues include:

5.1.1 What is the Appropriate General Pattern of Land Utilization in the Region?

Land uses may be distributed in an almost infinite variety of configurations. "Clustered" and "dispersed" patterns represent the traditional polar alternatives. In "cluster" patterns, land uses are concentrated, and in some cases densities and types of land uses are mixed. Some "clustered" plans call for mixed-density residential neighborhoods clustered around community cores containing commercial, educational, and recreational facilities. In such developments, residential neighborhoods are often separated by large open spaces. Much of Weld County typifies this pattern where rural communities are characterized by concentrations of residential uses around commercial, public service, and in some cases, employment activities. Greeley, the largest of Weld's communities to a large extent represents a concentrated urban area. Outward growth has been minimized, with development priorities focusing on the infilling and intensification of the existing urban area. Additionally, peripheral expansion has largely located contiguous to existing development.

A "dispersed" land use pattern can assume two forms:
1) uniform densities and land uses covering a large area;
2) fragmented parcelizations, or "leapfrogging" development.
Much of the Denver area characterizes the former. Outside the downtown core, residential densities are relatively constant over extensive areas with commercial and public service facilities scattered throughout the urban area. Little attempt has been exercised to differentiate densities to reflect zones of greater urban activity or provide for differing lifestyles.

Development on the periphery of Denver and recent activity in the Fort Collins-Berthoud corridor is characteristic of a fragmented pattern. Webster's New World Dictionary defines "fragmented" as "a part broken off, detached, or incomplete." For various reasons, including lower land costs, new residential tracts will often locate in the general proximity, but not contiguous, to existing development. Another reason such fragmented patterns frequently occur is the absence of a land use plan or strategy to guide development. The lack of a comprehensive land use plan for the unincorporated portions of Larimer County has contributed to the dispersed or fragmented development pattern that presently exists along the Berthoud-Ft. Collins corridor.

Alternative A, reflecting the land use pattern that would be expected to result if the historic trends in land use decisions continue, portrays a relatively concentrated land use pattern in Weld County and a fragmented or dispersed pattern in Larimer County. Alternative B displays a more concentrated land use pattern in Larimer County than does Alternative A; however, development is still dispersed along the corridor between Loveland and Ft. Collins. Within Weld County, Alternative B portrays a more dispersed land use pattern than Alternative A. The Greeley urban area reflected in Alternative B covers a much larger area at lower densities than is reflected in Alternative A. The remainder of the communities generally exhibit concentrated land use patterns similar to those portrayed in Alternative A. The land use patterns portrayed in Alternative C are the same as those prepared for Alternative B in Weld County. However, the Larimer County pattern is much more concentrated than the one reflected in Alternative B. The land use pattern portrayed by Alternative D is the most concentrated overall pattern of all the alternatives. The patterns in both Larimer and Weld County are concentrated around existing communities and most of the vacant land within Loveland, Ft. Collins and Greeley is filled in. As a result, the population densities of Alternative D are higher than any of the other alternatives.

In recent years, the appropriateness of dispersed versus concentrated land use patterns has been questioned due to attendant, economic, environmental, and social costs. A recent publication prepared for the Council on Environmental Quality, The Costs of Sprawl [Real Estate Research Corporation, April 1974] supports arguments against dispersed land use patterns. The report states: "Planning to some extent, but higher densities to a much greater extent, result in lower economic costs, environmental costs, natural resource consumption, and some personal costs for a given number of dwelling units."

Pertinent factors relating to the appropriate land use pattern for the Region include:

1. Dispersed land uses necessitate a more extensive circulation network than concentrated patterns, incurring costs considerably higher than would be attributable to a concentrated pattern of development. The greater the dispersion, the greater the linear length of roadways required to connect residences with destination points (employment, shopping, entertainment, etc.). In addition, the effectiveness of public transportation systems depends on concentrations of potential users. Lower concentrations and densities result in higher operating cost and generally lead to a greater reliance on the automobile to serve the needs of residents.

2. On a per capita basis, at first glance it would appear that the costs of providing public services (police and fire protection, health and educational facilities, etc.) would be constant for dispersed and concentrated land use patterns. However, the costs of providing services to a dispersed population can be considerably higher than the costs of providing equal services to a concentrated population. To maintain adequate levels of police and fire protection additional facilities

must be built and maintained in the local areas thus increasing the capital operating and maintainence cost of providing such services over the costs that would be incurred in providing a similar level of service to a concentrated population from centralized facilities. For those services where the provision of additional facilities are not necessary to protect the health and welfare of the residents, the costs are still higher of providing services to a dispersed population versus a concentrated one. In these cases the residents must incur transportation costs of getting to and from the service location and the farther from the facility they live, the higher the transportation cost.

In addition, dispersed development may incur inequities in the financial support of public service systems. Those residing in outlying areas may use libraries, museums, parks, and other services in urban areas without appropriate compensation to the municipality providing the service. Hence, the resident of the municipality assumes the burden of costs for others' benefits.

3. As a general rule, the greater the dispersion of land uses, the greater the capital costs of providing utility service systems (water, sewer, energy, and communication). Collection and distribution systems would have to cover more distance to service a dispersed versus a concentrated population; therefore, the capital costs of providing such services would be higher. In addition, concentrated land use patterns provide for the construction of centralized water and sewage treatment plants which can realize economics of scale and treat water or sewage at a lower per gallon cost than smaller plants providing treatment for a dispersed population.

4. The economic viability of a recycling and maintenance program for older community areas is directly related to intensification of use in the area. The outward shift of uses often accounts for deterioration of the older areas. Recent shifts of commercial activity to the south of Fort Collins, the north and west of Loveland, and the south and west of Greeley has occurred at the expense of the downtown areas in these cities.

5. A decreasing supply of land available for development is accompanied by a commensurate increase in the value of developable land. In general, the greater the scarcity of developable land, the higher the price such land will bring. If land uses are concentrated, land values for developable land on a per-acre basis would be higher than they would be for a dispersed pattern.

6. Air quality is directly correlated to the distance and number of daily automobile trips. Dispersed land use patterns encourage longer trips; hence, heightening air pollution, while concentrated patterns minimize total vehicle miles traveled (VMT), thus lessening pollution. According to The Cost of Sprawl, automobile pollutants can be reduced 20 to 30 percent by concentrating urban land uses. The LWCOG has prepared a study documenting the transportation related impacts of the land use alternatives.

7. Water consumption is directly related to the density of land uses. Per capita consumption ratios are lower in concentrated urban areas than in dispersed suburban communities. Suburban developments use more water than urban developments to irrigate extensive lawn and garden areas. The per capita consumption rate of apartment house dwellers is roughly half that of suburban dwellers [Milne 1976].

8. Noise levels are impacted by the pattern and density of land uses. In a dispersed pattern, the lengths of highways and local streets would be greater than in a concentrated pattern. Consequently, noise impacts would be spread over a larger area. A concentrated pattern would result in increased noise levels at centralized activity points and reduced levels in outlying areas. Therefore, exposure to noise varies significantly with the land use patterns. It should be noted, however, that actual noise exposure is a function of the specific siting of land uses (i.e., a concentration of residents in a high-noise area would expose a greater number of residents than a dispersed pattern). It is the greater opportunity for avoidance of high noise that can be attributed to a concentrated pattern.

9. A dispersed land use pattern will disrupt native vegetation and wildlife to a greater extent than a concentrated pattern. The degree of disruption will depend on the extent of fragmentation of the dispersed uses. The greater the dispersion, the greater the amounts of land that are utilized; consequently, the greater the potential for disruption.

   Development in a concentrated urban pattern would be focused primarily in and around existing urban and suburban areas where vegetation and wildlife have already been disturbed. Species that are less sensitive have adapted to the presence of man. Those of greater sensitivity have migrated to locations away from existing communities or become locally extinct. Continued concentrations of urban uses would have a minimum impact on existing species, while a dispersed pattern would affect outlying areas where sensitive species have migrated, causing substantial disruption.

10. Consumption of natural gas and electricity is a function of housing type, distribution and orientation, and industrial demand. Apartment units consume less energy than single-family units. Consequently, the increasing densities of a concentrated pattern require less energy per unit than a dispersed pattern. Additionally, there is a correlation between the length of a transmission system and the loss of electrical energy. Because a dispersed pattern requires longer transmission systems than a concentrated pattern, it results in higher losses in energy during transmission.

    Gasoline usage is a function of total VMT. In a dispersed land use pattern, VMT is higher than in a concentrated pattern. Therefore, dispersed land use patterns create higher gasoline consumption on a per capita basis than do concentrated patterns.

11. A dispersed land use pattern would tend to perpetuate fragmentation of public services. As population and land uses grow and disperse, attempts to consolidate individual special districts and governmental units would be hindered.

    Fragmentation of services often results in a low level of effectiveness and efficiency, and overlapping jurisdictions hinder a coordinated effort to provide for and guide growth. Agencies often compete for available funding, and tax dollars can be spent on capital improvements that contradict improvements made by other agencies. In some cases, improvements bear no relationship to either existing or potential concentrations of population.

    A concentrated pattern of urban and suburban uses would tend to increase consolidation of the public service districts and their boundaries. Consolidated districts reflecting concentrations of development, whether urban or rural, contribute to the efficiency and effectiveness of guiding growth.

All of the factors discussed above indicate advantages that could be gained by directing future development in the Region in a concentrated pattern and the disadvantages of allowing development to occur in a dispersed manner. Based on these factors, it is obvious that the Region would benefit through the development and adoption of a land use strategy that resulted in a concentrated land use pattern.

This first land use issue addresses the generalized land use patterns. The following issues focus on specific locational uses which, when resolved will in the context of the overall regional land use distribution strategy, help define the best regional land use pattern.

5.1.2 Should Agricultural Lands be Protected from the Intrusion of Urban and Suburban Development?

As is evident in reviewing the maps depicting the agricultural capability (Figure 3.5.2-A) and suitability (Figure 3.6.3-F) and existing nonurban land uses (Figure 3.5.5-B) any significant expansion of existing urban and rural communities will consume lands currently in or capable of agricultural production. To avoid consumption of these lands, new development would have to be restricted to: 1) intensification and infilling of existing urban areas; 2) development in the mountainous areas or the extreme fringes of the Region. Though many vacant parcels are found in existing communities, this capacity is insufficient relative to projected demands. Development of fringe areas would result in a highly dispersed regional land use pattern and all the associated disadvantages and costs outlined in Section 5.1.1.

Therefore, it would be inappropriate to require retention of all productive agricultural lands at the exclusion of other options. A more logical approach would be the allocation of urban growth in such a manner that agricultural production is maximized and cost of urbanization is minimized. Such a solution is possible by allocating development around existing communities in areas of less productive agricultural lands.

Alternative D portrays the most concentrated land use pattern and would result in the direct conversion of the least amount of productive agricultural land to urban uses. Alternative A would result in the direct conversion of approximately 30 percent more productive agricultural land to urban uses than Alternative D. However, Alternative A also portrays a highly dispersed land use pattern in Larimer County which will disrupt agricultural activities to a greater extent than the direct consumption of productive land indicates. With the increasing capital intensity of agricultural activities large, contiguous parcels of land must be maintained to ensure the economic viability of such activities. The dispersed land use pattern portrayed in Alternative A would break up the existing agricultural land use pattern and would therefore jeopardize the viability of farming on much of the lands not directly converted to urban uses. Alternatives B and C would result in the conversion of approximately 65 percent more productive agricultural land to urban uses than Alternative D. However, due to the concentrated patterns reflected by these alternatives, the overall impact of such land use patterns on agricultural activities in the Region would be less than those that would result if Alternative A is followed.

5.1.3 What Should be the Relationship of the Pattern of Urban Development to Existing Services?

In allocating future urban development the degree to which it corresponds with the location of existing public services is of concern. An important indicator of the quality of life is the adequacy of services and facilities in meeting the needs of the population. Among the services essential to the functioning of a community are sewage treatment, water, solid waste disposal, highways, energy (electrical and natural gas) distribution, schools, health facilities, and police and fire protection. Accessibility to and the quality of services are measures of their adequacy and are significantly affected by the pattern of land use allocation.

Public services have been developed throughout the Region to serve its residents. Sanitation districts and service areas largely correspond to existing urban and rural developments; domestic water lines serve urban and rural populations; police and fire facilities have been distributed to allow them rapid response to emergencies; highways have been located to provide access from residences to places of employment, shopping, and recreation; schools are located to serve residential groupings; and health facilities are centralized in urban areas.

Many of the services have been structured to easily accommodate demands attributable to population growth. For example, a review of the capacity of the existing wastewater treatment facilities for major urban areas indicates that existing and planned facilities can accommodate the projected regional growth. In fact, the facilities in Ft. Collins actually could accommodate more growth than is projected by any of the land use alternatives and Loveland's facilities could accommodate more growth than Alternatives A, B, and C. A detailed evaluation of the Alternatives was conducted as part of the 208 program and is available from the LWCOG for review [LWCOG 1977]. This evaluation concluded that if regional growth does not occur within the potential service districts of existing facilities, existing facilities will be inefficiently utilized and new facilties could be required. Inefficient use of existing facilities combined with possible requirements for new facilities would unnecessarily increase the cost of wastewater treatment for the Region. Such unnecessary cost increases could be avoided by directing growth to those areas with existing services or where existing service districts could easily provide service.

When new development locates in areas of available service, costs incurred by the developer, and ultimately the community, are substantially less than those which would be experienced if development were to locate outside of such areas.

Alternatives B, C, and D support the concept of maximizing development in areas of existing or potential public service and minimizing development outside of these areas.

However, to a large extent, Alternative A disregards existing service districts in Larimer County. This reflects the perceived ability to readily change these boundaries to conform to specific site land use proposals and the lack of a well-defined plan for future use allocation.

5.1.4 What is the Significance of Vacant Lands in Determining the Pattern of Future Land Uses?

Much of the peripheral and, to a lesser extent, the internal development of the urban areas of Larimer County, particularily Fort Collins and Loveland, is characterized by a scattered pattern of developed and undeveloped lands. This has resulted from rapid growth in the absence of a strong policy to infill the available vacant lands within existing communities. Without such a policy many areas have been purchased in anticipation of rapid development and taken out of agricultural production. However, due to factors beyond these property owner's control, development has occurred in other areas and their property remains in a transitional vacant or undeveloped use. Such properties are problems to property owners who must maintain the land and to cities that must provide public services, and to the public that looks at scattered vacant lands breaking up the visual character of the area.

In efforts to efficiently manage growth by infilling vacant lands and reducing the premature conversion of productive agricultural land, the cities of Loveland and Fort Collins have been forced to annex large sections of undeveloped land adjacent to their boundaries. Only by so doing can the cities ensure that infilling will occur resulting in the efficient utilization of their public services and facilities. The scattered development pattern that would occur in the absence of such defensive annexations by the cities would require the extension of public services over a large noncontiguous area which would result in unnecessarily high costs of providing such services and the continued premature conversion of agricultural land to transitional vacant uses.

The adoption of any regional land use strategy will reduce the problem of having land prematurely enter a transitional stage; however, only a policy strongly advocating infilling of existing vacant lands will help existing communities efficiently utilize their resources. Weld County has been pursuing such a policy since the adoption of its comprehensive plan; however, Larimer County has yet to adopt such a policy. This is why the major problem of transitional uses occurs in Larimer County.

5.1.5 What are the Implications of Environmental Hazards and Constraints on the Future Land Use Pattern, and How Can They be Avoided or Mitigated?

In considering future land use growth, it is important to weigh the implications of environmental hazards and constraints. Some of these will act as absolute constraints, preventing land use development, while the effects of others can be mitigated or even tolerated.

As discussed in the evaluation of urban land use suitability (Section 3.6.2.2), a number of natural environmental systems are present in the Region which would severely impact the pattern of land utilization. The most significant hazards are the floodprone areas of the Cache La Poudre, Big Thompson, and South Platte, and St. Vrain rivers, and Boulder Creek. Development of urban uses (excluding certain extractive industries) in these areas is inappropriate due to the potential loss of life or property.

Without exception, policy directions suggested by the citizens' advisory subcommittees and the local planners, as expressed in the land use alternative reinforced this concern. Recommendations centered on the limitation of the flood plains for open space recreation uses and extractive industries.

Other hazards present in the Region include areas of severe slope (in excess of 30 percent), building site soil constraints, erosion hazards, and septic tank limitations. None of these represent an "absolute" threat to life or property. However, the costs of remedial actions can be substantial. As a general guide, it is advisable to restrict intensive urbanization on steep slopes, unless no other options are available, which is not the case in the Region. Areas characterized by severe septic tank limitations necessitate construction of sanitation systems for urban or suburban uses. Building site constraints and erosion hazards can be ameliorated by engineering design and careful siting. However, mitigation actions should be exercised only when the costs to be incurred are judged to be offset by the benefits.

Ignorance or disregard of the potential impacts of natural hazards can result in destruction of property and loss of life. Therefore, it is important to develop policies that will eliminate or minimize these problems. In some cases, it may be advisable to restrict certain land uses, such as on flood plains, so that problems can be avoided; in others, measures may be taken to minimize the impacts of natural hazards.

5.1.6 To What Extent Should the Land Use Pattern Respect the Sensitivities of the Region's Natural Environmental Systems?

A considerable body of recent Federal legislation has been directed toward the impacts of growth on the natural environment. Too often, natural systems have been disregarded and, consequently, significantly disrupted by urban expansion. Certain species of wildlife and vegetation have been destroyed, while others have become seriously endangered. A number of natural resources have been utilized to their capacity, or even beyond.

As discussed in Section 3.5.4, the Region is characterized by abundance and diversity of wildlife. A number of areas have been defined as "critical" habitats; these are sensitive to or threatened by the introduction of urban uses. Among these are the breeding grounds of the White Pelican, areas of the South Platte River supporting Bald Eagles, the Pawnee National Grasslands, the Boyd Lake Recreation Area, deer wintering ranges in the foothills of the Rocky Mountains, numerous wildlife and vegetative buffers around lakes throughout the Region, and antelope ranges near Platteville and Wellington. Figure 3.5.4-I illustrates the location and significance of the habitats in the Core Area. Certain portions of these areas (e.g., the Pawnee National Grasslands) are prohibited from development for urban uses.

Generally, the land use alternatives prepared by the citizens' committee and the local planners have recognized environmentally sensitive areas, designating them for open space or recreational uses. Most vulnerable to urban expansion are the wildlife habitats surrounding lakes in Larimer County, particularly Boyd Lake, Fossil Creek Reservoir, Carter Lake, Horsetooth Reservoir, the cluster of lakes immediately north of Fort Collins, and the Red Feather Crystal Lakes area. The recreational and visual amenities offered by these make them extremely attractive for urban development. The land use alternatives reflect varying levels of growth in these vulnerable areas with Alternative A portraying growth in such areas.

5.1.7 What Should be the Type and Character of Development in the Foothills and Valleys of the Rocky Mountains?

The foothills of the Rocky Mountains exhibit a unique geologic and biotic environment which could be adversely disrupted by intensive development. The area consists of a series of hogback ridges, rising steeply from the plains, and intervening valleys. The geologic and soil characteristics physically inhibit development. Severe slopes restrict the extent of use and construction often requires blasting. Most of the area is highly unsuitable for septic tanks, as the soils cannot effectively filter wastewater discharge. Therefore, intensive development of the foothills could, without the presence of sanitation treatment systems, adversely impact water quality in downstream areas.

Deer, fowl, elk, and other wildlife species are found in the foothills. The area is a highly used hunting, fishing and camping area and intrusion of urban uses would significantly lessen its recreational attractiveness.

Although none of the land use alternatives designate development in the foothills, the maintenance and the proper utilization of the unique physical, recreational, and visual element of the area is a concern. Development in the foothills and valleys should be carefully structured to prevent degradation of water quality, ensure geologic stability and maintain and enhance recreational resources.

5.1.8 Should Resources Be Allocated to the Recycling of Deteriorating Areas? How Can Further Deterioration be Avoided?

As communities age and grow, areas of initial development often deteriorate. New areas develop on the urban fringe, including residential, commercial and industrial activities due to the "newness" of the area and lower cost for land and development. When commerce and employment move, residents tend to follow. Marginal commerce and industry often move to older areas, where they suffer high turnover rates. This is a classic problem associated with growing communities.

Development of the Foothills Regional Shopping Center in the southern part of Fort Collins, accelerated deterioration of the older downtown commercial center (along U.S. Highway 287, near the Cache La Poudre River). The regional center offering improved parking, major retail stores, and a concentration of diverse stores in limited and easily accessible areas, severely lessened the viability of the downtown Fort Collins area. Recently, the city has undertaken a program for the revitalization of this area.

Greeley has also experienced a shift in commercial activity and a resultant deterioration of its downtown area. Development of a Regional center near Northern Colorado University and development west along U.S. 34 have lessened the attraction, and consequently, the viability of the Eighth Avenue downtown area. In recognition of this problem Greeley has been actively involved in redevelopment efforts to revitalize residential and commercial areas in the downtown area.

In a similar manner the downtown area of Loveland around Fourth Street between Lincoln and Washington Avenue has been adversely impacted by development along U.S. 34 west of town and U.S. 287 north of town. The effect on downtown Loveland of these new developments has not been as great as the effects experienced by downtown Fort Collins and Greeley. However, as Loveland continues to grow, the problem will intensify. Loveland has also undertaken a program to redevelop its downtown area to compete with outlying development.

For successful redevelopment of these downtown areas and prevention of further deterioration of older commercial areas, it is essential to increase the extent and densities of adjacent residential areas. By increasing the number of residents, the potential market for retail uses is heightened. Residents would be able to walk to areas of commerce, rather than use the automobile. Precedents in other Regions indicate that this would effectively encourage redevelopment by the private sector; thus, lessening the dependence on public sector actions.

Alternative D is the only land use alternative that considered the problem of deteriorating areas throughout the Region. The city, county, and regional planners displayed extensive growth in the north Fort Collins and south Loveland areas as a means to increase the residential base for the downtown area in these cities. Greeley's problem was addressed in Alternative D by indicating increased density in the downtown area thus reflecting a change over from single-family homes to high density residential dwelling units. Land use Alternative A would perpetuate the problem of deterioration of downtown Loveland and Fort Collins through extensive development between these two cities. However, Alternative A would have the same impact on the downtown Greeley area as Alternative D. Alternatives B and C would perpetuate the deterioration of downtown Greeley through extensive westward expansion of that community instead of intensifying residential uses in the downtown area as suggested by Alternatives A and D.

5.1.9 Should Urban Land Uses be Developed along U.S. 287 Linking Fort Collins and Loveland?

To many the principal land use issue confronting the Region is the appropriateness of facilitating development along U.S. Highway 287; thus creating a corridor of urban and suburban uses extending from Fort Collins to Loveland and possibly as far as Berthoud. This is the principal difference between all the land use alternatives. Alternatives A and C portray extensive development in this area while Alternatives B and D portray very limited development.

Considerable development, zoning, and subdivision activity has occurred in this corridor during recent years. Tracts of residential and commercial uses are scattered between the two communities. However, only 20 percent of the land zoned for commercial use is presently developed. This indicates that there is extensive commercial zoning beyond the projected land use demands for the year 2000.

From many standpoints including rural community characteristic; availability of public services, i.e., water, sewer, police and fire protection, proximity to major employment centers; existing land use; and lack of sensitive environmental resources, the area between Loveland and Fort Collins is suitable for development. However, a regional land use planning process must look beyond the simple question of whether land is suitable for development, it must raise and answer the question of what is the most appropriate distribution pattern required to accommodate an anticipated level of growth. Review of the land use alternatives clearly indicate that at least within the planning period, 1975-2000, the amount of land required to accommodate the regional growth is far less than the amount of developable land. In such a situation, land use planning should identify those areas that if developed, would create the greatest benefit to the Region and those where development could be delayed without creating extensive adverse effects. It is in an attempt to answer this question that the issue of allowing development between Loveland and Fort Collins has come up in the development of the land use alternatives.

Development of this area would have certain benefits, but it would also create problems. In a similar manner limiting development, or delaying it for an indefinite period of time, would have certain benefits, but would also create problems.

Intensive development of this area would significantly alter the prevailing urban land use pattern. The extent of such alteration would obviously be dependent on the location and intensity of development. Alternative A portrays the most extensive development of this area with urban development scattered throughout the area. In addition to the problems already attributed to a dispersed land use pattern, existing rural character of this area would be drastically changed if such scattered development occurred. One of the primary reasons why this area is presently attractive is the rural character of the community. Many people purchase homes on lots in this area because it is "out in the country." If scattered urban development occurs, the area would take on the appearance of a suburban community. This is not to say that it still would not be an attractive area for the other reasons mentioned, but simply that the existing character of the area would change.

Any development in this area, whether dispersed as reflected in Alternative A or concentrated along U.S. 287 as reflected in Alternative C, would increase vehicular congestion problems along U.S. 287 and consequently necessitate upgrading of alternate north-south routes to maintain access. Such development would also result in higher VMT and related problems discussed in Section 5.1.1 and would perpetuate the deterioration of the downtown areas of Loveland and Fort Collins.

On the other side of the question, if no development is allowed in this area as generally depicted by Alternatives B and D, people who have made investments in this area in anticipation of it being developed will suffer adverse economic consequences. Investments have been made towards providing water and sewer service to this area. Individuals have put up private capital for the construction of a sewage treatment plant and are counting on a certain level of development to realize a return on this investment and offset the operation and maintenance costs of this facility.

If no development is allowed in this area, the costs of maintaining viability of continuing its operation would come into question. In certain cases, land in this area has been taxed according to its development potential and not its existing use. If development were not allowed in these areas property owners would have suffered undue taxation.

These problems point out the tradeoffs that must be made in determining the appropriate land use pattern for the Region and particularily for the area between Loveland and Fort Collins. The land use alternatives tend to reflect absolute of development or no development where the logical answer to the dilemma may be a limited level of development recognizing the problems.

5.1.10 How and to What Extent can Limited Resources be Conserved; and to What Extent does this Concern Impact Land Use Development and Distribution?

Consumption of limited resources such as energy and water is an unavoidable consequence of population growth and its accompanying urban and suburban development. The rate of consumption is a function of the nature, intensity, and distribution of land use, the design and occupancy of structures, and lifestyles.

With national concerns being focused on the conservation of these resources, it is imperative that attention be focused on development of land use strategies to carefully manage their use. From an energy standpoint, a pattern of land uses which facilitates the establishment of totally self-contained communities is the ideal; where the place of residence, employment, commerce, and recreation are concentrated within close proximity, thus reducing VMT. In reality, this ideal is not wholly attainable. Past regional land use decisions, such as the location of Kodak, Hewlett-Packard, and new regional shopping centers, has prevented this option. However, this does not preclude setting this ideal as a general goal for future land use decisions in the Region.

The two major factors influencing municipal water consumption are the size of families and type of housing. Clearly control of family size is beyond the scope of land use planning; however, housing type is a basic element of land use planning. A family living in an apartment uses approximately one-half as much water as a family of the same size living in a single-family home. Therefore, by encouraging intensification of residential uses the demands on water resources can be minimized.

Although these considerations were generally not incorporated into the development of the land use alternatives, the alternatives reflecting concentrated patterns would be more conservation oriented than alternatives reflecting dispersed patterns.

5.1.11 How can Adopted Land Use Plan Policies and Programs Effectively Guide Future Development in the Region?

Once a land use strategy has been adopted by regional, county, and city entities, it must be effectively implemented for the orderly use and management of resources. Lack of commitment to the policy plan on the part of decision-makers will result in an inconsistent and haphazard land use development. Wholesale granting of variances, conditional use permits, and plan changes in the name of "flexibility" often reflect an attitude of indifference or a fear of planning as an effective mechanism to guide future growth. When "flexibility" is used to encourage innovation or to accommodate more realistic projections, it can be a powerful tool in creating a "dynamic" rather than "static" plan. This kind of flexibility is crucial to a plan's success, since a plan is often "out-of-date" the day after publication. On the other hand, if a plan's flexibility reflects not innovation, but indifference, as is often the case, the plan will not be an effective method of guiding growth. A "plan-as-you-go" attitude benefits only a limited element of the community, and in fact, it often results in detrimental effects for the community on a long-term basis. If planning is to be effective, it must have the support of those charged with its implementation. If it is adopted only to satisfy legislative requirements at a higher level of government and is ignored on a continuing, practical basis, there is, in effect, no plan at all.

Of concern is the development of a viable and practical plan to guide orderly land use and resource development in the Region as well as commitment to its intent and specific policies from those responsible for its enforcement. If successful, a "plan for the future" will be more than a glossy document; it will be an active and vigorous instrument to remedy existing problems and accommodate future changes.

5.2 ALTERNATIVE EVALUATION

To provide for a full understanding of the differences between the land use alternatives the land use issues discussed above have been used to develop specific criteria to compare the environmental, economic, and land use aspects of each alternative. In many cases the land use issues encompassed factors which lead to the selection of more than one criteria. The evaluation criteria are presented below. The table following each section relates the land use alternatives to the evaluation criteria.

5.2.1 Environmental Criteria

The environmental criteria identified below were developed to evaluate the effects the land use alternatives will have on the environmental resources of the Region. Each criteria is designed to ask the question "To what extent does the land use alternative..."

1. Avoid development in environmentally hazardous areas
2. Avoid development in environmentally sensitive areas
3. Impact regional air quality
4. Impact local air quality

5. Impact noise levels
6. Promote conservation of domestic water resources
7. Promote conservation of energy resources
8. Effect the scenic quality of the Region

Table 5.2.1 indicates how the land use alternatives compare with these environmental criteria.

5.2.2 Land Use Criteria

The differences in the land use patterns portrayed by the alternatives can be better understood by comparing them with the criteria listed below. These land use criteria were selected to help differentiate the physical consequences of the land use alternatives. Each criteria is designed to ask the question "To what extent does the land use alternative result in or support..."

1. Concentrated or dispersed land use pattern
2. Direct consumption of agricultural land
3. Premature conversion of agricultural land
4. Infilling of vacant lands
5. Existing planning and zoning designations
6. Revitalization of deteriorating urban areas
7. Development in proximity to employment and commercial centers
8. Increased urban densities
9. Sense of community

Table 5.2.2 indicates how the land use alternatives relate to the above criteria.

5.2.3 Economic Criteria

The economic criteria listed below were developed to compare the effects which the land use alternatives would have on the Region's economic or man-made resources. Each of these criteria is designed to ask the question "To what extent does the land use alternative efficiently utilize existing..."

1. Wastewater treatment facilities
2. Transportation and circulation network
3. Police and fire protection services
4. Parking areas
5. Civic services and facilities

Table 5.2.3 compares these criteria with the land use alternatives.

TABLE 5.2.1 ENVIRONMENTAL CRITERIA

	A	B	C	D
1. Avoid Development in Environmentally Hazardous Areas	Floodprone areas designated for extractive industries, agricultural production, open space, or recreation. Development in other hazardous areas avoided.	Floodprone areas designated for extractive industries, agricultural production, open space, or recreation. Development in other hazardous areas avoided.	Floodprone areas designated for extractive industries, agricultural production, open space, or recreation. Development in other hazardous areas avoided.	Floodprone areas designated for extractive industries agricultural production, open space or recreation. Development in other hazardous areas avoided.
2. Avoid Development in Environmentally Sensitive Areas	Development infringes on following riparian habitat areas: 1. Carter Lake 2. Boedecker Lake 3. Boyd Lake Area 4. Terry Lake 5. Horsetooth Reservoir 6. Reservoirs north of Ft. Collins 7. Timnath Reservoir	Development infringes on following riparian habitat areas: 1. Boyd Lake Area 2. Terry Lake 3. Reservoirs north of Ft. Collins	Development infringes on following riparian habitat areas: 1. Boyd Lake Area 2. Terry Lake 3. Reservoirs north of Ft. Collins	Development infringes on following riparian habitat areas: 1. Boyd Lake Area (to a lesser extent than A,B or C) 2. Terry Lake (to a greater extent than A, B or C) 3. Reservoirs north of Ft. Collins (to a greater extent than A, B or C)
3. Impact on Regional Air Quality	Reflects the most dispersed land use pattern resulting in highest VMT and largest associated increase in regional air pollution.	Concentrated land use pattern results in lower VMT and associated lower regional air pollution problems than A or C.	Dispersed land use pattern results in higher VMT and associated greater regional air pollution problems than B or D but less than A.	Reflects the most concentrated land use pattern resulting in lowest VMT and associated increase in regional air pollution problems.
4. Impact on Local Air Quality	Dispersed land use pattern would generate localized pollution problems in newly developed urban areas of Larimer County. Concentrated land use pattern in Greeley could intensify local pollution problems. Concentrated land use along U.S. 287 would create local problems.	Concentrated land use pattern in Ft. Collins and Loveland could intensify local problems without mass transit. Less concentrate land use pattern in Greeley would increase the area where local problems exist.	Concentrated land use along U.S. 287 would generate local problems in this area.	Highly concentrated land use pattern in Greeley, Loveland, and Ft. Collins could intensify local pollution problems without mass transit. Reduced local pollution problems in rural areas.

TABLE 5.2.1 ENVIRONMENTAL CRITERIA (Continued)

	A	B	C	D
5. Impact on Noise Levels	Ambient noise levels increased throughout existing rural areas of Larimer Co. and U.S. 287 where development would occur. Increased ambient noise levels in cities of Loveland and Ft. Collins due to growth. Compounded increase in ambient noise levels in Greeley due to intensification of land use and growth.	Ambient noise levels in rural areas generally not impacted. Levels in Greeley, Ft. Collins, Loveland increased due to growth.	Ambient noise levels along 287 increase due to designated growth noise levels in major urban areas also increase due to growth.	Ambient noise levels in rural areas not impacted. Levels in major urban areas compounded due to growth and intensification of urban development.
6. Promote Conservation of Domestic Water Resources (including lawn watering).	1. Promotes unnecessary consumption of water by low density scattered residential development throughout Larimer County. 2. Promotes conservation of water by increasing density of residential uses in Greeley.	Perpetuation of existing low density residential uses in major urban areas promotes unnecessary consumption of water resources.	Promotes unnecessary consumption of water in Greeley, Loveland, Ft. Collins and designated urban area along U.S. 287 by allowing low density residential uses.	Promotes conservation of water in Larimer and Weld Counties by increasing residential densities in Greeley, Loveland, and Ft. Collins.
7. Promote Conservation of Energy Resources	Increased VMT related to dispersed land use patterns in Larimer County will promote unnecessary consumption of gasoline. Concentration of land use in Weld County resulting in reduced VMT promotes conservation of gasoline. Low residential density would result in minimal domestic heating savings in all areas except Greeley	Concentrated land use pattern promotes gasoline conservation; however, to a lesser extent in Weld County than A and D. Conservation of domestic heating energy greater than A or C but less than D.	Development along U.S. 287 increased VMT over B and promotes unnecessary gasoline consumption in Larimer County (to a lesser extent than A) Same impact as B in Weld County. Medium-low residential density would result in minimal domestic heat savings.	Concentrated land use pattern throughout the Region reduces VMT and promotes conservation of gasoline. Hi density multiple unit dwellings in urban areas would potentially have least total domestic heating requirement.
8. Effect the Scenic Quality of Region	Will alter the visual character of the area between Loveland and Ft. Collins changing it from rural agricultural area to intermittent urban or suburban areas. Least change of visual character in Weld County.	Generally maintain rural area visual characteristics. Expansion of urban areas but only adjacent to existing urbanized areas.	Convert the Corridor along U.S. 287 to an urban area. Minor changes in fringes of other urban areas.	Least change in visual character of Weld County. Minor changes in visual character in urban fringe areas of Larimer County. Biggest change in area around reservoirs north of Ft. Collins

TABLE 5.2.2 LAND USE CRITERIA

	A	B	C	D
1. Concentrated or Dispersed Land Use Pattern	Highly dispersed land use pattern in Larimer County and highly concentrated land use pattern in Weld County.	Concentrated pattern in Larimer and Weld Counties; however, Greeley is not as concentrated as in A or D.	Less concentrated land use pattern in Larimer County than B with development along U.S. 287. Same pattern for Weld County as B.	Most concentrated land use pattern throughout Region.
2. Direct Consumption of Productive Agricultural Land	17,200 acres 2.2% of Regional Total	21,400 acres 2.6% of Regional Total	22,100 acres 2.7% of Regional Total	13,000 acres 1.6% of Regional Total
3. Premature Conversion of Agricultural Land	Promote the continued premature and essential conversion of agricultural land in Larimer County to transitional vacant uses. Promote the retention of productive agricultural lands in Weld County for Agricultural uses until necessary for urban use.	Promote retention of agricultural lands for agricultural uses by providing guidelines as to which lands should be ultimately developed.	Same as B	Same as B
4. Infilling of Vacant Lands	Much of the vacant land within the incorporated areas of Larimer County would remain vacant. Extensive infilling in the incorporated areas of Weld County would result.	Infilling of vacant lands would occur in all incorporated areas of the Region.	Infilling would occur but to a lesser extent than B to allow for development along U.S. 287.	Reflects the most intensive infilling in all incorporated areas of the Region.
5. **Existing Planning and Zoning Designations**	Closely follows existing planning policies and zoning designations in Weld County. Follows past policy of allowing dispersed development in Larimer County where roughly only 20% of land zoned for commercial uses along U.S. 287 have been developed.	**Generally consistent with Weld County policies. Reflects pattern inconsistent with trends in land use decisions in Larimer County.**	**Same as B.**	**Same as B.**

TABLE 5.2.2 LAND USE CRITERIA (Continued)

	A	B	C	D
6. Revitalization of Deteriorating Urban Areas	Would support urban renewal programs in Weld County particularly for the downtown Greeley area. Would perpetuate the deterioration of downtown Loveland and Ft. Collins and lead to potential failure of urban renewal programs in those cities.	Would support urban renewal programs throughout the Region, but to a lesser extent than A or D.	Would support Greeley's urban renewal program in a manner similar to B. Would perpetuate the deterioration of downtown Loveland and Ft. Collins by possibly providing a mid-city shopping area.	Would strongly support urban renewal and revitalization programs throughout the Region.
7. Development in Proximity to Employment and Commercial Centers	Development in Weld County concentrated around existing communities would be in close proximity to existing centers. Scattered development in Larimer County would not be in close proximity to existing centers; however, small new centers could develop in new residential areas.	Development throughout the Region would be in close proximity to existing centers. Thereby stimulating new centers to locate in the same areas.	Development along U.S. 287 corridor would create the possibility of this area becoming a new center. Generally development, except U.S. 287 corridor, close to existing centers.	Same as B.
8. Increased Urban Densities Existing Density Greeley 4.2 p/ac Ft. Collins 4.8 p/ac Loveland 4.2 p/ac Windsor 3.1 p/ac	Year 2000 Density People/acre 6.53 4.31 3.22 6.25	Year 2000 Density People/acre 5.91 5.46 4.71 6.00	Year 2000 Density People/acre 5.91 5.43 3.92 6.00	Year 2000 Density People/acre 6.53 5.82 6.6 6.25
9. Sense of Community	Supports community identity of rural and urban areas in Weld County. Alters identity of rural area between Loveland and Ft. Collins and creates an area of suburban sprawl from Loveland to Ft. Collins.	Supports Community identity of all rural and urban areas in Region.	Creates an urbanized strip from Loveland to Ft. Collins altering rural character of this area and linking two cities. Supports community identity in rural and urban areas of Weld County.	Same as B.

TABLE 5.2.3 ECONOMIC CRITERIA

	A	B	C	D
1. Wastewater Treatment Facilities	Result in underutilization of Ft. Collins system by approximately 50% a minor underutilization of Loveland's system, and total use of Greeley's system by 2000. Would require the expansion of south Ft. Collins system to twice its present capacity and expansion of Windsor's system. Would require extensive new collection lines to service scattered development in Larimer County.	Result in minor underutilization of major urban systems. Would not utilize capacity of south Ft. Collins system. Would require expansion of Windsor's system.	Result in minor underutilization of all major urban systems including south Ft. Collins. Would require extension of collection lines to service development along U.S. 287. Would require expansion of Windsor's system.	Result in maximum utilization of urban systems except south Ft. Collins which would be underutilized. Would require expansion of Windsor's system.
2. Transportation and Circulation Network	Require new or improved E-W and N-S corridors to serve scattered development between Loveland and Ft. Collins. Could result in traffic congestion in all urban areas. Require more traffic lights and increase travel times between Ft. Collins and Loveland than B,C,D. Hinder the efficiency of a regional or intra-urban mass transit system.	Require maximum utilization of existing urban arterials, but no expansion of new cross-county corridors. Encourage intra-urban mass transit.	Require improvement of U.S. 287 to accommodate new development. Would support operation of intra-urban and possibly an inter-urban, between Loveland and Ft. Collins, mass transit system. Require more traffic lights and increased travel time than B, but less than A.	Same as B. Encourage intra-urban mass transit.
3. Police and Fire Protection	Require the costly provision of police and fire protection services to scattered development in Larimer County. Require more lengthy response times for emergency service if new facilities are not located in new population areas. Loveland and Ft. Collins would also have to increase services to provide for increased non-resident shoppers and employees.	Require expansion of existing facilities, but only within urban areas. No extensive new facilities would be required.	Require the development of facilities to provide adequate protection to development along U.S. 287 and expansion of existing facilities.	Same as B.

TABLE 5.2.3 ECONOMIC CRITERIA (Continued)

	A	B	C	D
4. Parking Areas	More required because of scattered reliance on individual automobile travel.	Less emphasis on intra-urban individual auto travel, less parking required.	More required because of scattered reliance on individual automobile travel but not as pronounced as A.	Same as B.
5. Civic Services and Facilities	Scattered development in Larimer County would result in corporate area non-residents using recreational and cultural facilities supplied by the cities of Loveland and Ft. Collins without paying taxes.	Encourages more equitable use and payment for recreational and cultural facilities supplied by cities of Ft. Collins and Loveland.	Same effect as A except not as severe.	Same as B

Chapter 6.0

CHAPTER 6.0

THE RECOMMENDED PLAN

It is the intent of this Chapter to recommend a strategy for the orderly use of land in the Region to the year 2000. Recommendations reflect the review of regional characteristics (Chapter 2.0); evaluation of land use determinants conducted by city, county, and regional planners and the consultant as expressed in the land use suitability analyses (Chapter 3.0); land use alternatives reflecting historic trends in regional land use decisions, policies of the Citizen's Committee, and policies adopted by local governing authorities (Chapter 4.0); the evaluation of the land use alternatives in terms of land use issues and associated evaluation criteria raised by the alternatives (Chapter 5.0); and the professional judgment of the consultant.

It should be pointed out that the recommendations contained herein constitute preliminary policy directions since they are based on a limited scope of investigation. They do represent a "starting point" or framework, requiring refinement based on more definitive and comprehensive evaluations. Efforts such as the Section 208 wastewater management technical engineering analyses and local planning are mechanisms of refinement and validation.

However, it should be cautioned that in developing community land use concepts, the initial focus must be on the Region. No community exists in isolation from all others; actions exercised in one often impact all others. Independent and unconstrained activities in each community or geographic area, without reference to the regional context, can incur significant long-term impacts. The classic example is the independent development of rail transit in two adjacent communities; wherein the rails of an intercommunity line were offset so that only the inside rail connected. The impacts are obvious.

Elements of the recommended plan include:

1. Population projections and related land use demands.

2. Statement of policies to resolve the issues raised by the land use suitability analysis and land use alternatives.

3. Application of the policies to the allocation of land uses in the Region.

Items 1 and 2 are discussed in the Plan Derivation section of this Chapter; Item 3 is included in the Plan Description section.

6.1 PLAN DERIVATION

To ensure orderly utilization and efficient management of the regional resources, it is essential to determine the lure of anticipated growth for the entire Region and for each of the communities within the Region. Only in this manner can the expenditure of funds for unneeded public service systems (roadways, sewers, waterlines, schools, health facilities, police and fire protection) be avoided. Unconstrained and unrealistic projections for the Region or the local communities can result in overbuilding of service systems, which ultimately incurs significant costs for the local taxpayer.

6.1.1 Population Projections

One measure of regional and community growth is reflected by the population increases anticipated to occur within a given time period. As discussed in detail in Section 4.1, the LWCOG has developed a series of regional population projections which adequately serve as an indicator of regional growth and therefore as a basis for land use planning. According to these projections (see Table 4.1) the regional population is expected to increase to 506,000 people by the year 2000; an increase of approximately 113 percent over the 1975 level of 239,200 people.

To determine the anticipated growth for each of the communities within the Region, a series of community population projections were developed. These projections were developed in close coordination with the local planning staffs using the regional projections as a control total. The first step in developing the local projections was to calculate the percentage of regional growth that each community attracted during the 1970 to 1975 period. This period was selected because the Region experienced very rapid growth during this time period. It was then assumed that each community would continue to attract that percentage of regional growth between 1975 and 2000. Certain exceptions were noted, such as the potential increase in the ability of Windsor to attract urban growth due to the presence of Kodak. The local population projections resulting from this relatively simple statistical procedure were then reviewed by local planning staffs and revised upwards and downwards to reflect local growth management policies and other factors that were expected to alter the basic assumption. In this way the population projections developed for the communities within the Region are sensitive to local growth trends and to the regional growth potential as identified by the results of the regional population projection process. This procedure for developing community population projections is consistent with EPA's proposed guidelines concerning Grants for Construction of Treatment Works (Federal Register February 4, 1977).

Table 6.1.1-A includes the community population projections developed following the methodology discussed above for Larimer and Weld Counties.

The information in Table 6.1.1-A suggests that the majority of the anticipated regional growth will occur within the major urban areas of Greeley, Loveland, Ft. Collins and Windsor. The smaller communities will experience some growth and a few specific unincorporated urban and rural areas will also grow during the planning period. However, the rural areas scattered throughout the Region will only experience limited growth. In fact, during the 1975-1980 period, a portion of existing rural areas will be incorporated into urban areas.

As discussed in Section 4.1, the regional population projections used as a control total for the community population projections, were developed by the LWCOG and provided to the land use consultant as a basis for land use planning. Evaluation of the subregional conditions characteristics indicate that changes in the regional population projection would primarily effect the population projections for the major urban areas. Loveland, Ft. Collins, Greeley, and Windsor would not significantly alter the projections for the other communities in the Region. Table 6.1.1-B reflects the population levels for the major urban areas assuming a regional population of 456,000 by the year 2000 instead of the 506,000 level initally indicated.

TABLE 6.1.1-A REGIONAL AND COMMUNITY POPULATION PROJECTIONS [a]
(November 1977)

	1970 [b]	1975 [c]	1980	1985	1990	1995	2000
LARIMER COUNTY							
Incorporated Areas [d]							
Berthoud	1,446	2,072	3,800	4,500	5,300	6,000	7,000
Estes Park	1,616	2,052	2,100	2,500	3,000	3,300	3,900
Fort Collins	43,337	60,600	80,200	96,200	112,500	127,000	149,400
Loveland	16,220	24,926	31,300	37,800	43,400	52,000	60,900
Timnath	177	153	450	550	650	700	800
Wellington	691	1,213	2,000	2,400	2,700	3,100	3,700
Unincorporated Areas							
Boxelder S.D.		1,500 [a]	3,330	3,980	4,640	5,250	6,000
South Fort Collins S.D.		1,500 [a]	4,450	5,510	7,590	8,590	10,000
Spring Canyon S.D.		800 [a]	1,000	1,250	1,500	1,750	2,000
Red Feather/ Crystal Lakes		250 [a]	600	1,000	1,300	1,700	2,000
Upper Big Thompson S.D.		2,000 [a]	2,200	2,500	2,900	3,500	4,000
Other	26,413	30,233	28,395	30,115	30,450	30,510	31,300
Total Larimer County	89,900	127,299	159,825	188,305	215,930	243,400	281,000

TABLE 6.1.1-A (Continued)

	1970[b]	1975[c]	1980	1985	1990	1995	2000
WELD COUNTY							
Incorporated Areas [d]							
Ault	841	932	1,800	2,100	2,400	2,700	3,000
Dacono	360	1,243	2,500	3,200	3,700	4,200	4,600
Eaton	1,389	1,629	2,500	2,900	3,300	3,700	4,000
Erie	1,083 [e]	1,651 [e]	1,600 [e]	1,600 [e]	1,650 [e]	1,700 [e]	1,800 [e
Evans	2,570	3,455	5,000	6,500	7,400	8,300	9,100
Firestone	570	811	1,000	1,100	1,300	1,400	1,600
Fort Lupton	2,489	3,041	5,000	6,500	7,400	8,300	9,000
Frederick	696	705	1,800	2,300	2,600	2,900	3,200
Garden City	142	197	250	250	250	250	250
Gilcrest	382	451	500	500	800	800	800
Greeley	38,902	53,500	66,000	78,200	92,800	105,800	115,850
Grover	121	175	175	175	175	175	175
Hudson	518	683	1,000	1,200	1,300	1,400	1,500
Johnstown	1,191	1,580	1,600	1,600	1,600	2,000	2,200
Keenesburg	427	505	550	800	800	1,300	1,300
Keota	6	2	10	10	10	20	20
Kersey	474	665	1,700	2,100	2,500	2,800	3,000
La Salle	1,227	1,780	2,575	3,200	3,700	4,200	4,500
Lochbuie	650	1,038	1,050	1,100	1,250	1,400	1,500
Mead	195	216	215	215	500	500	500
Milliken	702	1,117	1,500	2,475	3,100	3,600	4,000
New Raymer	68	86	70	70	85	85	85
Nunn	269	318	325	325	350	350	350
Pierce	452	714	1,200	1,700	2,000	2,500	3,000

TABLE 6.1.1-A (Continued)

	1970[b]	1975[c]	1980	1985	1990	1995	2000
Platteville	683	1,024	2,100	2,800	3,200	3,400	3,600
Rosedale	66	67	75	75	100	100	100
Severance	59	78	80	600	700	700	800
Windsor	1,564	2,426	4,000	6,000	7,500	8,600	10,000
Unincorporated Areas	31,201	31,812	30,500	32,000	33,500	35,020	35,170
Total Weld County	89,297	111,901	136,675	161,595	185,970	208,200	225,000
TOTAL	179,197	239,200	296,500	349,900	401,900	451,600	506,000

[a] Toups Corporation, November 1977.
[b] U.S. Bureau of Census.
[c] Local Planning Departments.
[d] 1970 and 1975 figures are for actual incorporated areas; 1980-2000 figures are for projected incorporated areas.
[e] Erie population reflects only Weld County portion.

TABLE 6.1.1-B URBAN AREA POPULATION PROJECTIONS [a]

	1975[b]	2000[c]	2000[d]	Change
Ft. Collins	60,600	149,400	125,000	24,400
Loveland	24,926	60,900	52,000	8,900
Greeley [d]	57,735	128,800	114,600	15,200
Windsor	2,426	10,000	8,500	1,500
Total	141,427	349,100	299,100	50,000

[a] Toups Corporation, 1977.
[b] Local Planning Departments.
[c] Assumes regional population projection of 506,000.
[d] Assumes regional population projection of 456,000.

This information, compared with the data presented in Table 6.1.1-A indicates that if for some reason the regional population projection is reduced by 10 percent, the major urban communities will generally experience a 15 percent reduction in the projected population levels. Such a reduction could easily be accommodated in the land use planning process by extending the target date for the plans in these areas. For example if the regional growth rate is 10 percent less than presently anticipated, the target year for the land use plan for the major urban areas would be extended 5 years. Therefore, land use planning is sensitive to projected population levels, but changes in control total population projections can be incorporated into the planning process without completely revising the plans.

6.1.2 Land Use Demands

To better understand the anticipated regional growth, it is important to determine the amount of land that will be required to accommodate the projected population levels. Based on the regional population projection of 506,000 people by the year 2000, an additional 30,570 acres of residential, 330 acres of commercial, 2,440 acres of industrial, 2,740 acres of institutional and 1,360 acres of local recreational land will be required. (Refer to Section 4.2 for a detailed discussion of these regional land use demands.)

Section 4.2 suggests that there is a linear correlation between the population level of an individual community and the amount of residential land required to accommodate that population. The specific relationship depends on the characteristics of the particular community, including family size, prevailing residential densities and trends toward intensification or lessening of densities. To develop a regional land use plan, the residential land use demands for each of the incorporated cities, certain unincorporated urban areas, and the rural areas were calculated. The basic assumption underlying these calculations of residential land use demands include:

1. For urban areas, an average family size of 3.2 people. This is consistent with the average family size of the urban areas of the Region.

2. For rural areas, an average family size of 3.5 people. This is consistent with the average family size of rural areas in the Region.

3. For urban areas, an average residential density of 3.5 dwelling units per acre which is consistent with the average density of present development activities in the urban areas.

4. For suburban areas, an average residential density of 3 dwelling units per acre.

5. For rural areas, an average residential density of 1.0 dwelling units per acre which is slightly higher than existing rural densities but accounts for a trend towards the infilling of undeveloped land within rural communities.

Table 6.1.2 presents the residential land use demands required to accommodate the projected population levels for the incorporated areas, certain unincorporated urban areas, and the rural areas of the Region. The averages reflected in Table 6.1.2 were allocated to each designated area according to the policies discussed in the following section.

Section 4.2 also suggests that the relationship between community population levels and commercial, industrial, institutional, and recreational land use demands is not linear and depends on other community factors. For that reason the commercial, industrial, institutional, and recreational land use demands were not disaggregated according to community areas. The acreages for these land use categories were allocated according to the land use policies discussed in the following section.

TABLE 6.1.2 RESIDENTIAL LAND USE DEMANDS [a]

Community/area	Population Increase 1975-2000	Family Size	Additional Dwelling Unit Demand	Density	Additional Acreage Demand
INCORPORATED AREAS					
LARIMER COUNTY					
Berthoud	4,928	3.5	1,408	2.0	469
Estes Park	1,848	3.5	528	1.0	528
Fort Collins	88,800	3.2	27,750	3.5	7,930
Loveland	35,974	3.2	11,240	3.5	3,270
Timnath	650	3.5	185	1.0	185
Wellington	2,487	3.5	710	1.0	710
WELD COUNTY					
Ault	2,068	3.5	590	3.0	195
Dacona	3,357	3.5	960	3.0	320
Eaton	2,371	3.5	675	3.0	225
Erie	149	3.5	40	3.0	14
Evans	5,645	3.2	1,765	3.5	505
Firestone	789	3.5	225	3.0	75
Fort Lupton	5,959	3.5	1,700	3.0	565
Frederick	2,495	3.5	710	3.0	565
Garden City	53	3.2	17	3.5	5
Gilcrest	349	3.5	100	3.0	35
Greeley	62,350	3.2	19,485	3.5	5,500
Grover	--	--	--	--	--
Hudson	817	3.5	230	1.0	230
Johnstown	620	3.5	180	1.0	180
Keenesburg	795	3.5	230	1.0	230
Keota	18	3.5	5	1.0	5
Kersey	2,335	3.5	670	1.0	670
La Salle	3,720	3.2	1,165	3.0	390
Lochbuie	462	3.5	130	1.0	130
Mead	284	3.5	80	1.0	80
Milliken	2,883	3.5	825	3.0	275
New Raymer	--	--	--	--	--
Nunn	32	3.5	1	1.0	1
Pierce	2,318	3.5	665	3.0	220
Platteville	2,576	3.5	736	3.0	245
Rosedale	33	3.5	10	1.0	10
Severence	722	3.5	205	3.0	65
Windsor	7,574	3.5	2,165	3.0	720

TABLE 6.1.2 (Continued)

Community/area	Population Increase 1975-2000	Family Size	Additional Dwelling Unit Demand	Density	Additional Acreage Demand
UNINCORPORATED URBAN AREAS					
Boxelder S.D.	4,500	3.2	1,406	3.5	402
South Fort Collins S.D.	8,500	3.2	2,656	1.0[b]	2,656
UNINCORPORATED RURAL AREAS					
Spring Canyon S.D.	1,200	3.5	342	1.0	345
Red Feather/ Crystal Lakes	1,750	3.5	500	1.0	500
Upper Big Thompson S.D.	2,000	3.5	570	1.0	570
Other	4,723	3.5	1,350	1.0	1,350

6.1.3 Recommended Land Use Policies

A Land Use Plan is a "policy document" to guide orderly growth to the year 2000. Policies represent the strategies for the use and management of the Region's environmental, economic, and social resources. They are derived in response to the results of the land use suitability analysis, the land use alternatives, the issues raised in the evaluation of the land use alternatives, and the evaluation criteria used to evaluate the alternatives. The following policies recommend the strategy that would result in the most efficient use of the Region's resources and be most responsive to existing land use policies.

6.1.3.1 General Pattern of Land Use Development in the Region

1. Population and land use growth shall be concentrated in and around existing communities.

2. Each community shall designate a breadth of land use types and densities within their jurisdiction. The larger areas shall designate lands in a manner to promote self-contained communities (i.e., residential, employment, commerce, recreation, cultural, public services). Smaller communities shall designate a range of uses appropriate to the market support (e.g., convenience commercial, local schools).

3. Intensification of existing land use densities and infilling of vacant parcels shall be encouraged.

4. Open space buffers shall be established between communities. These shall include recreational greenbelts and/or areas of agricultural production.

5. Proposals for the development of new residential projects not within or closely connected to existing communities shall be discouraged.

6. Proposed residential projects shall be encouraged to develop as "planned unit developments." In such cases, residential densities would be considered as an <u>average</u> for the total proposed development site, to promote clustering and the provision of open space.

7. Commercial development shall be encouraged to locate within existing communities, unless it can be demonstrated by the developer that the proposed commercial use cannot be reasonably located in these areas.

8. Commercial development designed to serve the agricultural base of the Region shall be located wherever practical within an existing community; however, whenever distance from a community makes this impractical or financially enviable, facilities within easy access to each agricultural area will be encouraged.

9. Automobile oriented commercial uses shall be encouraged to locate either within existing communities or at intersections of major highways and freeways. In the latter case, the developer must justify the need for the proposed commercial use, and define its associated environmental, economic, and social impacts.

10. Public service facilities (schools, libraries, health facilities, police and fire centers, governmental administrative facilities, cultural centers, etc.) shall be located within existing communities.

11. Neighborhood and community parks shall be provided in all urban areas.

12. Industrial uses shall be encouraged within existing communities; excluding low-employee related agricultural industries and those dependent on the unique resources of a particular site (e.g., mineral extraction, lumbering, etc.).

13. Costs of providing services within the communities, excluding those directly incurred by a developer, shall be borne by the community residents.

14. Proposals for new development outside existing communities shall be carefully evaluated according to their:

    a. Impacts on the regional distribution of land uses,

    b. Impacts on the economic viability of uses in existing urban areas,

    c. Costs to the residents of the Region for the provision of urban services,

    d. Impacts on agricultural production,

    e. Relationship to critical wildlife and vegetative habitats,

    f. Relationship to areas of environmental hazard,

    g. Impacts on regional and local recreational systems,

h. Impacts on school systems,

i. Requirements for modification of existing circulation and transportation systems,

j. Impacts on air quality,

k. Impacts on regional VMT and resultant air pollution and noise,

l. Relationship to regional and local water and wastewater management systems,

m. Consistency with resident attitudes and perceptions.

The means of the evaluation shall be an impact report prepared by an impartial third party. If significant impacts are deemed to occur, the developer shall propose means for mitigation. Based on this evaluation, the responsible jurisdictional agency shall judge as to the appropriateness of the proposed project.

15. If proposed development plans are accepted by the jurisdictional agency, the developer shall bear all costs associated with provision of:

a. Water service,

b. Sewer service,

c. Roadways,

d. Utilities,

e. Access of children to the nearest school,

f. Other services deemed appropriate by the jurisdictional agency.

Additionally appropriate regional, county, and city land use plans shall be modified to reflect acceptance of the proposed project.

6.1.3.2 Maintenance of Lands in Agricultural Production

1. Agricultural production shall be encouraged in those areas currently in or capable of production.

2. Fragmentation of lands in agricultural production by scattered development of residential, commercial, industrial, or other uses shall be discouraged.

3. Expansion of communities shall be limited to immediately contiguous areas, to prevent fragmentation of agricultural operations.

4. In defining service areas, agriculturally productive lands shall be considered and avoided to the extent possible.

5. Agricultural buffers shall be maintained between the communities of Fort Collins, Loveland, Windsor, Greeley, Berthoud, and other rural communities in the Region.

6. Expansion and development of agri-business and agriculturally, oriented industry shall be encouraged, provided adverse environmental or economic impacts are not incurred.

7. Proposed developments in productive agricultural areas shall be assessed according to impact on regional resources, with specific attention directed towards the impacts on the local and regional agricultural viability.

8. Nonagricultural development shall be encouraged to obtain its water from sources which are considered nonessential to the maintenance of agricultural production.

6.1.3.3 Relationship of Urban Growth to Existing Urban Services

1. Future urban development shall be encouraged in areas of or immediately contiguous to existing or planned urban services. Services which shall be considered should include sanitation, domestic water, energy, roadways, schools, health, cultural, parks, and police and fire protection.

2. Each community and jurisdictional agency shall specify service area to accommodate projected land use demands to the year 2000. Specific service areas should be phased in 5-year increments. The total area to be encompassed shall be limited to that necessary to support the year 2000 population. Modification to service area boundaries shall be considered no less often than every 5 years to reflect actual development patterns and changes in rates of population and land use development. The maximum extent of the boundaries shall relate to needs anticipated for a period no less than 15 and no greater than 25 years.

3. Adequate public services shall be provided in defined areas to meet the needs of the resident population.

They shall be expanded at a rate commensurate with growth. Phasing of their implementation shall be timed to prevent gaps in service. As feasible, non-utility services (libraries, recreational centers, etc.) shall be established in central urban areas, with branches located in outlying communities. When there is insufficient population to support a facility, a common facility, to be shared by a number of small communities, shall be established at a central point.

4. Existing districts with insufficient capacity shall be upgraded to meet forecast demands defined herein, or subsequent refinements adopted by the local jurisdictional agencies.

5. New special districts shall not be created without an comprehensive evaluation of the economic, environmental, and social impacts of such action prepared by recognized experts. New districts shall be responsive to potential demands and not be provided solely to stimulate growth.

6. Proliferation of service districts shall be discouraged while consolidation of existing service districts shall be encouraged when it tends to improve the efficiency and economy of the service.

7. New energy generation systems shall require a comprehensive analysis of environmental, economic, and social impacts. This evaluation shall be conducted by independently recognized experts. Particular attention shall be focused on alternative sites and alternative energy sources. Siting shall avoid sensitive ecological habitats, natural hazards, and urban and rural communities.

8. Any development that will create an undue burden on existing public facilities and will diminish the capacity of public agencies to maintain the existing level of service shall be discouraged.

9. Major arterials shall be developed on a regional basis (pursuant to Transportation Title 23, U.S. Code Section 134).

10. A unified and integrated circulation system shall be provided throughout the Region. It shall be differentiated according to its function (e.g., regional thoroughfare, arterial, secondary, and collector).

11. Existing street and highway facilities shall be utilized to the maximum extent possible.

12. The circulation system shall relate to existing land uses and topographic features. The system shall interconnect residences, commercial, employment, public services, and recreational areas in the Region.

13. Public transportation systems shall be evaluated according to their appropriateness and feasibility. Emphasis shall be placed on service to those of highest need (e.g., the low-income and elderly, who are dependent on public services). Attention shall be directed on the potential joint use of rail corridors throughout the Region.

14. Minimization of travel time shall be encouraged by concentrating community facilities, intensifying land use densities, minimizing outward expansion, and establishing central shopping and industrial facilities.

6.1.3.4 Infilling of Undeveloped Lands in Urban and Rural Communities

1. Development of vacant lands within communities shall be encouraged. Incentives, in the form of increased densities or tax bonuses, shall be offered to developers.

2. To heighten the economic attractiveness of undeveloped parcels, a phased service area boundary will be established around communities in the Region.

3. Disincentives, such as a higher utility connection fee, shall be considered by communities as a means to prevent "leap-frogging" development within the defined service areas. Such a fee should be graduated according to the distance from existing development.

6.1.3.5 Environmental Hazards

1. In areas deemed significantly hazardous to the health and welfare of the public, future development shall be limited and controlled unless appropriate corrective measures can be implemented.

2. Floodprone areas of the Cache La Poudre, Big Thompson, Little Thompson, South Platte and St. Vrain rivers, and Boulder Creek shall be designated as "Flood Plain Management Areas" and special development standards applied therein. These shall include:

   a. In the remainder of the flood plain area, residential, commercial, or industrial uses shall be facilitated, providing appropriate flood protective measures are exercised, subject to approval by the City or County Engineers (as applicable).

b. Wherever flood control measures are provided so as to eliminate the flood hazard, the Flood Plain Management Classification and appropriate requirements shall be removed.

c. Portions of all floodprone areas shall be maintained as permanent open space; providing a recreational greenbelt linking communities in the Region.

3. Areas of excessive slope (exceeding 30 percent) shall be designated as "Hillside Management Areas," with appropriate performance standards developed by cities and counties to minimize potential hazards (landslides, erosion, excessive runoff and flooding).

4. Within service areas, measures to mitigate the impacts of environmental hazards shall be exercised, where feasible, to facilitate infilling development. In particular, engineering and siting solutions shall be used in areas of severe and moderate building site soil constraints and erosion hazard. These measures should not be exercised, however, unless it can be demonstrated that they are consistent with the attainment of a unified community or are necessary for the maintenance of public health and welfare.

6.1.3.6 Environmental Sensitivities

1. Future growth shall be directed away from areas exhibiting high environmental sensitivity to land use development unless appropriate mitigating measures can be implemented.

2. Disruption and degradation of the environment shall be minimized as land use development occurs. Land uses shall be integrated so that they are compatible with natural environmental systems.

3. Expansion of urban uses into areas of rare and endangered species shall be prohibited. The breeding grounds of the White Pelican surrounding Milton and Lower Latham reservoirs and the wintering range of Bald Eagles along the South Platte River, east of Greeley, shall be designated as permanent open-space preserves.

4. Significant plant and wildlife habitats in the Region shall be designated as "Habitat Management Areas." These areas shall include:

a. Boyd Lake State Recreational Area,

b. Pawnee National Grasslands,

c. Wellington Wildlife Area,

d. Antelope ranges between Wellington and Nunn,

e. The foothills of the Front Range of the Rocky Mountains,

f. Black Hollow Reservoir,

g. Windsor Reservoir,

h. Banner Lakes Wildlife Area,

i. Barbour Ponds State Recreation Area,

j. Boedecker Lake,

k. Portions of the periphery of Carter Lake,

l. Portions of the periphery of Horsetooth Reservoir,

m. Marshes along the Cache La Poudre, Big Thompson, Little Thompson, South Platte and St. Vrain rivers, and Boulder Creek.

These areas shall be limited to grazing, educational observation, fishing, hunting, hiking, picnicking, and other light recreational activities. Habitat disturbance shall be prohibited, excluding specified hunting and fishing activities.

5. Environmental degradation shall be minimized by enforcing controls on sources of pollutants and noise. High levels of air and water quality shall be pursued. Sewage and by-products of industrial operations shall be treated and not permitted to degrade natural systems. In the construction of freeways, major highways, airports, and/or rapid transit lines, the counties and cities shall work closely with the relevant implementing agency to define and implement measures to control levels of pollution and noise. Any land use that will pollute any stream, body of water, subsurface aquifer, aquifer recharge, the air or surrounding surface shall require the development of a proper treatment facility or environmental protective operation before the land use can be allowed.

6. Land use development shall be concentrated within and adjacent to existing communities to minimize regional and local air quality and noise levels and disturbance of native vegetative and wildlife communities.

7. Sanitary waste collection and treatment systems shall be required in all service areas, and areas characterized by severe and moderate septic tank limitations.

6.1.3.7 Development in the Foothills and Valleys of the Front Range of the Rocky Mountains

1. All foothill areas characterized by slopes in excess of 30 percent shall be classified as "Hillside Management Areas" and appropriate conditions of development applied.

6.1.3.8 Recycling and Regeneration of Deteriorating Land Uses

1. Recycling and regeneration of deteriorating urban areas shall be encouraged. Appropriate rehabilitation, demolition, and rebuilding programs shall be pursued. Continued maintenance and rehabilitation shall be encouraged to prevent community deterioration.

2. To prevent further deterioration and provide an incentive for public sector redevelopment, residential densities shall be intensified in areas immediately adjacent to the older "downtown" areas of Fort Collins, Greeley, and Loveland.

3. Extensive expansion of urban uses in the U.S. Highway 287 corridor between Fort Collins and Loveland shall be discouraged, to minimize shifts of commercial and residential centers. To counter the deterioration of the downtown areas caused by development along U.S. Highway 287, growth shall be focused to the north of Fort Collins (north of the Cache La Poudre River, in the area of the cluster of lakes) and to the southwest of Loveland (south of the Big Thompson River, toward Boedeker Lake).

4. Expansion of Greeley to the west along U.S. 34 shall be discouraged. Older downtown areas of Greeley shall be converted from low density residential use to higher density uses as the existing structures require replacement. Both actions will counter the deterioration of the downtown Greeley area.

5. Through the use of the appropriate local public agencies, the provision of public facilities deemed necessary for the revitalization of deteriorated community areas shall be pursued.

6. Educational programs shall be established promoting continuing maintenance of housing. A program of seminars shall be conducted at local schools to inform the public regarding maintenance techniques and available funding.

7. As sufficient community development funding becomes available, grants for the rehabilitation of deteriorating units shall be made available by the counties and cities.

6.1.3.9 Development in the U.S. Highway 287 Corridor between Fort Collins and Loveland

1. Development of a continuous strip of urban uses in the corridor along U.S. Highway 287, between Fort Collins and Loveland shall be discouraged.

2. Development of "Residential Planned Unit Developments" shall be encouraged in the area immediately south of Harmony Road, flanking U.S. Highway 287.

3. Development of Fort Collins shall be encouraged to Harmony Road as its southern limit; and Loveland to approximately two (2) miles north of Lake Loveland, as its northern limit.

4. Areas between the Residential Planned Unit Developments and Loveland shall be encouraged to remain in agricultural production. Tax incentives shall be considered as a means to maintain the economic viability of the area for agricultural use.

5. Commercial uses shall be discouraged along U.S. Highway 287 from Harmony Road to the northern limits of Loveland, unless it can be reasonably demonstrated by the developer that the proposed commercial use cannot be reasonably located in other areas.

6.1.3.10 Conservation of Natural Resources

1. Development of urban land uses (residential, commercial, industrial, and public facilities) shall be concentrated in and adjacent to existing development to minimize consumption of limited water and energy resources.

2. Land use densities shall be intensified to promote the viability of mass movement systems in the urban communities.

3. Development of residences apart from existing communities shall be discouraged, to minimize the total vehicle miles traveled and energy consumption in the Region.

4. Use of alternative energy resources (e.g., solar) shall be encouraged in the development of residential tracts.

5. In developing strategies for the treatment of wastewater discharge, the feasibility of reuse for agriculture, injection into the ground water supply, industry, and/or use as cooling water for electrical generation shall be examined. When treated or percolated wastewater is deemed safe for these uses, such actions shall be encouraged.

6. Development shall be discouraged in areas of potential mineral extractions. These include oil extraction in the southwest, coal deposits in the northeast, and sand and gravel deposits along the Poudre, Big Thompson and South Platte rivers.

6.1.3.11 Effective Implementation of the Land Use Plan

1. Plan flexibility shall be encouraged as a means of accommodating changing demands and lifestyles and inducing innovation for the benefit of the region. However, the plan shall not be flexible to the point that it has no real significance or control. It shall be utilized as an active and persuasive tool in guiding the region's future.

2. Population growth and land use development should be monitored, and appropriate plan and zoning designations should be updated by the counties and cities in the Region. These procedures should be utilized no less often than every 5 years. As the demand for land approaches saturation, service area boundaries should be expanded into areas suitable for development. In expanding the service areas, specific attention should be directed to:

   a. Revision of environmental data base.

   b. Revision of land use suitability maps.

   c. Employment and population forecasts.

   d. Economic, environmental, and social impacts of alternatives.

3. Proposed projects inconsistent with the intent or defined policies of the land use plan shall not be permitted without a comprehensive evaluation of the economic, environmental, and social impacts of the actions conducted by recognized experts.

6.2 PLAN DESCRIPTION

Application of the defined land use policies (Section 6.1.3) to the distribution and intensity of land uses for the year 2000 is illustrated in Figures 6.2-A and 6.2-B. Figure 6.2-A portrays the entire regional recommended strategy and Figure 6.2-B details the regional strategy within the Core Area. These plans represent the recommended strategy for the orderly use and management of the Region's environmental, economic, and social resources. As stated, the plan is based on the professional evaluation of the results of the land use suitabilities analysis, the land use alternatives, evaluation of the alternatives and the defined policies.

Figure 6.2-A and 6.2-B are generalized representations of detailed land use plans that are available for review in the LWCOG office. These generalized plans only differentiate between urban and nonurban land uses. However, the detailed plans reflect the land use classifications identified below and the allocation of the defined residential, commercial, industrial, institutional and recreational land use demand identified in Section 6.1.2.

6.2.1 Land Use Classifications

The land use classifications reflected on the detailed plans were developed relative to the type, intensity, and special conditions of the use of the land in the Region. These are applicable to the management of all land within the Region. General classifications have been developed due to the regional scope of the land use planning program. These clarifications may be disaggregated into more definitive classes by the counties and cities in their planning efforts. However, these regional classifications constitute a general level of description serving as a framework within which greater definition can occur. Classifications designated on the Recommended Land Use Concept include:

1. Urban

   Refers to all urbanized lands as depicted on the overall regional map plan.

2. Residential

   a. Low Density: refers to single-family detached dwelling units; areas generally in excess of one dwelling unit per acre are designated.

   b. High Density: refers to attached dwelling units (townhouses, condominiums, apartments, etc); areas generally in excess of twelve (12) dwelling units per acre are designated.

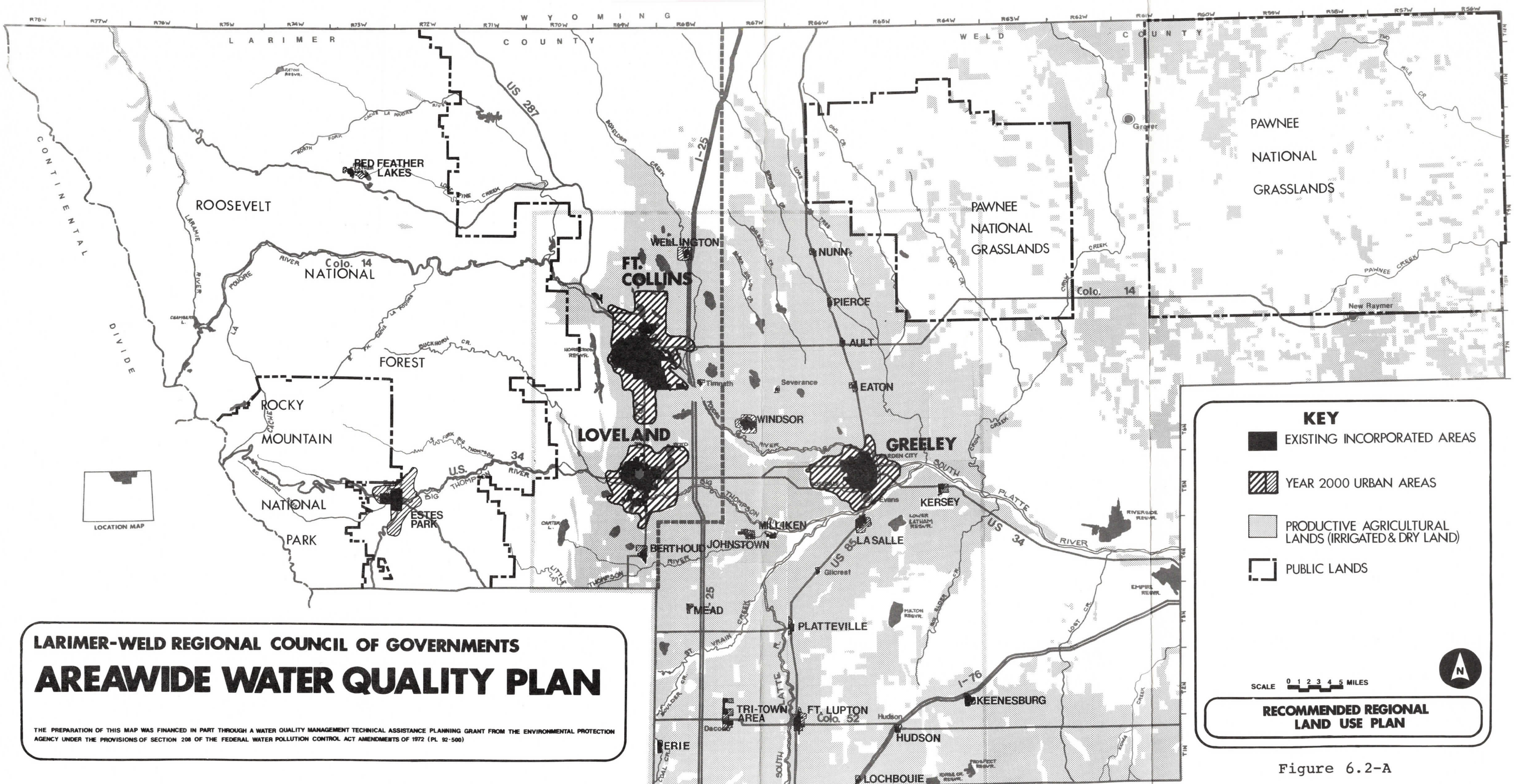
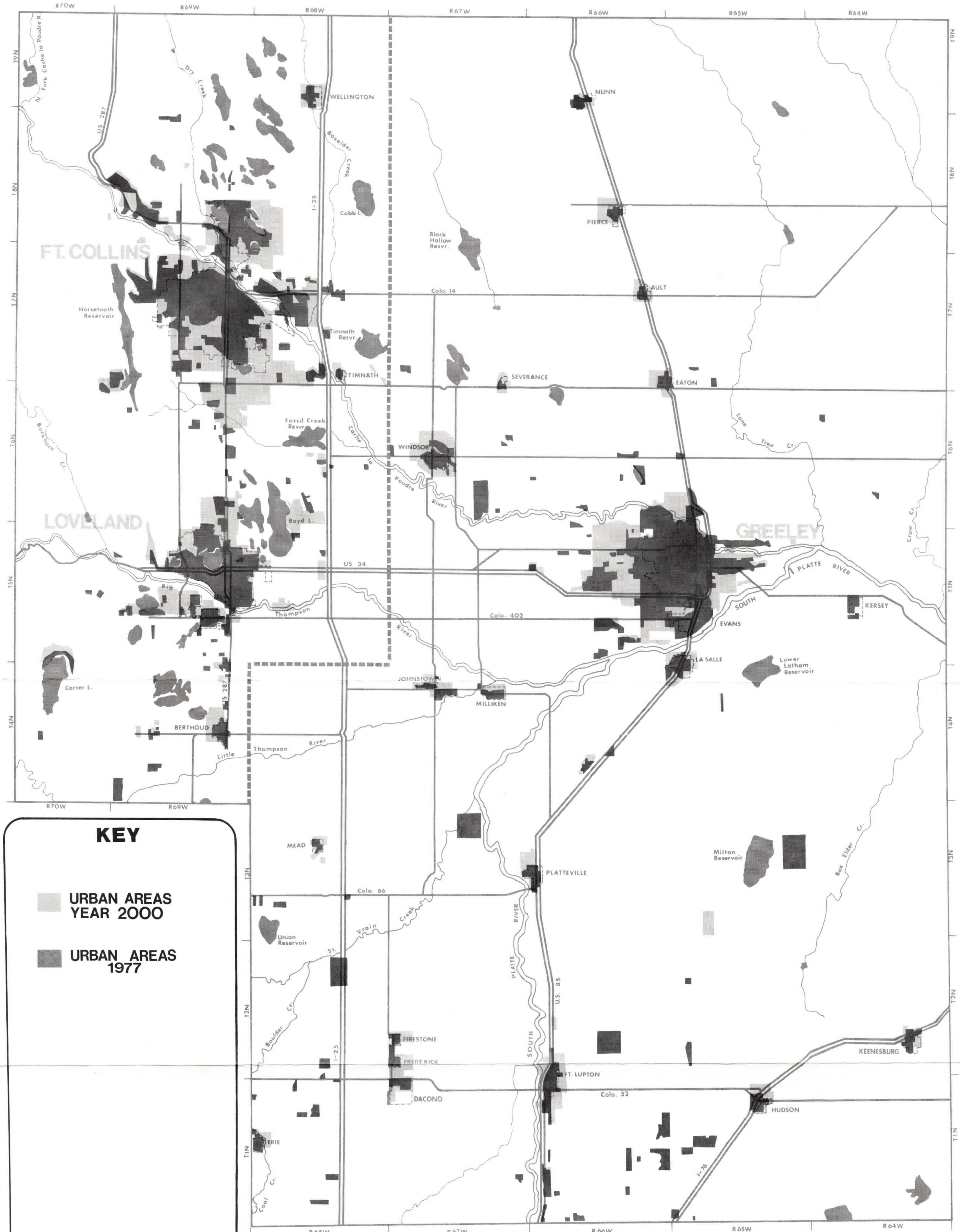

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
AREAWIDE WATER QUALITY PLAN
THE PREPARATION OF THIS MAP WAS FINANCED IN PART THROUGH A WATER QUALITY MANAGEMENT TECHNICAL ASSISTANCE PLANNING GRANT FROM THE ENVIRONMENTAL PROTECTION AGENCY UNDER THE PROVISIONS OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 (PL 92-500)
KEY
EXISTING INCORPORATED AREAS
YEAR 2000 URBAN AREAS
PRODUCTIVE AGRICULTURAL LANDS (IRRIGATED & DRY LAND)
PUBLIC LANDS
SCALE 0 1 2 3 4 5 MILES
N
RECOMMENDED REGIONAL LAND USE PLAN
LOCATION MAP
WYOMING
LARIMER COUNTY
WELD COUNTY
CONTINENTAL DIVIDE
ROOSEVELT NATIONAL FOREST
ROCKY MOUNTAIN NATIONAL PARK
PAWNEE NATIONAL GRASSLANDS
RED FEATHER LAKES
WELLINGTON
FT. COLLINS
LOVELAND
GREELEY
ESTES PARK
NUNN
PIERCE
AULT
EATON
WINDSOR
Severance
Timnath
KERSEY
MILLIKEN
JOHNSTOWN
BERTHOUD
LA SALLE
Gilcrest
MEAD
PLATTEVILLE
TRI-TOWN AREA
FT. LUPTON
ERIE
HUDSON
KEENESBURG
LOCHBOUIE
Grover
New Raymer
Evans
US 287
I-25
US 85
US 34
I-76
Colo. 14
Colo. 52
SOUTH PLATTE RIVER
BIG THOMPSON RIVER
LITTLE THOMPSON
CACHE LA POUDRE RIVER
BOULDER CREEK
ST. VRAIN CREEK
LONE TREE CREEK
CROW CREEK
LOST CR.
PAWNEE CREEK
RIVERSIDE RESVR.
EMPIRE RESVR.
MILTON RESVR.
LOWER LATHAM RESVR.
HORSETOOTH RESVR.

Figure 6.2-A



KEY

URBAN AREAS YEAR 2000

URBAN AREAS 1977

SCALE

0 1/2 1 2 3 4 5 MILES

N

Alternative E
Consultant's Recommended Plan

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

AREAWIDE WATER QUALITY PLAN

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Fig. 6.2-B

March, 1977

c. Subdivisions > 50 percent developed: refers to lands, generally in the mountainous areas of Larimer County, that have been subdivided and are more than 50 percent developed.

d. Subdivisions < 50 percent developed: refers to lands, generally in the mountainous areas of Larimer County, that have been subdivided but are less than 50 percent develped.

3. Commercial

Only areas in excess of ten (10) acres are designated. Neighborhood commercial areas are, generally, excluded. Commercial types have not been disaggregated, but include:

a. Community Commercial: refers to convenience goods stores serving several neighborhoods. Typical of uses within such developments are supermarkets, drugstores, small clothing stores and gift shops, hardware stores, shoe stores, jewelry stores, specialty shops, ice cream parlors, candy stores, coffee shops, small restaurants, donut shops, branch banks and savings and loan firms, etc.

b. Regional Commercial: refers to a concentration of uses serving a market area of many square miles and a population of 100,000 to 200,000. Included would be several major department stores, supporting clothing and service stores, an automobile center, hotels/motels, movie theaters, restaurants, and other related uses.

c. Office Commercial: refers to non-retail, professional offices (law, architecture, engineering, insurance, airlines, banks and savings and loan administration, medical, dental, and other such firms).

d. Recreational Commercial: refers to commercial uses oriented towards the needs of the users of the Region's recreational resources. These include boat service and equipment stores, private boat launching ramps, ski lodges, etc.

e. Airports (Loveland-Fort Collins, C.S.U., and Greeley).

f. Highway Commercial: refers to uses oriented to transient populations (automotive and truck service stations, restaurants, motels and hotels, etc.).

4. Industrial: refers to land that has been designated for light, medium, and heavy industrial uses with supporting service commercial. In general, light and medium areas shall be developed to industrial park standards in urban areas. Heavy industry shall be buffered from surrounding land uses.

5. Institutional: refers to educational facilities, governmental facilities, community, cultural and activity centers, health facilities, police and fire stations, and other public facilities. Generally, specific sites are not designated for future schools and public facilities; rather sites represent generalized locations to serve future concentrations of residential.

6. Recreation: refers to private and public community-oriented recreational uses. Neighborhood and most community parks, particularly those less than ten (10) acres in size, and linear greenbelts have not been designated. Generally, areas depicted include golf courses and major urban parks.

7. Transportation/Circulation Systems: includes freeways/expressways, major arterials, and principal secondary highways.

8. <u>Resource Management Areas</u>

   a. Hillside Management Areas: refers to all areas where the average slope exceeds thirty (30) percent.

   b. Flood Plain Management Areas: refers to the flood plains of the Cache La Poudre, Big Thompson, Little Thompson, South Platte and St. Vrain rivers, and Boulder Creek.

   c. Habitat Management Areas: refers to lands designated as critical vegetative and wildlife habitats.

9. Agricultural Lands: refers to those lands currently in agricultural production (irrigated or dryland); excluding those areas into which urban and rural communities are extended.

10. Woodlands: refers to all lands, primarily in the mountainous areas of Larimer County, that are forested.

11. Rangelands: refers to all lands used for open livestock grazing.

12. Water Bodies: refers to lakes, ponds, and reservoirs.

13. Other (for Core Area): refers to rangelands, the Pawnee National Grasslands (used for cattle grazing, limited recreation, and educational observation), and lands vacant and undeveloped.

6.2.2 Recommended Land Use Plan

The recommended land use plan for the year 2000 (Figures 6.2-A and 6.2-B) recognizes and emphasizes continuance of the prevailing patterns of land use, as balanced by the sensitive management of the area's unique environmental and social resources. Growth is concentrated within and adjacent to existing urban and rural communities; limiting outward expansion to defined service areas and discouraging development of new activity centers.

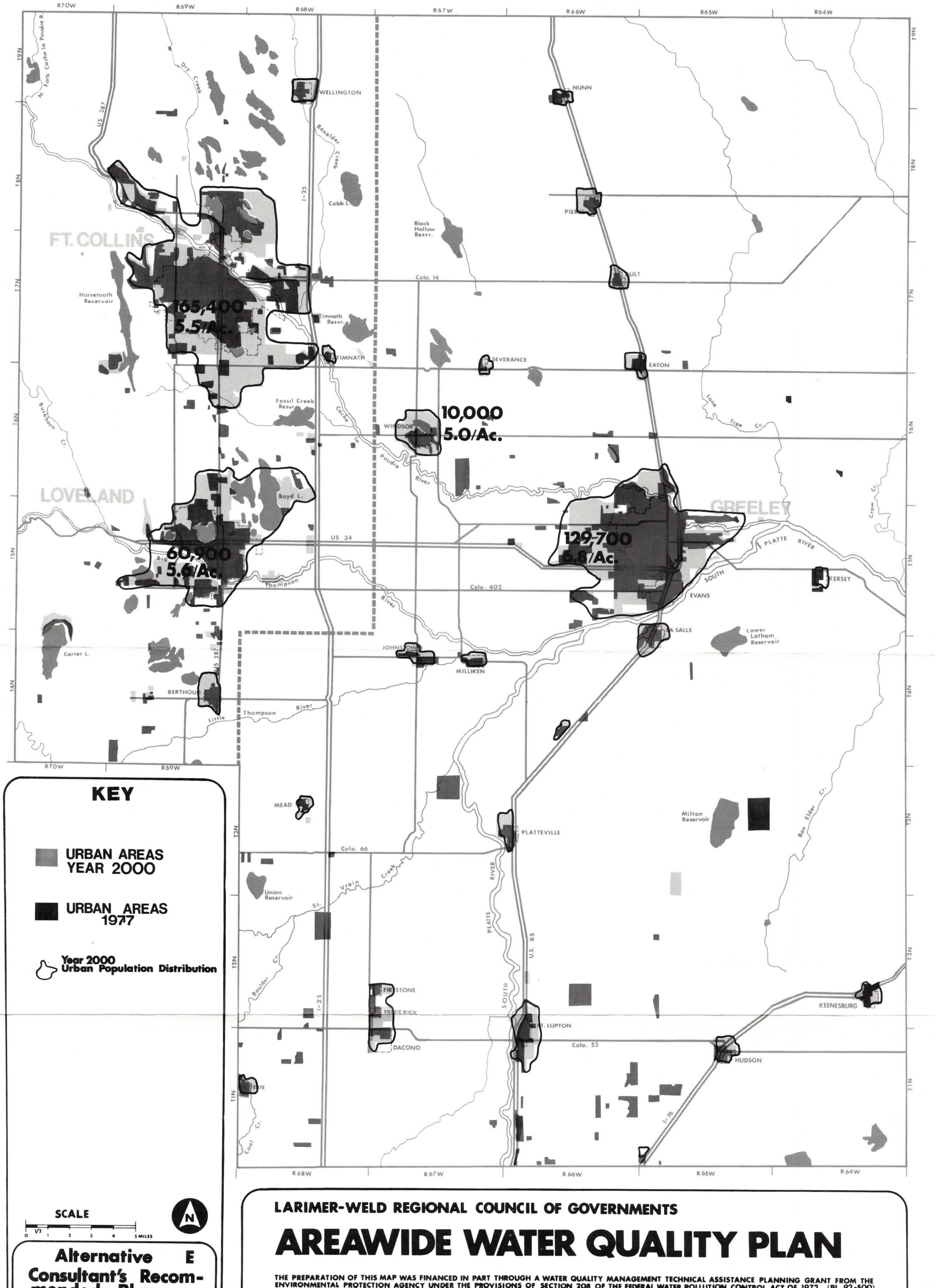
Most of the growth will be focused into the principal urban centers, Fort Collins, Loveland, Greeley and Windsor. As reflected in Tables 6.1.1-A and 6.1.2-A, these four urban areas will attract 77 percent of the regional population growth and require 61 percent of the additional residential acreage required to support the regional population. Table 6.2.2 and Figure 6.2.2 include the anticipated population densities associated with the recommended land use pattern. Due to the concentration of growth in and around these urban areas, the population density of each area would increase enabling the Region to realize the benefits of a concentrated land use pattern versus the costs of a dispersed land use pattern. The most extensive increase in density would occur in the Windsor area where the area would generally experience a change from a suburban density of 3.0 people per acre to a density of 5.0 people per acre, more reflective of an urban area. The Greeley area would also experience a significant increase, 55 percent, in population density due to the conversion of low density residential uses to more intense residential uses. The population densities of Loveland and Fort Collins would also increase, but not to as great an extent as in Windsor or Greeley.

Referring to Figure 6.2-B, development of Fort Collins is generally projected to Harmony Road in the south, to Overland Trail in the west, and along the south bank of the Cache La Poudre River in the east and southeast. Major expansion is projected to the north of the river, in the areas surrounding the cluster of lakes (Terry Lake, Windsor Reservoir, etc.). Development in this area extends approximately 2.0 miles north of the northern bank of the river (at U.S. Highway 287), to the northerly extension of Shields Avenue in the west, and approximately 2.5 miles to the east of U.S. Highway 287. Extensive development in this area is encouraged to offset the adverse economic impacts on the older downtown area of recent residential and commercial development in the

TABLE 6.2.2 POPULATION DENSITY OF MAJOR URBAN AREAS FOR RECOMMENDED LAND USE PLAN [a]

Area	Existing 1975 Acreage [b]	1975 Population [c]	1975 Population Density (People/acre)	2000 Acreage	2000 Population	2000 Population Density (People/acre)	Percentage Change in Density
Larimer County							
Fort Collins Area	13,500	63,600	4.7	30,000	165,400	5.5	+17
Fort Collins	60,000				149,400		
Boulder, S.D.	1,500				6,000		
S.F.C., S.D.	1,500				10,000		
Loveland Area	6,000	24,926	4.2	10,900	60,900	5.6	+33
Weld County							
Greeley Area	13,134	57,932	4.4	19,000	129,700	6.8	+55
Greeley		53,500			115,850		
Garden City		197			250		
Evans		3,455			9,100		
La Salle		780			4,500		
Windsor	800	2,426	3.0	2,000	10,000	5.0	+67

[a] Toups Corporation, 1977.
[b] LWCOG.
[c] Local Planning Departments.



LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS

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FIG. 6.2.2

March, 1977

south, along U.S. Highway 287. This will substantially increase the number of residents in close proximity of the downtown area and should encourage private sector redevelopment of the areas. Residential units could be clustered around the lakes and interconnected with common recreational spaces, which are also linked to the lakes, thereby maximizing the potential of this area to become a very desirable residential community.

South of the Cache La Poudre, in areas surrounding the downtown commercial sector, it is proposed to increase residential densities. This, coupled with the proposed development in the north, is intended to further increase the residential base for commercial uses in the downtown area. Multiple unit development is also recommended to the west of C.S.U., along Elizabeth Street, providing housing for faculty and students.

Residential uses are recommended to infill vacant parcels to the northwest approximately to the Cache La Poudre River and to the southwest of Prospect Avenue and U.S. Highway 287 to Overland Trail and Harmony Road. Throughout these areas supporting neighborhood commercial, schools, parks, and other public service uses should be located to serve the needs of the residents.

Development of Hewlett-Packard along Harmony Road, near I-25, will act as a significant attractor of future urban development. As a consequence, southeasterly growth of Fort Collins is proposed to extend to this facility. Generally, residential uses are depicted to extend 2.0 miles east of U.S. Highway 287. North of Harmony Road, extending for one mile, residential is proposed to link U.S. Highway 287 with Hewlett-Packard. As in other areas, supporting commercial, educational and public service uses should be developed throughout this area to meet the needs of the resident population.

Additional commercial development in Fort Collins is recommended adjacent to the downtown area, both north and south of the river, and along U.S. Highway 287 to Harmony Road. The northern development is intended to intensify and increase the economic viability of the downtown area. It should be developed as a concentration of community-oriented retail-commercial facilities, with uses similar to those found in the newer foothills regional center. In the south, undeveloped parcels in the U.S. Highway 287 strip should be developed to promote a pattern of contiguous use and prevent introduction of incompatible uses.

Intensification of Fort Collins industrial uses primarily is focused along Colorado Highway 14, within and adjacent to the flood plain of the Cache La Poudre River. Presently, the area is characterized by a scattering of industries. Vacant parcels should be infilled with uses compatible with those existing.

Loveland is characterized by growth to the southwest, west, north, and northeast. In the southwest, residential uses are extended from Taft Avenue to the southern shore of Boedecker Lake, along Colorado Highway 402. Development in this area will constitute a major new section of the community. The western, northern, and eastern shores of the lake should be maintained as recreational open space, reflecting the area's designation as a critical habitat. In the west, residential development is recommended east of Wilson Avenue and north of 28th Street, surrounding the golf course. East of Taft Avenue, residential development is proposed to extend approximately 2.0 miles north of 28th Street, and approximately 0.5 mile east of U.S. Highway 287 (to the Boyd Lake Recreation Area).

Minimal expansion is projected to the east along U.S. Highway 34, as it is limited by the southwest boundary of the Boyd Lake Recreational Area. Development to the southeast is limited by the lack of attractiveness of the area (principally attributable to the operations of the Great Western Sugar Refinery) and the Big Thompson River.

Single-family and multiple dwelling units are proposed in a limited area on the east shore of Boyd Lake, extending to the railway line. This tract is currently in early stages of development. Between this development and the Loveland-Fort Collins Airport, a light-intensity industrial park is proposed. Aside from serving as a buffer between the residences and the airport, it capitalizes on the potential attractiveness small-scale airports offer to research and development types of industries.

In the extreme west, north of U.S. Highway 34, along the hogback ridge, existing residential uses are extended north. Development should conform to "Hillside Management" policies with attention directed at maintaining the natural geologic formation through sensitive siting of units.

Throughout Loveland's residential areas, supporting commercial, schools, parks, and other public services should be located to meet the needs of the resident population.

New commercial development at the intersection of U.S. Highway 287 and 28th Street should be expanded to serve the increased residential population in the north of the city. Convenient retail-commercial facilities should be located here (goods, theaters, etc.). If sufficient demand for a major department store occurs, it should be located here.

Aside from the aforementioned industrial area around the airport, additional industry should be located in the south of the community adjacent to U.S. Highway 287 and within and adjacent to the flood plain of the Big Thompson River. Scattered industrial development in this area should be infilled with similar uses.

Between Fort Collins and Loveland, a residential planned unit development, accommodating a population of 10,000 is proposed. The area shall be bounded, generally, by Harmony Road on the north and Shields Avenue in the west, and extend approximately 2.0 miles south, and ranging from 2.0 to 3.0 miles east. The average density of development shall be one (1) dwelling unit per acre. However, clustering of units and the provision of open space shall be encouraged. Development of this character offers the opportunity to avoid continuous sprawl along U.S. Highway 287, provision of open space recreational and visual corridors, and establishment of a unique community image, clearly distinguishing the area from adjacent residential development. Schools, neighborhood commercial, local recreation, and other supporting uses shall be encouraged within this area.

Urban development in Greeley will be characterized by in-filling of the area between the Cache La Poudre and South Platte rivers, and expansion to the west. Expansion of urban uses north and south of the river is not recommended. Generally, westward expansion is projected to extend approximately 4.0 to 5.0 miles west of Eighth Avenue.

Residential densities are intensified in the downtown corridor, extending from First Street to the commercial center southeast of Northern Colorado University. In the northern portion of the corridor, multiple units should be developed to increase the resident market and the economic viability of older commercial areas. Additional areas will be designated for office commercial, to take advantage of the nearby governmental complex. In the southern portion, multiple units will provide needed housing for faculty and students and act to maintain the economic viability of the regional shopping center. The proposed expansion and intensification of residential and commercial activities, combined with the presence of governmental facilities including the University, create an opportunity for the development of a strongly defined and identifiable community core in Greeley.

East of the central community corridor and U.S. Highway 85, vacant parcels will be infilled with residential uses extending north from 24th Street to the Cache La Poudre River, and industrial extending south from 24th Street to an easterly extension of 28th Street.

West of the downtown corridor and north of 10th Street, residential uses will be extended to the south bank of the Cache La Poudre River. A large area of multiple dwelling units is proposed in the area ranging from 2.0 to 3.0 miles west of 23rd Avenue and extending 1.0 mile south of the river. In the southwest, residential development is proposed to infill the lands from U.S. Highway 34 in the north to 0.5 mile south of Colorado 402, and from U.S. Highway 85 in the east extending approximately 2.0 miles west.

In the western portion of Greeley, residential development is proposed to surround the golf courses south of Tenth Street and north of U.S. Highway 34. Multiple residential units are proposed in the area immediately, east of the golf course located on U.S. Highway 34. Presently, much of this land is sporadically developed; thus, it is recommended to infill all undeveloped lands.

Schools, local commercial, parks, and other public facilities shall be located throughout the residential areas to meet the needs of the population. They shall be located so that they are easily accessible, preferably by walking, from residences.

Additional commercial uses are proposed along 10th Street and U.S. Highway 34, and additional industrial uses within and adjacent to the Cache La Poudre River, west of Eleventh Avenue, and east of U.S. Highway 85, extending to the Greeley Airport. These commercial areas should be limited to convenience goods stores, fast-food establishments, and other highway oriented uses. Near the airport, industrial uses should be limited to light manufacturing and research and development facilities. Heavier industries should be encouraged west of Eleventh Avenue.

Located between Greeley and Fort Collins, Windsor is expected to experience a significant rate of growth due to its proximity to the Kodak site. Presently, most employees have chosen to reside in the three major urban communities for the access to the service and activities that can only be offered by a diversified urban environment. However, continuing employee growth at Kodak will encourage development of the area immediately adjacent to Kodak. Recent construction activity has validated this trend. Limited on the southwest by the flood plain of the Cache La Poudre River, future development of Windsor is projected to the southeast (adjacent to Kodak), northeast, and northwest. Supporting commercial, educational, and public service uses will be located throughout the Windsor community.

Review of Figure 6.2-B reveals a pattern of outward expansion and infilling of existing rural communities. Recommended patterns and directions of growth for each of these communities include:

1. Nunn: infilling of existing developed areas.
2. Pierce: growth to west of U.S. Highway 85.
3. Ault: growth to the west and south.
4. Eaton: to the west.
5. Evans: (discussed as an integral part of Greeley).
6. La Salle: to the east of U.S. Highway 85.
7. Gilcrest: to the west of U.S. Highway 85.
8. Platteville: west of U.S. Highway 85 to the South Platte River.
9. Fort Lupton: to the east.
10. Lochbuie: to the north and west.
11. Hudson: to the north and east.
12. Keenesburg: to the west and east.
13. Laporte: to the west, east of U.S. Highway 287.
14. Wellington: to the east, west, and south.
15. Timnath: to the northwest, along the Cache La Poudre River.
16. Severance: to the south.
17. Berthoud: to the northwest, west, and south.
18. Firestone, Frederick, and Dacono (the Tri-Cities): infilling and linking of the three communities; primary growth to the east and south.
19. Johnstown: to the east.
20. Milliken: to the north and east.
21. Mead: to the northeast.
22. Erie: to the east.

23. Carter Lake: infilling of undeveloped parcels.

24. Horsetooth Reservoir: south of existing development (on the western shore).

25. Kersey: to the west.

Throughout the Region sensitive ecological habitats have been classified as areas for resource management, thus prohibiting urban development and encouraging, in most cases, passive recreational activities (wildlife observation, hunting, fishing, etc.). The areas surrounding Lower Latham Reservoir and Milton Reservoir should be protected as the habitat of a rare and endangered species (the White Pelican). Activities herein should be limited to wildlife observations; hunting, fishing, cattle grazing, and development should be prohibited. Areas depicted as "Habitat Management Areas" include:

1. Boyd State Recreation Area, northeast of Loveland.

2. Pawnee National Grasslands, the northeast of the Core Area.

3. Wellington Wildlife Area, north of Fort Collins.

4. The foothills of the Front Range of the Rocky Mountains, excluding areas designated for residential development and agricultural production.

5. Black Hollow Reservoir, north of Highway 14.

6. Banner Lakes Wildlife Area, southwest of Keenesburg.

7. Barbour Ponds State Recreation Area, west of Mead.

8. Boedecker Lake, southwest of Loveland.

9. Portions of the periphery of Carter Lake.

10. Portions of the periphery of Horsetooth Reservoir.

Flood plains of the Cache La Poudre, Big Thompson, Little Thompson, South Platte and St. Vrain rivers, and Boulder Creek are depicted for the development of a continuous greenbelt linking communities along these rivers. This would facilitate the protection of life and property due to periodic flooding and provide a major recreational ammenity traversing the Region.

Areas currently in agricultural production (irrigated and nonirrigated farmlands), excluding those proposed for conversion to urban use, are designated for continued agricultural use. To the maximum extent feasible, fragmentation of these lands has been minimized to promote their continuing viability. In addition to their crucial role as a source of food, these areas act as significant open space buffers between the communities in the Region.

Scattered along and at intersections of the major thoroughfares outside communities are concentrations of highway-oriented commercial uses. Automotive and truck service facilities, restaurants and fast-food establishments, and motels are typical of the appropriate uses. Major concentrations are found at the intersections of:

1. Interstate 5 and Colorado Highway 52,

2. U.S. Highway 34 and Interstate 5,

3. Colorado Highway 14 and Interstate 5.

In the confines of the Region, there are nearly 1,500 square miles of federally owned or controlled land. Most of this land is in the Rocky Mountain National Park (see Figure 6.2-A), Roosevelt National Forest, and the Pawnee National Grasslands. Much of the land in the Rocky Mountain National Park and the Roosevelt National Forest is subject to intensive recreational use by residents of the Region, but even more so by tourists. It has been estimated that in 1975 approximately 5,000,000 recreation visitor-days occurred within these two areas and by the year 2000 these areas may be supporting as many as 7,000,000 visitor-days each year [LWCOG 1976]. Much of this visitor use is concentrated in the peak summer months when nearly 80 percent of the total visitor count in the Rocky Mountain National Park occurs. The present master plan for the national park calls for minimal expansion of the physical facilities within the park boundaries. This policy in concert with the anticipated increase in visitor use will create additional need for visitor services outside the park boundaries. Estes Park will be most affected by the increased visitor use. Much of the anticipated population increase for Estes Park and the Upper Big Thompson Sanitation District will occur in support of increasing tourist use of this area. Future growth of the Estes Park area is suggested toward the south and east. Extensive tourist oriented commercial development is also projected for the Estes Park area to accommodate the influx of nonresident tourists. This development will generally occur along U.S. Highways 34 and 36 east of the town and along Colorado 66 to the south and east.

Another area that is being affected by increased residential use in the mountainous portions of Larimer County is the Red

Feathers/Crystal Lake area. In excess of 3,000 lots have already been subdivided in this area (Figure 6.2-A). It is anticipated that the majority of these lots will be purchased for second home sites by residents of the Region and by people living outside the Region. However, the resident population of this area is also expected to increase significantly resulting in the creation of a small community. No new development areas are designated in the Red Feather/ Crystal Lakes area due to the availability of existing subdivided land.

Further review of Figure 6.2-A indicates that extensive areas in western Larimer County have been subdivided but are less than 50 percent developed. Relative to the projected growth in the rural portions of the Region (Tables 6.1.1-A and 6.1.2) there is more than sufficient land subdivided and undeveloped or partially developed to accommodate project growth. Therefore, no additional lands were designated for development in the rural portions of the Region.

Chapter 7.0

CHAPTER 7.0

PLAN MAINTENANCE PROCEDURES

The alternative plans presented in this report including the recommended plan all cover a planning period of approximately 25 years. Each alternative was based on assumptions and projections about the future of the Region. The Region could experience significant changes during the next years that could invalidate the assumptions or projections used to develop this plan. For example, the plans were based on an assumption that the private automobile will remain the primary mode of transportation in the Region at least through the year 2000. Any action that alters this assumption, such as a massive increase in the price of gasoline or restrictions on travel in the Region for the maintenance of air quality, would make the plan inoperable unless the plan includes an effective updating and maintenance program.

This chapter presents recommendations for a program to maintain and improve the plan that is adopted. Included in these recommendations are suggestions pertaining to the agencies that should carry out the maintenance procedures. The procedures discussed in this chapter are applicable to any agency that may end up with the responsibility for updating and maintaining the plan.

The plan maintenance program includes procedures for updating the planning data base, reviewing and, as necessary, revising the plan's policies and revising the plan itself as required. As long as planning data is consistent with the assumptions and projections used to develop the plan and is consistent with the plan, no further updating is required. However, if the planning data changes and deviates from the plan or the assumptions and projections used to develop the plan, the plan's policies, and the plan must be re-evaluated and possibly changed.

This chapter also identifies areas where additional information would strengthen the basis of the plan. In addition, such new information could indicate weaknesses in the assumptions and projections used to develop this plan and require revision of the plan.

7.1 BASIC DATA UPDATING

The alternative plans presented in this report are based on the regional characteristics with special emphasis on the following data categories for the Core Area:

1. Landform
2. Soils
3. Surface Hydrology
4. Wildlife Habitat
5. Transportation/Transmission Network
6. Water and Sewer Service Area
7. Population Projections
8. Existing Land Use and Future Land Use Demands

These categories were selected because they were considered to be the most significant determinants of future land use patterns in the Region.

To make the decision as to whether or not the land use decisions and resultant land use patterns in the Region are following the adopted plan, the agency responsible for maintaining the plan must be continually informed of the land use decisions being made in the Region. The procedure discussed below is designed to facilitate the flow of information, between the local governments making land use decisions and the agency responsible for maintaining the plan, necessary to determine if the plan and policies need to be updated.

The LWCOG has prepared an existing land use map as indicated in Section 3.5.5. A reproducible copy of this map should be distributed to each local agency involved in making land use decisions. The agencies should be asked to reflect any changes that have occurred during the previous six month period on this map and return it to the agency responsible for maintaining the plan. These changes should then be compared with the land use plan. As long as the changing land use patterns are consistent with the plan, no further action is required. If significant differences occur between the land use patterns and the plan such as extensive residential, commercial or industrial development occurring in areas designated for other uses, the policies on which the plan is based must be re-evaluated and the plan may have to be revised.

Population projections are the basis for this plan and for other regional planning activities. Therefore, it is essential that the projections are as accurate and realistic as possible. As indicated in Section 4.1, the population projections used in this planning process were based on projections of the economic trends in the Region. The I/O model developed by the LWCOG can be used to update the regional population projections in coordination with the Colorado Division of Planning. The LWCOG should undertake an updating of the regional population projections at least every five years unless significant changes in the economic projections or anticipated population levels occur during that time period in which case the updating should occur as soon as the changes are experienced.

At least every five years the LWCOG should conduct new surveys of the major firms in the Region to check if their growth projections are still viable and to extend their projections five years farther into the future. If possible, this survey should be extended to include growth projections for all of the sectors of the regional economy. The new growth projections should be incorporated into the I/O model to develop updated economic and employment projections. In turn these projections should be transmitted to the Division of Planning and incorporated into their Population and Employment projection model. The resultant population projections should then be compared with the projections used in this planning process. If there are significant differences (in excess of 25 percent deviation) between the two population projections, the land use demands should be recalculated and the plan revised to accommodate the new land use demand whether they are higher or lower than the demands used in this planning process. The plan should also be revised to include the additional five year projections periods thereby ensuring that the plan continually reflects long-term growth demands.

The LWCOG should also recognize that significant deviations from the economic assumptions might occur during the five year review period. Such changes could necessitate updating the population projections, the land use demands, and the plan immediately. The updating procedure for this situation would be essentially the same as that for the periodic five year update. However, instead of surveying all sectors of the economy, only the sectors where the changes occurred would be re-evaluated. This is all that is necessary because the I/O model internally calculates the effects of such changes on the other sectors. Changes that could necessitate immediate updating would include:

1. Decision of a major new industry to locate in the Region.

2. Decision of an existing major employer to reduce or relocate their activities.

3. Decision by a governmental agency to significantly expand or contract their operations in the Region.

Local governments must keep the LWCOG informed of such decisions when they occur within their jurisdiction, so the LWCOG can undertake the necessary population projection, land use demand, and plan revisions.

The information pertaining to the regional transportation and transmission networks was based on existing conditions. As new roads, highways, freeways, transmission lines, or alternate forms of transportation and transmission are developed in the Region, the transportation and transmission network information should be updated. The regional networks influence and are impacted by future land use patterns. Therefore, it is imperative that the agency responsible for maintaining the plan is aware of all plans and programs that could influence the regional network.

The location of existing and proposed water and sewer service areas also strongly influence land use patterns. It is crucial that land use planning and water and sewer planning be coordinated. If this does not occur, areas may be designated for development which cannot be provided with water or sewer service. To coordinate land use planning and water and sewer planning, the agency responsible for maintaining the plan must be kept informed of all proposed expansions of existing water or sewer service areas and creation of new service areas or districts. To assist the regional agency in its coordination efforts, the water and sewer districts must inform the regional agency of their expansion plans. When these plans are consistent with the land use plans, no further action is required. However, when the sewer or water expansion plans conflict with the land use plan, resolution of that conflict must occur if the land use plan is to maintain its usefulness as a decision-making guideline. The resolution of such conflicts is a matter of public concern and should be resolved in a public forum by either elected officials or some form of public vote.

Landform, soils, surface hydrology and wildlife habitat will experience little change and will not require periodic updating. However, new studies may refine or improve the data used in this planning process. As such studies are completed, the results should be compared with the data developed in this program and then inconsistencies in the data should be resolved either by revising the regional data base or the data developed by the new study. The agency responsible for maintaining the regional plan should be responsible for updating these data categories as new studies are completed. The regional agency should let it be known that they are maintaining a current data base and are interested in obtaining the results of any studies undertaken in the Region that could improve the regional data base.

7.2 POLICY AND PLAN UPDATE

Each of the alternative plans graphically portrays the policies that guided the allocation of growth within the Region. In areas where local land use policies or plans existed, these policies were generally reflected in the regional alternatives. In areas where there were no locally adopted land use policies, policies were developed and applied as indicated in Chapters 4 and 5. These policies reflected on the final plan and the resultant land use allocations could be considered as recommendations to the local government that has the ultimate responsibility to adopt and implement land use policies and decisions.

As local governments adopt new or revise existing land use policies, it may be necessary to revise the policies used to develop the regional plan. Therefore, any local government that adopts new or revises existing land use policies should immediately transmit the newly adopted policies to the agency responsible for maintaining the regional plan. Upon receipt of newly adopted land use policies, in either written or mapped form, they should be compared with the policies used to develop the regional plan. If the new policies are generally consistent with the regional policies, no further action is necessary. When the newly adopted local policies differ from the regional policies, the agency responsible for maintaining the regional plan should identify the regional consequences of the newly adopted local policies and attempt to resolve the conflicts in a public forum.

Chapter 8.0

CHAPTER 8.0

APPENDICES

8.1 DATA MAPPING METHODOLOGY, SOURCES, AND RELIABILITY AND UPDATING

Two major processes contribute to the final basic data maps at 1:48,000 scale. The first process involved coding, editing, and automating the eight basic data maps; followed by mapping them at 1:48,000 on an electrostatic printer. A brief outline of each process and a list of each electrostatic printer map follows:

Coding, editing, and automating:

1) Overlay grid with .33" grid cells (representing 1/16 square mile) onto basic data maps.
2) Transcribe individual cells information to coding sheet.
3) Punch coded information onto IBM cards.
4) Store single variable (SV) files in computer and produce printer map (1/10" x 1/2" cell size).
5) Edit printer map and update computer file to obtain final 'clean' maps.

Electrostatic printer maps:

1) Dump basic data maps with legends onto magnetic tapes.
2) Produce 1:48,000 (.33" grid cells) electrostatic printer maps for the following categories:

   Urban Land Use
   Non-Urban Land Use
   Transportation and Transmission Lines
   Slope
   Pawnee, Colorado Division of Wildlife, and Habitat Areas
   Surface Hydrology
   Agricultural Capability
   Erosion Hazards
   Building Site Soils Limitations
   Septic Tank Limitations

All of the computer work was done on an IBM-360 computer which has a storage capacity of less than 95,000 kilobytes Programs developed by ESRI were utilized to input and process the data. The programs used were from ESRI's Grid Package and included the Grid View, Grid Merge, and Grid Model. ESRI will maintain the data band and programs necessary for any additional work. Additional work could be contracted through Toups Corporation or with ESRI directly.

The information provided in the remainder of this section assesses the adequacy of the data mapped and used in the land use suitability analysis and points out areas for future data acquisition and updating.

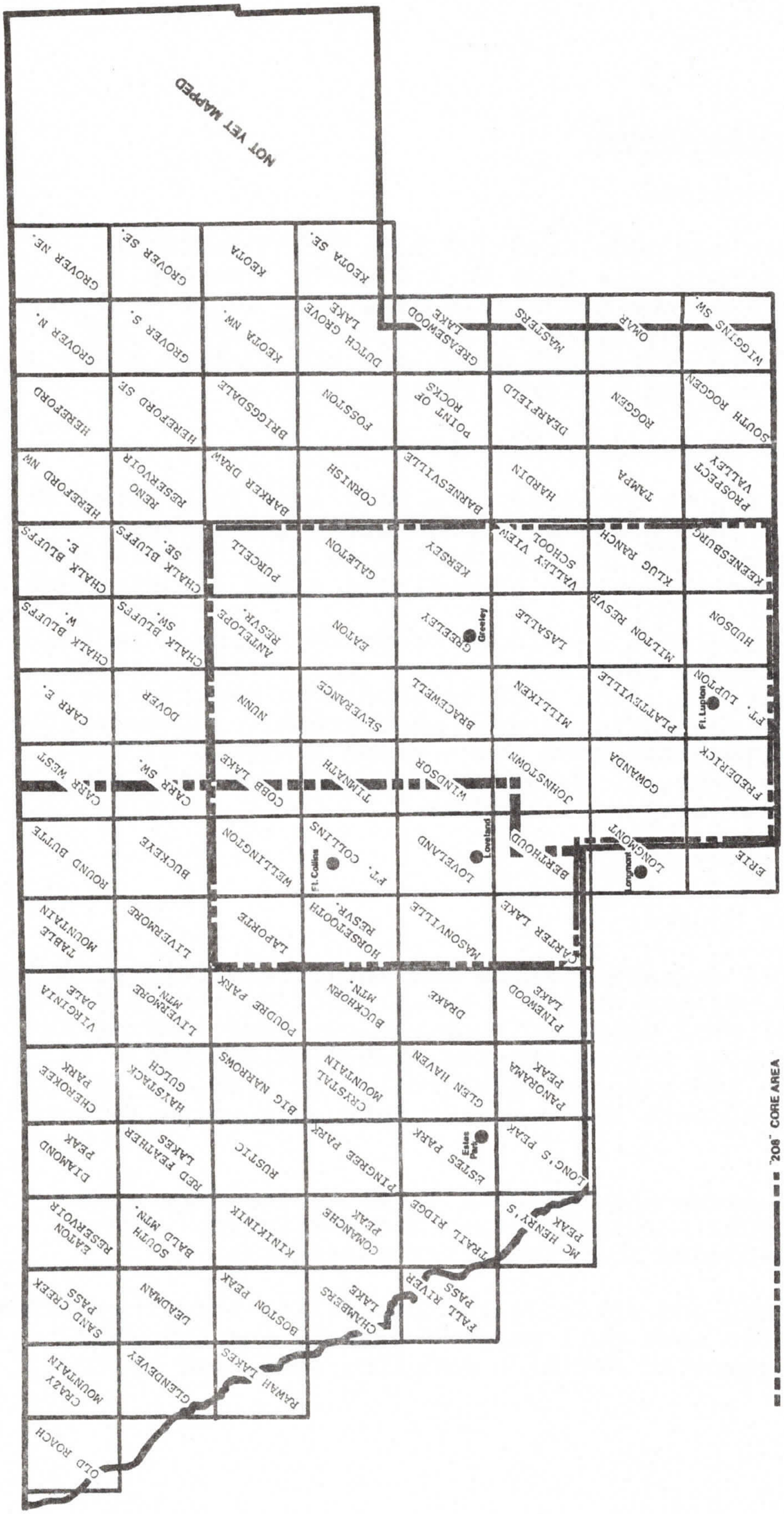

FIG. 8.1
TOPOGRAPHIC MAP INDEX - REGION TWO
USGS QUADRANGLES SCALE 1:24,000

8.1.1 Slope/Land Form

8.1.1.1 Data Sources

Slope analysis was made from U.S.G.S. 7.5' Quadrangle Topographic Series base maps at 1:24,000. Contour intervals vary on the quadrangle maps from 10 to 40 feet. Visual inspection of overall slope characteristics for the 40 acre grid cells were made, and the average slope characteristics were assigned to each cell.

8.1.1.2 Data Reliability and Updating

Slope analysis at a gross 40 acre cell size is of limited value in land form areas with moderately level slope characteristics. In these areas the 40 acre cell is too gross to permit acceptable generalized slope differentiation.

Future slope analyses should be conducted using a small cell size, ideally 10 acres or less, and should include an aspect analysis. The results should be verified by ground checks and aerial stereo photographic interpretation. There is no immediate need for a slope analysis of the core area; however, it should be incorporated into any future drainage or runoff studies.

8.1.2 Soils

8.1.2.1 Data Sources

Detailed soils characteristics and interpretations provided by the field offices of the U.S.D.A. Soil Conservation Service (SCS) were compiled from various base sources at different mapping scales ranging from 1:24,000 scale to 1:1,200 scale and reduced mechanically to 1:48,000 for direct encoding onto the computer data base using 40 acre grid cells.

In the far eastern and northern areas of the Core Area, base detail soil information was not available. Those areas were excluded from soils interpretation.

The engineering and agricultural capability interpretations as prepared for each soil mapping unit by the SCS were recalled by computer decision modeling developed by the consultant.

8.1.2.2 Data Reliability and Updating

Data used was the most reliable at the time of inventory. The SCS is in the process of updating the soils surveys and compiling a complete soil survey for Larimer and Weld County. These updates are not expected to significantly alter the results used in this study. However, certain inconsistencies between the updated information and that portrayed on the maps are bound to occur and the results of the new studies should be compared with the information used in these studies. Overall, the data is considered reliable to the level of the 40 acre grid cell.

8.1.3 <u>Surface Hydrology</u>

8.1.3.1 Data Sources

Surface hydrologic features such as streams, reservoirs, and lakes were encoded from U.S. Geologic Survey 7.5' Quadrangle Topographic maps which had been photographically reduced to a scale of 1:48,000. Flood prone areas were encoded from 1:24,000 scale, U.S. Geologic Survey <u>Flood Prone Area Maps</u>. By definition, flood prone areas shown have a 1 in 100 chance on the average of being inundated by flood water during any year. Flood areas have been delineated without consideration for present or future flood control storage that may reduce flood levels (U.S.G.S., 1970, 1974).

8.1.3.2 Data Reliability and Updating

Surface hydrologic features change slowly over time; therefore, the need to update frequently is minimal.

Flood prone areas are an indicator of possible hazard to health, life, and property. As a resource determinent, flood potential requires closer inspection to determine areas which may have been affected by historic flooding or by modification of land use within a drainage basin. There are completed detailed flood plain studies for much of the immediate urbanizing area including the majority of the flood plain of the Cache la Poudre River between Fort Collins and Greeley and the flood plain of the Big Thompson River in the vicinity of Loveland.

As urbanization continues and hydrologic characteristics of the drainage change, additional detailed flood plain mapping should be conducted. Flood prone area information is considered to be adequate for the level of analysis conducted.

8.1.4 Wildlife Habitat

8.1.4.1 Data Sources

Wildlife habitat information was compiled directly or indirectly from the Colorado Division of Wildlife and natural land form characteristics portrayed on U.S.G.S. 7.5' Quadrangle Topographic series maps. The information was extracted from the following sources:

1. 1976, Wildlife Habitat Map prepared by EDAW, Inc., for Platte River Power Authority Power Plant Feasibility Study. Information supplied by Colorado Division of Wildlife, Regional Office, Fort Collins, Colorado. This map indicated the location of critical habitat buffer zones, hunting preserves, and general range and habitat conditions.

2. Colorado Division of Wildlife. Boundaries of leased lands for wildlife habitat preservation or recreation. Only major land areas were mapped. Several small lakes and surrounding acreages were excluded because of data field limitations. This is particularly true in the Riverside and Empire Reservoir areas. (Written communication with Don Bogart, Colorado Division of Wildlife, September 21, 1976).

3. U.S.G.S. Miscellaneous 7.5' Quadrangle Topographic Series Maps. Features mapped include the following, if they could be construed as having critical habitat value for wildlife:

    1. Streams and Rivers
    2. Marshes and Bogs
    3. Lakes and Reservoirs

   These features were mapped if they constituted a habitat of greater than 20 acres or in the case of streams and water bodies, if they passed through a grid cell.

8.1.4.2 Data Reliability and Updating

Additional information about wildlife habitat is continually being gathered and refined. Data from the Colorado Division of Wildlife, special research studies on particular wildlife species and changing land use patterns will affect the accuracy data base. Undoubtedly more and better information will become available in the future. However, unlike physical features of more stationary nature, wildlife habitat may change over a short period of time due to natural environmental changes resulting from extended periods of drought or wet weather conditions or induced changes in environment such as land use conversions. Also lease agreements on specific habitat or recreation areas by various governmental or private entities may change the status of those areas for other uses. As this data changes rapidly, updating of the data base should be carried out as frequently as practical. Ideally this should be done in any land use information updates.

8.1.5 Transportation/Transmission Network

8.1.5.1 Data Sources

Highway, railroad, and power transmission alignments were mapped directly from U.S.G.S. 7.5' Quadrangle maps, supplemented by information from the 1976 State of Colorado General Highway Maps prepared by the Colorado Division of Highways and the 1976 View Relations and Transmission Network Maps prepared by EDAW, Inc., for the PRPA Power Plant Feasibility Study. Any cell through which a transportation or transmission corridor passed was indicated.

8.1.5.2 Data Reliability and Updating

The mapped information accurately reflects the location of all transportation corridors. The location of proposed transmission lines are approximate. Due to the constraint imposed by the 40 acre grid cell, the extent of transportation and transmission corridors are broader than the actual corridors. Overall, the data is considered reliable for the regional analysis.

As new highways, railroads, and transmission lines are developed or existing ones are expanded, this information should be incorporated into the regional data base.

8.1.6 Sewer Service Map

8.1.6.1 Data Source

Existing sanitation district and sewer service boundaries were mapped on a 1:48,000 scale base map from the data sources listed below. Within each boundary line, the presently-serviced areas were mapped. Anticipated service areas to 1980, 1980-1985, and 1985-90 were also mapped as illustrated by the individual sources. This 1:48,000 scale display map was then visually checked by the Larimer County Planning Department, the Weld County Planning Department, and the City of Greeley, Loveland, and Fort Collins Water and Sewer Departments. This information then encoded by 40 acre grid cells. A computer map was not prepared for this information. The information stored in the computer was used in the land use suitability analysis.

1. Title Services of Northern Colorado. 1975. Larimer County Field Atlas, Title Services of Northern Colorado.

2. City of Loveland Water and Sewer Department. 1976. City of Loveland Sewer System Map (Scale: 1" = 600'), City of Loveland.

3. Nelson, Haley, Patterson, and Quirk, Inc.,1976. Sewer Rates and Sewer System Master Plan for the City of Loveland. City of Loveland, Colorado.

4. Black and Beatch Consulting Engineers, 1974. Report on the Infiltration/Inflow Analysis of Sanitary Sewer System. City of Fort Collins, Colorado.

5. Oblinger-Smith Corporation. 1972. Larimer County Water and Sewer Facility Plan. Colorado Division of Planning.

6. Oblinger-Smith Corporation. 1972. Weld County Water and Sewer Facility Master Plan. Colorado Division of Planning.

7. Wright-McLaughlin Engineers-Engineering Consultants. 1974. Sanitary Sewage System Expansion for the Greeley Region-Weld County, Colorado, Part I. City of Greeley, Colorado.

8. Weld County Planning Department, 1973. Weld County Comprehensive Plan. Weld County.

9. M & I Consulting Engineers. 1976. South Fort Collins Sanitation District Facilities Map. South Fort Collins Sanitation District.

10. South Loveland Sanitation District. 1976. Facilities Map. South Loveland Sanitation District.

11. M & I Consulting Engineers. 1976. Master Plan for Wastewater System Improvements for the Weld County Tri-Area Sanitation District. Tri-Area Sanitation District.

12. Weld County Planning Department (Roy Jost). 1973. Platteville Comprehensive Plan. Weld County.

13. Weld County Planning Services. 1976. Pierce Comprehensive Plan. Weld County.

14. Harman, O'Donnell & Henninger Associates. 1969. Windsor Comprehensive Development Study (Sanitary Sewer System Map). Town of Windsor.

8.1.6.2 Data Reliability and Updating

The information accurately reflects the location of existing and proposed sewer service areas and district boundaries within the constraints of the 40 acre grid cells. This information is considered reliable for the regional analysis.

As new service areas are defined or districts are formed, this information should be incorporated into the existing data base.

8.1.7 Land Use

8.1.7.1 Data Sources

Larimer-Weld Regional COG compiled an existing land use map from the following sources:

Larimer County:

Land use categories from a 1:24,000 scale base land use map prepared by the Larimer County Planning Office were traced on 1:24,000 scale 7.5 min. topographic maps supplemented by photo-interpretation of aerial photos flown in 1975 by Hogan and Olhausen Engineers. A final check of this information was made by Larimer County Planning Office in 1976. This information was then transferred by the COG to the 1:48,000 scale Core Area maps after modifications for regional land use categorization.

Weld County:

An acceptable land use map with appropriate classifications was not available at the time the study began; therefore, land use information for Weld County was compiled from the following sources:

1. U.S.D.A. Soil Conservation Service. 1973. Land Use Map of Larimer and Weld Counties, scale 1:126,720.

2. U.S.G.S. Orthophotoquads, scale 1:24,000, Colorado Division of Planning, Mark Hurd, Aerial Surveys, Inc. 1970.

3. Land use classification map of Boulder-Fort Collins-Greeley area front range urban corridor, Colorado. Linda Driscoll for U.S. Geological Survey, scale 1:100,000. 1974.

4. Stereo photos, Colorado Geological Survey (partial coverage of Weld County), 1:80,000. 1975.

5. Weld County Feedlots Map. Weld County Planning Office. Scale 1:48,000. 1973.

6. Weld County Subdivision Map. Weld County Planning Office. Scale 1:48,000. 1973.

Weld County land use information was compiled on the 1:24,000 7.5' orthophotoquads, then traced on 1:24,000 U.S.G.S. quad maps. This was then reduced mechanically to the 1:48,000 maps.

8.1.7.2 Data Reliability and Updating

The existing land use information is a highly accurate representation of the land uses as of 1976 and is reliable for use in the regional analysis.

Since land uses change almost daily, this information should be periodically updated as suggested in Section 7.1.

8.1.8 Other Mapped Data Sources

Other spatially portrayed physical resource and hazard data for localized areas in the region is available for specific areas. An inventory of all such sources would be quite lengthy. Table 8.1.8 shows most data which has been compiled at a scale of 1:24,000. As the base data is frequently being expanded and where possible, updated, this compilation may not reflect new sources prepared after July, 1976.

TABLE 8.1.8
AVAILABLE DATA BASE
1:24,000 SCALE
LARIMER-WELD REGION
STATUS JULY 1976

LARIMER COUNTY	TOPOGRAPHIC BASE MAP (USGS)	CONTOUR INTERVAL (ft)	ORTHOPHOTOQUAD (1970 CDOP)	LAND USE (1976 LWRCOG)	ENV. GEO. HAZ. (R & ASSOC.)	SURF. GEO. RES. (CGS)	ECOSYSTEM (CFS)	WILDFIRE HAZARD (CFS)	FLOODPRONE AREA (USGS)
	1	2	3	4	5	6	7	8	9
*BERTHOUD	1969	10'	o	o	o	o	o		o
BIG NARROWS	1962	40'				o	o	o	
BOSTON PEAK	1962	40'				o	o	o	
BUCKEYE	1960	10'				o	o		
BUCKHORN MTN.	1962	40'					o	o	
*CARR SW.	1977	10'				o	o		
CARR WEST	1977	10'					o		
CARTER LAKE	1971	40'	o	o	o	o	o		o
*CHAMBERS LAKE	1962	40'					o	o	
CHEROKEE PARK	1967	40'					o	o	
*COBB LAKE	1960	10'	o	o	o		o		
COMANCHE PEAK	1962	40'					o	o	
CRAZY MOUNTAIN	1967	40'				o	o	o	
CRYSTAL MOUNTAIN	1962	40'					o	o	
DEADMAN	1967	40'				o	o	o	
DIAMOND PEAK	1967	40'					o	o	

	1	2	3	4	5	6	7	8	9
DRAKE	1962	40'				o	o	o	
EATON RESERVOIR	1967	40'					o	o	
ESTES PARK	1961	40'			o	o	o	o	
*FALL RIVER PASS	1958	40'					o		
FORT COLLINS	1969	10'	o	o	o	o	o		o
GLEN HAVEN	1962	40'			o	o	o	o	
*GLENDEVEY	1967	40'				o	o	o	
HAYSTACK GULCH	1960	40'					o	o	
HORSETOOTH RESERVOIR	1971	40'	o	o	o	o	o	o	o
KINIKINIK	1962	40'				o	o	o	
LAPORTE	1962	40' 20'	o	o	o	o	o	o	o
LIVERMORE	1960	20'				o	o	o	
LIVERMORE MTN.	1960	40'					o		
LONG'S PEAK	1961	40'				o	o	o	
LOVELAND	1969	10'	o	o	o	o	o		o
MASONVILLE	1971	40'	o	o	o	o	o		o
*MC HENRY'S PEAK	1957	40'					o		
*OLD ROACH	1955	40'				o	o	o	
PANORAMA PEAK	1962	40'				o	o	o	
PINEWOOD LAKE	1962	40'				o	o	o	
PINGREE PARK	1962	40'				o	o	o	
POUDRE PARK	1962	40'					o	o	
*RAWAH LAKES	1962	40'				o	o	o	
RED FEATHER LAKES	1967	40'			o		o	o	
ROUND BUTTE	1967	20'				o	o		
RUSTIC	1962	40'				o	o	o	
SAND CREEK PASS	1967	40'					o	o	
SOUTH BALD MTN.	1967	40'			o		o	o	

	1	2	3	4	5	6	7	8	9
TABLE MOUNTAIN	1967	40'				o	o		
*TIMNATH	1971	40'	o	o	o	o	o		o
TRAIL RIDGE	1957	40'					o		
VIRGINIA DALE	1967	40'					o		
WELLINGTON	1960	10'	o	o	o	o	o		o

WELD COUNTY

ANTELOPE RESERVOIR	1960	10'	o	o					
BARKER DRAW	1969	10'							
BARNESVILLE	1950	10'							
BRACEWELL	1969	10'	o	o					
BRIGGSDALE	1977	10'							
*CARR E.	1977	10'				o	o		
CHALK BLUFFS E.	1977	10'							
CHALK BLUFFS SE.	1977	10'							
CHALK BLUFFS SW.	1977	10'							
CHALK BLUFFS W.	1977	10'							
CORNISH	1977	10'							
DEARFIELD	1977	10'							
DOVER	1977	10'							
DUTCH GROVE LAKE	1977	10'							
EATON	1971	10'	o	o					
*ERIE	1971	10'	o	o					
FORT LUPTON	1969	10'	o	o					
FOSSTON	1977	10'							
FREDERICK	1969	10'	o	o					
GALETON	1960	10'	o	o					

	1	2	3	4	5	6	7	8	9
GOWANDA	1969	10'	o	o					
*GREASEWOOD LAKE	1950	10'							
GREELEY	1969	10'	o	o					
GROVER N.	1977	10'							
GROVER NE.	1977	10'							
GROVER S.	1977	10'							
GROVER SE.	1977	10'							
HARDIN	1950	10'							
HEREFORD	1977	10'							
HEREFORD NW.	1977	10'							
HEREFORD SE.	1977	10'							
HUDSON	1949	10'	o	o					
JOHNSTOWN	1969	10'	o	o	o	o			
KEENESBURG	1950	10'	o	o					
KEOTA	1977	10'							
KEOTA NW	1977	10'							
KEOTA SE.	1977	10'							
KERSEY	1950	10'	o	o					
KLUG RANCH	1950	10'	o	o					
LASALLE	1969	10'	o	o					
*LONGMONT	1971	10'	o	o					
*MASTERS	1950	10'							
MILLIKEN	1969	10'	o	o					
MILTON RESERVOIR	1971	10'	o	o					
NUNN	1960	10'	o	o					
*OMAR	1971	10'							
PLATTEVILLE	1969	10'	o	o					
POINT OF ROCKS	1951	10'							

	1	2	3	4	5	6	7	8	9
PROSPECT VALLEY	1971	10'							
PURCELL	1960	10'	o	o					
RENO RESERVOIR	1977	10'							
ROGGEN	1971	10'							
SEVERANCE	1971	10'	o	o					
SOUTH ROGGEN	1950	10'							
TAMPA	1971	10'							
VALLEY VIEW SCHOOL	1950	10'	o	o					
*WIGGINS SW.	1951	10'							
*WINDSOR	1969	10'	o	o	o	o	o		o

*Quadrangle covers more than one county.

ABBREVIATIONS:
- USGS - United States Geologic Survey
- CDOP - Colorado Division of Planning
- CGS - Colorado Geologic Survey
- CFS - Colorado Forest Service
- R & ASSOC. - Robinson and Associates Geologists, Denver.

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