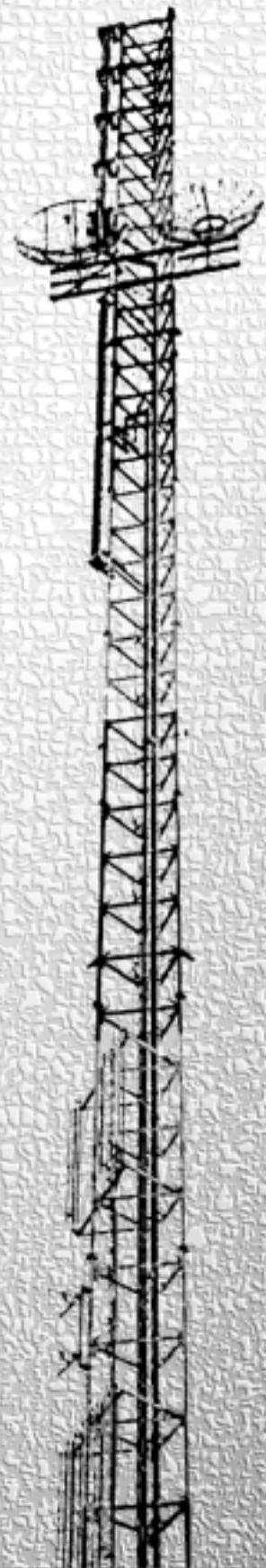


Jefferson County Telecommunications Land Use Plan



Jefferson County Telecommunications Land Use Plan

4 Acknowledgments

6 Telecommunications Land use Plan

Introduction

Executive Summary

Telecommunications Technology & Regulatory Framework

Findings & Policies

Demand for New Facilities

Engineering & Economic Concerns

Visual & Noise Impacts

Residential Interference

Health Issues

Property Values

Tower Siting & Review Procedure

14 Addendum: Low Power Mobile Radio Service

Introduction

Background

Low Power Mobile Radio Service Technology

Low Power Private Mobile Radio Service Technology

Types of Facilities

Health Issues

Community Response

Federal, State & Local Regulations

Future Demand

Site Selection

Industry Site Selection Criteria

Citizens' Site Selection Criteria

General Policies for Site Selection

Site Selection Policies

Zone District Use Standards Chart

Visual Impact & Screening Policies

Implementation Policies

Zoning Resolution Changes

Community Notification

Third Party Review

Abandonment

21 Glossary

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Telecommunications

Introduction

What it is:

This document is three separately adopted portions combined to make one user-friendly document. The Telecommunications Land Use Plan consists of a set of findings and policies (original plan adopted May 8, 1985, revised policies adopted January 20, 1993) to be used as a guide for making land use decisions on the siting and design of telecommunication facilities. This document includes County policy regarding broadcasting, satellite and two-way communication facilities. The Low Power Mobile Radio Services Addendum (adopted October 19, 1994) includes policies specific to that type of use.

Who did it?

In May 1984, the County Commissioners appointed an advisory panel composed of representatives of industry, public agencies and citizen interests. The advisory panel developed recommendations for the policies contained in this Plan. Advisory groups also updated the policies in 1993 and developed the Low Power Mobile Radio Services Addendum in 1994. All plans were adopted by the Jefferson County Planning Commission.

To understand the report better:

To adequately address the complicated issues involved in the field of telecommunications, it was necessary to use some technical terms and symbols. There is a glossary at the back of the Plan to assist the lay reader.

Executive Summary (1985)

The Telecommunications Land Use Plan is the component of Jefferson County's comprehensive plan which provides guidelines for land use decisions related to telecommunication facilities. The Plan was adopted by the County Planning Commission after receiving recommendations from an advisory panel which met for over 10 months.

Jefferson County faces a considerable demand for telecommunication facility is due to the growth of this industry, the presence of mountainous terrain in close proximity to market areas, and changes to Federal Communication C (FCC) regulations. In the foreseeable future, Jefferson County will see a demand for four to five new UHF television stations, the relocation of seven to eight FM radio stations and one new FM station, nine low-power television stations 100 to 150 two-way transmitters, 11 to 12 cellular radio

sites for mobile telephone, and a considerable number of commercial satellite and microwave relay sites. While many of the smaller facilities such as microwave and two-way can be located on existing towers or other tall structures, there are very few broadcasting towers capable of physically handling additional antennas. The owners of those towers with some additional physical capacity are reluctant to share with others due to the threat of competition, interference, or perceived management problems.

Telecommunication facilities can cause many impacts on the surrounding community if they are not properly sited and designed. This is especially true of high-powered broadcasting facilities. To avoid and minimize these impacts, the Plan contains policies regarding visual and noise impacts, residential interference, health issues, property values, and recommended locations.

Telecommunications Technology & Regulatory Framework (1985)

Major Types of Facilities

1. Broadcasting - Used to transmit AM & FM radio signals and VHF or UHF television. With the exception of AM, these towers are generally located on high ground as the technology requires "line-of-sight" between the transmitter and receivers. AM radio does not require line-of-sight as its signals travel along the ground. Since Jefferson County has a lot of mountainous terrain in close proximity to the metropolitan area, it is quite attractive for FM and television towers. These towers are generally constructed of steel lattice or tubular steel and can be self-supporting or guyed. Guyed towers occupy more land area as guy wires must extend from the base a distance of two-thirds of the tower height. Self-supporting towers are bulkier than guyed towers. Antenna weight ranges from 3,000 to 10,000 pounds.

2. Two-way radio (also called land-mobile radio) - This is the most common type of communication system operated by government agencies and private business. Mobile units communicate with a fixed base station. As two-way antenna are lightweight, a single tower can hold several. They can also be placed on tall structures such as buildings or water towers. Like broadcasting facilities, "line-of-sight" is needed between the transmitting and receiving units. Towers can be guyed or self supporting.

3. Fixed Point Microwave - Microwave relay is used to transmit sound and visual images between two or more fixed points. "Line-of-sight" is needed between microwave dishes. They can often be located on other towers or buildings.

4. Commercial Satellite - Satellite signals are received by large dishes. While elevated sites are not needed, line of sight is required between the ground station and transmitting satellite. The large satellite dishes south of Morrison are a good example of this technology.

5. Cellular Radio - A relatively new technology used for mobile telephone systems. Low powered transmitters are used to transmit signals in a small area or "cell". Antennas must be 150-175' high and can be located on towers or buildings. As the transmission range is small, several towers are needed to cover a large area. Jefferson County currently has three cellular radio sites operated by New Vector Communications, and others are planned by their competitor, MCI. Only two "carriers" are allowed in a metropolitan market.

Federal Regulation of Telecommunications (1985)

Radio and television towers are currently regulated by the Federal Communications Commission (FCC), the Federal Aviation Administration (FAA), and the Occupational Safety and Health Administration (OSHA).

The FCC issues licenses for new telecommunication facilities, determining need, coordinating frequencies, and requires that towers be located at the most central point at the highest elevation available (47 CFR 73.685 (b)). Interference problems also come under the FCC's jurisdiction.

Recently the FCC passed a regulation called "Docket 80-90" which requires all FM stations to have an antenna height of 984 feet above average terrain. The application of this regulation locally will mean that every FM station but one will have to increase the height of their antenna. The deadline for compliance in March 1, 1987, which is why many FM stations are now proposing or looking for higher facilities. Failure to do so means that current licenses held would be downgraded, thereby lowering the market value of these stations.

The FAA regulates tower height, coloring and lighting to ensure aircraft safety.

OSHA regulates the occupational exposure to nonionizing electromagnetic radiation emitted from radio, microwave, television and radar facilities.

Current County Regulations (1985)

Jefferson County regulates telecommunication facilities through its zoning regulations. There is no zone district which permits towers as a use-by-right. Towers are allowed in a Planned Development Zone District (PD) or as a Special Use under the agricultural zone districts, meaning that public hearings must be held and the County Commissioners must approve the request. This process is identical to that used to rezone property. If someone wants to build a tower outside an agricultural district, the property must be rezoned.

Most of the towers now located on Lookout Mountain are located in Mountain Residential-One (MR-1) zoned areas. These towers were built before County zoning regulations specifically prohibited

them in these areas. Consequently, they are considered "grandfathered" and allowed to continue operation. However, if a significant change is proposed to one of these towers, rezoning is required which allows for public hearings.

Findings (1985) & Policies (1993) Demand For New Facilities

Findings:

1. The new facilities which will be needed in the foreseeable future are:

a. Broadcasting

Two new UHF television stations, one allocated to Boulder and one to Denver, have construction permits; there may be two or three more issued in the foreseeable future.

- One new FM radio station allocated to Evergreen, but no construction permit granted.

- 7-8 FM radio stations may relocate due to FCC rule 80-90.

- Nine low power TV (1 RW ea.).

Jefferson County is where the transmitter facilities of Denver's major broadcasters are located. Considerable demand for additional broadcasting facilities is expected in the future.

b. Two-way

- 300-350 fixed transmitters in next 10 years for metro area, 100-150 could locate in Jeffco (assuming 70 units (phones) per transmitter, this would provide service to 21,000 - 24,500 units).

c. Cellular radio

- 33-35 new tower sites in metro area could be needed -1/3 could be in Jeffco.

d. Microwave relay

- While it is impossible to predict the number of relay sites or dishes needed, the number is expected to increase substantially. Variables which could affect demand are: the tendency of industry to go to microwave when lease line charges by phone company are high enough, fiber optic technology which may replace microwave in certain cases, and radio frequency standards established by the federal government which could make it more difficult to build new towers.

2. The demand which could be physically accommodated on existing towers or other structures is:

a. Broadcasting

- TV channels 7,9 have towers which could technically handle more FM and two-way facilities. However, they are not approved for multiple use.

- FM towers probably could not handle additional antennas (nor does there seem to be a desire of FM stations to co-locate on existing FM towers as none of them meet FCC Docket 80-90). In addition, no FM towers are approved for multiple use.

b. Two-way

- There are ten existing towers capable of adding 300 additional transmitters. Based on 70 units per transmitter, 21,000 units could be handled on existing towers.
- There may be a need for some new two-way sites close to populated areas to accommodate higher frequencies being given on new licenses. The reason for this need is that facilities utilizing higher frequencies have a shorter transmission range.
- It is likely that the lease space on existing two-way towers is 50% higher than that which was reported (another 10,000-10,500 units).
- Much of this demand could be met through using buildings instead of tower structures.

c. Cellular radio

- 10-15% of needs can be accommodated on existing towers or other structures. (150-175' needed)

d. Microwave

- Microwave users usually lease space on other towers, except for common carriers such as Mountain Bell.

3. There are tower owners which have facilities they are willing to lease as follows:

a. Broadcasting

- TV channel 7, possibly.
- TV channel 9's local management doesn't have an interest.

b. Two-way

- Owners of at least 10 existing towers have space they are willing to lease.

c. Cellular Radio

- New Vector Communications and MCI (the other cellular radio company which will soon begin construction) do not lease tower space to each other currently but this may change.

d. Microwave

- There may be microwave tower owners willing to lease, but they're unknown.

4. The rates charged by tower owners for leased space are:

a. Broadcasting

- Lease rates cover a wide range - up to \$2000-6000/month.

b. Two-way

- \$100-300/ rack (case full of equipment).

c. Cellular Radio

- No figures are available as New Vector Communications doesn't currently rent space to others.

d. Microwave

- \$100-300/ rack (case full of equipment).

5. The reasons used by tower owners who are unwilling to lease space are:

a. Tower lacks physical strength.

b. Competition

c. Security

d. Complicates management and maintenance

e. Equipment building may lack space.

f. Fear of interference

g. Technical incompatibility

h. Fear of increased liabilities.

6. Existing TV broadcasters are reluctant to upgrade their facilities or consolidate on new tower because:

a. Existing TV broadcasting facilities (except for Channel 31) do not have to protect the Boulder quiet zone as they were built before this was a requirement.

b. They are reluctant to upgrading their facilities or locate on new towers as they would have to protect the quiet zone which reduces market coverage.

7. The industry trends or other variables that will reduce or increase the need for facilities are:

a. Deregulation of the communication industry is leading to more users, market entries, and new services (e.g., cellular radio).

b. Regulations such as FCC Docket 80-90 will lead to a demand for new towers or relocation to higher existing towers.

c. New technologies.

d. Facilities are being shared more.

e. Population growth.

f. Rental rates are increasing for shared tower space.

g. General economic conditions.

h. Placement of antennas on buildings in downtown Denver doesn't appear practical as the taller buildings are at FAA heights limits and utilizing shorter buildings present concerns with shadowing of signals and possible health effects.

Engineering & Economic Concerns

Findings:

1. Concerning television, most viewers' antennas are oriented toward Lookout Mountain which leads to television broadcasters wanting to locate new transmitting facilities in this area. Consumers also have an interest in convenient antenna orientation.

2. Most FM stations want to comply with FCC Docket 80-90 as failure to do so means that the current licenses held would be downgraded, thereby lowering the market value of these stations.

3. It is difficult to place broadcasting facilities in the Boulder area, as the FCC requires that Boulder's "quiet zone" (due to the sophisticated instruments used at the National Bureau of Standards facility) be protected.

4. High mountaintop sites are needed for TV and FM broadcasting facilities. Line-of-sight is needed for the desired audience.

5. Two-way facilities are not generally compatible with high power broadcasting facilities; however, co-location is possible under certain circumstances.

6. The FCC has determined that there is a legitimate need for cellular radio in the metropolitan area.
7. The presence of high mountain top sites in Jefferson County and its proximity to most market areas in the metropolitan area make it quite desirable for broadcasters and two-way communication providers.
8. Under select circumstances, shared use of antennas is possible.

Policies:

1. Broadcasting sites should be capable of serving most of the metropolitan area.
2. The two-way and cellular radio sectors need to find sites capable of serving their desired markets.
3. Telecommunication sites should recognize consumer needs.
4. Telecommunication facilities should be located, designed and operated in a manner that will comply with all FCC permits and conditions to prevent objectionable levels of interference.
5. Telecommunication facility location and design must meet the requirements imposed by the FAA and FCC.

Visual & Noise Impacts

Findings:

1. The key concerns related to visual impact are:
 - a. Unsightly proliferation of towers affects scenic values, economic values and the sense of privacy.
 - b. Some communication sites are poorly maintained and the appearance of equipment buildings is often incompatible with adjoining residential areas.
2. The FAA requirements regarding the coloring and lighting of towers are:
 - a. Any tower over 200' tall must be painted aviation orange and white and lit with sidelights and top beacons unless the FAA grants a waiver.
 - b. The FAA will allow towers over 200' tall to be painted other than orange and white if day and night strobe lights are installed.
 - c. If a tower is near an airport, or in the airport's flight path, lighting and coloring requirements may apply for towers less than 200'. Generally, these requirements apply if a tower is within 20,000 feet of a major airport or within 10,000 feet of a general aviation airport (like the Jeffco Airport).
 - d. The FAA has the discretion to grant waivers under specified conditions; for example, if a tower is proposed near a taller existing structure, painting and lighting requirements might be waived.
3. The factors that must be considered in looking at visual impact are:
 - a. Relationship of tower location to visual corridors for homes, cars, pedestrians and bikes.
 - b. Type of terrain and near and far visual impacts.
 - c. Presence of trees which help shield or block view angles for those around towers.

- d. Use of colors and materials which are compatible with surrounding area.
- e. FAA requirements for coloring and lighting.

Policies:

1. Telecommunication facilities should result in a minimal visual impact for those residents in the immediate area and for those in the larger community who view these facilities from a distance.
 - a. Examples of minimal visual impact would be:
 - 1) A facility sited so that at least 80% of the height of the tower(s) and accompanying structure(s) is screened from view from off of the subject property by vegetation or landform.
 - 2) A uni-directional facility which is surrounded by vegetation or landform that screens the tower(s) from view on the non-broadcast side and screens accompanying structure(s).
 - 3) A facility where all broadcast equipment is contained within a building, the size, character and location of which is permitted by the underlying zone district.
 - 4) A facility that is located down-slope from the top of a ridge line so that from key public viewpoints, a minority of the height of the tower is viewed against the sky.
 - b. For facilities located in highly developed portions of the County, buildings may be used to accomplish the screening noted above.
 - c. It is acknowledged that large, multi-use towers located within major use transmission areas cannot be effectively screened. In order to minimize the visual impact, such new facilities should be located in close proximity to other comparable structures. Accompanying buildings, ground-mounted antennas, and other equipment and structures should be subject to screening recommendations.
2. The visual impact of telecommunication facilities should be compatible with the aesthetic character of the surrounding area.
3. FAA requirements for coloring and lighting of towers must be considered in looking at visual impact.
4. The specific communication facility design issues that should be examined in looking at visual impact are: coloring, lighting, relationship to view corridors, topography, materials and architecture. Towers and antennas should be neutral in color to blend with the visual backdrop, unless specifically required by the FAA to be painted otherwise.
5. The visual impact of existing communication facility sites should be reduced where possible.
6. To minimize the visual impact of new telecommunication towers, these measures should be implemented where possible:
 - a. Avoid tower heights and locations which necessitate FAA coloring and lighting. Towers of any height should not be lighted unless specifically required by the FAA. If FAA lighting is required, strobe lights should be avoided unless specifically required by the FAA.
 - b. Tower and antenna consolidation.
 - c. Locating away from key public viewpoints.

- d. Utilize monopoles or guyed towers rather than bulky self-supporting lattice towers whenever possible.
- e. Placement of two-way and microwave antenna inside accessory buildings when technically possible.
- f. Locating towers near similar uses or near industrial areas.
- g. Planning antenna on existing structures of sufficient height (i.e., water tower, buildings, etc.).
- h. Any new road to a telecommunication site should be acceptable to County Engineering and the local fire department and its visual impact should be minimized by reseeding excavated areas, avoiding cuts and fills when possible, and other feasible measures.
- i. Where possible, waivers to FAA coloring and lighting requirements should be sought.
- j. Careful placement of power lines.
- k. Noise impacts could be minimized through careful location and screening.
- l. Placement of two-way towers within forested areas with antennas just above treeline.

7. To minimize the visual impact of microwave dishes and commercial satellite operations, these measures should be used if technically feasible:

- a. Microwave dishes
 - Place inside structures.
 - Use non-reflective colors - galvanized or gray.
 - Use open grid dishes instead of solid ones.
- b. Commercial satellite operations:
 - Use colors compatible with the surrounding environment.
 - Incorporate landscaping.
 - Place in depressed areas shielded from view.

8. To minimize the visual and noise impacts of new equipment buildings and accessory uses (fuel tanks, fences, etc.), these measures should be utilized:

- a. Equipment buildings should blend in with the surrounding area by considering coloring, texture of materials, topography and scale of buildings.
- b. Fuel tanks can be buried or screened with landscaping, fencing or berms.
- c. Trash areas can be screened.
- d. The noise impacts of cooling and other types of equipment could be minimized through proper location and screening.
- e. Noise should not exceed state noise standards.

9. To minimize the visual and noise impacts of existing communication sites, these measures should be implemented:

- a. Within a specified time period, all existing sites used primarily for communication (not those where communication is accessory to a business like a towing business with two way communication equipment) should minimize visual and noise impacts by using the following measures:

- 1) Making equipment buildings compatible with the surrounding area by considering coloring, texture of materials, landscaping and screening. This should be done within a three year time period.
- 2) Burying and screening of fuel tanks. This should be completed within one year.
- 3) Unused or abandoned equipment must be removed, stored inside, or screened. This should be completed within one year.
- 4) The noise impacts of cooling or other types of equipment (like that used for UHF TV) could be minimized through proper screening. This should be completed within one year.
- 5) Noise should not exceed state noise standards.
- b. Measures other than regulation such as tax incentives should be considered to encourage the clean up of existing sites.
- c. Abandoned towers should be removed. County legal staff should explore ways of doing this.

Residential Interference

Findings:

- 1. The key concern related to residential interference is: Residences near areas with high RF levels often experience interference to their electronic appliances which is inconvenient and may result in the need of equipment modifications.
- 2. The representative interference problems experienced by some of the residents of Lookout Mountain are:
 - a. VCR operation results in fuzzy pictures.
 - b. Garage door openers are erratic - often times, the operator must be right in front of the door to make it work; sometimes, garage door won't open.
 - c. Cordless phones shut off or have extreme levels of static.
 - d. Regular phones pick up FM stations.
 - f. KOSI is picked up on the low-band emergency radios. This problem is also experienced by low-band users outside the Lookout Mountain area.
 - g. Radio stations such as KYGO, KPKE, and KOSI are received on stereo turntables.
 - h. Tape recorders won't work - just get a buzz.
 - i. TV stations often received on different dial settings.
 - j. Computers - fuzzy images received on terminals.
- 3. The factors which influence interference problems more than others are:
 - a. Close in residences receive more interference unless screened by topography.
 - b. Interference problems seem to increase when there is snow on the ground.
 - c. Increased interference occurs during the morning hours.
 - d. Being on the same horizontal plane as tower antennas increases interference problems.
- 4. The probable causes of these problems are:

- a. KOSI and KYGO are major sources of interference due to the lower height of their antennas; in fact, any low to the ground antenna is likely to cause interference.
 - b. General interference is to be expected with the high levels of RF in the area (a one-quarter to one-half mile radius from where towers are located primarily).
 - c. If homes are on roughly the same horizontal plane as antennas, interference can extend a significant distance beyond a one-quarter to one-half mile radius.
 - d. High tension power lines in the area are a contributing factor as they pick up broadcast transmissions and re-radiate them.
 - e. Many electronic appliances are built without good shielding and filters due to the industry's desire to keep them affordable.
 - f. Some interference problems are frequency related and beyond the County's authority such as FM stations being received on low band emergency radios.
5. What factors, other than high RF levels, cause disruption to residential electronic appliances?
- a. Momentary power interruptions can cause computer disruption.
 - b. Erratic operation of electronic garage doors is often caused by radios used in aircraft flying over the area.

Policies:

1. New telecommunication facilities will minimize interference for nearby residents.
2. The responsibility for resolving interference problems should be shared by all parties involved.
3. The practical solutions to the current residential interference problems on Lookout Mountain that should be implemented are:
 - a. The broadcast industry should be encouraged to establish an education program for residents to provide information on techniques which residents could use to reduce interference problems. For example, the following information would be helpful for many interference problems:
 - Use direct audio and video inputs for TV's and VCR's.
 - Use "keyed" electronic garage door openers instead of transmitter operated ones.
 - Electronic appliances may have to be placed in special locations in the home.
 - Use metal shielding boxes on appliances to reduce interference.
 - Many manufacturers of electronic appliances will send filters, free of charge, for use in their equipment to reduce interference.
 - How contacting the local "technical committee" may give you ideas of how to reduce interference.
 - FCC has a pamphlet available which gives ideas on how to reduce interference.
 - b. The broadcasting industry should establish a "technical committee" to address interference problems on Lookout Mountain. This committee would provide technical assistance to homeowners on causes of and solutions to interference problems.

- c. If existing facilities are "upgraded", they should be reviewed according to the criteria and regulations for new facilities.

Upgraded facilities are those involving the addition of a broadcast station, change in tower height, addition of a new tower, change in primary site use, or broadcaster wanting to use a site or facilities that have been used by another broadcaster. A change in the licensed ownership of a station should be exempted from the definition of "upgraded" facilities.

4. The practical solutions that should be used by the County to avoid interference problems when new towers are sited:
 - a. Encourage the establishment of cooperative multiple use sites. One incentive which could be used to accomplish this is the use of public lands for cooperative tower sites or using public funds to buy land for tower sites or the buffer surrounding tower sites.
 - b. The factors which should be considered in minimizing the interference from new towers are:
 - Setbacks.
 - Height of tower - towers should be elevated above populated areas.
 - Antenna design (modifications to the antenna to minimize signal strength in a given direction).
 - Adjusting transmitter power levels.
 - Topography, i.e., locating tower on mountain top above residential areas.
 - c. The County should retain a paid private consultant to provide information on the technical considerations (i.e., interference) in siting new towers. The funds needed to pay this consultant could be raised by increasing the application fee for tower requests.
 - d. Rezoning of land near established broadcasting sites for more intensive residential uses should be discouraged.
 - e. Rezoning of residentially zoned land for towers should be discouraged.

Health Issues

Findings:

1. The key concern regarding the health effects of exposure to RF emitted from communication antennas is:
 - Short-term exposure to high levels of RF or long term exposure to low levels of RF could be hazardous to human health.
2. These facts are known about the actual health hazards posed by exposure to RF:
 - While the scientific community agrees that RF exposure presents health concerns, there is disagreement on the level at which RF exposure becomes an actual health hazard.
 - Thermal effects occur when exposure levels exceed 5,000 to 10,000 uW/cm² in the resonant frequencies (30-300 MHZ which is where FM and VHF TV fall).
 - A study prepared by the Environmental Protection Agency (EPA) titled *Biological Effects of Radio Frequency Radiation* indicates that there are physiological effects (i.e., secretion of some hor-

mones, decreased weight of some hormone producing glands and changes in white blood counts, brain waves, and the lens of the eye) at much lower levels. Whether or not these health effects are adverse to human health is unknown.

It should be noted that the principal health concerns come from high power broadcasting facilities (i.e., FM, UHF TV, VHF TV). The possible health effects of microwave seem minimal as power levels are low and antennas used are highly directional. Two-way and cellular radio also use low power levels and should not present health concerns.

3. The current health standards for RF exposure are:

- The FCC has adopted the ANSI standards for non-occupational exposure.
- OSHA enforces a standard of 10,000 uW/cm² for occupational exposure based on the level at which thermal effects occur.
- ANSI has adopted a voluntary standard for non-occupational exposure of 1,000 uW/cm². This standard was calculated by taking the 10,000 uW/cm² at which damaging thermal effects occur and using a seemingly arbitrary factor of 10 (10,000 uW/cm² divided by 10 = 1,000 uW/cm²).
- Multnomah County, Oregon, and the State of Massachusetts have adopted a standard which is 1/5 of ANSI's or 200 uW/cm². The Portland Planning Commission is using an interim guideline of 100 uW/cm². New York City recently considered, but did not adopt, a standard 1/20 of ANSI's or 50 uW/cm². The Canadian government is proposing a RF exposure standard of 1000 uW/cm² for the general public. All of these standards are for frequencies in the 30-300 MHZ range.

4. Regarding the current levels of RF on Lookout Mountain:

- EPA has conducted preliminary studies to determine both the "average" exposure and "hot spots".
- Average exposure is 20 uW/cm² based on random measurements along Cedar Lake Road. The EPA conducted this study using a Holaday Industries Broadband Meter. At each location, three measurements were taken and averaged. The average values at each location were then averaged. It should be noted that these measurements were restricted to the road; no private property was tested. The 20 uW/cm² average does not consider areas outside of the Cedar Lake Road circle.

An earlier study shows that there are "hot spots" such as in front of KOSI's transmitter building where the reading was 530 uW/cm². The highest level found near a home was 133 uW/cm².

5. Current RF levels on Lookout Mountain do not exceed the existing federal standards. There are "hot spots" exceeding the standard utilized by other jurisdictions.

6. The factors which determine the level of RF exposure are:

- a. Proximity to antenna (both horizontally and vertically).
- b. Length and intensity of exposure.
- c. Power level of transmitter.
- d. Pattern of antenna.

e. Humidity/heat - higher humidity and heat affect the body's ability to dissipate heat.

It is impossible to make RF projections for the expected new facilities on other than a case specific basis.

According to EPA, new transmitters could be safely placed on Lookout Mountain if placement is judicious and engineered to take into account the factors described in #6.

7. Is there currently a probable health risk to residents of Lookout Mountain or elsewhere in the County due to RF from towers?

No actual health risks due to RF exposure to Lookout Mountain residents have been documented, although there could be some health effects. It is not known if these effects are adverse to human health.

Policies:

1. Telecommunication facilities should be located and designed to prevent exposure to RF in excess of current, projected, or suggested standards. At the time of rezoning application, the applicant should show that when the proposed facility is fully operational, the NIER level measured at the property line will not exceed the standard established by ANSI C95.1 or the most current applicable standard.

2. The practical measures that could be used to reduce RF exposure for residents living near existing tower sites or that would minimize RF exposure in future siting of towers are:

- a. Encourage stations to lease space on tall, existing towers.
- b. Require an adequate buffer separating towers from residential and commercial uses, based on RF standards.
- c. The County should adopt the ANSI standards for RF exposure (i.e., 1000 uW/cm² for 30-300 MHZ). The County should review adopted standards on a regular basis and change its regulations when necessary to reflect new evidence of health effects, improved measurement of RF levels, or standards promulgated by the State of Colorado, the Federal Government, or national industry groups like ANSI. Health standards should only apply to transmitters with a power output above 2,000 watts. Power output below this level does not present a health concern.
- d. The ANSI standards should apply to new or upgraded facilities. Applicants should provide calculations to show what the cumulative RF levels would be at various locations. These calculations should be reviewed by the County's consultant.
- e. Expected RF levels should be calculated for the nearest habitable structure near the proposed tower, adjacent residentially zoned property, locations with the highest theoretical RF level, and other locations deemed necessary by the County after consideration of topography and antenna pattern.
- f. Actual RF levels should be measured at the locations described above, after start-up of facility. If RF levels exceed the adopted standard, transmitter power level should be reduced to a level which will meet RF standards until operations are modified. Failure to do so will be considered a zoning violation.

Property Values

Findings:

1. The key concerns with regard to property values are:
 - a. Increased towers can lead to less interest in long term ownership- rental properties are more likely.
 - b. Residents expect the value of their property won't be decreased once they have purchased property.
2. The effects of towers on nearby property values are:
 - a. Towers adversely affect property values but the exact amount is hard to determine due to different methods used by property appraisers and the uniqueness of each property.
 - b. Lookout Mountain property value trends cannot be compared to another area due to its unique views.
3. The specific characteristics of telecommunication facilities that seem to negatively impact property values are:
 - a. Visual Impact
 - b. Interference
 - c. Concern over possible health effects

Tower Siting & Review

Policies:

1. All telecommunications facilities:
 - a. Towers and other structures should be located in the area of least visual impact within the site which will allow the facility to function consistent with its purpose.
 - b. The applicant must show that their proposed equipment cannot be accommodated and function as required by its construction permit or license without unreasonable modifications on any other existing facility.
 - c. Dishes and accessory buildings should be located to minimize their visual impact while functioning consistent with their purpose.
 - d. Applicants should make reasonable efforts to obtain waivers to FAA coloring and lighting requirements.
 - e. The ODP should specify a timeframe within which all buildings or towers to be abandoned or consolidated will be removed.
 - f. The applicant should show that adequate fire protection is available.
 - g. All other recommendations concerning interference, health and design of accessory structures should be followed.
2. Broadcast facilities proposed within major use transmission areas should meet the following guidelines:
 - a. The new tower should be stressed to accommodate multiple users. If the new tower is to be used for major broadcasters (TV or FM), it should be stressed for a multiplexed FM antenna and/or two multiplexed TV antenna or the equivalent.

b. New towers on Lookout Mountain should be located on the eastern slope (based on a North-South axis) of Lookout Mountain unless it can be demonstrated that a proposed tower in another location would have less visual impact and still function consistent with its purpose.

c.1) New towers should be permitted only when an equal face area (one face width x height) of existing tower(s) can be removed or as credited in c.2), c.3), or c4) below. If a new tower is proposed in a major use transmission area, the tower(s) to be removed must come from that area.

c.2) Buildings or other structures that have an adverse visual impact and that are located within the vicinity of a proposed tower may be considered for removal credit for new towers proposed at less than 200 feet high, or for a portion (not to exceed 200 vertical feet) of a taller tower.

c.3) Some tower face area credit should be allowed for new facilities that will provide space for at least 2 different TV or FM stations which are not the same channel and are not redundant or back-up systems.

c.4) Some tower face area credit should be allowed for 2-way or land mobile towers where a minimum of 25% of the tower's designed capacity will be made available for future use.

d. Multiplexing and other methods should be used whenever possible and practical to maximize the capacity of towers.

3. Facilities proposed outside major use transmission areas:

a. It should be demonstrated that there is not suitable space on existing towers at other telecommunications sites or on other sufficiently tall structures like buildings or water towers where the intended telecommunications use can be accommodated and function as required by its construction permit or license without unreasonable modifications.

b. If suitable space does not exist as described above, one of the following options should be used:

1) Build a facility capable of serving multiple users; or

2) Locate a tower in close proximity to other towers; or

3) Locate a new tower in areas where the tower and accessory building can be at least 80% screened by existing vegetation, land forms, or structures.

c. New structures should accommodate other users such as two-way radio, consistent with the site's development potential. Sites must be reviewed on a case-by-case basis to determine the extent of shared use that could be accommodated without creating objectionable impacts.

Low Power Mobile Radio Service Addendum

Introduction

The use of low power mobile radio service has increased at an astonishing rate since its introduction in the mid 1980's. An ever-increasing number of users are taking advantage of the advancement of telecommunication technology to meet their communication needs. The market for low power mobile radio service telecommunication has grown from only a few well-to-do individuals to a wide variety of users. Businesses, public safety departments, and recreational users are finding new ways to utilize the advancing technologies. Some forecasters predict as many as 100 million customers for low power mobile radio service within the next ten-years.¹

Recent regulatory changes by the Federal Communication Commission (FCC) have opened up new portions of the radio spectrum to allow new wireless competition into the market. Now, in addition to cellular, low power low power mobile radio service communication have expanded to include Enhanced Specialized Low Power Mobile Radio (ESMR) and Personal Communication Services (PSC). These new low power mobile radio services will have physically similar facilities to the better known cellular facilities.

The current Jefferson County Telecommunications Plan was adopted in 1985 when the industry was making its debut and has since been updated in 1992. It was intended to focus on major broadcasting facilities in centralized areas within the County and does not adequately address low power mobile radio service technology. The purpose of this document is to develop an addendum to the *Telecommunications Land Use Plan* to address the land use issues brought on by the rapid growth in demand for low power mobile radio service.

Low power mobile radio service technology differs from the more traditional broadcasting technology. Traditionally most broadcasters transmit their signal from tall towers from low to high power in an attempt to reach as many people as possible in a large geographic area. In contrast, low power mobile radio service networks typically

use low facilities at lower power to reach a limited number of users in a small geographic area. For several of the low power mobile radio technologies, each site is called a "cell site". The sites may be interconnected to other sites which in turn create a low power mobile radio service network. Because of these fundamental differences, low power mobile radio service facilities should not be viewed by the plan in the same way as other telecommunication facilities, but should be a separate section of the Jefferson County Telecommunications Land Use Plan.

Until the adoption of this Plan, there is no differentiation in review procedures for various types of telecommunication facilities. All are classified together as "radio, television and microwave transmission and relay towers" and dealt with similarly in the zoning regulations. A 500-foot broadcast tower, for example, was evaluated in the same manner as building-mounted panel antennas. A more refined review and evaluation procedure, based on rational siting criteria and appropriate impact mitigation, was streamlined the approval process and brought greater efficiency to benefit the public, the industry and the County. Low power mobile radio service technology and system design parameters place unique constraints upon facility placement that until recently, were not recognized in the County's regulatory framework.

This Plan distinguishes low power mobile radio service communication from other broadcasting type telecommunication technologies and establishes policies that deal with issues of demand, visual mitigation, noise, engineering, residential impacts, health, and facility siting. This Plan supersedes all the references to low power mobile radio service technology found in the current Telecommunications Plan, but it is not the intent of this Plan to override existing Community Plan's policies and recommendations.

Concurrently with the adoption, corresponding changes should be made to the Jefferson County Zoning Resolution to institute the policies and recommendations of this Plan.

Background

Low Power Mobile Radio Service Technology

Low power mobile radio Service communication works this way: A mobile or hand-held portable hand sets transmits a signal from a caller to a site antenna. The call is then relayed from the site antenna via a land based telephone line or microwave dish to a centrally located switch computer. The switch computer completes

the call by tying into the Public Switched Telephone Network [PSTN (land line)] to a land line telephone or sending it back to a site to be transmitted to another low power mobile radio service handset. As a low power mobile radio service user passes through different sites, the call is switched from site to site by the switch. This process is known as hand-off. In this fashion, the caller can continue the call uninterrupted.

¹ USA Today, 7/26/94, page 1B

For the most part, low power mobile radio service employs a cellular-like technology. This initial network provides coverage for a FCC licensed service area. The size of the site's coverage area may vary depending on engineering and geographic constraints. Generally, sites with high antennas cover large geographic areas where demand for service is low. These site facilities are called coverage sites. In areas where demand for service is high, the site will cover a small geographic area and use lower facilities. These sites are called capacity sites. Each site has a maximum number of telephone calls that can be handled at one time. When this number is reached, the site has reached its capacity. A site at capacity must be split to cover smaller geographic areas, to cover the same area as the original site. The same number of radio channels are reused throughout the system. Since channels must be reused in the network, it is important that each site have a height and power level that does not interfere with other sites in the operating system.

To maintain maximum efficiency, low power mobile radio service sites are engineered to maintain a line of sight between the user and the low power mobile radio service antenna. To ensure the signal is transmitted unobstructed, it is necessary to elevate the antenna of the site above any topographic feature and/or tree tops found within the site's assigned geographic area.

As the low power mobile radio service industry evolves, technological changes can be expected that will impact the growth of low power mobile radio service users and the ultimate design of low power mobile radio service facilities. One such technological advance on the horizon for implementation in the near term that will help the low power mobile radio service providers meet the need for additional capacity sites is the shift from analog to digital signal processing. The industry is debating over digital technology standards - Time Division Multiple Access (TDMA), currently used by cellular and ESMR; and Code Division Multiple Access (CDMA), available in the future. These technologies promise to boost low power mobile radio service capacity by a factor of three to six, once the system is fully converted and without major additions to the existing physical systems. These and other changes in low power mobile radio service technology may require physical alteration of antenna systems on low power mobile radio service facilities.

In addition to the advances that will increase capacity without major additions to the existing physical systems, there also are changes expected in the sizes of and applications for low power mobile radio service equipment. Cellular ESMR and PCS will provide services in addition to voice transmission. They will offer data transmission, paging system, message service and fleet service capabilities. Low power mobile radio service transmitters and receivers are expected to be smaller in the future, requiring less space for the "equipment building" function of the site. "Micro-cells," linked in parallel by fiber optic cable or other means of transmitting voice and/or data from the main site will offer future designers application opportunities that do not currently exist. Although the number of sites may increase significantly in the future using the new, smaller equipment that the industry anticipates, their physical characteristics should be very different than what exists today.

Low Power Private Mobile Radio Service Technology (PMRS)

Low power private mobile radio services are separated from Commercial Mobile Radio Systems (CMRS) by the FCC primarily because this mobile radio service is for private use and not connected to the public telephone network. This type of radio service is a not-for-profit service in and of itself but it may be part of a business operation which may be for profit such as a two-way radio service used by businesses that operate a fleet of vehicles or emergency response providers. In general, PMRS utilizes a single site which may cover a larger geographic area than commercial network facilities.

Types of Facilities

There are three categories of low power mobile radio service facilities that incorporate some or all of the typical components listed below. Roof and/or Building Mounted Facilities occur when low power mobile radio service antennas are attached to or mounted on an existing structure, such as a water tank or building. Freestanding Facilities use some type of stand-alone structure for antenna support, such as a wooden pole, steel monopole, lattice tower, or light standards. Micro-cell or Repeater Facilities are used to extend low power mobile radio service coverage or capacity to dead spots or high traffic areas. These facilities are linked to a "donor" site by a donor antenna, microwave, fiber optic, or phone line connection. Required equipment is much smaller than for the other two facility types.

Depending upon its type, a low power mobile radio service telecommunications facility may include all or some of the following elements:

1. Equipment Storage

A small unmanned, single story equipment building less than 500 square feet gross floor area (GFA) in size used to house radio transmitters and related equipment. This equipment may also be placed inside an existing structure when appropriate space is available. Micro-cells do not require any accessory building.

2. Antennas

a. Omnidirectional antennas, also known as whip antennas, are used when 360 degree coverage is desired.

b. Directional antennas, such as panel antennas, are used to transmit and receive signals for situations when directional coverage is desired. Panel antennas are typically rectangular in shape.

c. Microwave antennas are used to link two technologically compatible telecommunication facilities together by line of sight. They are typically circular or parabolic in shape and can be a grid or solid materials.

3. Antenna Mounting

Structures on which antennas can be mounted include:

a. A roof, building side, or other structure such as a silo, windmill, water tank, smokestack, or existing communication tower.

b. Monopoles made of wood or metal are used for lower heights of 30 to 150 feet and when structural loads are relatively light.

c. Lattice towers (steel structures) which have 3 or 4 sides. They can be guyed or self supporting. Greater heights and larger structure loads can be accommodated using these towers.

d. A cross bar or platform is often used to provide horizontal separation of antennas on the mounting structure.

4. Fencing

The freestanding pole, tower, and/or building is usually fenced with security fencing.

Health Issues

The level of radio frequency (RF) radiation emitted from low power mobile radio service relay transmissions have been determined to be far below the level now known to cause negative health effects. The levels have been determined to be only a small fraction of the radiation the public is exposed to on a daily basis.

The Federal Communications Commission (FCC) has adopted the American National Standards Institute (ANSI) standards for RF emissions, which are recognized by Jefferson County as being acceptable. In the immediate vicinity (within 50 feet) of a low power mobile radio service transmission tower, the power density has been determined to be no more than 1/150 of the ANSI exposure standards. This level is well below the most restrictive exposure standards in effect across the country, which are one-fifth of the ANSI Standards. As the distance from the antenna increases, the power level decreases by an inverse squared factor. Microwave relay antennas utilize very low levels of power. The power density emitted is typically no greater than 1/500,000 of the ANSI exposure standard, at the tower base. Therefore, based on the above, there are no expected negative health effects from exposure to a low power mobile radio service telecommunications facility.

Community Response

Despite enthusiastic response of Jefferson County citizens to low power mobile radio service, strong objections have been raised to the presence of low power mobile radio service facilities in communities and neighborhoods. These objections are based on the visual effect of these facilities and the presence of this type of activity in residential areas. This has been the case not only in zoned residential districts, but also in areas which are zoned as agricultural, but which are actually used as residential property. This document recognizes that certain types of low power mobile radio service telecommunications facilities are inappropriate in areas of single-family residential development.

1. Electromagnetic Interference

Because of the frequencies assigned to the low power mobile radio service providers by the FCC and the relatively low power output by low power mobile radio service facilities, possible interference to household appliances such as radios, television and cordless telephones for nearby residents will be minimal. The FCC has established regulations governing interference that state it is the responsibility of the carrier to promptly resolve any electromagnetic interference problems created.

2. Residential Property Values

Low power mobile radio service facilities should be located and designed to minimize any adverse effect they may have on residential property values. Strict compliance to the policies and recommendations of this Plan and adherence to the design standards and careful location of facilities should minimize any adverse effects on property values.

Federal, State, & Local Regulations

1. Federal Communications Commission

In August of 1993, when Congress enacted the Omnibus Budget Reconciliation Act of 1993, the public mobile and private radio categories were replaced with two newly defined categories - Commercial Low Power Mobile Radio Service (CMRS) and Private Mobile Radio Service (PMRS). CMRS includes all services that are for: a) profit, b) interconnected to Public Telephone Switched Network, and c) available to the public or such classes of eligible users as to be effectively available to a substantial portion of the public. At this time, this definition would include: Cellular, ESMR and Paging Services, and Personal Communications Services/ Personal Communications Networks. All other forms of wireless telecommunications which are not CMRS are considered Private Low Power Mobile Radio Service (PMRS). PMRS include industrial, land transportation, special emergency, public safety and government, automatic vehicle monitoring, personal mobile (CB's), and HAM operators.

The FCC has authorized a very limited frequency band for both CMRS and PMRS.

2. Federal Aviation Administration (FAA)

Under authority granted in the Federal Aviation Act, the FAA reviews the location and height of proposed towers to prevent possible interference with nearby airport operations. The agency has jurisdiction over towers that exceed 200 feet in height, as well as smaller towers located within 20,000 feet of a major airport (commercial and military aircraft facility) and 10,000 feet of a general aviation airport (serving smaller aircraft). The FAA requires that such towers be painted and/or appropriately illuminated. The FAA also has authority to review possible interference problems with aircraft-to-ground communications caused by transmission facilities in or near flight paths. It is the responsibility of the carrier to file a notice of proposed construction when necessary and receive painting and/or lighting instructions from the FAA.

3. State and Local Regulation

Low power mobile radio service telecommunication is considered a non-regulated public service that the Colorado Public Utilities Commission has chosen not to regulate at this time. From the standpoint of local land use regulations, low power mobile radio service telecommunication companies are considered private enterprises subject to applicable local zoning controls, to the extent not otherwise preempted by state and federal laws.

Future Demand

The low power mobile radio service industry has experienced rapid growth since its inception, and it is expected future technologies offered to the public will also be popular. Growth of this industry is being fueled by a number of factors such as lower cost of telephones and services, expanding areas of coverage, new advances in low power mobile radio service technologies, expanded services, and a wide variety of new users. In unincorporated Jefferson County, the number of sites will grow steadily. This trend is expected to level off once each provider has established their network and converted to the digital base technology.

Based upon the projected demand for low power mobile radio service and the engineering constraints of the network, the following are likely places for sites:

1. Population Centers

Most population centers within the unincorporated areas of the County currently have some level of low power mobile radio service. These areas are likely to require new sites as new industries are licensed by the FCC. Demand will increase and site capacity will reach its limit and must be split to increase capacity for current and future technologies.

2. Transportation Corridors

New sites are also likely along major transportation corridors within the County.

3. Areas of Variable Topography

Topography places constraints on the "ideal" line-of-sight signal path for low power mobile radio service transmissions. Additional sites may be needed in some locations to fill in the shadowing caused by topographic changes.

Predicting the growth of low power mobile radio service telecommunications, and, more specifically, the number of new sites that will be required in any future time-frame by low power mobile radio service providers, is virtually impossible. Demand for low power mobile radio service relates to many factors including customer usage and economic conditions, by market sector and geographic sub-area. Increasing use of portable low power mobile radio service phones has impacted coverage requirements. Low power mobile radio service is increasingly being used for non-voice transmission, including data such as mobile fax and telemetry, Global Positioning System/Geographic Information System and Emergency Services interconnect.

Site Selection

Industry Site Selection Criteria

In siting a new site, the industry requires a location that is technically compatible with the established network. A general area is identified based upon engineering constraints and the desired area of service. Specific locations within that general area are evaluated using the following criteria (not listed in any order of priority):

1. Topography as it relates to line of sight transmission for optimum efficiency in telephone service.
2. Availability of road access.
3. Availability of electric power.
4. Availability of land based telephone lines or microwave link capability.
5. Leasable lands and willing landlords.
6. Screening potential of existing vegetation, structures and topographic features.
7. Zoning that will allow low power mobile radio service facilities.
8. Compatibility with adjacent land uses.
9. The least number of sites to cover the desired area.
10. The greatest amount of coverage, consistent with physical requirements.
11. Opportunities to mitigate possible visual impact.
12. Availability of suitable existing structures for antenna mounting.

Citizens' Site Selection Criteria

Citizens believe that the following criteria should be addressed by the site selection process (not listed in any order of priority):

1. Certain types of low power mobile radio service facilities should not be located in single-family residential areas.
2. Preservation of view corridors.
3. Potential for preservation of pre-existing character of site.
4. Minimal impact on residential areas surrounding commercial or industrial zoned sites.
5. Selection of sites which lend themselves to visual mitigation.
6. Compatibility with surrounding land uses.
7. Pre-existing zoning that allows low power mobile radio service facilities.
8. Use of existing buildings.

General Policies for Site Selection

Site selection should be made in compliance with the Low power mobile radio Service Telecommunication Facilities Zone District Use Standards, which are set forth in the chart that appears within this section. Community and neighborhood visual concerns should be considered paramount in the consideration of and selection of sites. These concerns should be evaluated by a consideration of all the policies set forth in this Plan and in relevant Community Plans.

Site Selection Policies

The accompanying Zone District Use Standards Chart contains regulations which consider the following policies applicable to low power mobile radio service telecommunications facilities.

A. Within any zone district, sites should be located in the following order of preference:

1. On existing structures such as buildings, communication towers, water towers, and smokestacks.
2. In locations where the existing topography, vegetation, buildings, or other structures provide the greatest amount of screening.
3. Sites should be located on bare ground without visual mitigation only in certain commercial and industrial zone districts, based on defined parameters (see the visual mitigation policies in the following section).

B. Certain types of low power mobile radio service facilities are more appropriate in some zone districts than others and certain facilities create a greater impact on the surrounding area than others. The Zone District Use Standards contained in the chart on the following pages provide the basis for modifications to the Zoning Resolution which have been adopted along with this Plan concerning suitability of zone districts to accommodate the various types of low power mobile radio service facilities. In addition to the chart, the Plan has established a set of uniform standards for visual mitigation applicable to the various types of facilities and zone districts. These policies balance low power mobile radio service industry and homeowner concerns and are based on the specific impacts of the different types of low power mobile radio service facilities in relation to the character of land uses found in the County's zone districts. For example, the policies recognize that freestanding low power mobile radio service facilities generate the greatest impacts and, therefore, are most suitable in commercial and industrial zone districts.

**Low Power Mobile Radio Service Telecommunication Facilities:
Recommended Zone District Use Standards.**

Facility Type			
Zone District	Roof and/or Building Mount	Freestanding Facility	Micro-Cell or Repeater
SF Residential	NP	NP	NP
R-3 (Multifamily)	P	NP	SU
R-3A (Multifamily)	P	NP	SU
R-4 (Multifamily)	P	NP	P
C-1 (Convenience)	P	NP	P
C-1 (Neighborhood)	P	NP	P
C-1 (Community)	P	P	P
C-1 (Regional)	P	P	P
C-2	P	P	P
RC-1	P	P	P
I-1	P	P	P
I-2	P	P	P
I-3	P	P	P
I-4	P	P	P
PD	NP	NP	P
C-0	NP	NP	NP
A-1	SU	SU	SU
A-2	SU	SU	SU

P=Permitted (Use by Right)
 NP=Not Permitted
 *This plan recommends rezoning to Planned Development when seeking to locate a facility in NP zones
 SU=Special Use

C. Facilities should be located to minimize any adverse effect they may have on residential property values.

D. Facilities should be located to avoid a dominant silhouette on ridge lines, and preservation of view corridors of surrounding residential developments should be considered in the location and design of low power mobile radio service facilities.

E. Location of sites in commercial or industrial zones should consider the impact of the site on the surrounding neighborhood, particularly any adjacent residential neighborhood.

F. Facility must be architecturally and visually (color, bulk, size) compatible with surrounding existing buildings, structures, vegetation, and/or uses in the area or those likely to exist under the terms of the PD or underlying zone district. Micro-cell or repeater facilities may be considered architecturally or visually compatible if they are mounted on existing structures such as light standards, telephone poles, or otherwise camouflaged to disguise their low power mobile radio service use.

G. Less obtrusive facilities are preferred, and sites in industrial and commercial areas are preferred.

H. Co-Location: Where the result is less visual impact and the engineering of the low power mobile radio service network permits it, sites should be co-located with other low power mobile radio service facilities as well as other existing telecommunication sites and public structures. In co-location, anti-trust laws are a consideration.

I. Network Compatibility: At the time of site selection, the applicant should demonstrate how the proposed site fits into the overall network of the low power mobile radio service system within the County.

J. This plan recommends rezoning to Planned Development when seeking to locate a facility in a standard zone district which does not permit a commercial mobile radio facility.

Visual Impact & Screening Policies

The unique and diverse landscapes of Jefferson County are among its most valuable assets. Protecting these valuable assets will require that location and design of low power mobile radio service telecommunication facilities be sensitive to the setting in which they are placed. This is especially true in the mountainous parts of Jefferson County, where homes may be oriented to capture significant views and where site distance is greater. Visual concerns should include both those found on and off site. The following policies have been incorporated into the modifications to the Zoning Resolution establishing the visual impact and screening criteria of Jefferson County applicable to low power mobile radio service telecommunication facilities.

The following visual policies applicable to low power mobile radio service telecommunication facilities:

1. Low power mobile radio service facilities should be located and designed to minimize any adverse effect they may have on residential property values.

a. The use of compatible colors and facility designs should be compatible with surrounding buildings and/or uses in the area or those likely to exist in the area and should prevent the facility from dominating the surrounding area.

b. Location and design of sites in commercial or industrial zones should consider the impact of the site on the surrounding neighborhood, particularly the visual impact within the zone district.

c. Fencing should not necessarily be used to screen a site, and security fencing should be colored or should be of a design which blends into the character of the existing environment.

d. Freestanding facilities should be located to avoid a dominant silhouette on top of ridges.

2. Certain components of a site create a greater impact than other components. For example, the cross bar or other antenna mounting device and accessory building which may typically be part of a freestanding low power mobile radio service facility or a micro-cell or repeater site, may create a greater impact in a rural or mountain environment. A horizontal plane in a vertical setting can be intrusive, so the cross bar or other horizontal mounting device should be placed below the tree line to adequately mitigate its visual effect. These components should be afforded maximum screening, using existing vegetation and/or topography to minimize visual impact on the surrounding community.

3. Facilities should be architecturally compatible with surrounding buildings and land uses in the zone district or otherwise integrated, through location and design, to blend in with the existing characteristics of the site to the extent practical.

4. Site location and development shall preserve the pre-existing character of the site as much as possible. Existing vegetation should be preserved or improved, and disturbance of the existing topography of the site should be minimized, unless such disturbance would result in less visual impact of the site on the surrounding area. The effectiveness of visual mitigation techniques should be evaluated, taking into consideration the site as built.

5. At the time of rezoning or special use request, an evaluation of the visual impact should be taken into consideration if vegetation is to be removed for wildfire mitigation.

6. Innovative design should be used whenever the screening potential of the site is low. For example, by using existing light standards and telephone poles as mounting structures, or by constructing screening structures which are compatible with surrounding architecture, the visual impact of a site may be mitigated.

7. Roof and/or Building Mount Facility

Antennas on the rooftop or above a structure shall be screened, constructed and/or colored to match the structure to which they are attached. Antennas mounted on the side of a building or structure shall be painted to match the color of the building or structure or the background against which they are most commonly seen. Microwave antennas exceeding 12 inches in diameter on a roof or building-mounted facility shall not exceed the height of the structure to which they are attached, unless fully enclosed.

If an accessory equipment shelter is present, it must blend with the surrounding building(s) in architectural character or color.

8. Minimum setbacks for microcells and repeaters are those required for any accessory building or structure within the applicable standard zone district.

9. Minimum Setbacks for Freestanding Monopole and/or Lattice Towers

Minimum setback when located within 250 feet of any property zoned for residential land use: the tower height or the minimum setback for any accessory building within the applicable standard zone district, whichever is greater.

Minimum setback when not located within 250 feet of any property zoned for residential land use: the standard setback for a building or structure within the applicable standard zone district.

The structure must be architecturally and visually (color, bulk, size) compatible with surrounding existing buildings, structures, vegetation, and/or uses in the area or those likely to exist under the terms of the underlying zoning. Such facilities will be considered architecturally and visually compatible if they are mounted on or given the form of a light/sign standard or otherwise camouflaged to disguise the facility.

Implementation Policies

A. Zoning Resolution Changes

To address the policies and recommendations contained in this Plan, changes have been made to the Jefferson County Zoning Resolution as follows:

1. It distinguishes the low power mobile radio service industry from the other telecommunication industries. This is because the low power mobile radio service industry is technologically unique, rapidly expanding in the market economy, and shares few planning and land use impacts with other traditional telecommunication providers.
2. It clearly defines low power mobile radio service telephone communications and the types of facilities used by the industry.
3. The contents of the Zone District Use Standards chart and Visual Impact and Screening policies included in this Plan have been incorporated into the Jefferson County Zoning Resolution for regulation of low power mobile radio service facilities.
4. Administrative review for some types of facilities, as set forth in the Zone District Use Standards chart, have been accepted.
5. Setback requirements have been reviewed and accepted for reasonableness and flexibility, especially when evaluating visual impacts concerning the location of low power mobile radio services facilities on a particular site.

B. Community Notification

Prior to and subsequent to site application submittal for those sites where the facility is not a permitted use, the applicant should offer to meet informally with community groups and interested individuals who reside within the immediate vicinity (including adjacent landowners and registered homeowner associations) to explain the site development concept proposed in the application. The purpose of these meetings is to solicit suggestions from these groups about the applicant's proposed site design and impact mitigation measures. The industry needs to make a concerted effort to incorporate the community suggestions for impact mitigation generated by these meetings and report on their efforts in the hearings on the site application. The industry should be prepared

to discuss technical and visual aspects of alternative sites as applicable at these informal meetings.

C. Third Party Review

The low power mobile radio service industry uses various methodologies and analysis tools, including geographically based computer software, to determine the specific technical parameters of a low power mobile radio service facility, such as expected coverage area, antenna configuration, topographic constraints that affect signal paths, etc. In certain instances there may be a need for expert review by a third party of the technical data submitted by the low power mobile radio service provider. The Planning Commission and/or Board of County Commissioners may require such a technical review, to be paid for by the applicant for the low power mobile radio service facility. Selection of the third party expert may be by mutual agreement among the applicant and interested parties or at the discretion of the County, with a provision for the applicant and interested parties to comment on the proposed expert(s) and review qualifications.

The expert review is intended to be a site-specific review of technical aspects of the low power mobile radio service facility and not a subjective review of the site selection. Such a review should address the accuracy and completeness of the technical data, whether the analysis techniques and methodologies are legitimate, the validity of the conclusions and any specific technical issues outlined by the Planning Commission, staff, or interested parties. Based on the results of the third party review, the County may require changes to the application for the low power mobile radio service facility that comply with the recommendations of the expert.

The expert review of technical submission shall address the following:

- a. the accuracy and completeness of submissions;
- b. the applicability of analysis techniques and methodologies;
- c. the validity of conclusions reached; and
- d. any specific technical issues designated by the Planning Commission or the Board of County Commissioners.

Abandonment

Low power mobile radio service facilities which are not in use for six months for low power mobile radio service purposes shall be removed by the low power mobile radio service facility owner. This

removal shall occur within 90 days of the end of such six month period. Upon removal, the site shall be revegetated to blend with the existing surrounding vegetation.

Glossary

AM (Amplitude Modulation): Method of varying the amplitude of a radio signal while maintaining frequency; used to transmit AM radio signals and TV picture signals.

Antenna: A transmitting and/or receiving device used in telecommunications that radiates or captures radio signals. A group of electrical conductors that transmit or receive radio waves.

Band: A defined range of radio frequencies dedicated to a certain purpose (i.e., the FM band).

Broadcasting: Transmitting radio and television programming to reach the general public; contrasts with transmissions designed for a limited number of receivers.

Cellular Telecommunications: A Commercial Low Power Mobile Radio Service licensed by the Federal Communications Commission (FCC) to two providers in a specific geographical area in which the radio frequency spectrum is divided into discrete channels which are assigned in groups to geographic cells within a service area and which are capable of being reused in different cells within the service area.

Common Carrier: An organization authorized to provide telecommunication services to a third party.

Cross Bar: A structure at or near the top of the low power mobile radio service telecommunications facility which provides support and horizontal separation for the antenna(s).

Directional Antenna: An antenna or array of antennas designed to concentrate a radio signal in a particular area.

Duplex Antenna: One capable of transmitting the signals of two stations from one antenna.

Effective Radiated Power (ERP): The product of the antenna power input and the numerically equal antenna power gain.

FAA (Federal Aviation Administration): The federal agency responsible for aircraft safety.

FCC (Federal Communications Commission): The federal agency which regulates telecommunications.

FM (Frequency Modulation): Method of impressing an audio signal on a VHF frequency by varying the frequency; use to transmit FM radio, two-way radio, and television audio signals.

Frequency: The number of cycles completed each second by a sound wave; measured in hertz (Hz).

Interference: Disturbances in reception caused by intruding signals or electrical current.

Land-Mobile Systems: Two-way radio service for mobile and stationary units in which each user is assigned a particular frequency.

Lattice Tower: A guyed or self-supporting three- or four-sided, open, steel frame structure used to support telecommunications equipment.

Low Power Commercial Mobile Radio Network: A system of low power commercial telecommunications facilities which allow wireless conversation to occur from site to site.

Low Power Commercial Mobile Radio Service: a) profit, b) interconnected to Public Switch Network, c) available to the public or such classes of eligible users as to be effectively available to a substantial portion of the public, and must propose to or has develop, multiple networked sites within the County.

Low Power Mobile Radio Service Telecommunications Facility: A facility which consists of equipment for the reception, switching, and transmission of low power mobile radio service communications. Such facility may be elevated (either building-mounted or ground-mounted) transmitting and receiving antennas, low power mobile radio service base station equipment, and interconnection equipment. The categories of facility types include: 1) roof and/or building mount facilities, 2) freestanding low power mobile radio service facilities, and 3) micro-cell or repeater facilities. For purposes of district height limitations, height of freestanding low power mobile radio service telecommunications facility shall be measured from the average elevation of the finished grade of the building or structure.

Roof and/or Building Mount Facility: A low power mobile radio service telecommunications facility in which antennas are mounted to an existing structure on the roof (including rooftop appurtenances) or building face. Roof or building-mounted facilities may include micro-cell and/or repeater facilities. Such facilities must be screened, constructed or colored to match the existing structure to which

they are attached. Roof and/or building-mounted facilities shall not exceed the following maximum criteria.

1. The facility may include up to a maximum of 4 whip antennas, which may extend a maximum of 15 feet above the highest portion of the structure to which they are attached, including any rooftop appurtenances.
2. The facility may extend a maximum of 6 feet above the highest portion of the structure to which it is attached, including any rooftop appurtenances.
3. A single accessory building may be constructed provided that the building does not exceed 500 square feet gross floor area (GLA); and
4. Antennas on the rooftop or above a structure shall be screened, constructed and/or colored to match the structure to which they are attached. Antennas mounted on the side of a building or structure shall be painted to match the color of the building or structure or the background against which they are most commonly seen. Microwave antennas exceeding 12 inches in diameter on a roof or building-mounted facility shall not exceed the height of the structure to which they are attached, unless fully enclosed. If an accessory equipment shelter is present, it must blend with the surrounding building(s) in architectural character and color.

Freestanding Low Power Mobile Radio Service Facility: A low power mobile radio service telecommunications facility that consists of a stand-alone support structure, antennas and associated equipment. The support structure may be a wooden pole, steel monopole, lattice tower, light standard, or other vertical support. Whip antennas on a freestanding low power mobile radio service facility may extend a maximum of 15 feet above the highest portion of the structure to which they are attached; panel antennas may extend a maximum of 6 feet above the highest portion of the structure to which they are attached.

Micro-cell: A low power mobile radio service telecommunications facility used to provide increased capacity in high call-demand areas or to improve coverage in areas of weak coverage. Micro-cells communicate with the primary low power mobile radio service facility in a coverage area via fiber optic cable or microwave. Coverage area for a micro-cell is typically a one-mile radius or less. Micro-cells shall not exceed the following maximum characteristics:

1. Pole height: not to exceed the height limit of the underlying zone district as measured from the average elevation of the finished grade of the building or structure; height is measured to the top of antennas.
2. Number of whip or panel antennas: four.
3. Number of microwave antennas: one.
4. Size of antennas whip antennas: no greater than 3" diameter and up to 24 inches long for each such antenna; for panel antennas: no greater than one square foot of surface area for each such antenna; for microwave antennas: as allowed by the applicable zone district regulations.
5. Size of accessory building: no building permitted.

6. Setback requirements: That required for any accessory building or structure within the applicable zone district.

Low Power Telecommunications Facility: An unmanned facility consisting of equipment for the reception, switching and/or receiving of wireless telecommunications operating at 1,000 watts or less effective radiated power (ERP), including but not limited to the following:

1. Point-to-point microwave signals.
2. Signals through FM radio translators.
3. Signals through FM radio boosters under 10 watts effective radiated power (ERP).
4. Cellular, Enhanced Specialized Mobile Radio (ESMR) and Personal Communications Networks (PCN).
5. Private Low Power Mobile Radio Service (PMRS).

MHZ: Megahertz or 1,000,000 Hz.

Microwave: Electromagnetic radiation with frequencies higher than 1,000 MHz; highly directional signal used to transmit radio frequencies from point to point at a relatively low power level.

Microwave Antenna: A dish-like antenna manufactured in many sizes and shapes used to link communication sites together by wireless transmission of voice or data.

Monopole: A structure composed of a single spire used to support telecommunications equipment.

Multiplex Antenna: One capable of transmitting the signals of several stations.

MW/cm²: Milliwatts per square centimeter; a measurement of the radio frequencies hitting a given area.

Nonionizing Electromagnetic: The lower portion of the electromagnetic spectrum;

Omnidirectional Antenna: An antenna that is equally effective in all directions, and whose size varies with the frequency and gain for which it is designed.

Private Low Power Mobile Radio Service: All other forms of wireless telecommunications which have similar physical facilities as Commercial Low power mobile radio Service, but do not meet the definition of commercial mobile radio service.

RF: Radio Frequencies

Radiation: Includes household electric current, radio, television, microwave communication, radar, and visible light. It is insufficient to ionize tissue (unlike ionizing radiation created by fission of atoms); causes thermal effects at high levels; may cause nonthermal effects.

Repeater, Equipment: Contains both a receiver and transmitter; used to relay radio signals over large distances or to provide signals in an area otherwise in shadow.

Repeater, Low Power Mobile Radio Service Telecommunications Facility: Extends coverage of a cell to areas not covered by the originating cell. Repeater facilities shall not exceed the following maximum characteristics:

1. Pole height: in all zones, not to exceed the underlying zone district height limit as measured from the average elevation of the finished grade of the building or structure; height is measured to the top of antennas.
2. Number of whip or panel antennas: four.
3. Number of microwave antennas: one.
4. Size of antennas for whip antennas: no greater than 3" diameter and 12 feet long; for panel antennas: four square feet of surface area for each such antenna; for microwave antennas: as allowed by applicable zone district regulations.
5. Size of accessory building: one accessory building up to 100 square feet gross floor area (GFA) in size.
6. Setback requirements: that are required for any accessory building or structure within the applicable zone district regulations.

Shadow: Area within which a radio signal is received poorly or not at all due to manmade or natural obstructions in line of sight from the transmitter.

Translator: Equipment containing both a receiver and transmitter; used to relay TV signals over large distances or to provide signals in an area otherwise in shadow.

Transmission Tower: The structure on which transmitting and/or receiving antennas are located. An AM radio tower is its own transmitting antenna.

Transmitter: Equipment that generates radio signals for transmission via antenna.

UHF: Ultra High Frequency with bands from 300 to 3,000 Mhz; includes UHF-TV (such as Channel 31), microwave, and some land mobile and common carriers.

uW/cm²: Microwatts per square centimeter; a measurement of the radio frequencies hitting a given area.

VHF: Very High Frequency with bands from 30 - 300 MHz; includes FM radio, VHF-TV (Channels 2 to 13) and some land mobile and common carriers.

Whip Antenna: An antenna that is cylindrical in shape. Whip antennas can be directional or omnidirectional. Their size varies based upon the frequency and gain for which they are designed.

It was moved by Commissioner EIKNER that the following Resolution be adopted:

BEFORE THE PLANNING COMMISSION

COUNTY OF JEFFERSON

STATE OF COLORADO

RESOLUTION

RE: Amendments to the Jefferson County Telecommunications Land Use Plan

WHEREAS, the Jefferson County Telecommunications Land Use Plan has been in effect since 1985 without revisions; and,

WHEREAS, it is the opinion of this Planning Commission that changes in technology warrant updating the Plan; and,

WHEREAS, it is in the best interest of the County, potential applicants, and other involved parties to update and clarify certain policies of the Plan; and,

WHEREAS, numerous public hearings were held before the Planning Commission concerning revisions to the Plan; and,

WHEREAS, based on the evidence, testimony, exhibits and recommendations of the Jefferson County Planning Department, comments of public officials, agencies and citizens of the County and comments from other interested parties, the Planning Commission finds as follows:

1. That proper publication and public notice has been provided for the hearings before the Planning Commission.
2. That the hearings before this Planning Commission have been extensive and complete and that all pertinent facts, matters and issues have been submitted and considered, and all interested parties heard.
3. That the revisions to the Telecommunications Land Use Plan, as amended herein, adequately address the problems and concerns raised in the public hearing by interested parties.
4. That it is the opinion of the Commission that the Jefferson County Telecommunications Land Use Plan should be revised in accordance with the draft dated December 1, 1992, except as conditioned herein.
5. That said Plan revisions are in the best interest of the health, safety, welfare and morals of the citizens of Jefferson County.

NOW, THEREFORE, BE IT RESOLVED that the Jefferson County Telecommunications Land Use Plan be revised, as delineated by the above resolution with exceptions as noted herein be and hereby is APPROVED; and adopted as a component of the Jefferson County Comprehensive Plan pursuant to Section 30-28-108, C.R.S., and that said approved Jefferson County Telecommunications Land Use Plan be certified to the Board of County Commissioners pursuant to 30-28-109 C.R.S. as amended.

Conditions:

1. In Tower Siting Policies, policy A.2., change the word 'should' to 'must'.
2. In Tower Siting Policies, policy B.3.b., revise to read: "Buildings or other structures that have an adverse visual impact AND THAT ARE LOCATED WITHIN THE VICINITY OF A PROPOSED TOWER . . ."

Commissioner KRAPES seconded the adoption of the foregoing Resolution, and upon a vote of the Planning Commission the Resolution was adopted by unanimous vote of the Planning Commission of the County of Jefferson, State of Colorado.

I, JO ELLEN BLAKEY, Executive Secretary Pro-tem of the Jefferson County Planning Commission do hereby certify that the foregoing is a true copy of a Resolution duly adopted by the Jefferson County Planning Commission at a regular hearing held in Jefferson County, Colorado, on January 20, 1993.



Jo Ellen Blakey,
Executive Secretary Pro tem

It was moved by Commissioner NICOL that the following Resolution be adopted:

BEFORE THE PLANNING COMMISSION

COUNTY OF JEFFERSON

STATE OF COLORADO

RESOLUTION

RE: ADOPTION OF LOW POWER MOBILE RADIO SERVICE TELECOMMUNICATIONS LAND USE PLAN ADDENDUM

WHEREAS, on May 8, 1985, the Jefferson County Planning Commission approved and adopted the Jefferson County Telecommunications Land Use Plan as a component of the Jefferson County Comprehensive Plan; and

WHEREAS, on January 20, 1992, the Jefferson County Planning Commission approved and adopted amendments to the Jefferson County Telecommunications Land Use Plan; and

WHEREAS, on September 22, 1993, the Jefferson County Planning Commission approved an Interim Cellular Telecommunications Land Use Plan as an Addendum to the Telecommunications Land Use Plan which established policies and recommendations for cellular and cellular-like developments; and

WHEREAS, in accordance with the Jefferson County Planning Commission direction, the Jefferson County Planning staff reviewed said Interim Addendum to the Telecommunications Land Use Plan and presented recommended changes to the Planning Commission to bring it into harmony with the amended regulations adopted by the Board of County Commissioners; and

WHEREAS, the Jefferson County Planning Department has completed extensive research, analysis, review and community meetings on said Addendum and has proposed revisions to said Addendum and proposed renaming the Addendum the Low Power Mobile Radio Service Telecommunications Land Use Plan Addendum ("Addendum"); and

WHEREAS, public hearings on the proposed Addendum were held by the Jefferson County Planning Commission on October 5, 1994 and October 12, 1994, at which time this matter was continued for decision on October 19, 1994; and

WHEREAS, based on the evidence, testimony, exhibits and recommendations of the Jefferson County Planning Department, comments of public officials, agencies, and citizens of the County and comments from other interested parties, the Planning Commission finds as follows:

1. That adequate publication of public notice has been provided for hearings before the Planning Commission.
2. That the hearings before the Planning Commission have been extensive and complete and that all pertinent facts, matters, and issues have been submitted and considered, and all interested parties heard.
3. That the proposed Addendum, as amended and set forth in Exhibit "A" which is attached hereto and incorporated herein by this reference, adequately address the problems and concerns raised in the public hearings by interested parties.
4. That it is the opinion of the Planning Commission that the Low Power Mobile Radio Service Telecommunications Land Use Plan Addendum, as set forth on attached Exhibit "A" should be accepted.
5. That said Addendum, as set forth in Exhibit "A", is in the best interest of the health, safety, welfare and morals of the citizens of Jefferson County.

NOW, THEREFORE, BE IT RESOLVED that the Low Power Mobile Radio Service Telecommunications Land Use Plan Addendum, as set forth on Exhibit "A" attached hereto and incorporated herein as Exhibit "A", be and hereby is APPROVED and adopted, effective immediately, as an Addendum to the Jefferson County Telecommunications Land Use Plan and as a component of the Jefferson County Comprehensive Plan pursuant to Section 30-28-108, C.R.S., and that said approved Addendum to the Jefferson County Telecommunications Land Use Plan be certified to the Board of County Commissioners pursuant to Section 30-28-109, C.R.S., as amended.

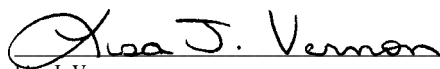
BE IT FURTHER RESOLVED that the Interim Cellular Telecommunications Land Use Plan adopted by the Planning Commission on September 22, 1993 be and hereby is rescinded as a component of the Jefferson County Comprehensive Plan.

BE IT FURTHER RESOLVED that the Jefferson County Telecommunications Land Use Plan with the Addendum is adopted as a Jefferson County Special Plan. Said Plan and Addendum, as set forth in Exhibit "A", shall be applied in conjunction with the Jefferson County General Land Use Plan and other applicable Jefferson County Special Plans in effect. Where conflicts arise between the plans, any applicable Special Plans and Community Plans shall be given equal weight and conflicts in recommendations shall be resolved on a case by case basis. The Jefferson County Special Plans currently include the Mineral Extraction Policy Plan, Sanitary Landfill Plan, Telecommunications Plan with the Low Power Mobile Radio Service Addendum, the Major Thoroughfare Plan and the Jefferson County Open Space Plan.

BE IT FURTHER RESOLVED that the Planning Department shall review all rezoning applications not yet decided by the Board of County Commissioners for compliance with all applicable adopted components of the Jefferson County Comprehensive Plan, including the Low Power Mobile Radio Service Telecommunications Land use Plan Addendum, when applicable.

The resolution was adopted by a unanimous vote of the Planning Commission of the County of Jefferson, State of Colorado.

I, LISA J. VERNON, Executive Secretary of the Jefferson County Planning Commission do hereby certify that the foregoing is a true copy of a Resolution duly adopted by the Jefferson County Planning Commission at a regular hearing held in Jefferson County, Colorado, on October 19, 1994.


Lisa J. Vernon,
Executive Secretary