III. Existing and Future Environment

SALT LAKE COUNTY: PRESENT & FUTURE

Present Conditions

PLANNING BOUNDARIES - A DEFINITION OF THE STUDY AREA

Salt Lake County is located in the northern portion of Utah flanked by the Wasatch Mountains to the east and the Oquirrh Range to the west. The Traverse Mountains join the Oquirrh and the Wasatch Mountains so as to close the southern end of the county except for the narrow gorge carved by the Jordan River entering the county. The northwestern end of the County opens out to the Great Salt Lake, a remnant of the ancient sea known as Bonneville.

The sub-setting of Salt Lake County is a product of the work of Lake Bonneville with both Wasatch and Oquirrh Mountains bearing the terraced scars of the ancient sea. Alluvium from the eroding mountains spreads out below the foot of Rose, Butterfield, Coon, Cottonwood, Mill, Parleys, Emigration, City Creek and Red Butte Canyons forming plateaus overlooking the Jordan River.

When the valley was first settled in the late 1840's, new pressures were placed on the canyon water supply. As mining and agricultural industries expanded, the waters of the Wasatch Mountains provided an ample supply of clean, potable water. But the extensive growth experienced in the early half of the 20th century necessitated storage, treatment, and preservation of the water suddenly in high demand. As a result of continual urban growth, the Jordan River soon became the disposal line for the valley, receiving more and more sewage (both treated and untreated) and other pollution from urban and agricultural areas.

The Salt Lake County hydrologic basin is truly a textbook example of the age old battle of man with his environment - the conquest of its mountain riches, wildlife, and finally, its water.

HISTORY

During the early nineteenth century, English and American trappers explored the Utah and Salt Lake Valleys. Among these early explorers were William H. Ashley and Entienne Provost sent by the Rocky Mountain Fur Company to explore and trap mink and beaver. John C. Fremont passed through the Valley in 1843.

A small party of Mormon pioneers led by Brigham Young entered the Salt Lake Valley on July 24, 1847, to establish a permanent settlement. In spite of the lateness of the season, crops were planted, gravity-flow irrigation systems established, and crops harvested that fall. Within two years, Salt Lake City had a population of 5,000 and became one of the fastest growing communities in the West. The town was laid out in square 10-acre blocks that were oriented in north-south and east-west direction. Wide streets were provided between the blocks and areas were set aside for parks, churches, businesses, and similar uses at the time the city was laid out. Most of the roads in the area are still square with the compass.

The valley continued to grow with Mormon settlement. Additional growth occurred when the Union Pacific Railroad was completed in 1873 and the Denver and Rio Grande Western Railway was completed in 1889.

Members of the Church of Jesus Christ of Latter-Day Saints (Mormon Church) were leaders in the settlement of the Study Area. However, with the discovery of gold in California came an influx of miners, soldiers, and settlers. This developed into many years of conflict, both philosophical and physical, involving marital law, anti-Mormon legislation, court expropriation of Church property, and delay of statehood.

CULTURE

Early Mormon struggles and persecution resulted in a unique cultural and political heritage manifested today in the Study Area. There is strong group and family solidarity. People in the Study Area say they prefer to "take care of themselves." The historic cultural background has been translated into an anti-Federal government outlook. Over the past ten years a rapid in-migration of people with mixed religious and cultural backgrounds has produced the existing population. The Study Area is characterized by large families oriented toward single family residential preferences. A generalized desire to provide employment and housing has been translated into strong pro-development attitudes which are reflected in the local media and governmental institutions. New growth has produced typical, relatively unstable communities in the south half of the county with attendant issues of school crowding, criminal justice problems and general service delivery strains on local government. The formation of social groups to enhance community social values is beginning to produce dialogue on community issues as the population mix changes.

As is the case with many other parts of the United States, religious ties may be weakening in the Study Area, particularly in the cities. However, the Mormon Church remains a strong force in shaping the culture of the Salt Lake area. Within Salt Lake County is Salt Lake City which is the capital city of the State of Utah. The University of Utah is also located in Salt Lake City and with Westminster College provide some academic values for the Study Area.

It appears that the usual liberal-conservative issues and divisions do not fully apply in Salt Lake County. There is a strong element of conservatism within the county. Conservative factions, together with some land developers and realtors, were considered responsible for defeating a land use bill passed by the legislature in 1973 by public referandum. The culture of the Salt Lake County population is changing rapidly as the population increases with all the attendant social and institutional confusion rapid change brings.

PRESENT WATER QUALITY MANAGEMENT

Many Federal, State and local government agencies are involved in the management of water resources. At the federal level, the U.S. Environmental Protection Agency is charged with the responsibility for implementing the provisions of both the Federal Water Pollution Control Act as amended in 1977 and the National Environmental Policy Act of 1969 and for administering the federal construction grant program for wastewater facilities.

Within the State of Utah, the Utah State Division of Health and the Utah Water Pollution Committee have primary responsibility and authority to prevent waste disposal practices from becoming a hazard to health or a detriment to water quality.

Local agencies, industries and individuals are obligated to finance, build, and operate wastewater facilities that will provide acceptable means of waste disposal and meet all applicable water quality standards.

Federal regulations are based on the Federal Water Pollution Control Act as amended in 1977. The 1972 and the 1977 Amendments establish as a national goal the discharge of pollutants into the waters of the United States be eliminated by 1985, that the quality of the nation's waters be restored and maintained, and that as an interim goal, wherever attainable, there be achieved, by 1 July 1983, water quality which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water.

It is recognized by EPA that while the 1983 objective carries with it defined, specific, enforcement mechanisms, the 1985 goal is an ideal toward which Congress intended the country to strive. To reach this goal, the Act requires that waste discharges must be of a specified, improved quality before release to receiving waters. To assure that improved quality is attained, new authority was given to federal and state governments to fully develop a national permit system to regulate the quality of discharged wastes (initiated in 1972).

Present control tactics for the County, designed to meet the water quality requirements, include the establishment of water quality planning criteria, classification of stream segments, allocation of waste loads and regulation of waste discharge through the discharge permit program (National Pollutant Discharge Elimination System).

TOPOGRAPHY

Salt Lake County is bounded on the east by the Wasatch Mountains, on the west by the Oquirrh Mountains and on the south by the Traverse range. The Great Salt Lake is the eventual recepient of water in the north-flowing Jordan River. Streams originating from the Wasatch Front flow westward into the Jordan River, the only outlet from Utah Lake in Utah County to the south. No major streams originate from the western side of the valley. The three mountain ranges along with the Great Salt Lake create a virtually enclosed hydrologic basin in the County.

The elevation of the Great Salt Lake is about 4200 feet above sea level. The Wasatch Front reaches elevations of over 11,000 feet above sea level. The Oquirrh Mountains, to the west, reach altitudes of over 9200 feet. The land surface between these ranges of mountains consists of a series of benches, each of which slopes gradually away from the mountains and drops sharply to the next bench. Hence, an east-west profile across the valley would show a series of steps leading from the mountains on each side down to the Jordan River and the flat valley floor. The land for a number of miles southeast of the shore of the Great Salt Lake is monotonous, flat, and covered with alkali soil that supports little vegetation.

The Salt Lake Valley has a maximum length of 31 miles and an approximate width of 23 miles. Roughly 65 percent of the 764-square mile County lies within the valley itself with the remaining 35 percent in the surrounding mountainous areas.

Figure III-1 indicates the main topographic factors affecting the study area.

CLIMATE

The Great Salt Lake and the surrounding mountain ranges greatly influence the climatic conditions of Salt Lake County. The transitional climate of the area can best be described as semi-continental and semi-arid.

Approximately 60 percent of the annual precipitation falls in the winter and spring. These storms are of orographic origin - storms caused by moist Pacific air forced over a topographic barrier resulting in condensation of water vapor into droplets and ice crystals. Summer precipitation is associated with thunderstorms developed from moist air from the Gulf of California. Figure III-2 shows the most frequent thunderstorm paths in Salt Lake County. Average precipitation varies from 12 to 15 inches per year at the Salt Lake Airport to 35 and 40 inches in the Wasatch Mountains. Average annual precipitation at selected stations in the County is illustrated in Figure III-3.

Due to the surrounding mountains, there exists a tendency for cold air to pool at the bottom of the valley and form strong inversions during the

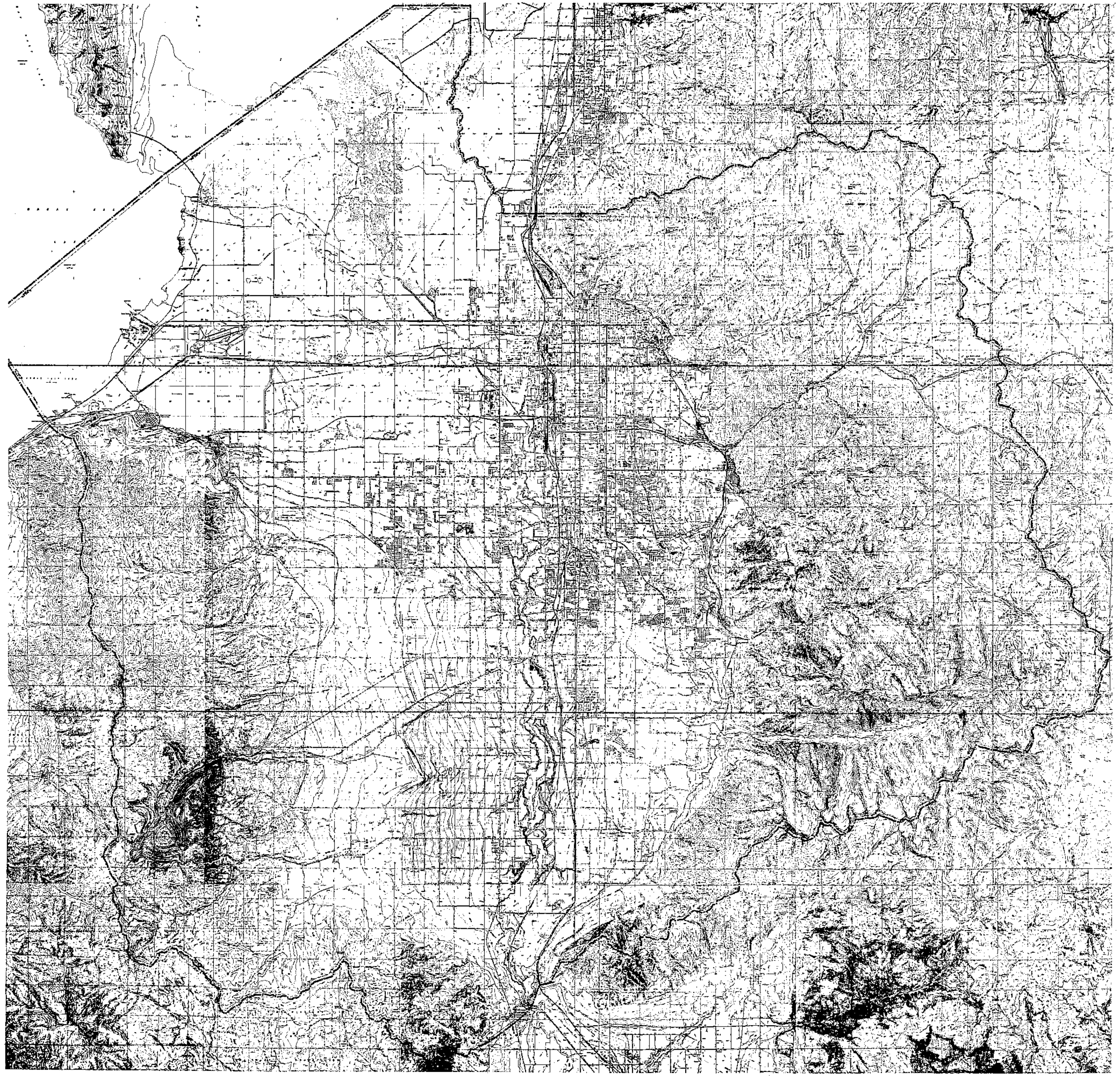


FIGURE III-1
TOPOGRAPHIC MAP
SALT LAKE COUNTY
UTAH

Salt Lake County Water Quality & Pollution Control
208 Water Quality Plan

NORTH

Sq. Miles 9 1

Financed Under Section 208 of the Federal Water Pollution Control Act of 1972, as amended.

miles 0 1 2 3 4 5

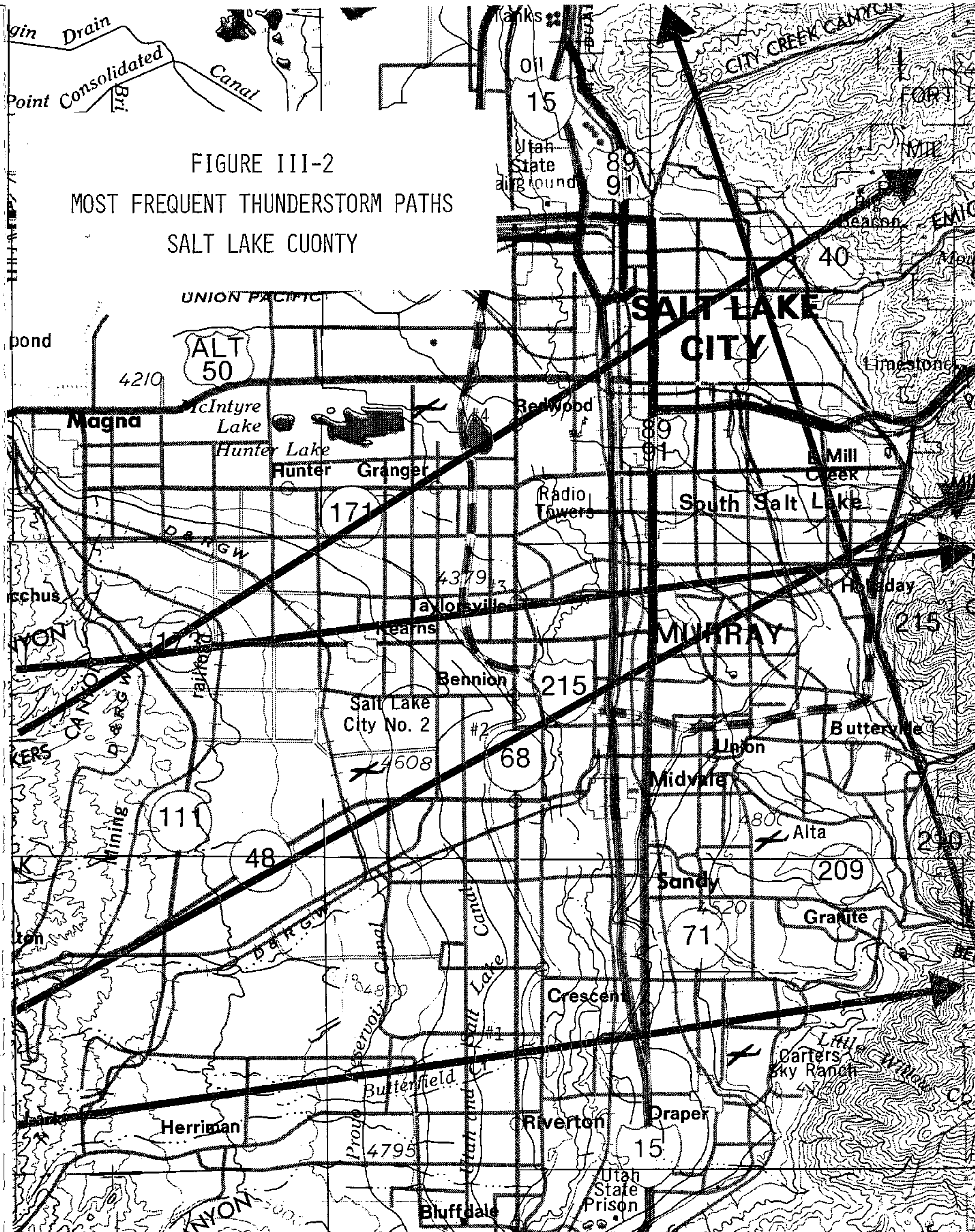
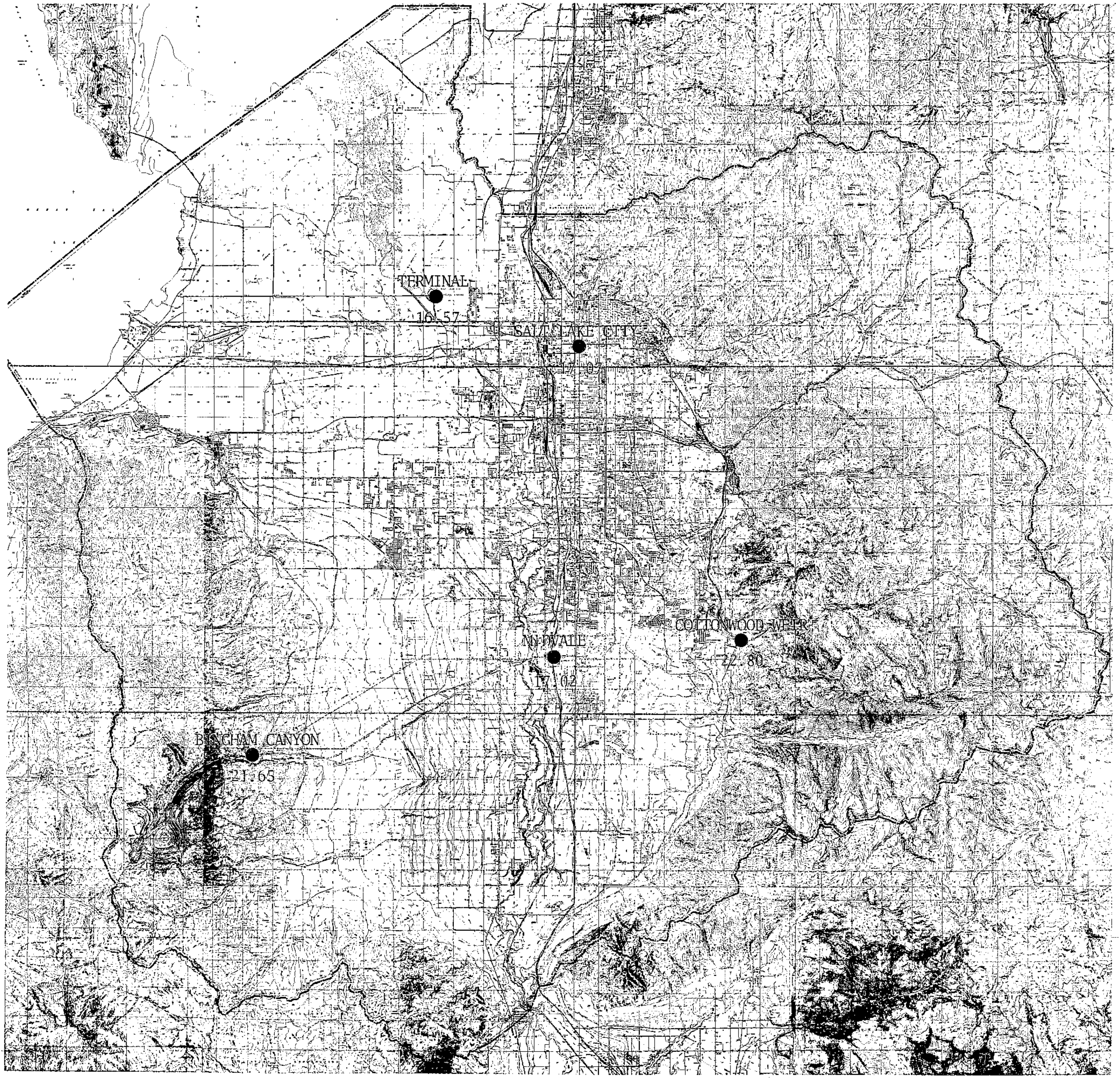


FIGURE III-2
MOST FREQUENT THUNDERSTORM PATHS
SALT LAKE CUONTY

FIGURE III-3
AVERAGE ANNUAL PRECIPITATION
1970-1976
(IN INCHES)



Salt Lake County Water Quality & Pollution Control
208 Water Quality Plan

NORTH

Sq. Miles
9
1

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miles
0 1 2 3 4 5

colder parts of the year. These inversion periods create air pollution problems and drastic temperature gradients. Notwithstanding the cold air pools, temperatures decrease with increasing altitudes.

Wind patterns in the study area are highly variable depending upon location. The normal winds are determined by topography with essential up canyon winds during the warm part of the day and down canyon during the cool part. Storm activities can produce extremely strong, gusty winds. A wind rose depicting the general wind patterns at the Salt Lake Airport weather station during normal and storm conditions is shown in Figure III-4. During fair weather conditions, winds typically blow from the south, southeast or northwest. During inclement weather conditions, winds originate in the north and northwest.

A wind rose depicts the percentage of time that wind blows in a specified direction at various speeds. For example, in Figure III-4, the Fair Weather Wind Rose shows that approximately 9.7% of the time, winds are less than 5 mph at the Salt Lake Municipal Airport and that winds greater than 30 mph blow from the South approximately 0.2% of the time. (Note that the direction of wind is read going into the center of the rose).

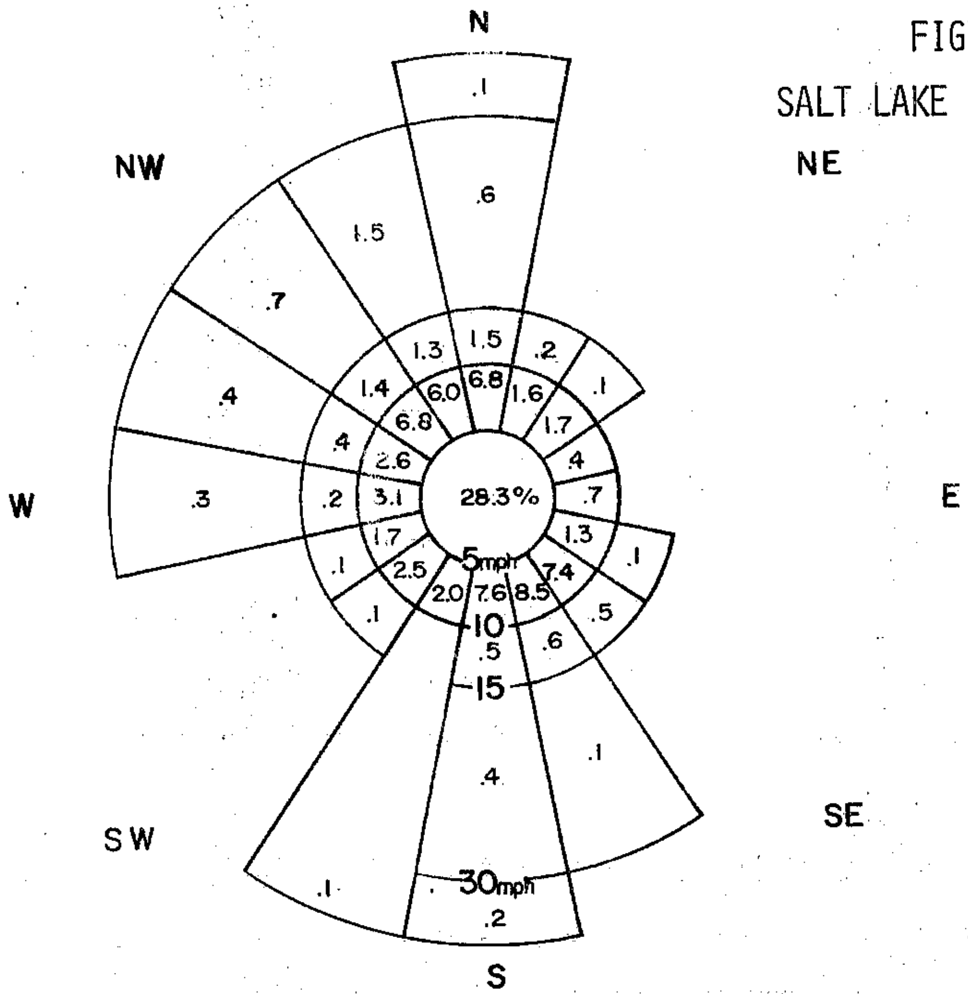
Generally, the climate of the valley can be described as variable but not extreme with major factors affecting weather conditions being the topographic conditions of the valley.

AIR QUALITY

With the major environmental awakening of the late 1960's came governmental actions to protect the quality of the nation's air. The combination of goals established by the EPA and Congress have become the framework for the air quality programs established in individual states across the nation.

FIGURE III-4

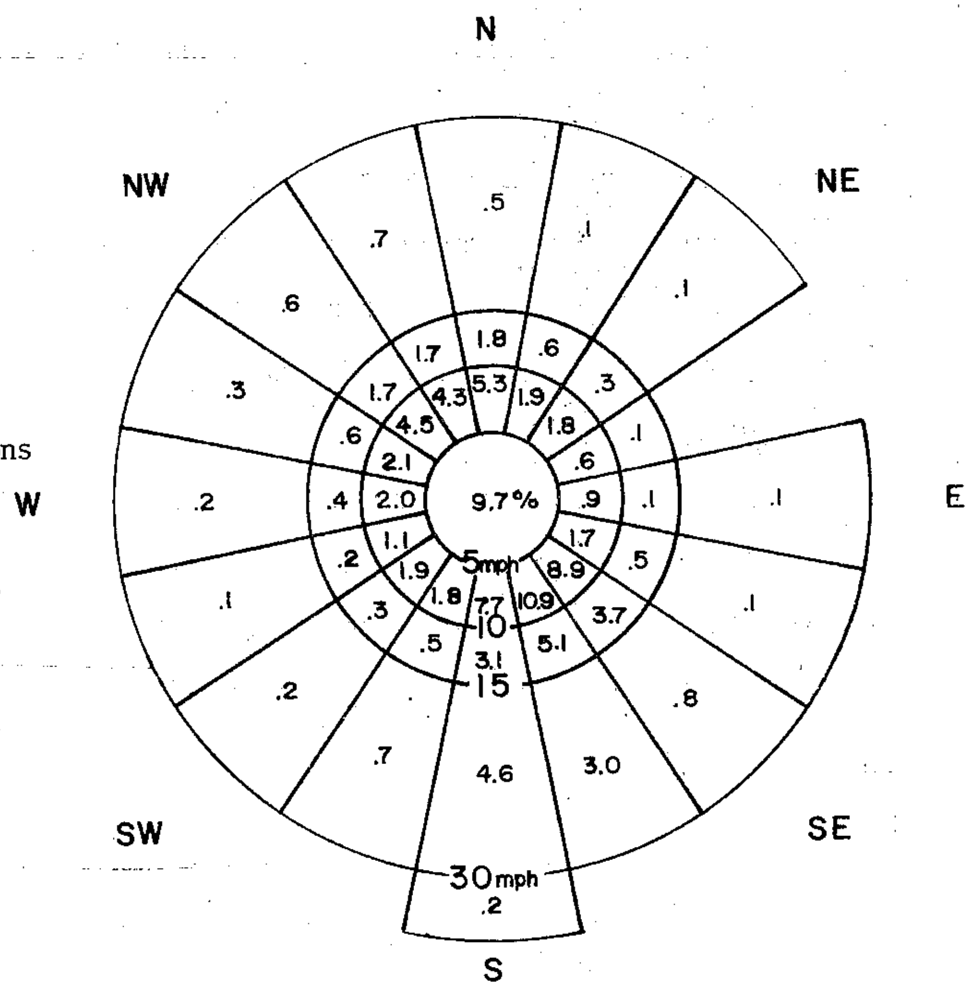
SALT LAKE COUNTY WIND ROSE



INCLEMENT WEATHER WIND ROSE*
Salt Lake Municipal Airport
Inclement weather conditions occur approximately 5.2% of the time.
Source: U.S. Weather Service, 1967 wind data period: 1955-1964

Figure 7.

FAIR WEATHER WIND ROSE*
Salt Lake Municipal Airport
Fair weather conditions occur approximately 94.8% of the time.
Source: U.S. Weather Service, 1967 wind data period: 1955-1964



Standards

Under the Clean Air Act (amended 1977), the EPA has established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. These criteria pollutants are carbon monoxide, sulphur dioxide, particulates, photochemical oxidants, hydrocarbons, and nitrogen dioxide. The values for these pollutants are shown in Table III-1.

Air quality standards are divided into two major categories; "non-attainment" standards and "attainment" standards. "Non-attainment" standards apply to areas where air quality violates the values set forth in Table III-1. These standards are further broken down into primary and secondary standards. Primary standards are set for protection of human health while secondary standards are set for protection of human welfare.

"Attainment" standards are set for areas where air quality is better than the standards set in Table III-1. In this case, only incremental pollution is allowed in three subclassifications (Classes I, II, and III). A schematic representation of the applicability of air quality standards is shown in Figure III-5.

It should be noted that the standards in Table III-1 are maximum values that are allowed. Any concentration less those shown is more desirable.

The State has the option to set more stringent air quality standards than Federal standards (as in water quality standards) but at the present time they have not. Therefore, the national standards apply in Utah.

The following discussion of the six criteria pollutants is abstracted from Urban Environmental Management, Berry and Horton, 1974.

1. Hydrocarbons (HC). Major polluting hydrocarbons are those which result from the incomplete combustion of fuels and the evaporation of fuels

Table III-1. National Ambient Air Quality Standards

POLLUTANT	AVERAGING PERIOD	STANDARDS Primary	STANDARDS Secondary	REMARKS
SO_2	Annual	0.03 ppm (80 ug/M^3)	None	Arithmetic mean
	24 hours	0.14 ppm (365 ug/M^3)	None	Not to be exceeded more than once per year
	3 hours	None	0.5 ppm (1300 ug/M^3)	Not to be exceeded more than once per year
PARTICULATE	Annual	75 ug/M^3	60 ug/M^3	Geometric mean
	24 hours	260 ug/M^3	150 ug/M^3	Not to be exceeded more than once per year
CO	8-hour	9 ppm (10,000 ug/M^3)	Same as Primary	Not to be exceeded more than once per year
	1-hour	35 ppm (40,000 ug/M^3)	Same as Primary	Not to be exceeded more than once per year
PHOTOCHEMICAL OXIDANTS	1-hour	0.08 ppm (160 ug/M^3)	Same as Primary	Measured as Ozone. Corrected for NO_x and SO_2. Not to be exceeded more than once per year
HYDROCARBONS	3-hour	0.24 ppm (160 ug/M^3)	Same as Primary	Corrected for Methane. Not to be exceeded more than once per year
NO_2	Annual	0.05 ppm (100 ug/M^3)	Same as Primary	Arithmetic mean

Note: ppm = parts per million
ug/M^3 = micrograms/cubic meter

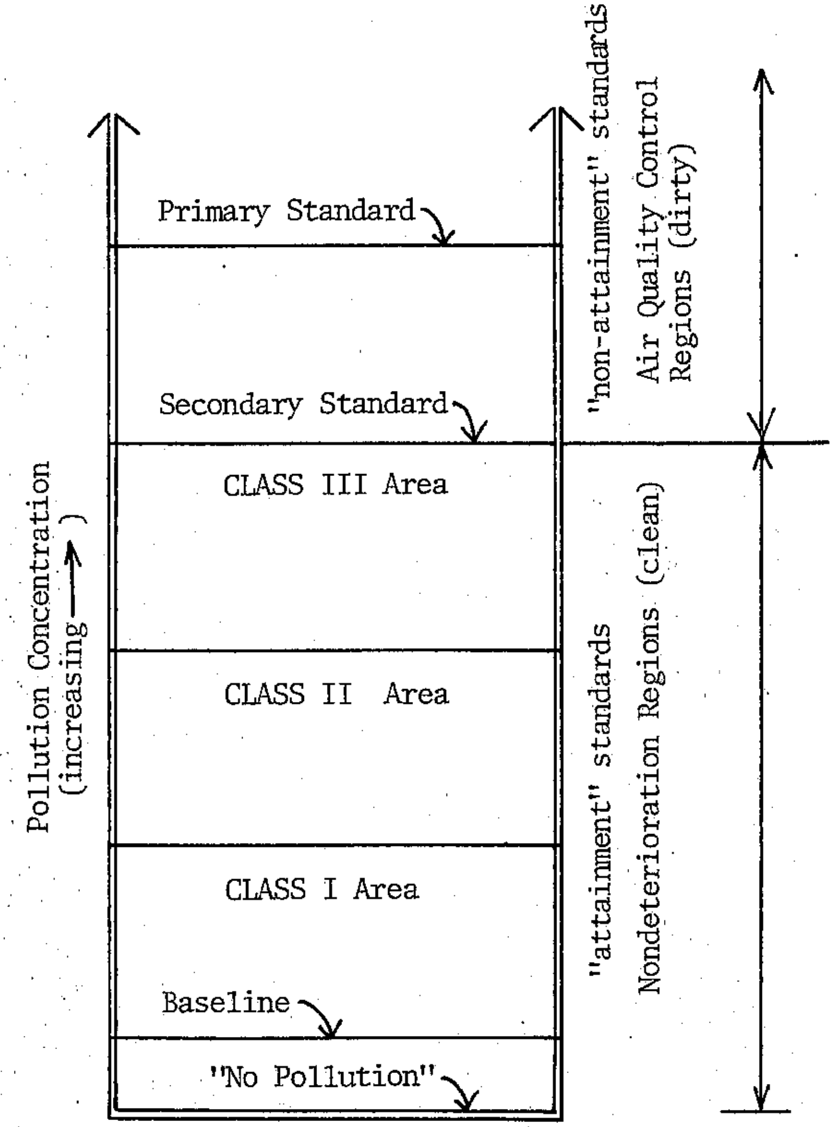


Figure III-5. Schematic Diagram of Air Quality Standards

and industrial solvents. Polluting hydrocarbons exist in the air primarily as gases (including methane, ethylene and acetylene); others, including cancer-inducing agents such as benzo-a-pyrene, are solid particulates.

2. Carbon Monoxide (CO). Carbon monoxide is a colorless, odorless, tasteless gas. The major source of CO is gasoline powered motor vehicles.

When CO enters the bloodstream, it interferes with the ability of the blood to transport oxygen, thus impairing the functioning of the central nervous system. It can cause dizziness, unconsciousness, or death.

3. Nitrogen Dioxide (NO_2). When nitrogen and oxygen react at high temperatures, nitrogen oxides are produced, usually in the form of nitric oxide (NO) and nitrogen dioxide (NO_2). Most nitrogen oxides are the result of fuel combustion.

4. Sulfur Dioxide (SO_2). The most significant sulfur oxide pollutants are sulfur dioxide, an invisible gas with a pungent odor, and sulfur trioxide, a gas which combines with water in the atmosphere to form sulfuric acid. Sulfur dioxide results from burning sulfur-bearing fuels in the production of electric power and space heating and, in Salt Lake Valley, from the smelting process in the production of copper. Sulfur dioxide can aggravate lung and heart disease, asthma, and the lung functions in children.

5. Particulates. Particulate air pollutants are any dispersed matter, solid or liquid, in which the individual aggregates are larger than single small molecules but smaller than about 500 um (um-micrometer). Particulates can cause respiratory ailments, visual pollution, and will increase the deterioration of some materials. Particulates can act as nucleation sites for the formation of sulfuric acid mist and can increase respiratory problems associated with SO_2. They can cause temporary or permanent injury to the linings of the lungs and throat. Such injury may weaken human resistance to infection. Particulates may also transport chemicals into the respiratory system which could cause such illnesses as cancer or lead poisoning. Salt Lake fugitive dust inventory is shown in Table III-2.

6. Photochemical Oxidants. Photochemical oxidants are chemical compounds which are the major components of smog. They are formed when hydrocarbons

and nitrogen oxides are exposed to sunlight. Most significant oxidants are ozone and peroxyacyl nitrates (PAN). Sources of photochemical oxidants are the same as those of hydrocarbons and nitrogen oxides. The most common effects of ozone and PAN are eye irritation and difficulty in breathing. They can cause irritation of mucous membranes in nose and throat, and at higher levels, impair lung functions.

Table III-2. Fugitive Dust Emissions Inventory, Salt Lake County

Source Category	Tons/Year (1974)
Agriculture	
Wind blown	74
Tilling	16
Unpaved roads	2190
Tailings	2781
Aggregate storage	1576
Industrial storage	Neg.
Road Construction	1625
Residential/commercial/industrial construction	10593
Sanding (ice & snow control)	2694
County Total	21549

Source: PED Co. - Environmental Specialist Inc., Fugitive Dust Emissions Inventory; Wasatch Front, Utah, Cincinnatti, Ohio, July 1975.

Current Air Quality

Currently there are three active air quality monitoring stations in Salt Lake County. A fourth station, located in Kearns, was abandoned by EPA and the State in 1977. As shown in Table III-3, the Salt Lake City station monitors particulates, SO_2, CO, NO_2, and Ozone. The airport station only monitors particulates while the Magna station monitors particulates and SO_2.

Table III-3. State Air Quality Monitoring Network in Salt Lake County

Station	Location	Pollutants Monitored				
		Part.	SO_2	CO	NO_2	O
Salt Lake City	610 South 200 E. Salt Lake City	X	X	X	X	X
Salt Lake Airport	175 North 2400 W. Salt Lake City	X				
Magna	2935 South 8560 W. Magna	X	X			

Source: Utah State Bureau of Air Quality

Table III-4 shows particulate data for three Salt Lake County stations for the years 1970 through 1977. Data for the Kearns station is shown for 1971 through 1976. The 1977 county-wide distribution of particulates and SO_2 are shown in Figure III-6 and III-7. It should be noted that these inventories for particulates and SO_2 are the only coutny-wide distributions available at the time of this writing (September 1978).

GEOLOGY AND SOILS

Both geology and soils have a critical influence on surface and subsurface hydrology. Surface runoff characteristics have been described in detail in the 208 Technical Report Best Management Practices (LU-14).

Table III-4. Particulate Data for Salt Lake County

PARTICULATE µg/M^3	SLC	MAGNA	SL AIRPORT	KEARNS
1970 Annual Geometric Mean	84	70	75	
1970 Annual Geo. Standard Deviation	1.65	2.02	1.78	
1970 # Of Observations	361	354	329	
1970 # > Nat'l Secondary Standard	41	52	34	
1970 # > Nat'l Primary Standard	8	10	4	
1970 Max. 24-Hour Average	353	1029	489	
1970 2nd High 24-Hour Average	351	788	417	
1971 Annual Geometric Mean	94	71	78	51
1971 Annual Geo Standard Deviation	1.63	1.94	1.80	1.73
1971 # of Observations	348	345	336	328
1971 # > Nat'l Secondary Standard	56	28	37	8
1971 # > Nat'l Primary Standard	8	12	3	4
1971 Max. 24-Hour Average	469	2031	350	474
1971 2nd High 24-Hour Average	452	1257	302	285
1972 Annual Geometric Mean	94	70	77	54
1972 Annual Geo Standard Deviation	1.58	1.87	1.73	1.66
1972 # of Observations	349	334	330	352
1972 # > Nat'l Secondary Standard	57	31	31	11
1972 # > Nat'l Primary Standard	9	12	2	0
1972 Max. 24-Hour Average	355	1465	278	221
1972 2nd High 24-Hour Average	331	898	261	220
1973 Annual Geometric Mean	89	75	73	54
1973 Annual Geo Standard Deviation	1.69	1.94	1.85	1.78
1973 # of Observations	342	333	314	330
1973 # > Nat'l Secondary Standard	49	47	29	13
1973 # > Nat'l Primary Standard	9	16	2	0
1973 Max. 24-Hour Average	340	991	294	259
1973 2nd High 24-Hour Average	330	865	294	233
1974 Annual Geometric Mean	93	84	85	58
1974 Annual Geo Standard Deviation	1.59	1.81	1.86	1.76
1974 # of Observations	343	342	285	342
1974 # > Nat'l Secondary Standard	42	47	43	14
1974 # > Nat'l Primary Standard	6	10	6	3
1974 Max. 24-Hour Average	704	3080	827	507
1974 2nd High 24-Hour Average	634	612	508	473
1975 Annual Geometric Mean	82	73	66	51
1975 Annual Geo Standard Deviation	1.76	2.16	1.93	1.82
1975 # of Observations	352	339	340	344
1975 # > Nat'l Secondary Standard	46	56	34	14
1975 # > Nat'l Primary Standard	8	24	4	2
1975 Max. 24-Hour Average	691	1456	637	392
1975 2nd High 24-Hour Average	349	850	622	273
1976 Annual Geometric Mean	96	100	79	76
1976 Annual Geo Standard Deviation	1.70	2.00	1.97	1.77
1976 # of Observations	354	343	314	339
1976 # > Nat'l Secondary Standard	70	97	49	42
1976 # > Nat'l Primary Standard	21	37	6	3
1976 Max. 24-Hour Average	352	2105	313	318
1976 2nd High 24-Hour Average	352	489	286	306
1977 Annual Geometric Mean	107	80	85	
1977 Annual Geo Standard Deviation	1.66	1.88	1.70	
1977 # of Observations	349	345	313	
1977 # > Nat'l Secondary Standard	91	53	40	
1977 # > Nat'l Primary Standard	18	19	8	
1977 Max. 24 Hour Average	473	576	414	
1977 2nd High 24 Hour Average	398	402	336	

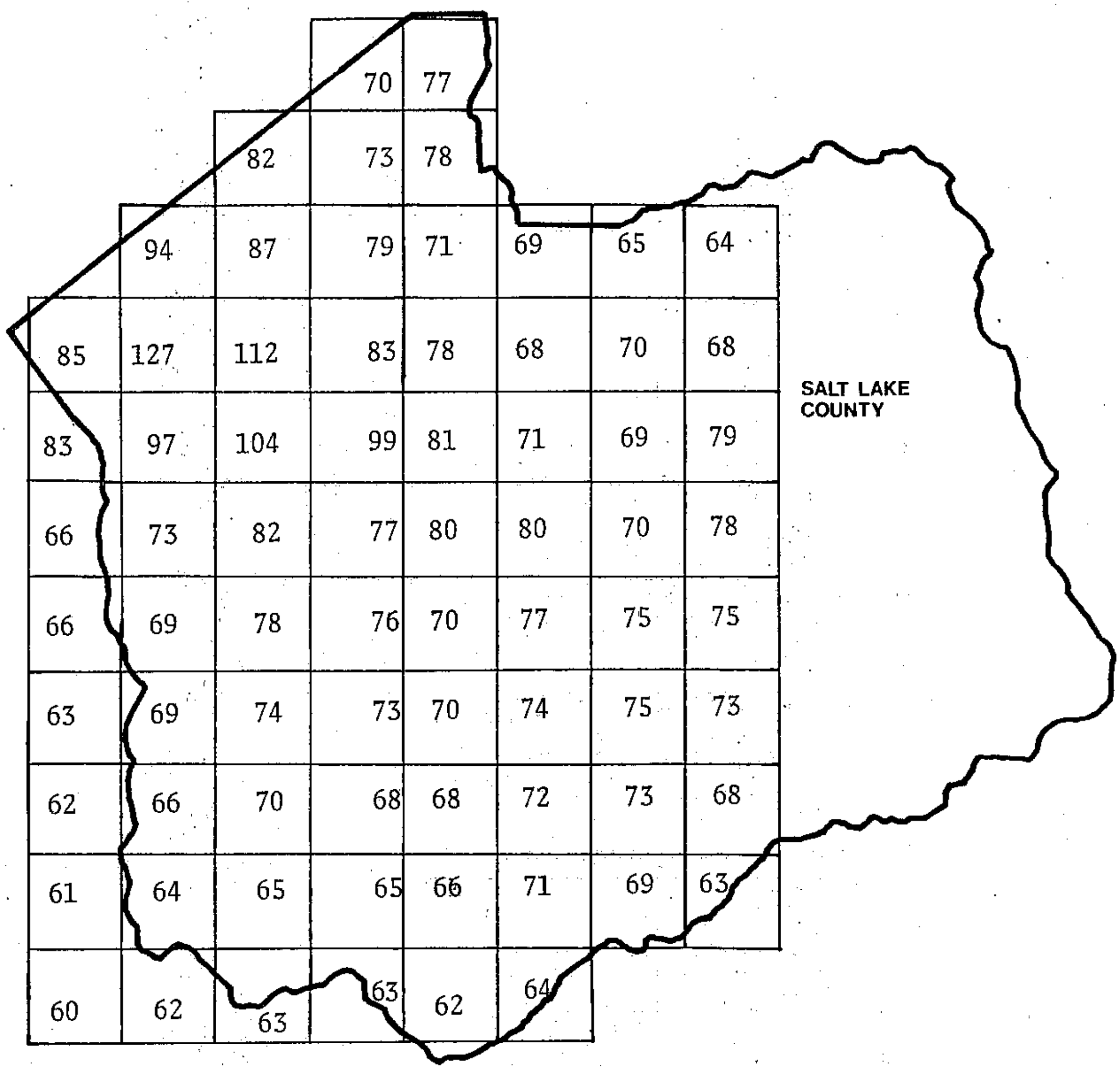


Figure III-6. 1977 Total Suspended Particulates (TSP) Inventory for Salt Lake County. (ug/m³; calibrated using CDM - includes background of 24 ug/m³).

Salt Lake County Water Quality & Pollution Control

208 Water Quality Plan

NORTH

5 km²	6250 ac.

Financed Under Section 208 of the Federal Water Pollution Control Act of 1972, as amended.

meters (thousands) 0 5 10 15

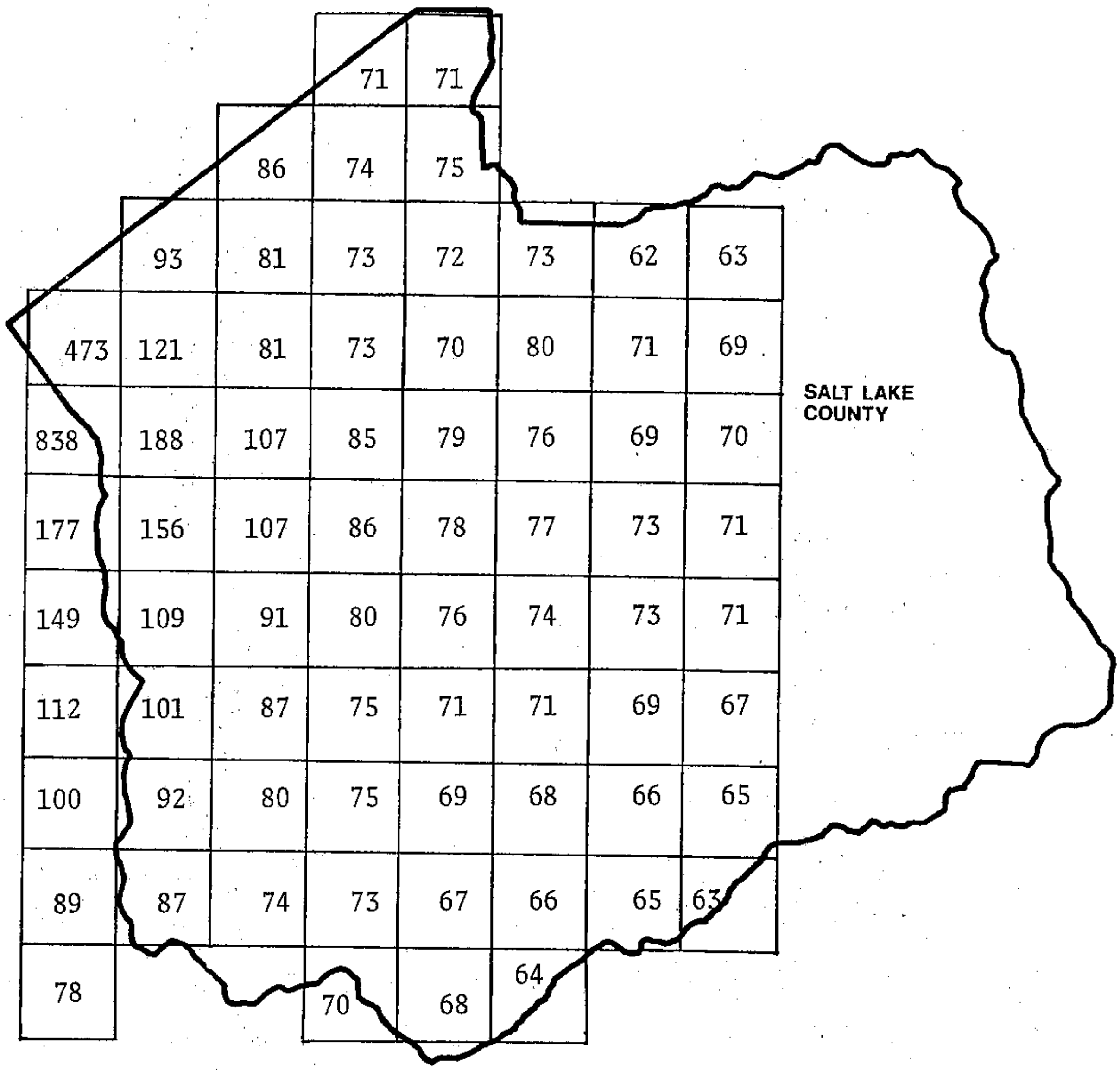


Figure III-7. 1977 Sulphur Dioxide (SO_2) Inventory for Salt Lake County. (ug/m^3; calibrated using CDM - includes background of 15 ug/m^3).

Salt Lake County Water Quality & Pollution Control

208 Water Quality Plan

NORTH

5 km^2	6250 ac.

Financed Under Section 208 of the Federal Water Pollution Control Act of 1972, as amended.

meters (thousands)
0 5 10 15

Since the most critical analysis of surface runoff relates to soils data, only issues of secondary importance relate specifically to geology. For example, structural alternatives relating to acquifer recharge by water injection would require more detailed mapping of geologic conditions than the data presently available. Detailed mapping has been carried out for most quadrants located in the Wasatch Canyons, but the only data available in any detail for Salt Lake Valley is in the Sugarhouse Quadrant, which covers primarily the foothills of Olympus Cove.

General geologic features of the County are shown in Figure III-8.

POPULATION AND LAND USE

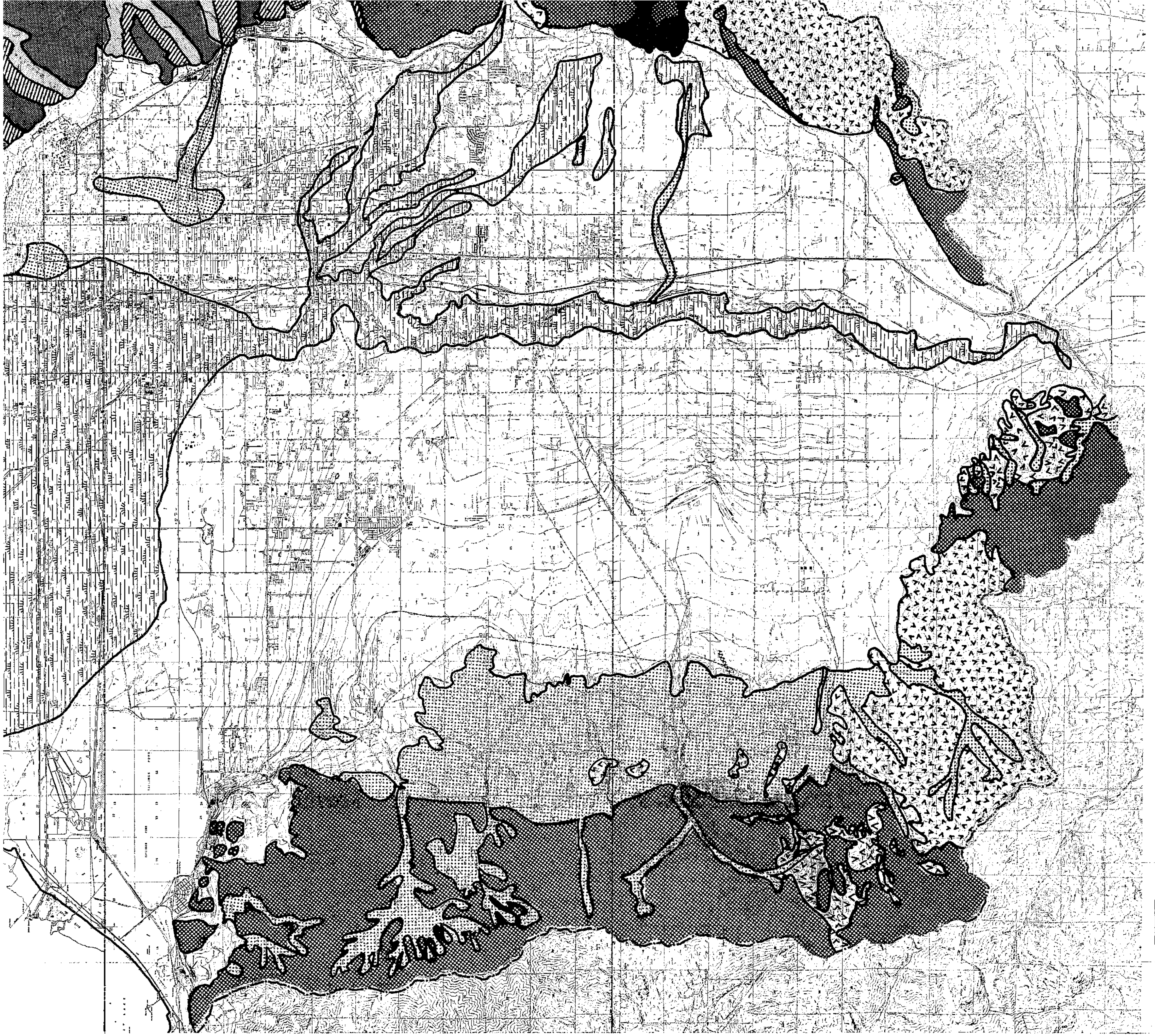
Presently, Salt Lake Valley accomodates over half a million people, living in approximately 168,000 homes. These homes occupy a total area of about 31,000 acres.

Since 1847, the County has steadily grown until it now serves the intermountain region as the center of commerce, industry, communication, medicine, education and finance. Attendant with a rapidly accelerating growth rate, problems have developed. In an effort to effectively meet those problems, Salt Lake County developed a master plan which was adopted by the County Commission in 1965. Since then, dramatic increases in population and shifts in land use patterns have occurred, necessitating an update of that plan. The 208 Project has provided significant input into this update which is in progress at the present time.

The past and present figures concerning population and land use are shown below (abstracted from Technical Report LU-11).

FIGURE III-8

GEOLOGY



VOLCANIC PLUTONIC

QUARTZITE

LIMESTONE

SANDSTONE

CONGLOMERATE

SHALE

ALLUVIAL DEPOSIT

FLOOD PLAIN DEPOSIT

LACUSTRINE DEPOSIT

TALUS AND GLACIAL TILL

COMPILED FROM UTH GEOLOGICAL SURVEY DATA FROM 1960 TO 1964.

Salt Lake County Water Quality & Pollution Control

208 Water Quality Plan

NORTH

40 160 640 ACRES 10

Financed Under Section 208 of the Federal Water Pollution Control Act of 1972, as amended.

MILES

0 1 2 3 4

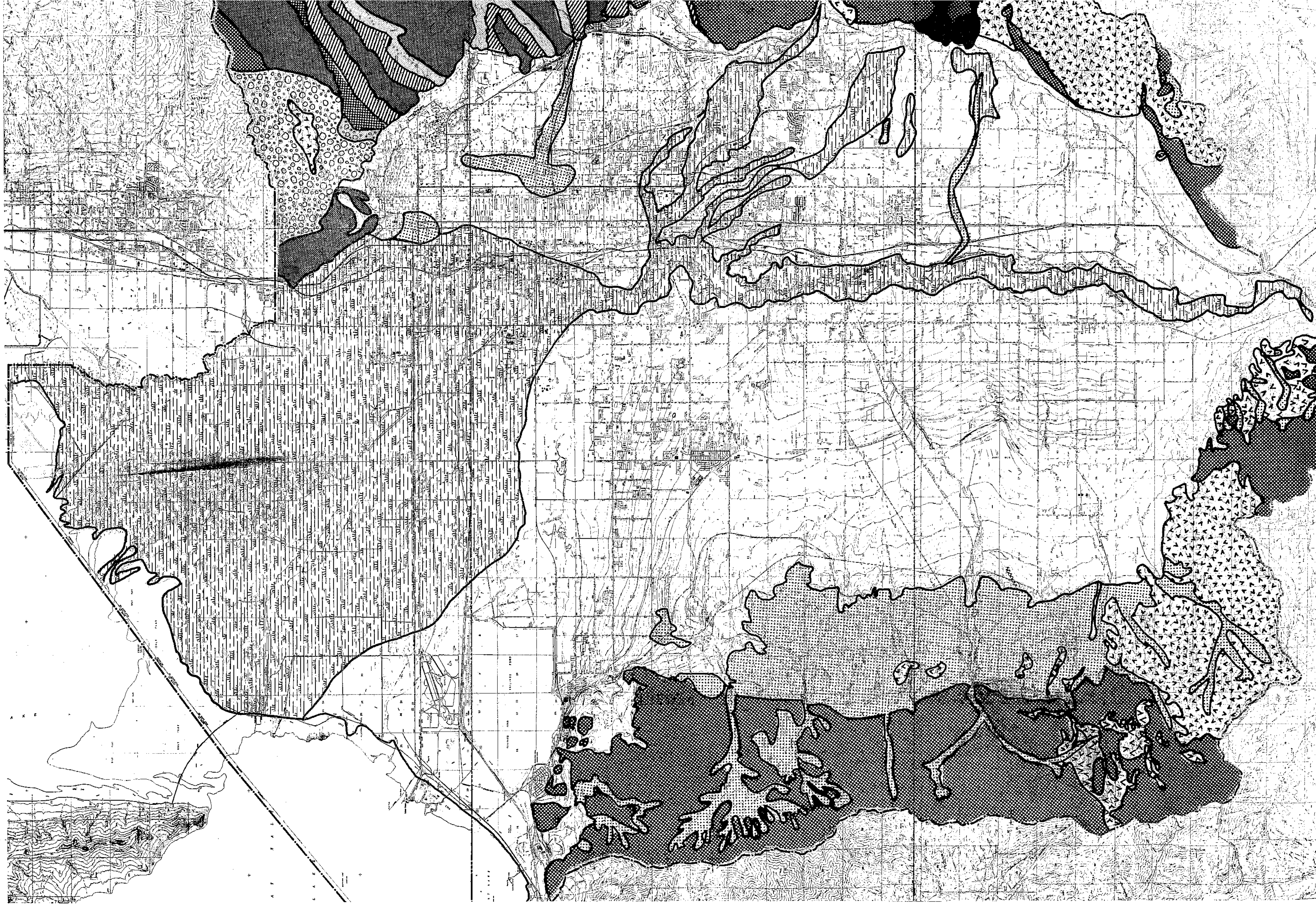
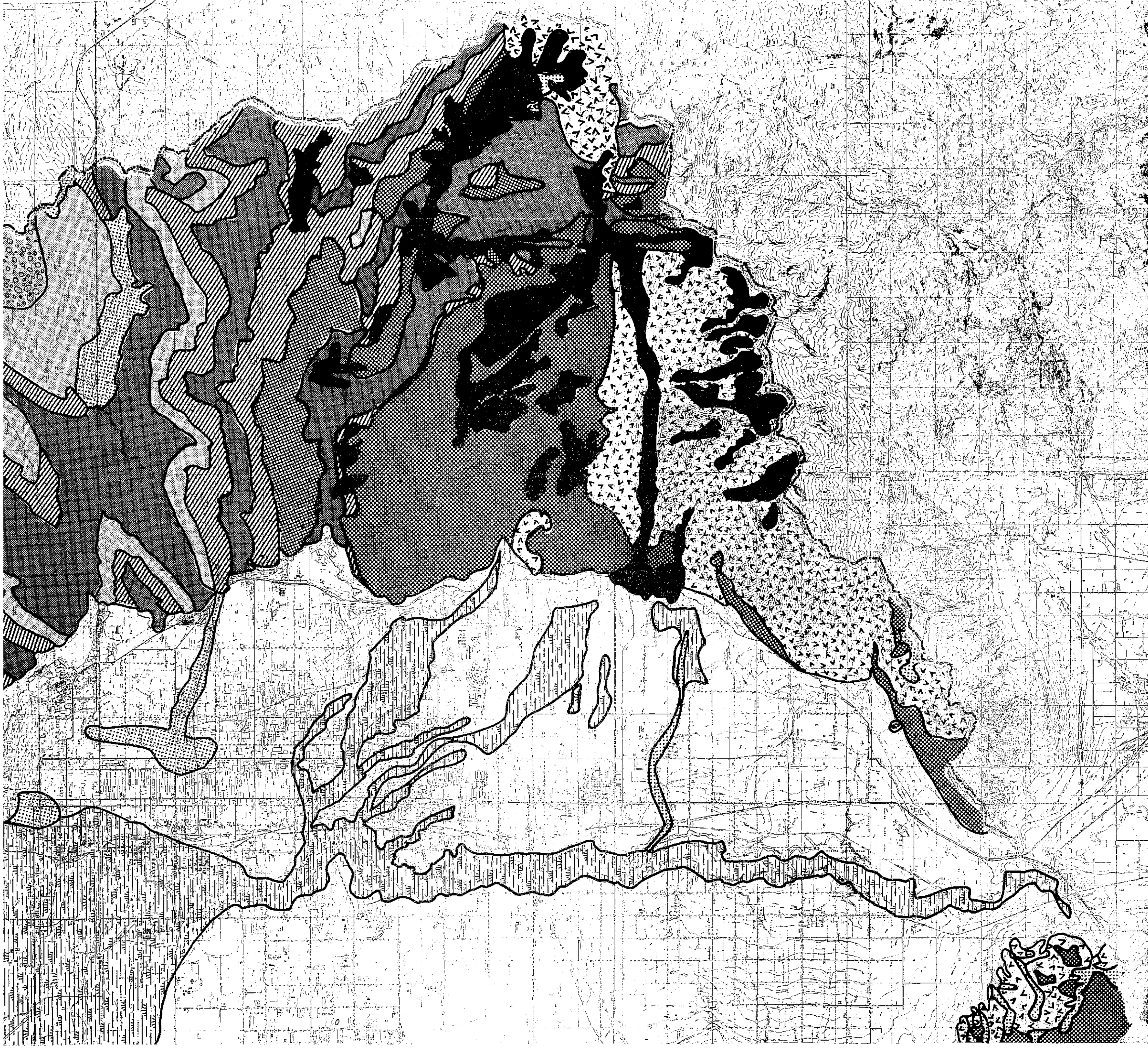


FIGURE III-8

GEOLOGY



COMPILED FROM UTH GEOLOGICAL SURVEY DATA FROM 1960 TO 1964.

Salt Lake County Water Quality & Pollution Control

208 Water Quality Plan

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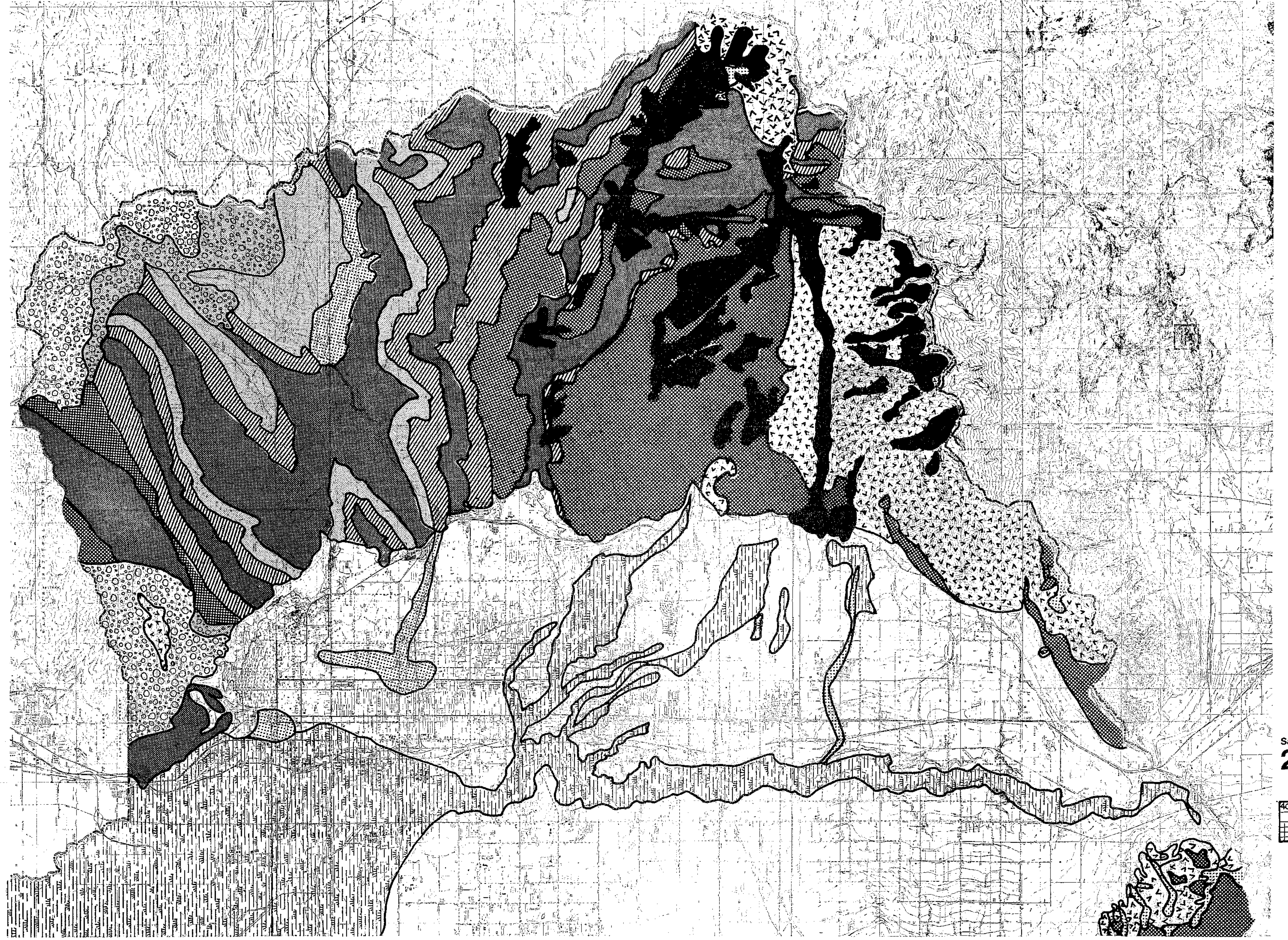


Sa
2

	1960	1970	1976
Population	383,035	458,607	521,500
Household Size	3.5	3.4	3.1
Occupied Dwelling Units	108,007	134,926	168,100
% Population Increase		19.73	13.71

The present land use conditions of Salt Lake County can be summarized in terms of past inefficient patterns of development. The present development pattern has generally resulted in:

1) loss of irreplaceable natural and recreational resources;
2) loss of the productive use of prime irrigated agricultural areas by the intermingling of subdivisions;
3) diversion of public and private investment to newly developing areas rather than upgrading of older areas;
4) existing service facilities being under-used while new facilities are being extended into new areas;
5) intense competition between jurisdictions for developments which generate revenues to pay for the needed urban services;
6) heavier reliance on the automobile for transportation at the expense of more efficient transit service (air pollution impacts).

The following description of the existing structure is taken from the Salt Lake County Master Plan summary which appeared in the Salt Lake Tribune in July, 1977. (Structural form of the County is shown in Figure III-9.)

> Salt Lake County consists of an unincorporated area which contains approximately half of the county population and nine incorporated cities* which contain the other half of the county population. How-

*Since the printing of the summary in July 1977, the southeastern community of Draper voted for incorporation. Draper becomes the tenth city in Salt Lake County.

ever, when viewed from the air these political subdivisions are not obvious. No physical features are readily identified as city or county boundaries. The most noticeable features are the railroads and highways, commercial and industrial districts, residential areas, the Jordan River, farm lands and mountains, the location of which combine to create the urban form and setting.

The area of greatest activity consists of the one to one and one-half mile wide section located on either side of I-15 which stretches the full length of the County. This "central corridor" is anchored on the north by the Salt Lake City central business district and on the south by a proposed regional shopping center and employment area. Between the two anchors lie industrial land, scattered single family homes, a regional shopping center, and strip commercial uses along State Street. Paralleling the central corridor on either side are the major residential areas of the valley. Our history and culture place high value on the single family home which accounts for the majority of our dwelling structures. However, due to many factors such as housing costs and family size, an increasing percent of families are living in condominiums or apartments. As a result, it is necessary to accommodate an increasing number of multiple family dwellings within the residential area. It is proposed that they be located on the periphery of rather than within single family neighborhoods.

As the population continues to increase, the single family area will spread out from the central corridor. The higher density developments will fill in the more centrally located sites where services are more conveniently available. These sites will generally be located on major thoroughfares where more convenient transit service is planned.

Mountains and Agriculture

The next land use area outbound from the cental corridor consists of the mountains and/or agricultural areas. The mountains are not suitable for development except recreation. Their role as culinary watersheds requires close supervision of any use or development.

Agricultural land traditionally receives the major thrust of urban expansion. It is proposed in the plan that methods be devised to permanently preserve the most valuable agricultural land.

Other Major Features

Numberous major facilities dot the valley flood and add emphasis to the more uniform pattern of commercial-residential-agricultural land uses. Some have located next to raw materials, others near markets to be served, others because of access to transportation systems and still others simply because of available land. Included in this category are the regional shopping centers, Kennecott Copper, Hercules, salt processing, the International Airport, the University of Utah, sand and gravel operations and others.

Transportation System

All of these components of the valley land use pattern are linked together and served by a network of freeways, railroads, air facilities, major streets and communication systems. Improvements to the system of major streets and freeways are planned as they become necessary to support the orderly, incremental growth of urban land uses. At the same time, the structure of these land uses is to be planned to support an expansion of the mass transit system and to make riding transit more convenient and attractive.

TERRESTRIAL AND AQUATIC ECOSYSTEMS

Terrestrial ecosystems in Salt Lake County range from subalpine systems in the eastern Wasatch Mountains to the Great Salt Lake desert in the northern portion of the country.

The Subalpine region of Salt Lake County is extremely limited. It can be characterized as having a very rugged terrain due to soils, topography, heavy snow accumulations and historic glacial action. Wet meadows are common. The Englemann Spruce-Subalpine Fir Association occurs in this ecosystem as well as large areas of exposed rock. Plant and animal life is restricted due to the harsh environment and lack of habitat area. This region is limited to elevations greater than 9000 feet.

Englemann Spruce - Subalpine Fir form the dominant vegetation associations in the Upper Montane ecosystem. This spruce-fir association is limited to higher elevations and covers only very small portions of the County.

The Lower Montane ecosystem is characterized by a climax community of Ponderosa pine (yellow pine) - Douglas Fir - White Fir. Intermixed throughout this community are subclimax stands of quaking aspen and lodgepole pine. These montane regions range in elevation from 6000 to 9000 feet.

The Lower and Upper Montane ecosystems provide diverse habitats of cover and living space, and food and water requirements for an abundant and varied wildlife. Animals are likely to migrate between the Lower and Upper Montane. Therefore, an inventory of organisms produces a list of species that could be considered common to both. Animals shy of encroachment into their habitat may tend to exist at the high elevations. Dominant species include Rocky Mountain Mule Deer, yellow-haired porcupine, and snowshoe rabbit. Small mammals are dominated by various species of squirrels, chipmunks, and shrews. Skunk, pika, and various rodents are also associated with this ecosystem. The more common smaller birds include woodpeckers and flycatchers, the rock wren, Western robin, mountain bluebird, and the gray-headed Junco.

The Grass-Sagebrush ecosystem ranges in altitude from about 4300 to 6000 ft. Various communities within the Grass-Sagebrush ecosystem are grass-sagebrush, wet meadow-stream side willow, mountain brush and marsh. Man's activities in the Grass-Sagebrush ecosystem have displaced many of the indigenous animals of the area. The niche these native organisms occupied has been filled by introduced and domestic species. Upland game such as pheasant and mourning dove abide in large number and compete with smaller populations of chukar partridge, sage and forest grouse, and quail.

The various habitat communities adjacent to the Jordan River are predominantly agricultural lands. Through disturbance, the indigenous plant communities have been replaced by exotic types. A limited area of grass-sagebrush exists in the vicinity of the Jordan Narrows.

The Great Salt Lake Desert ecosystem is limited to the area surrounding the Great Salt Lake in the Study Area. Major biotic communities include marsh, juniper, mixed brush, greasewood, shadscale, and vegetated dune. The altitudinal limits of this ecosystem ranges below 4300 feet in Salt Lake County.

The desert habitat types are dominated by small mammals and birds. Typical of the desert communities are the black-tailed jack rabbit, several species of ground squirrels, and the kangaroo rat. Only the red-shouldered hawk and the burrowing owl are confined to the Salt Desert.

While the climate of this area can be described as desert, much of the land is marshland. This marshland is a strip of land about seventy miles long and two to eighteen miles wide (total) on the southeastern shore of the Great Salt Lake. Much of the marshland has been developed by diking and impounding waters that formerly drained into Great Salt Lake. Development has been by private, state, and federal agencies. A consequence of this development is the production of great numbers of mosquitoes and other insect pests and vectors.

The major aquatic habitat in the county consist of City Creek, Red Butte Creek, Emigration Creek, Parley's Creek, Mill Creek, Big Cottonwood Creek, Little Cottonwood Creek, and the Jordan River. The following discussion is derived from the Utah State Division of Wildlife Resources' report SR-1.

City Creek

Upstream from the Salt Lake City Water Treatment Plant the stream runs over limestone substrate in a steep canyon vegetated with pine, oak, and grasses. Streamside vegetation is primarily fir, maple, birch, dogwood, chokecherry, and currant. Aquatic insects are sparse because of the lack of suitable stream habitat.

Below the Salt Lake City Water Treatment Plant the gradient decreases and slight meandering begins. Slope vegetation is mainly oak and June grasses; streamside vegetation includes cottonwood, elm, maple, birch, boxelder, and grasses. The fish population is small and dominated by brown trout.

Red Butte Creek

The watershed above Red Butte Reservoir is at low elevation with moderate side slopes vegetated with scrub oak and grasses. Streamside vegetation is birch, dogwood, elm, horsetail, wheatgrass, and thistle. Banks are well stabilized and fairly well shaded. The stream bottom is heavily silted due to excessive beaver dams. Aquatic insects are common and dominated by mayflies. Cutthroat and brook trout dominate the substantial trout populations.

Red Butte Creek below Red Butte Reservoir is a foothill-type watershed vegetated by oaks and willows. Bank cover composition is elm, scrub oak, wheatgrass, rose, and June grass. Bank stabilization and shading is poor. Mayflies are the common bottom fauna. A diversion above Fort Douglas dewaters the stream during most of the year.

Emigration Creek

Emigration Creek is 12.6 miles in length and flows entirely through private property. Above the Mount Olivet diversion ditch near the mouth of the canyon, the watershed is of moderate gradient vegetated with scrub oak on the south-facing slopes and oak and maple on the north-facing slopes. Bank vegetation is boxelder, cottonwood, mustard, clover, and June grass. Bank stabilization and shading are adequate for aquatic wildlife.

Below the Mount Olivet diversion Emigration Creek flows through foothills and residential areas, including Hogle Zoo and a golf course in Salt Lake City. Brush oaks comprise the hillside vegetation. Streamside vegetation is typically boxelder, scrub oak, and June grass. Bank stabilization is poor but shading is adequate.

Parley's Creek

From Mountain Dell Reservoir upstream to Lamb's Canyon Creek, Parley's Creek lies in a mid-altitude watershed with scrub oak, elm, and grasses on the side hills. The watershed is in good condition because of protection by the Salt Lake City Water Department. This section of stream is 2.6 miles in length and runs through land mostly owned by Salt Lake City. There is some private land and very little State land.

Above Mountain Dell reservoir streamside vegetation is primarily birch, willow, hawthorne, and grasses. Bank stabilization and shading are excellent. Stream bottom composition is suitable for aquatic insect production and natural reproduction of trout. Stream flow is variable but is seldom, if ever, less than 5 cfs.

From 1300 East, Salt Lake City, upstream to the piped source at the canyon mouth, Parley's Creek is a valley stream suffering from the extensive physical enchroachment by development, especially golf courses, parks, and freeways.

Within the section below the canyon mouth bank vegetation is cottonwood, hawthorne, Russian olive, and grasses. Bank stablization is fair. Stream shading is adequate. Stream substrate is good insect habitat but this section of Parley's Creek is devoid of organisms, including trout. The pool-to-riffle ratio is excellent.

Mill Creek

Upstream from the confluence of Mill Creek and the Jordan River to the Scott Avenue Hatchery, 880 Scott Avenue, Salt Lake County (3.4 miles), Mill Creek runs through Salt Lake County urban areas and is bordered primarily by exotic plants. Bank stabilization and stream shading are very poor.

Stream flow is variable but adequate for a fishery. The stream bottom is excessively silted and limits aquatic insect production.

From the hatchery (not presently in operation) upstream to 2300 East, Salt Lake County, (2.6 miles), the stream is occasionally dewatered for very short periods of time during the summer from about 2000 East to 2150 East. From 2300 East, Salt Lake County, upstream to the Elbow Fork diversion, 4.7 miles are on private land and 4.1 miles are on U. S. Forest Service land. The entire section flows down a moderate gradient in a mid-elevation watershed vegetated with oak and aspen. Streamside vegetation is boxelder, birch, dogwood, maple, willow, and grasses. Stream banks are badly denuded as a result of overuse by campers and picnikers. Stream shading and stream flow are adequate for fishery requirements. Aquatic insects (mayflies and caddis flies) are common in the stream. There are moderate populations of rainbow and cutthroat trout sustained by natural reproduction and supplemental annual plants of catchable rainbow trout. The fishery in this section is suffering mainly from overuse by recreators.

From the Elbow Fork diversion upstream to the headwaters (3.6 miles), the area is a high elevation watershed with moderate stream gradient. Conifers and aspen dominate the slope vegetation. Streamside vegetation consists of white and Douglas fir, dogwood, cow parsnip, and grasses. Bank stabilization and stream shading is excellent. Overall, this watershed is in excellent condition. Aquatic insects are abundant. Stream flow is adequate for the existing fishery. Because of the moderate gradient, the stream has few resting pools for fish. A modest population of rainbow trout exists as a result of limited natural reproduction and supplemental annual plants of catchable rainbows.

Big Cottonwood Creek

Most of the lower Big Cottonwood Creek drainage, from the Jordan River upstream to the State Highway 148 crossing at Knudsen's Corner (Holladay Blvd. and 6200 S. streets; 7 miles), is surrounded by Salt Lake County and other municipal residential areas and the ecosystems have been degraded significantly. Diversions dewater the stream near the canyon mouth.

The section of watershed from the Highway 148 crossing upstream to the Utah Power and Light Company's Stairs power plant is at low elevation and flows through the east Salt Lake County residential district. Vegetation includes willow, cottonwood, scrub oak, grasses, and exotic planrs. Bank cover composition is oak, birch, cottonwood, dogwood, rose, and grasses. Bank stabilization is fair and stream shading is adequate for fish protection. Stream flow is generally adequate for the existing fishery, although subject to extreme daily fluctuations due to upstream water treatment and power plant operation. Aquatic insects, dominated by mayflies and caddis flies, are abundant. Existing populations of rainbow and brown trout are moderate.

The section extending from the Stairs Power Plant upstream to the Storm Mountain reservoir (0.8 miles), is occassionally dewatered by the diversion located there.

From that diversion upstream to the Cardiff Flat Bridge (6 miles), the drainage is of steep gradient and vegetated with conifers, aspen, and oak. Bank vegetation consists of birch, alder, cottonwood, dogwood, and grasses. Stream shading is slightly inadequate for fish protection, but bank stabilization is very good. The entire section has adequate water flow year-round. Although the aquatic insect resource (primarily mayflies and caddis flies) is substantial, high stream velocity and lack of suitable fish resting pools (occasioned by steep stream gradient) preclude high natural trout production.

The wild fish population, dominated by brown trout, is moderate and augmented with annual plants of catchable rainbow trout.

The section extending from Cardiff Flat Bridge upstream to the stream termination at Mary's Lake (6.8 miles), is in a canyon of moderate gradient vegetated with conifer and aspen. Bank stabilization is excellent and provided by alder, willow, birch, and grasses. Stream shading is good. The stream bottom type is good for natural reproduction of fishes and this section is the most productive portion of Big Cottonwood Creek. Mayflies and caddis flies are very abundant and are a major food source for the excellent populations of rainbow, brown, and brook trout existing in this section.

Little Cottonwood Creek

The lower reach of Little Cottonwood Creek, from the Jordan River upstream to the water treatment plant, represents a fishery (and associated biota) almost totally degraded by channelization, diffuse source pollution, dewatering, and litter. The stream flows through a somewhat urbanized area near the canyon mouth and then through a more heavily urbanized area near the Jordan River. The resident fish population consists of brown trout. There is no planting of fish in this section.

Upstream from the treatment plant at the mouth of Little Cottonwood Canyon, Little Cottonwood Creek flows through a steep, glaciated canyon vegetated with conifers and aspen. Streamside vegetation consists of aspen, fir, dogwood, cottonwood, and grasses. Bank stabilization is good, but stream shading is inadequate for a fishery. Because of the steep gradient and large boulder substrate, production of fish and other aquatic life is low. The existing populations of rainbow and cutthroat trout are very small and average fish size is small. Stream flow is good.

Jordan River

In the northern portion of the Jordan River, stream velocity and volume are suitable for a warm fishery. The percent of stream bottom covered during low flow is adequate. A low pool-to-riffle ratio, resulting from extensive channelization, and high turbidity limit aquatic flora and fauna production. The stream bottom type is of poor quality and unsuitable as benthic insect or fish spawning habitat. Water temperatures are suitable for warm water fish species, although present water pollution prevents establishment of game fish population. Resident fish species are limited to carp (Cyprinua carpio), the Utah chub (Gila atraria), and the Utah sucker (Catostomus ardens). Natural fish propagation is poor.

The mid-section of the Jordan River is an area of moderate human development and poor aesthetics. Stream velocity, volume and percent of bottom covered during low flow is suitable for fishery maintenance. Channelization has destroyed much fish habitat and reduced the pool-to-riffle ratio. Although the length of the growing season is good, turbidity and pollution limit aquatic plant production. Stream bottom type is of fair quality and of suitable substrate for substantial benthic invertebrate populations. Bank cover and stream shading is poor, but water temperatures are sometimes suitable for trout. Predominant resident fish species are rainbow trout (Salmo gairdneri), brown trout (S. trutta), carp, black bullheads (Ictalurus melas), longnose dace (Rhynichthys cataractae), mountain suckers (Pantosteus platyrhynchus), and Utah suckers. Fish populations are small because of poor natural reproduction and heavy fishing pressure.

In the upper reaches of the river in Salt Lake County, stream velocity is adequate for a fishery, but volume is often inadequate because of excessive diversion. The percent of streambed covered during low flow is poor. Stream bank cover, shading and the pool-to-riffle ratio are good but turbidity limits aquatic production. The stream bottom type is good benthic invertebrate substrate. Water temperatures are suitable for a warm or cold water fishery. Natural fish propagation is fair and sustains populations of black bullheads, bluegill (Lepomis macrochirus), carp, channel catfish (Ictalurus punctatus), fathead minnows (Pimephales promelas), and white bass (Roccus chrysops). Water pollution slightly limits aquatic production.

HYDROLOGIC OVERVIEW

The major hydrologic features in Salt Lake County consist of surface water and groundwater systems.

From Utah Lake, the Jordan River meanders approximately 55 river miles northward to the Great Salt Lake. The river gradient is slight, averaging only 5.2 feet per mile. The river flow is supplemented by many tributaries entering the river from the east and depleted during the summer by diversions into irrigation canals. The major tributaries and their drainage basins are illustrated in Figures IV-1 and IV-11.

At the Jordan Narrows, ten miles north of Utah Lake, the bulk of the river flow is diverted into irrigation canals during the irrigation season (May-September). Flow immediately below the diversion varies from 1400 cfs during spring runoff to no flow during summer months. North of the diversions, the river meanders through a broad flood plain, gaining flow from groundwater, irrigation returns, and several small area wastewater treatment plants. The 20-mile reach of the river that passes through the Salt Lake City Metropolitan area is the recipient of many municipal and industrial waste discharges. The river also receives urban and storm runoff from these areas. At 2100 South Street, much of the river flow is diverted into what is called the Surplus

TABLE III-6

WATER USES IN SALT LAKE COUNTY

Use	Amount (Ac-Ft/Yr)	%
Irrigation	296,600	47
Industrial	160,100	26
Residential & Municipal	135,300	22
Stock (cattle, horses, etc.)	33,500	5

From SR-5

SOLID WASTES MANAGEMENT

Presently Salt Lake County and Salt Lake City are operating separate landfills. Salt Lake City's landfill is located at approximately 7200 West North Temple while Salt Lake County's facility is located at approximately 8000 West 2100 South. Both landfills are located in areas of high groundwater (0.4 ft.). The leachate from these landfills can cause serious health and water quality problems. Surface water runoff from the landfills can also pose added difficulities. Salt Lake County used to operate a trash dump near 3200 West and 6200 South where yard, garden, and other landscaping wastes were disposed This dump is now closed but remains a problem area for County officials. The dump is burning underground and is a source of cockroaches which have been infesting the houses of nearby residents. Four south county municipalities have also established and presently use a small landfill approximately six miles west of South Jordan called the "Trans-Jordan Pit." The locations of the existing landfills are shown in Figure III-10. None of the existing landfills in Salt Lake County are operated according to standards specified by the City-County Health Department. Therefore, the health authorities have demanded

Canal. This canal was designed to provide for a direct access to the Great Salt Lake for flood control purposes protecting downstream areas on the Jordan River. North of Salt Lake City, the river flows into marshland areas that feed the Great Salt Lake.

The groundwater system in Salt Lake County consists primarily of confined aquifers recharged in areas along the east bench area of the valley. Groundwater withdrawals have been increasing at a rate of about 1.5% per annum and presently constitute 125,000 acre-feet per year (SR-5). Much of the remaining recharge to the aquifer is naturally discharged into the Jordan River, its tributaries, and to the groundwater table by upward leakage.

Table III-5 provides a breakdown of the sources of the 632,700 acre-feet per year of water diverted between 1970-1975 in Salt Lake County. Additional water other than the previously described sources are diverted and piped into Salt Lake County from the Provo River in Utah County and from Tooele County for industrial and irrigation uses. Table III-6 indicates the various uses for the water diverted in the County.

TABLE III-5

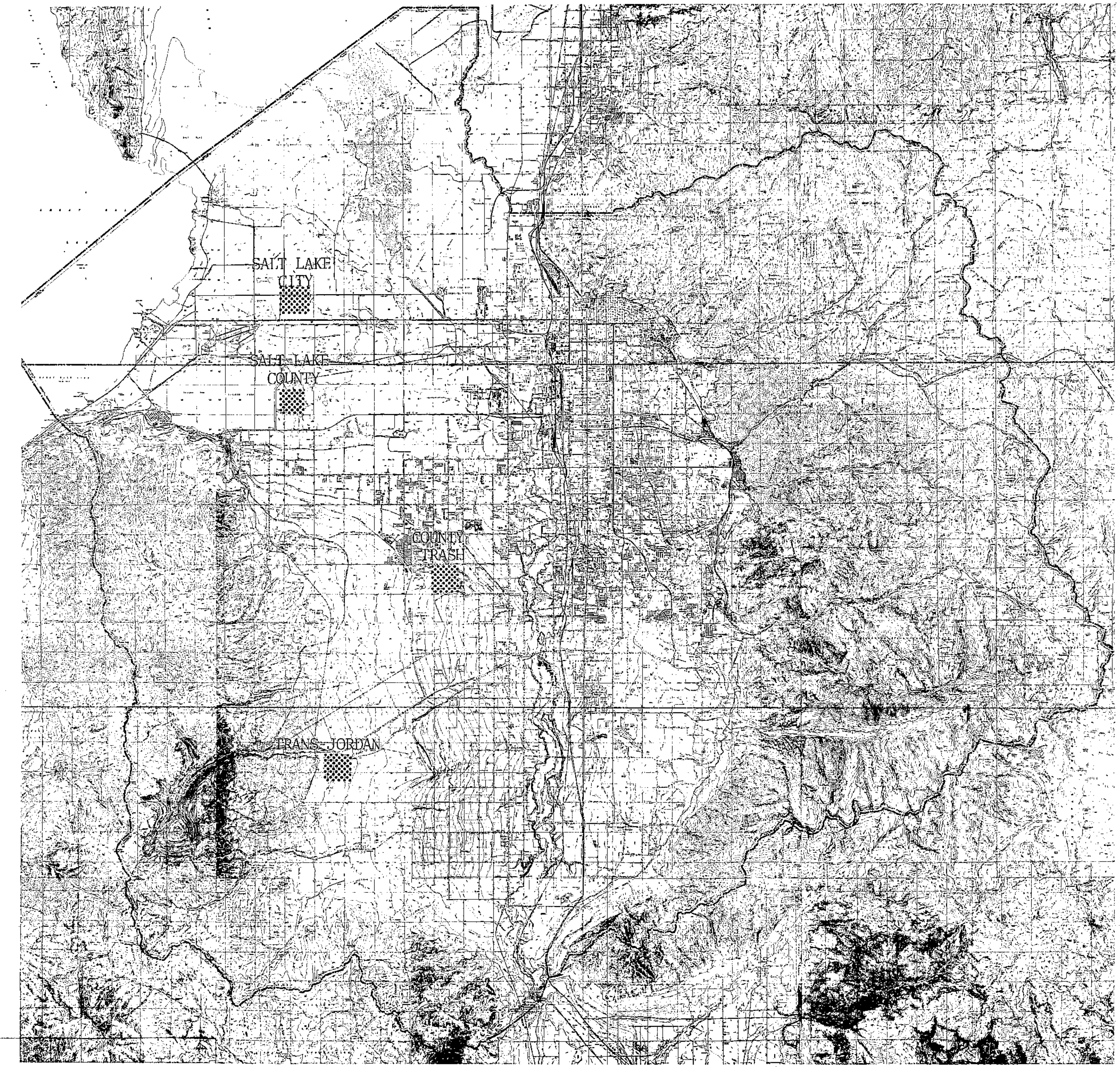
WATER SOURCES IN SALT LAKE COUNTY

Source	Amount (Ac-Ft/Yr)	%
Jordan River	323,000	51
Wells and Springs	142,000	22
Wasatch Front Streams	108,000	17
Provo River	50,200	8
Tooele County	9,500	2

From SR-5

FIGURE III -10

EXISTING LANDFILL SITES



Salt Lake County Water Quality & Pollution Control

208 Water Quality Plan

NORTH

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that both the major landfills discontinue operation at their present locations and transfer all solid waste to a more environmentally suitable area.

Collection services are provided by each municipality or contracted out to various private, commercial collection firms in the Valley.

The present solid waste generation is tabulated in Table III-7 according to source of wastes.

TABLE III-7

LANDFILL LOADINGS- TONS/DAY*

Category	County Landfill	City Landfill	Trans-Jordan Landfill
Residential	290	178	74
Commercial	202	197	70
Industrial	104	134	76
Private	20	8	10
Totals	616	517	230

*Working-day loadings
From SR-6

The total solid waste generation in the Salt Lake Valley is presently 1360 ton/working day. This yields a per capita waste generation of 4.80 lbs. per capita per day.

Future solid waste loadings in 1995 are based on applying a per capita waste generation multiplier of 1.56 (SR-4). Table III-8 tabulates the future loadings in Salt Lake County.

TABLE III-8

FUTURE LANDFILL LOADING CALCULATION

Category	Present per capita wastes generation	1995 Population	Multiplier	Loading (Tons/Day)
Residential	2.54	791,000	1.56	1570
Commercial	1.31	791,000	1.56	810
Industrial	1.06	791,000	1.56	650
				Total = 3030

Salt Lake City and County are undertaking an investigative study into the use of solid waste in a direct fuel recovery system. Pilot plant studies are just beginning. The conversion to resource recovery systems and the utilization of separated solid waste as a supplemental fuel source is quite realistic.

FINANICAL STATUS

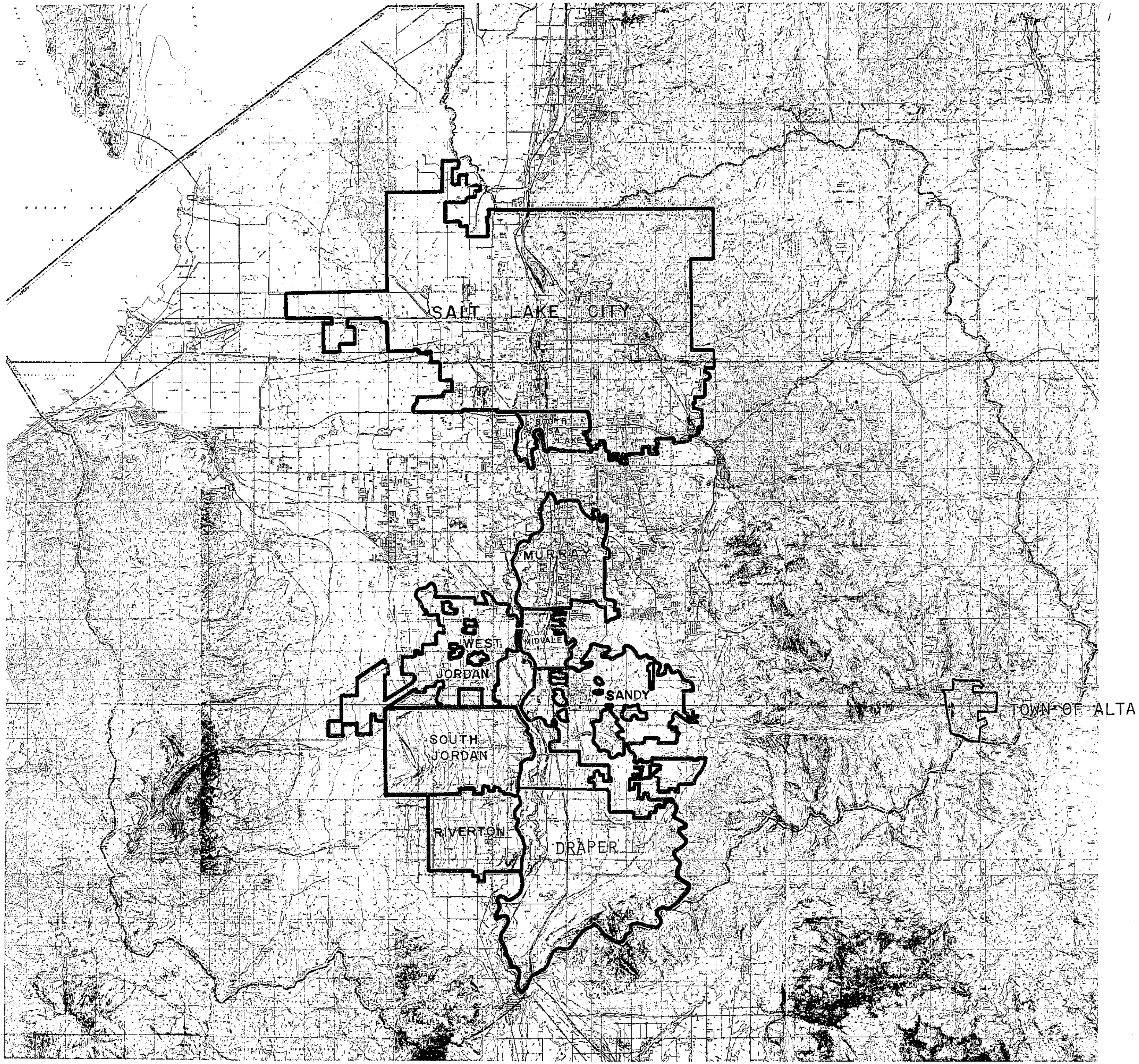
The fragmentization of governmental units in Salt Lake County, as shown in Figure III-11, has created problems in the past and will continue to do so in the future. The Salt Lake County Council of Governments, a voluntary membership organization, was formed to help work out problems created by this fragmentation of government. These problems center around the provision of services for residents within the County boundaries. Some services are provided on a county-wide basis (flood control, health department, and others) but these are only a few of many. Other services, such as wastewater treatment, are provided for by special service districts. These districts charge only those who receive the services rendered.

A recent Utah Supreme Court decision involving taxing within an incorporated areas has created a furor concerning county garbage collection services. The decision was based upon the issue of double taxation where residents of

FIGURE III- 11

GOVERNMENTAL AND JURISDICTION FRAGMENTATION

SALT LAKE COUNTY



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incorporated areas were being taxed to pay for county services outside of corporate boundaries.

Economies of scale can be achieved through consolidation of certain services, as has been demonstrated by combining city and county health departments, but municipalities are often reluctant to give up services that identify their own spheres of influence or power base.

The effect of this on-going struggle with reference to future water quality needs has, to a large extent, been overcome. The Salt Lake County Council of Governments has agreed to finance on-going water quality management from the County-wide Flood Control mil levy. Under this arrangement, the service being proposed under this area-wide water quality plan has been agreed upon by both cities and county to be shared.

Future Conditions

PROJECTED LAND USE

As reported early in the 208 Project, the population of Salt Lake County is expected to increase 52% in the next two decades, at an annual average rate of about 5%. This implies that an additional 270,000 people will have to be housed. The impact of this growth on water quality will be increases in wastewater, stormwater, and decreased agricultural return flows. Section IV discusses these specific impacts in more detail.

During the course of the 208 study period, the Project Management has had the benefit of three studies in Land Use: 1) Williams & Mocine, 208 Project Consultants for the Valley portion of the County, made initial estimates of projected population, holding capacity, and allocation of housing units by 208 Statistical Area. 2) EDAW, Inc., 208 Project Consultants for the Canyon portion of the County, were contracted by the Salt Lake County Planning Commission to provide a comprehensive update of the 1965 Master Plan. 3) The Salt Lake County Planning and 208 Project Staff conducted additional studies and drafted alternatives to the work of both consulting firms. Therefore, the Land Use patterns, assumptions, allocations, and maps are a composite of these joint efforts.

Technical Report LU-9, Economic and Demographic Futures, 1975-1995, provides the initial source of population and dwelling unit projections. Although common "Statistical Areas" were used in the first projection (drainage basins combined with Sewer District boundaries), subsequent allocations were made by municipality and common sewage treatment area. Figures III-12, III-13, III-14, and III-15 indicate the statistical areas and the population allocations made for each area. It is stressed that the assumptions made concerning these allocations are dynamic rather than static. They will change as economic forces shift, and predicting the complex shifting of a regional economy is most difficult, if not impossible.

The need for up-dating and re-adjusting the projections will be necessary as conditions change, because of unexpected expansions in the employment base at any one point in the county. Although the total county projection is relatively stable since it is based on employment factors, the direction and intensity of growth in any one specific location is most difficult to assess. More detailed description of this process can be reviewed in Economic Demographic Futures.

Table III-9 is a summary of the number of acres available for development and the number of acres estimated to be developed as a result of population

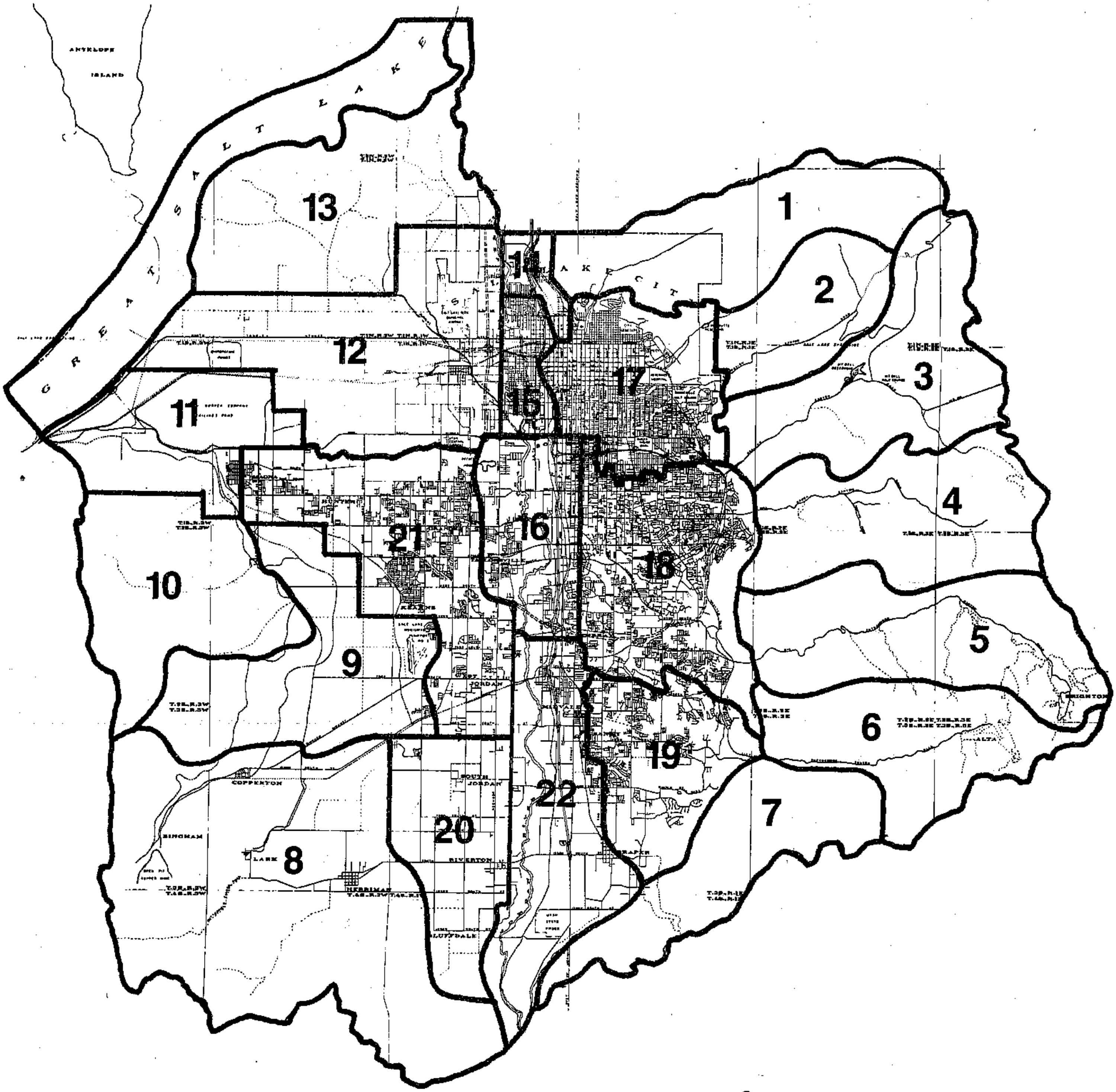

FIGURE III-12. WATER QUALITY PROJECT STATISTICAL AREAS

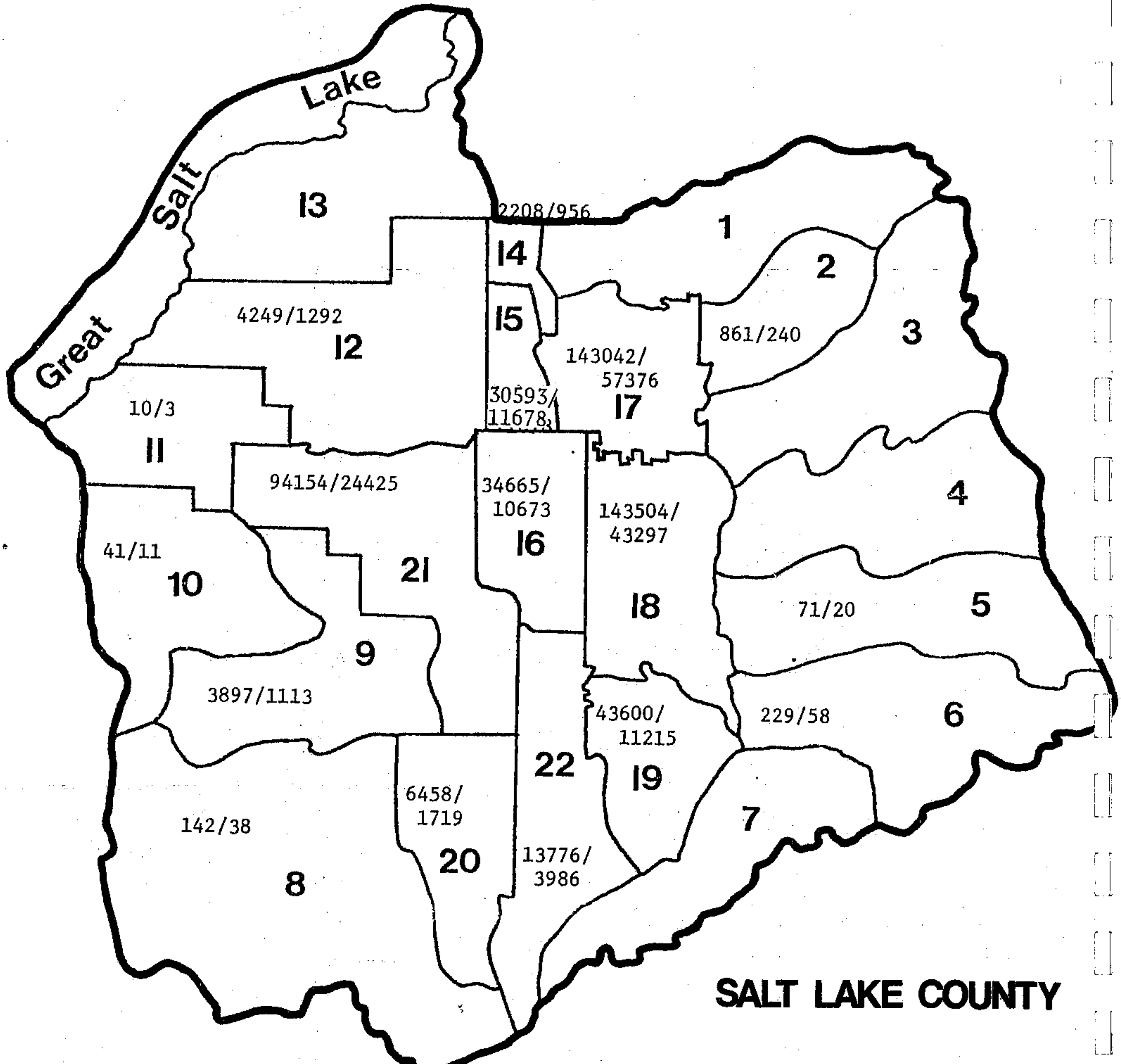

FIGURE III-13. 1975 POPULATION/DWELLING UNITS

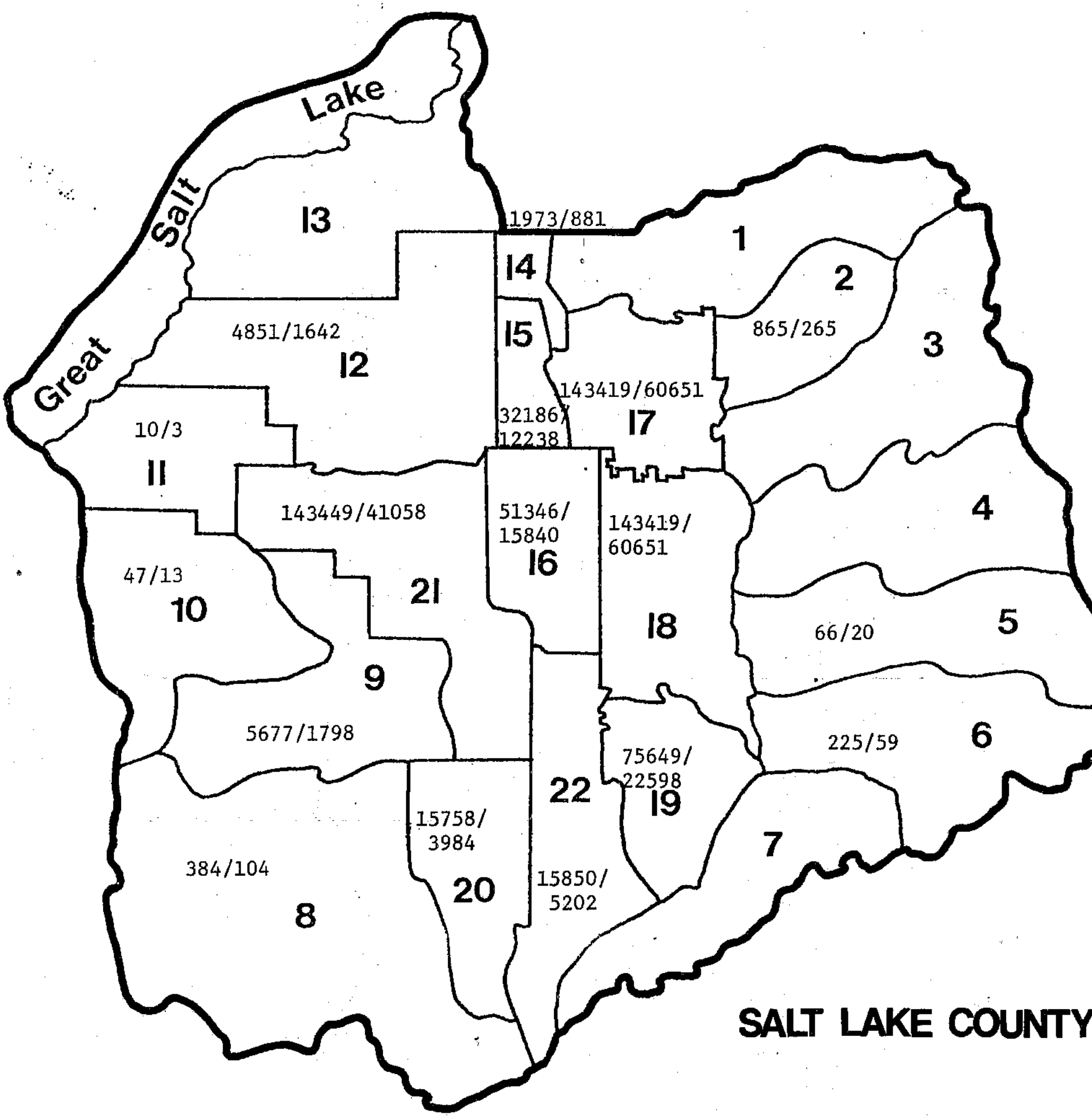

FIGURE III-14. PROJECTED 1985 POPULATION/DWELLING UNITS

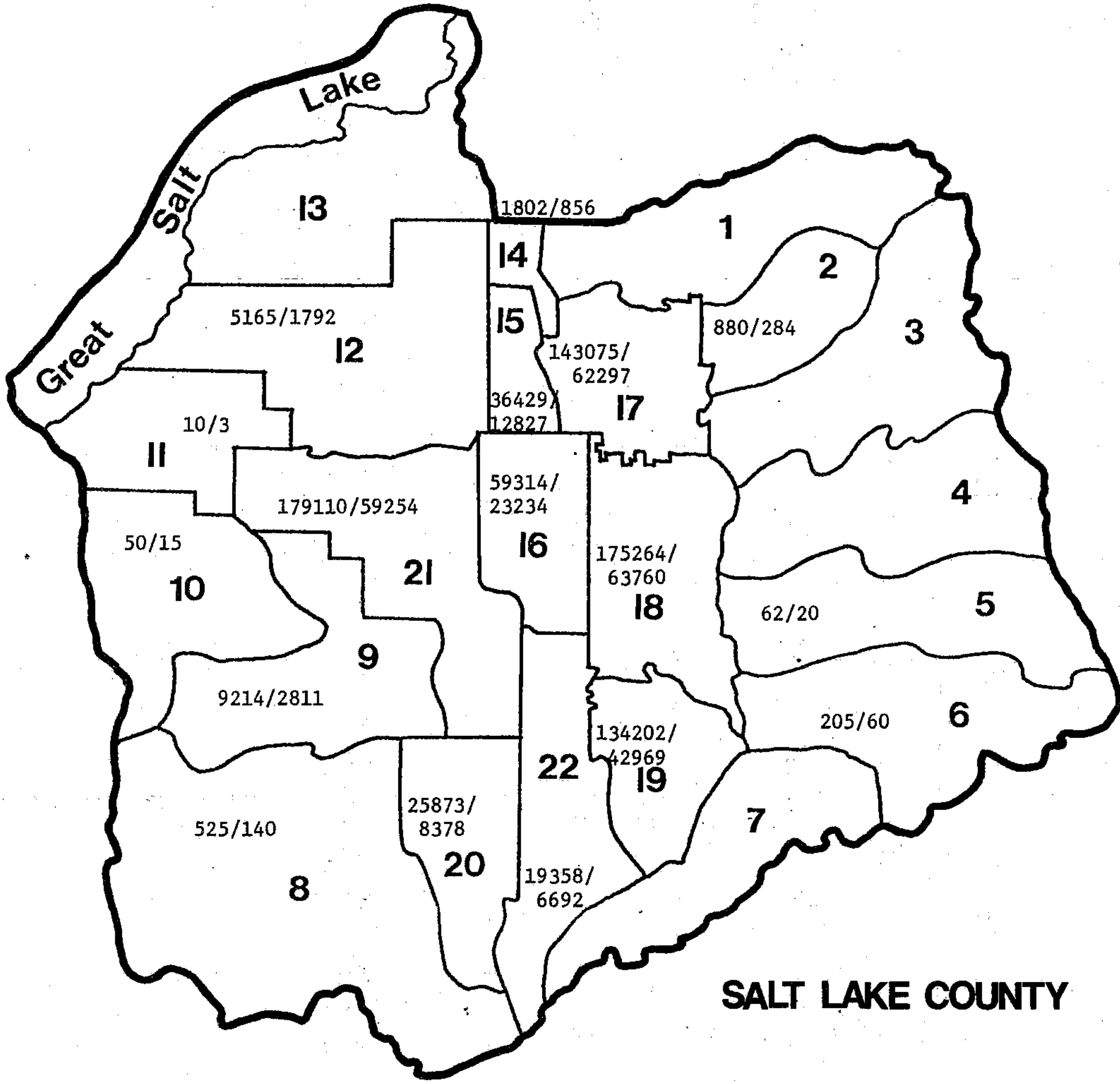

FIGURE III-15. PROJECTED (HIGH) 1995 POPULATION/DWELLING UNITS

TABLE III-9. ACREAGE ABSORPTION
BY STATISTICAL AREA

Salt Lake County Statistical Areas	ACRES				
	Total Available	Committed by 1995		Available after 1995	
		Residential	Non-Res.	Residential	Non-Res.
1					
2					
3					
4					
5	300			300	
6	90			90	
7					
8	1,960	1,510		150	
9	20,810	373	296	16,013	4,033
10					
11					
12	3,337	52	3,285		
13					
14	320		320		
15	205	89		116	
16	3,954	1,681	1,110	1,327	336
17	670	270	400		
18	6,435	1,656	990	3,024	
19	13,677	4,788	700	6,526	1,653
20	14,183	958	160	10,329	2,641
21	16,802	5,379	1,700	7,758	1,965
22	6,780	558	470	4,589	1,163
TOTAL	89,523	17,314	9,431	50,222	12,556

increase in respective statistical areas. The impact of these increases in residential and non-residential (commercial, industrial, institutional) growth are evident in Figures III-16 and III-17. These figures indicate the increase in acreage and where the increases are most likely. Note that one figure shows the next 20 years of expansion under low density, the other at medium density: (low density = 2-4 units per acre; medium density = 4-8 units per acre). Therefore, if residential units were clustered rather than developed in typical subdivisions, there would be almost 10,000 acres left open.

The differences in these growth alternatives are outlined on Table III-10 However, in order to most accurately assess the impact of growth on water quality, the Project Staff has represented the most land consuming alternative in its description. This approach provides the most realistic effects of growth on the local economy and water quality. The description of growth is divided into two elements - the Salt Lake Valley and the Wasatch Canyons.

Salt Lake Valley - 1995

Figure III-18 indicates the general development pattern expected in Salt Lake Valley over the next 20 years. This pattern is a composite of the efforts made to date in land use planning programs in Salt Lake County, and mainly outlines areas expected to be developed (urbanized) and areas expected to remain undeveloped.

The term "developed" refers to urbanization and includes all land use components except agricultural, open, and vacant land in general.

Development will have basically three impacts on future water quality:

1) Increased wastewater flows to the sewer treatment plants.

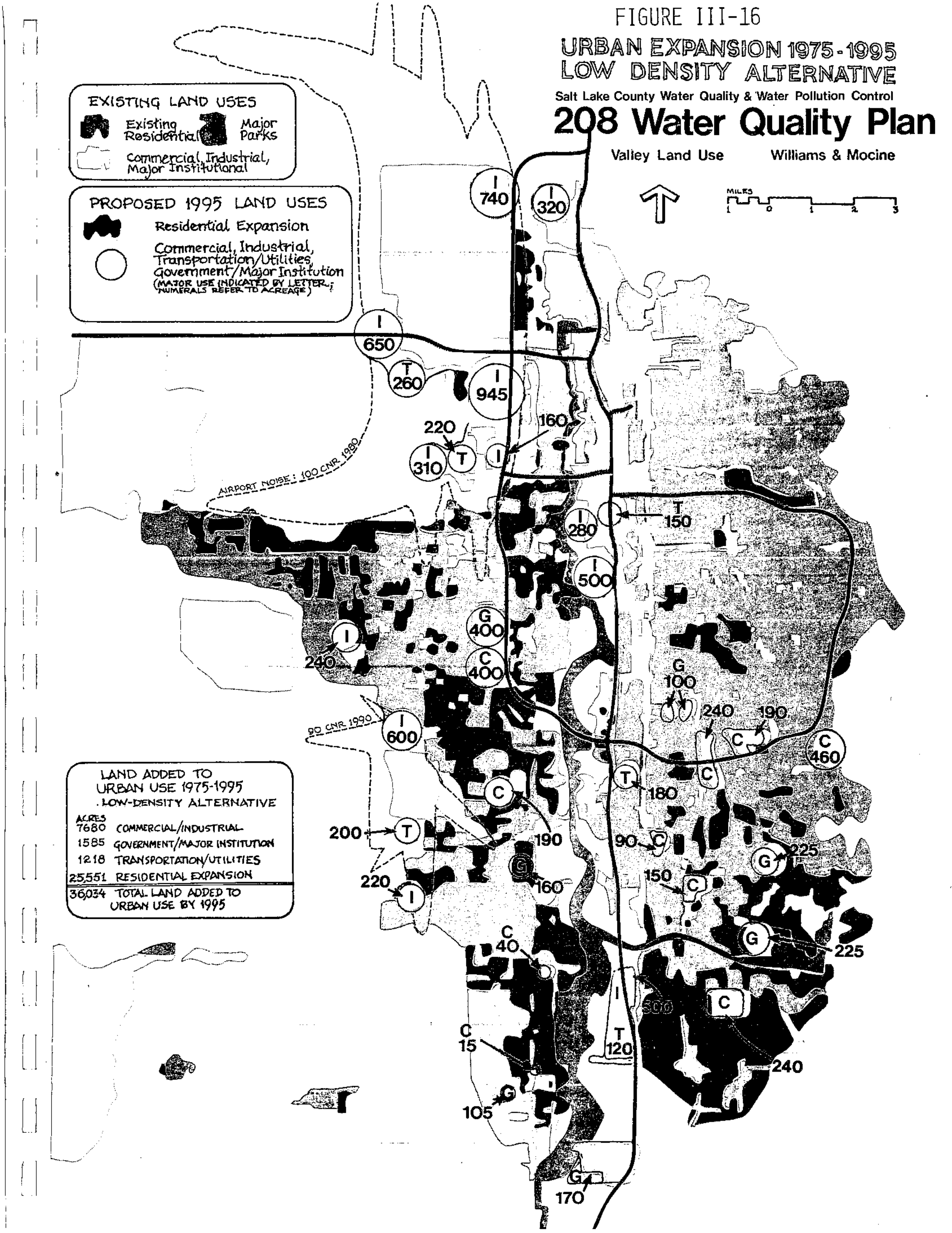

FIGURE III-16

URBAN EXPANSION 1975-1995
LOW DENSITY ALTERNATIVE

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208 Water Quality Plan

Valley Land Use — Williams & Mocine

FIGURE III-17

URBAN EXPANSION 1975-1995
MEDIUM DENSITY ALTERNATIVE

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208 Water Quality Plan

Valley Land Use — Williams & Mocine

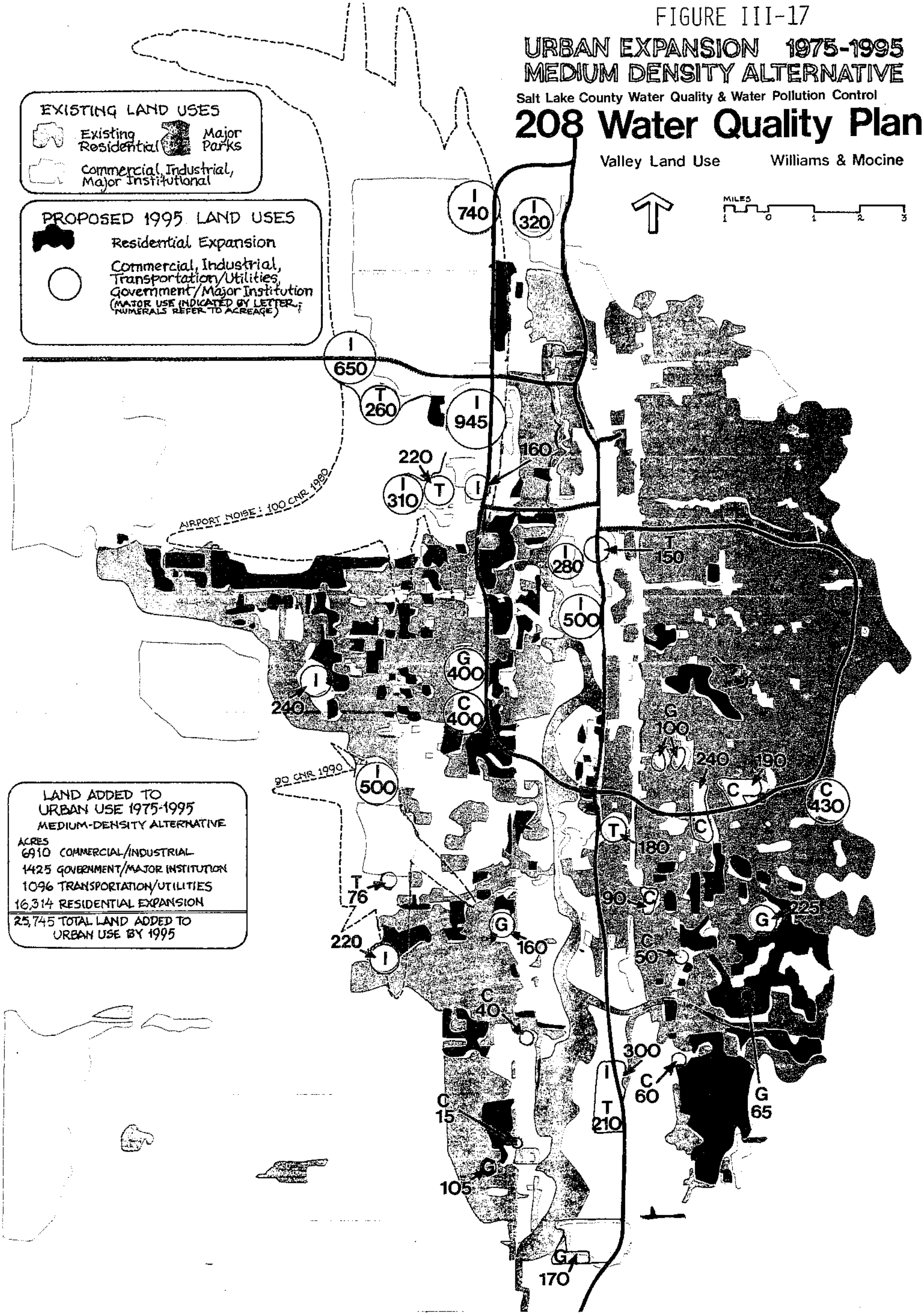


TABLE III-10

LOW AND MEDIUM DENSITY ALTERNATIVES

TOTAL RESIDENTIAL LAND USE AND DENSITY

SALT LAKE VALLEY

	Existing 1975			With Low Density Alternative 1995 [a]			With Medium Density Alternative 1995 [b]		
Statistical Areas	Residential Acres	Occupied Dwell. Units	D.U. Acres	Residential Acres	Occupied Dwell. Units	D.U. Acres	Residential Acres	Occupied Dwell. Units	D.U. Acres
9	332	1,113	3.4	725	2,811	3.9	705	2,811	4.0
12	417	1,292	3.1	486	1,792	3.7	469	1,792	3.8
14	81	956	11.8	81	856	10.6	81	856	10.6
15	1,723	11,678	6.8	1,855	12,827	6.9	1,812	12,827	7.1
16	2,388	10,673	4.5	4,779	23,234	4.9	4,069	23,234	5.7
17	5,470	57,376	10.5	5,740	62,297	10.9	5,740	62,297	10.9
18	9,360	43,297	4.6	13,227	63,760	4.8	11,051	63,760	5.8
19	3,628	11,215	3.1	11,875	42,969	3.6	8,416	42,969	5.1
20	630	1,719	2.7	2,071	8,378	4.0	1,588	8,378	5.3
21	5,077	24,425	4.8	12,632	59,254	4.7	10,450	59,254	5.7
22	1,089	3,986	3.7	1,759	6,692	3.8	1,647	6,692	4.1
8	370	38	0.2	720	140	0.2	720	140	0.2
Valley TOTAL	30,565	167,768	5.5	55,950	285,010	5.1	46,748	285,010	6.1

a. 1974, 1975 slats land use update and Salt Lake Co. Planning Dept. Land Use Map, 1975.

b. Based upon Williams & Mocine Predictions.

2) Increased urban and storm runoff to the Jordan River.

3) Decreased Agricultural Return Flows.

Detailed projections of various wasteloads allocations can be reviewed in Sections IV, V, and the end of Section III.

The causes for these impacts are summarized as follows:

CAUSE → / ↓ EFFECT	New Construction (116,000 new dwelling units)[a]	Additional Impervious Areas (Homes, Roads, etc. -- 22,000 acres)[b]	Added Waste Flows (31 million gallons/day)[c]	Consumption of Irrigated Agriculture (12,928 acres)[d]
1. Increased sewage flows	X		X	
2. Increased urban and storm runoff	X	X		X
3. Decreased Agricultural Return flows	X	X		X

Sources: a. ECONOMIC DEMOGRAPHIC FUTURES (LU-9)

b. BEST MANAGEMENT PRACTICES (LU-14)

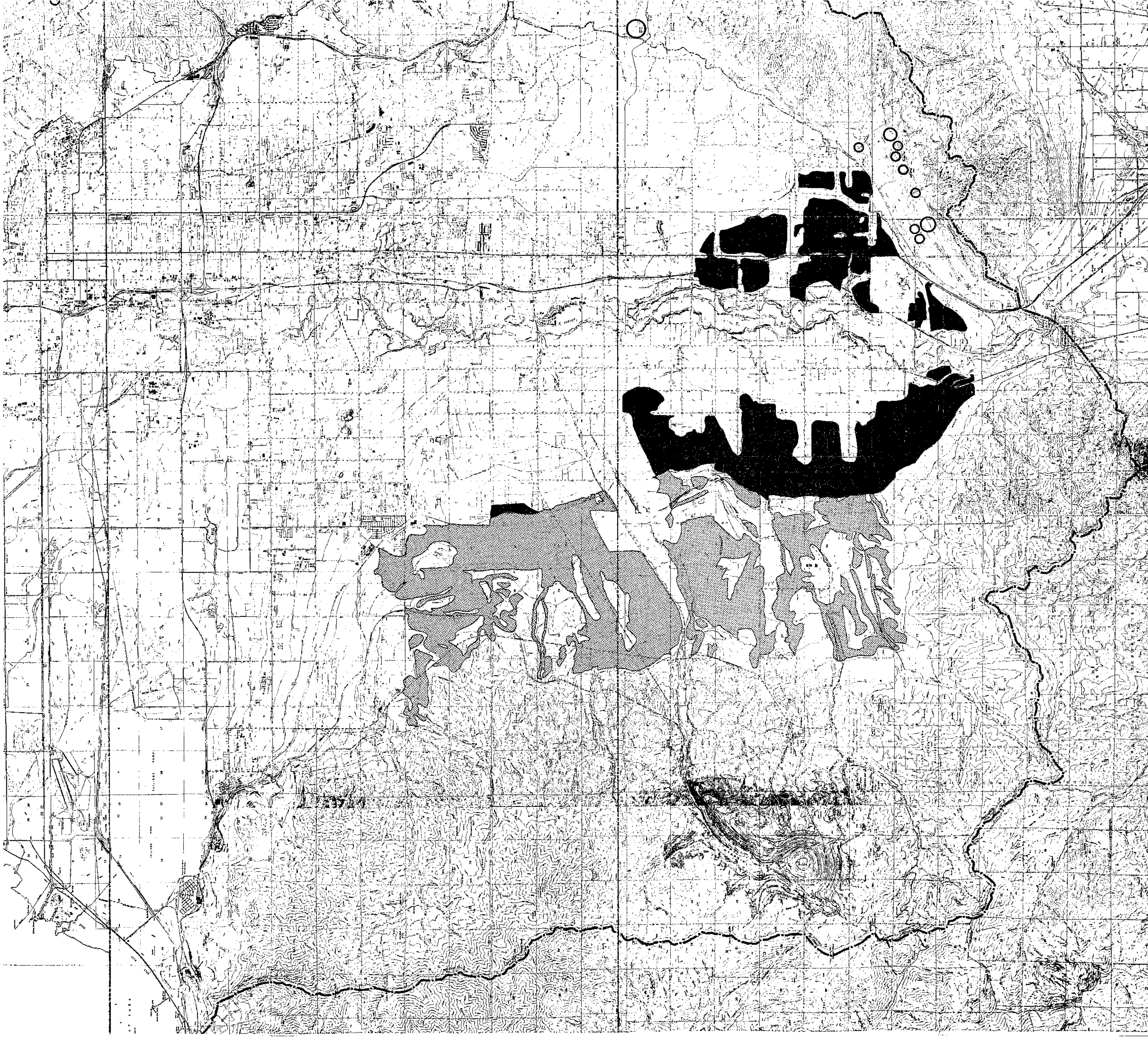
c. FACILITIES & FACILITIES MANAGEMENT INTERIM (FM-5)

d. AGRICULTURAL FUTURE? (LU-12)

Each item under the "cause" column deserves some explanation:

A. New Construction - Results of the 1977 208 Summer Stormwater Monitoring Program (unpublished) indicate dramatic pollutant increases in runoff from construction sites on upper bench areas of Salt Lake City.

FIGURE III-18
PROJECTED DEVELOPMENT
1995
SALT LAKE COUNTY



INDUSTRIAL
COMMERCIAL
RESIDENTIAL

AGRICULTURAL
PRIME LAND

PROPOSED NEW
AGRICULTURAL
PRIME LAND

CANYON
DEVELOPMENT

Salt Lake County Water Quality & Pollution Control
208 Water Quality Plan

NORTH

40 160 640 ACRES 10

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MILES
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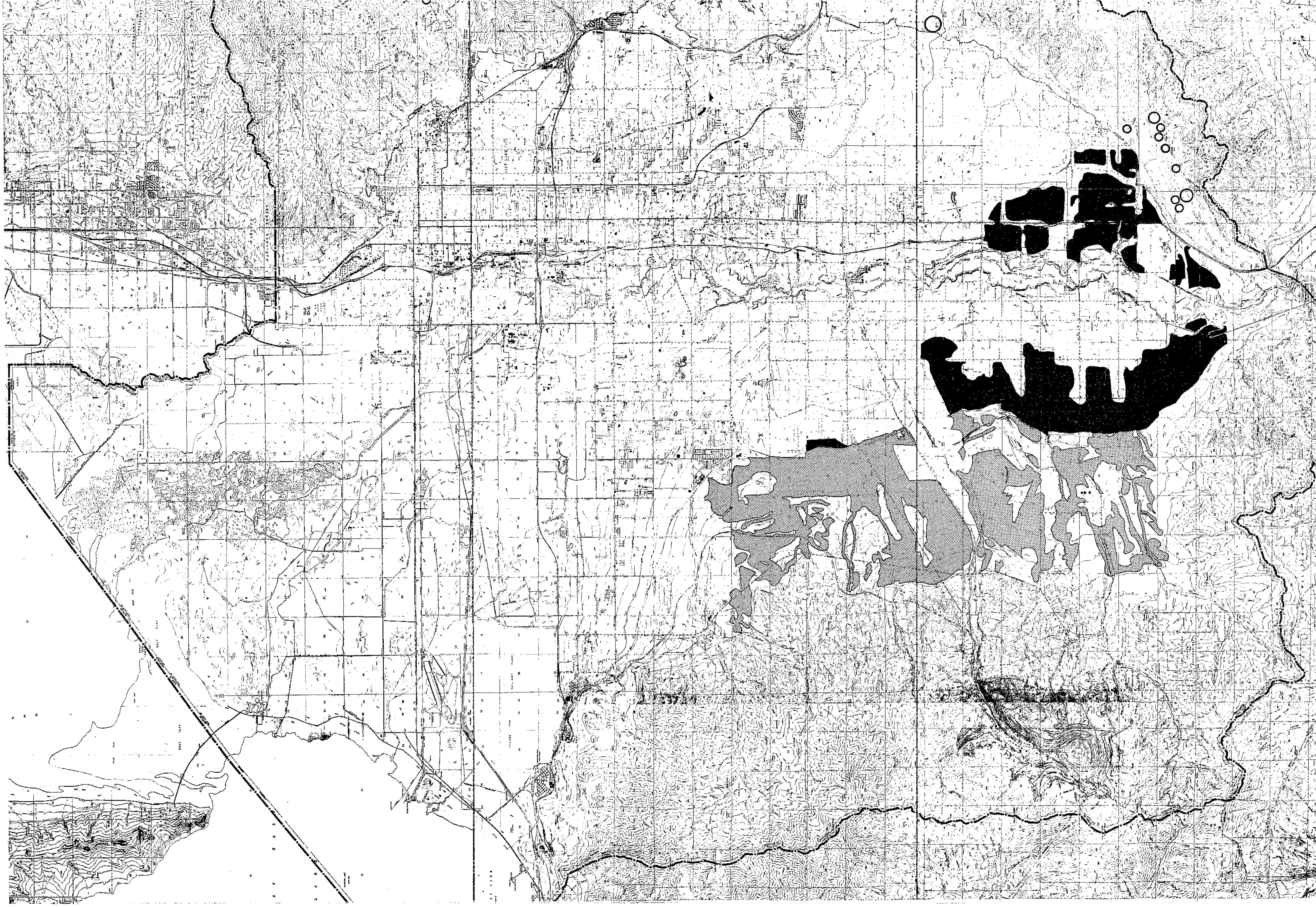

B. Additional Impervious Area- This applies to urban street runoff and the debris which it carries (wastes, nutrients, oil and grease, salts, etc.) Projections of storm runoff in Section IV indicate that the most highly urbanized section of Salt Lake Valley (North of 2100 South) produces the highest stormwater impacts.

C. Added Waste Flows- The generation of sewage from the increases in population will require extensive Treatment Facility improvement (see Section V).

D. Consumption of Irrigated Agricultural Land- The expansion of residential areas in the south portion of Salt Lake Valley will "consume" - at a minimum - about one-half of the irrigated agricultural land in the County. However, this consumption could be much higher than 12,000-13,000 acres if a sprawl growth pattern is permitted to continue (see Agricultural Future? LU-12). The reasons for this are the extensive fragmentation of large farming parcels and irrigation systems, the invasion of croplands by unauthorized tresspass and continuous vandalism, and the inflation of agricultural land values due to real estate speculation.

More specific locations, where impact can be expected from non-point pollution, are discussed in Section VI and VII.

Wasatch Canyons - 1995

Technical Report LU-13, (Technical Land Use Plan - Wasatch Canyons) presents a somewhat different approach than that taken in the Salt Lake Valley. The planning process began with a more exhaustive inventory of natural constraints, assessing the relative suitability for development of large canyon sites, and proposing hypothetical levels of use in each canyon. Typical development densities were used where appropriate (as in Brighton, where one cabin unit per acre was most often assumed) in order to "fill up" the acreage available that is most suitable for development. "Most suitable" refers to land that does not possess more than one limiting natural constraint (steep slope, avalanche hazard, susceptibility to slippage, etc). Therefore, the assumption made in this approach is that economics will guide development to where development expense can be held to a minimum. Table III-11 summarizes the respective canyons where new intensive development is most likely to occur. The assumptions made that give form to anticipated canyon growth include:

City Creek Canyon

Existing facilities and uses. No major expansion.

Red Butte Canyon

Existing facilities and uses. No major expansion.

Emigration Canyon

Anticipate moderate residential. Possibility of tripling the existing level of year-round dwelling units.

Parleys Canyon

Double the existing small number of cabins. Construct Little Dell Reservoir with associated camping and picnicking.

Mill Creek Canyon

Expect minimal cabin infill. Minor additional picnicking.

Big Cottonwood Canyon

Increase cabins to 140% of existing. Minor additional ski lift, picnic and campground capacity. No sewer, no construction of Argenta Reservoir.

Little Cottonwood Canyon

Increase dewlling units to 270% of existing (1975), mostly as high density lodge condominium development. Corresponding additional ski lift capacity. Moderate additional camp and picnic facilities. Extend sewer system.

TABLE III-11.

LAND SUITABLE FOR DEVELOPMENT (ACRES) (1) / WATERSHED — LAND SUITABILITY	Adjacent to existing development or road with Private ownership and No mapped constraints	Adjacent to existing development or road with Private ownership and 1 mapped constraint	TOTAL
City Creek Canyon	12 (2)	35 (2)	47
Red Butte Canyon	-- Not Measured --		
Emigration Canyon	2	201	203
Parley's Canyon	21	181 (3)	202
Mill Creek Canyon	0	46	46
Big Cottonwood Canyon	292 (4)	401 (5) (6)	693
Little Cottonwood Canyon	6 (7)	254 (7) (8) (9) (10)	260
Eastern Traverse Mountains	106	1,597	1,703

Notes:

(1) Excludes land already developed.

(2) All at canyon mouth.

(3) Some adjacent to I-80.

(4) 10 acres on site of proposed Argenta Reservoir.

(5) 94 acres on site of or downstream of proposed Argenta Reservoir.

(6) 58 acres of existing downhill ski terrain.

(7) An additional 9 acres with no constraints but public ownership and 8 acres with 1 constraint and public ownership were identified in Alta Village.

(8) 183 acres at or near canyon mouth.

(9) 19 acres on ski terrain in Albion Basin.

(10) Only 58 acres of suitable private land identified in the <u>upper</u> canyon.

Traverse Mountains

No existing development. Minor new residential and picnic capacity.

Table III-12 summarizes some of the most important uses for the two alternative levels of use. Figure III-19 shows the general location of the most suitable land for development in each canyon. It is within these locations that either the high or low use levels could be expected.

Whether low or high development levels take place in the canyons, it is clear (based on historical water quality data, WQ-1) that at least two impacts on water qualtiy can be expected. These impacts are mainly septic tank leakage and stormwater runoff:

1) Septic Tank leaching/Holding Vault leakage- The possibility of up to 490 new residential units in Emigration Canyon implies that additional leakage from sanitary holding vaults (now required by the City-County Health Department) can be expected unless sanitary sewer facilities are installed or proper operation of new holding tanks is required and monitored and old septic tanks are replaced by no-discharge holding tanks. Constant high pollution levels from existing septic tank drain fields will also persist unless removed and/or not operated. Additional waste disposal methods unless sanitarily operated can be expected to add to the high pollutant levels in Emigration Creek. This is expected in any canyon development.

2) Stormwater Runoff- The result of either use level in the canyons will be an increase in construction activity and an increase in impervious area. Both these increases can be expected to raise pollutant and stormwater discharge levels.

TABLE III-12 ALTERNATE USE LEVELS

WATERSHED	DEVELOPMENT	PRESENT (1975)	ALT. "A" 1995 HYPOTHETICAL LOW LEVEL OF DEVELOPMENT (total: existing plus proposed)	ALT. "B" 1995 HYPOTHETICAL HIGH LEVEL OF DEVELOPMENT (total: existing plus proposed)
City Creek Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	1 0 845	1 0 845	1 0 1,100
Red Butte Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	0 0 0	0 0 0	0 0 0
Emigration Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	240 0 0	260 0 0	730 0 0
Parleys Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	83 0 80	165 0 80	440 300-600 1,000
Mill Creek Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	73 0 1,842	81 0 2,000	100 0 2,600
Big Cotton-wood Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	514 685 1,530	729 800 1,700	1,460 1,000 2,000
Little Cotton-wood Canyon	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	1,104 480 0	2,154 550 100	2,960 700 200
Eastern Traverse Mountains	Total dwelling units Campground capacity (persons) Picnic area capacity (persons)	0 0 0	100 0 100	800 0 200

"Hypothetical Levels of Development" as described on Table III-12 are not projections. They do not represent what is expected to happen in the Canyons. These use levels merely present what is possible given the development of the most suitable land under existing zoning in the Canyons. They do not indicate what the probable levels of development could be.

If is difficult, if not impossible, to project the level of growth in each canyon based on suitability alone. There are too many variables that influence the level of development of any one point in any one canyon.

Therefore, the reasoning used in presenting hypothetical use levels for the canyons is simply to call attention to what may happen in the canyons given the availability of most suitable land. These possilities cannot be ignored when important canyon watershed safeguards and policies are to be debated and implemented. In summary, the Hypothetical Use Levels represent the highest and most critical levels that could result - assuming no zoning changes are allowed, and construction is undertaken using present technology.

FUTURE AIR QUALITY

The Clean Air Act amendments of 1977 require that each State shall demonstrate, through the State Implementation Plan (SIP), attainment of national primary and secondary standards as rapidly as possible. Primary standards, set for protection of public health, are to be attained no later than December 31, 1982. However, if the State can demonstrate that attainment is not possible for carbon monoxide (CO) and/or photochemical oxidants (Ox) with stationary sources and transportation emissions controls, then the State shall be eligible for a five year extension of the 1982 deadline (to December 31, 1987).

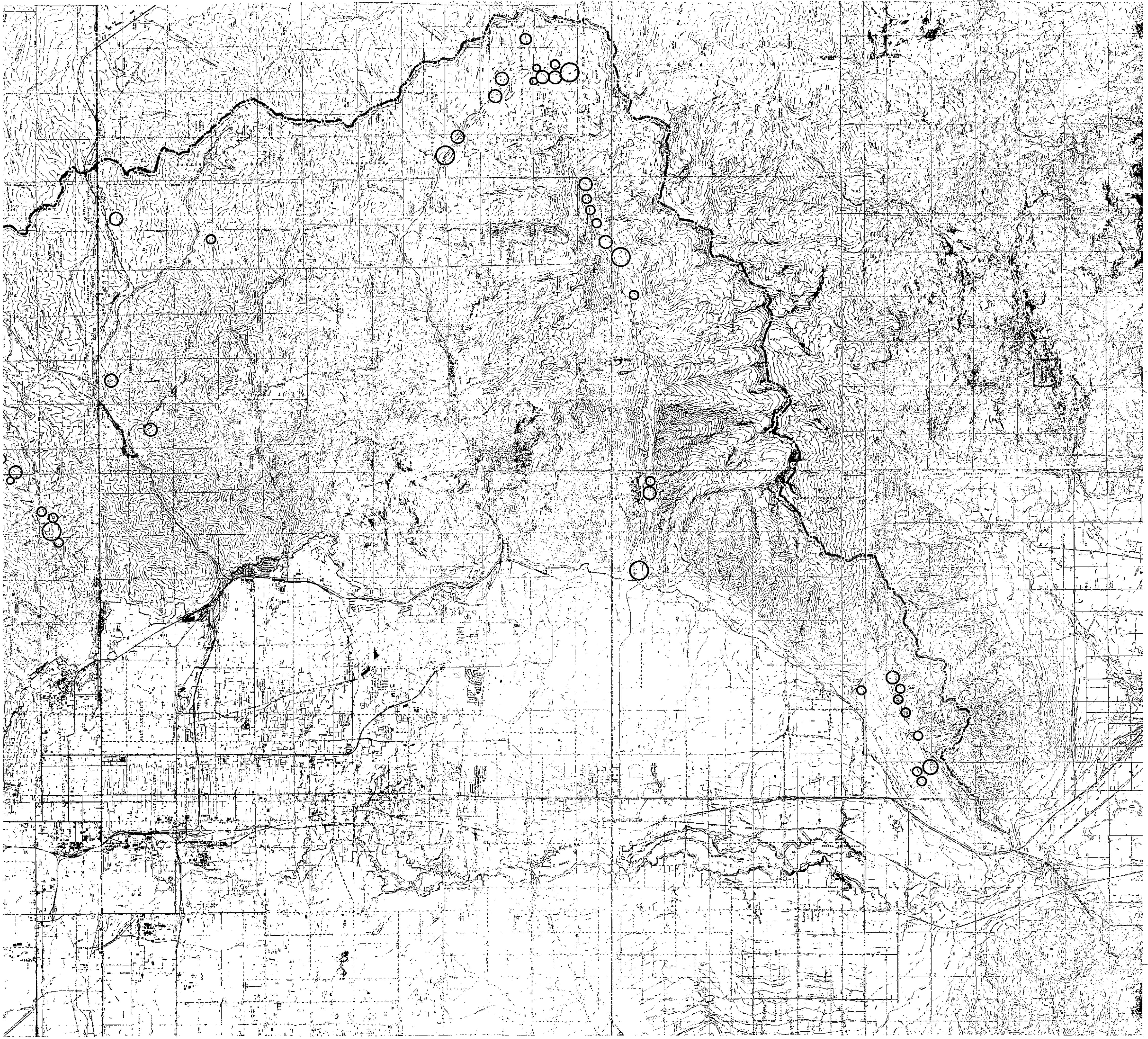

FIGURE- III-19

WASATCH CANYON DEVELOPMENT,

SUITABILITY, ANTICIPATED LOCATIONS

INDUSTRIAL
COMMERCIAL
RESIDENTIAL

MOST SUITABLE CANYON DEVELOPMENT LOCATIONS

Salt Lake County Water Quality & Pollution Control

208 Water Quality Plan

NORTH

40 160 640 ACRES

10

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MILES

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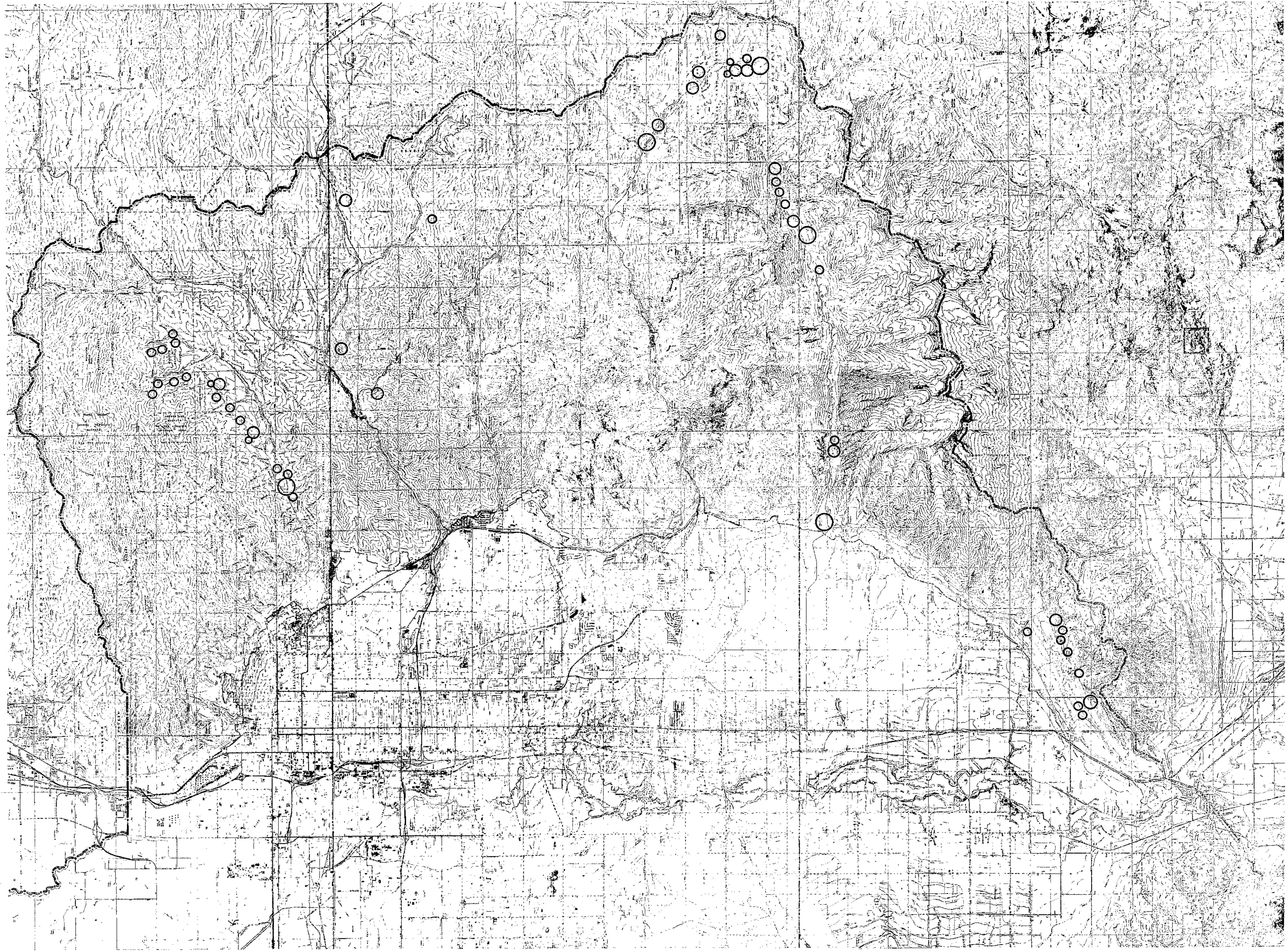

At this time, there exist no comprehensive air quality projections for Salt Lake County nor a SIP for the State. The discussion is taken from the Preliminary Transportation Control Plan for the Wasatch Front Region prepared by the Wasatch Front Regional Council. It is anticipated that there will exist an SIP on January 1, 1978.

Emissions growth due to population growth is at the discretion of the State if other measures are taken to meet the statutory deadlines of 1982 or 1987. However, these growth rate predictions must be consistent with other Federal planning programs (FWPCA 208, 201; HUD 701; FHWA 134; etc.). Traffic growth rates used in the Preliminary State Transportation Plan are 1% per year and 4% per year for the Salt Lake central and urbanized areas respectively.

Discussions with the State and the Wasatch Front Regional Council (WFRC) indicate that standards for SO_2, NO_x, Particulates, and CO will be attained in Salt Lake County. Salt Lake City will not attain December '82 CO standards and the entire county will not attain the December '82 photochemical oxidant standard.

Ninety (90) percent of all CO emissions and 58% of Hydrocarbon (HC) emissions in Salt Lake County are due to transportation. (Hydrocarbons are the primary precursors of oxidant concentrations). Twenty-four (24) percent of NO_x emissions result from this source. In 1977, the eight-hour standard for CO (9.0 ppm) was violated 24 days while the one-hour standard for photochemical oxidants (9.98 ppm) was violated 23 days at the Salt Lake City monitoring station.

To attain the CO standard, transportation emissions will need to be reduced by 40%. Based upon FMVCP, an inspection and maintenance program, and reasonable traffic control measures, the standard will be attained.

To attain the photochemical oxidant standard, an estimation of the impact on Ox through reduction of HC is necessary. It appears as though a 55% reduction in all HC emissions is necessary.

A reduction of approximately 25% in total HC emissions can be achieved through a transportation control program while a 30% reduction in total HC emissions is necessary from point sources. The 30% HC reduction required from other than transportation sources is equivalent to a 71% reduction in total process emissions. It is anticipated that the State will have to apply for a five-year extension from the December 31, 1982 to December 31, 1987.

The only control of air pollution sources that sewage treatment districts could impose, other than emissions from treatment plants themselves, is a limitation on sewer hook-ups. The result of this type action would be a change-over to septic and holding tanks, illegal hook-ups or illegal discharges (untreated) to surface waters of the county. These measures have been observed in Salt Lake County in the past. The HC problem cannot be totally solved by the implementation of a transportation control plan but rather needs the implementation of a point source emission reduction program. This aspect is not specifically related to growth itself.

Because of the limited authority of the special purpose districts which contain the largest land areas for future growth and because of observed past enforcement problems related to sewer hook-ups, the building of additional sewage treatment capacity is not a material contributor to growth, but provides a response to other pressures as long as growth subsidy is avoided in rate schedules and connection fees. The strongest need is for an overall SIP which addresses point source emissions and automobile caused pollutants.

ANTICIPATED WASTEWATER FLOWS

Increases in wastewater flows in Salt Lake County will result from increases in population and be decreased by sewer system rehabilitation. Coupled with increasing population will be an increase in industrial wastewater flows.

Projected domestic wastewater loading have been calculated by using the following factors:

1. Wastewater flow: 100 gallons per capita per day
2. BOD_5 load: 0.167 lbs. per capita per day
3. SS load: 0.167 lbs. per capita per day

As discussed later, it is expected that for industries discharging to municipal sewers, water use for employees will not change significantly over the next 25 years, and therefore, increases in industrial flow to municipal wastewater treatment plants will be proportional to increases in industrial employment.

Since the industrial flow to most municipal plants is minor, it was not considered necessary to accurately estimate employed industrial personnel increases over the planning period; it has been assumed that increases in industrial employment will be approximately the same as increases in total employment. Therefore, industrial wastewater flow and load projections have been made by increasing present flows and loads by the same proportion that total employment is projected to increase in the county.

Summer infiltration at most plants in higher than the average infiltration developed in the reconstruction of present flows. Final results of all county infiltration/inflow analyses are not available. Until they are, it is assumed that system rehabilitations will lower summer inflows and infiltration. Rehabilitation will affect average annual infiltration to some degree.

Projected future flows generated in facilities planning areas is shown in Table III-13.

Table III-13. Projected Average Daily Flows And Loads by Facilities Planning Areas

Planning Area		Year		
		1980	1990	2000
Salt Lake City	Flow (mgd)	36.0	36.6	37.1
	BOD_5 (lb/day)	37,000	37,800	39,500
Magna	Flow	1.2	1.5	1.7
	BOD_5	1,700	2,200	2,500
Upper Jordan	Flow	16.0	24.0	32.0
	BOD_5	23,500	35,300	47,000
Lower Jordan	Flow	40.0	45.0	51.0
	BOD_5	55,700	63,000	71,300

Maximum flows and loads for the Salt Lake Valley STP's can be adequately provided for by application of multiplication factors shown in Table III-14.

Table III-14. Multiplication Factors for Extreme Conditions

Item	Factor
Minimum Flow	0.4
Maximum Daily Flow	1.4
Peak Flow	
Plant Flow <10 mgd	2.5
Plant Flow >10 mgd	2.0

Source: FM-5