

# **Amateur Radio: An Interim Amendment to the Telecommunications Land Use Plan**

## **Introduction**

The purpose of the Telecommunications Land Use Plan is to provide guidance to county staff, the Planning Commission and the Board of County Commissioners in making rezoning decisions that include telecommunications as a proposed use. The plan also provides guidance in the development of telecommunications land use regulations. This amendment provides such guidance, specific to amateur radio service uses.

Amateur Radio Service is a communications service for the purpose of self training, intercommunications and technical investigations carried out by amateurs. Amateurs are those persons interested in radio technique solely with a personal aim and without pecuniary interest. This Federal Communications Commission (FCC) licensed non-commercial service contains volunteers for emergency communications during earthquakes, forest fires and other disasters; licensees to advance the art of radio techniques, provide a pool of trained technicians and radio operators.

## **Goals**

- To provide clarity, consistency and predictability in processing telecommunications land use applications.
- To promote a Telecommunications Land Use Plan (TLUP) and Zoning Resolution consistent with Federal law and regulations.
- To provide clear guidance for the adoption of amateur radio policies and the minimum practicable amateur radio regulations necessary for the protection of the health, safety and welfare of the community as a whole.
- To establish policies and recommendations which promote a reasonable accommodation for amateur radio.

## **Policies**

### **A. General**

1. There should be open communication between the county and the community, to ensure efficient management and equitable application of the TLUP policies and applicable zoning regulations.
2. The county should develop an overall telecommunications policy to guide and manage all aspects of telecommunications service within Jefferson County. The TLUP should be one component of this policy. As part of this comprehensive approach, coordinated planning and management of regional amateur radio issues should continue at the state, county and municipal levels.

3. The Planning and Zoning Department should update the TLUP at least every five years to reflect changes in technology as they affect land use within Jefferson County. This plan and associated zoning regulations should also be updated whenever any relevant federal or state telecommunications laws or regulations are promulgated which would effect the recommendations of this plan or the requirements of the zoning resolution.
4. Amateur Radio Service provides a public service. Jefferson County should accommodate amateur radio operations as a public benefit, within regulatory restrictions adopted to ensure the health, safety and general welfare of the community.
5. Homeowner associations' covenants, controls and restrictions (CC&Rs) are private agreements between homeowners. Therefore CC&Rs governing amateur telecommunications facilities may be more restrictive than the goals and policies of this plan but, as private agreements, are not subject to county enforcement.
6. For continued public safety, the Jefferson County Sheriff, the Governor of The State of Colorado and the federal government are empowered to temporarily waive, for the period of emergency, any or all of these policies and associated regulations by officially declaring a state of local, state or national emergency.

## **B. Process**

1. Time frames and procedures for processing land use applications for telecommunications facilities should match those for land use applications of similar type, complexity and level of controversy.
2. Precise zoning regulations and land development criteria should be adopted to ensure consistent application of standards.
3. To ensure a reasonable accommodation with minimum practicable regulation, as required by the FCC, administrative review should be encouraged for Amateur Radio land use applications. The applicant should demonstrate conformance with the appropriate siting and design criteria to qualify for administrative review.
4. Policies and Regulations should conform to applicable state and federal laws and regulations. Terms used in the TLUP and zoning resolution should match those in federal regulations for consistency and clarity as much as possible.
5. Amateur radio is fundamentally different from other telecommunications applications in that it is experimental by nature. As such, Amateur radio operators should be allowed to swap out antennas within a maximum allowed antenna square footage and within manufacturer's specifications for maximum wind load in accordance with the most recent version of TIA/EIA RS-222 without having to submit new telecommunications permits each time.
6. Amateur radio facilities of minimal height above ground level or above roofline should be exempt from permit requirements, though should still comply with all applicable zoning regulations.

## C. Siting and Design

### General Policies

1. **Site selection**  
Community visual impact concerns as well as the ability of amateur radio operators to communicate should be considered in the construction and placement of sites. These concerns should be evaluated with thoughtful consideration of all the policies set forth in this Plan and in relevant Community Plans.
2. **Adjacent Property and Community Character**  
Amateur Radio antennas and support structures are allowed as accessory uses on any property, but should be located and designed to minimize any adverse effect they may have on adjacent properties and existing community character. Strict compliance with the policies and recommendations of this Plan and adherence to the siting and design standards outlined in the zoning resolution should minimize adverse effects.
3. **Commercial Uses**  
No commercial uses should be allowed to co-locate on amateur radio support structures. Amateur radio facilities, however, should be allowed to collocate on commercial telecommunication facilities.

## Design Standards and Visual Impact and 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 amateur radio telecommunication facilities be sensitive to the setting in which they are placed. Visual concerns should include those found both on and off site.

### Visual and Aesthetic Policies:

1. Amateur radio facilities should be located and designed to minimize any adverse effect they may have on surrounding properties.
  - a. Least obtrusive antennas and antenna support structures are preferred.
  - b. The design and siting of telecommunications facilities should 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. As an allowed accessory use, amateur radio facilities in general should be considered compatible with other allowed uses, but the design and construction of these facilities should not visually overwhelm a neighborhood.
  - c. Freestanding facilities should be located to avoid a dominant silhouette on ridge tops.
  - d. Crank-up towers should be permitted and encouraged,
  - e. Freestanding Towers and associated antennas should visually blend as much as possible with their surroundings. If painted, non-reflective haze gray paint should be used in the plains and a non-reflective color that blends with the surrounding area should be used for facilities in the mountains.
2. Certain components of a facility create a greater impact than other components. Design criteria should be applied to all physical elements of a telecommunications facility, including equipment storage, antennas and antenna mounting. All components should

be afforded maximum screening, using existing on-site vegetation and/or topography to minimize visual impact on the surrounding community.

- a. The effectiveness of visual mitigation techniques should be evaluated, taking into consideration the site as built and the ability of the amateur to communicate. For rezoning and variance applications, photo simulations should be provided at the time of application to indicate the potential presence or absence of visual impact. In order to minimize the application burden on amateur applicants, balloon testing and photos of the proposed site and of the neighborhood from the proposed site should be considered as an alternative to photo simulations in appropriate cases.
3. Facilities in registered historic areas should be made visually unobtrusive by means of design or concealment.
4. View corridors should be preserved.
5. Anti climbing devices or a 5 foot tall locked property fence should be required for all towers.
6. Building Mount Facility  
Antennas and antenna support structures mounted on the side of a building or structure should, at a minimum, be painted to match the color of the building or structure or the background against which they are most commonly seen..
7. No portion of a tower or antenna should extend over the property line or **create** more than a *de minimis* intrusion into setbacks.
8. Setbacks  
Amateur radio facilities should be setback sufficiently from the property line so as to minimize impacts to adjacent properties. Setbacks should be at least equal to those required for other accessory structures within the same or similar zone districts.
9. Height Allowances
  - A. Graduated height allowances for antennas and support structures, proportionate to and compatible with the neighborhood should be adopted. These allowances should be most restrictive for the smallest properties and least restrictive for the largest, based upon suitability of less densely populated areas to accommodate the greater visual impact of taller facilities.
  - B. In no case should antenna support structures taller than 199 feet tall be permitted.
  - C. The use of crank up towers is encouraged on lots of 1/3 to 2 acres to provide enhanced radio capability with minimized, temporary neighborhood impact.
    1. The crank up tower should be kept in its lowest extension whenever it is not being used.
    2. The crank up tower should be extended above its minimum height not more than 12 hours of any 24-hour period from 1:00 a.m. Monday through 12:00 midnight Friday. Crank up tower extensions may be continuous and without limit throughout weekends and national or Colorado recognized holidays.
    3. The crank up tower may also be extended continuously without limit during any time officially proclaimed by any Chief of Police of a Jefferson County municipal police force, the Jefferson County Sheriff, the State of Colorado or the United States government as a local, national or state emergency.

## **D. Health and Safety**

### **Health Issues relating to RF Emissions**

The Federal Communications Commission (FCC) has adopted the American National Standards Institute (ANSI) standards for RF emissions as outlined in FCC OET Bulletin No. 65, Supplement for amateur radio. The county, in its role of protecting the health safety and welfare of its citizens, should be provided evidence at the time of application that all RF levels will comply with those standards set forth in OET Bulletin No. 65 and ANSI standard C95.1., including any revisions thereto.

### **Safety Issues**

1. A letter from the applicant should be provided at the time of rezoning certifying that a proposed facility will meet the requirements of the latest revision of TIA/EIA –RS 222.
2. The applicant should provide certification from a professional structural engineer at the time of permit application, with reference to the latest revision of TIA/EIA –RS 222 for telecommunications facilities. This should certify that the structural capacity of a proposed telecommunications facility can accommodate the maximum weight and wind load of planned equipment.

## **E. Electromagnetic Interference**

1. The FCC has established regulations governing interference that state it is the responsibility of the operators to promptly resolve any electromagnetic interference problems affecting licensed transmitters. Interference from transmitters to consumer electronics is subject to FCC regulation.
2. Operators should take the required steps to ensure their equipment is in compliance with FCC regulations and should cease operations while in non-compliance, with the exception of reasonable tests to determine effectiveness of attempted adjustments, repairs or remedial actions.

## **F. Unanticipated Changes in Technology**

Neither the TLUP nor the zoning resolution are intended to stand as obstacles to the goal of providing a state of the art Telecommunications Land Use Plan and Zoning, adaptive to trends in technology. The Zoning Administrator should therefore have the authority, within the limits of federal and state law and consistent with county regulations, to make reasonable allowances to evaluate new technologies and recommend approval or denial based on their similarity to current telecommunication services.

## **G. Emergency Services**

The relationship between telecommunications and the provision of emergency services is of vital importance, especially in the mountains where service may be limited. Amateur radio service that complies with all other policies and recommendations of this plan should be encouraged in underserved areas of the county.

## **H. Plan Implementation**

### **Community Notification**

1. Notification of any proposed change in allowed land use should be given to affected property owners and relevant home owners associations and interest groups in compliance with existing county regulations.
2. An applicant for a rezoning or special use should meet informally with community groups and interested individuals at least in accordance with the requirements of county policy, and more frequently for controversial cases, 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 applicant should make a concerted effort to communicate their intentions, incorporate the community suggestions for impact mitigation generated by these meetings, and report on their efforts in the hearings.

### **Abandonment**

Amateur radio facilities no longer used for the purpose for which they were installed should be removed. This removal should occur promptly after the use ceases.

### **Inventory**

Planning and Zoning should create and maintain an inventory of all telecommunications facilities permitted within Jefferson County.

### **Zoning Enforcement**

Zoning enforcement, in general, is done on a complaint basis. The county dispatches zoning enforcement officers to investigate and resolve community reported issues regarding land use concerns. The county should continue to expeditiously investigate all reports of zoning violations, including those at telecommunications sites.

### **RF Emissions Calculations and Measurement**

The FCC requires all amateur radio operators to calculate RF emissions to ensure compliance with OET Bulletin 65. If concerns are raised by staff or the community regarding RF emission levels, an amateur radio operator should produce their calculations as proof of compliance. If an operator, by virtue of an RF report, can demonstrate that federal emission standards cannot be exceeded, monitoring should not be necessary.

If an amateur radio site cannot demonstrate that RF emission standards will be met, the county should require RF measurements. If the results of such measurements indicate emissions are in violation of accepted standards, the county should notify the FCC, the licensee and the landowner of the zoning violation and process the offense in accordance with county policy.

# **Personal Wireless Services: An Interim Amendment to the Telecommunications Land Use Plan**

## **Introduction**

The use of personal wireless services has increased rapidly since its introduction in the mid 1980's, and particularly after adoption of the Telecommunications Act of 1996 (The Telecom Act). The Telecom Act deregulated the telecommunications industry, fostered competition and sought to accelerate deployment of converging technology. Today, an ever-increasing number of users take advantage of the advances in telecommunication technology to meet their communication needs. The market for personal wireless services has grown from only a few well-to-do individuals 15 years ago to a majority of adult Americans owning cell phones today. The Denver Business Journal reported that wireless phone subscribers now spend more time on their cell phones than they do on traditional landline home phones. More than half of cell phone users reportedly use them as our primary device for voice communication: (Denver Business Journal , May 28, 2003, p.A12). Businesses, public safety departments, and recreational users are also finding new ways to use the advancing technologies.

Now, in addition to analog cellular communications, the Telecom Act expanded the definition of personal wireless services to include Enhanced Specialized Mobile Radio (ESMR), digital Personal Communication Services (PCS), paging services and wireless broadband access, among others. As a result, it is estimated that new applications for personal wireless services (PWS) will lead to a five fold increase in the number of low power telecommunications facilities.

Such increases, if not addressed, would create significant land use challenges for the county. The Telecom Act significantly restricts local governments' control over PWS telecommunications in general, but it does preserve local governments' authority over land use decisions. In this capacity, the county seeks to develop policies and regulations which balance the industry's need to site their facilities, the public's desire for good wireless service and their concerns with community impacts. It is also the intent of this document to make recommendations that can, to the greatest extent possible, anticipate changes in telecommunications technology as they relate to land use decisions.

The current Jefferson County Telecommunications Land Use Plan (TLUP) was adopted in 1985 and updated in 1993. The 1985 TLUP focused on major broadcasting facilities in centralized areas within the County and did not adequately address other technologies. This document updates the 1993 low power addendum to the TLUP to address land use issues brought on by the rapid growth in demand for personal wireless services.

Personal wireless service technology differs from television and commercial radio broadcasting technology. Traditionally most broadcasters transmit their signal from tall towers in an attempt to reach as many people as possible in a large geographic area. In contrast, personal wireless service networks typically occupy sites with low facilities operating at lower power to reach a limited number of users in a small geographic area. The antenna may be interconnected to other sites that in turn create a personal wireless service network. Because of these fundamental differences in land use, personal wireless service facilities should not be viewed 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 the 1993 amendment to the TLUP, there was no differentiation in review procedures for various types of telecommunication facilities. All were classified together as "radio, television and microwave transmission and relay towers" and were 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. Personal wireless service technology and system design parameters place unique constraints upon facility placement that were not initially recognized in the county's regulatory framework. A more refined review and evaluation procedure, based on specific siting criteria and appropriate impact mitigation, was addressed in the 1993 low power amendment. This amendment addressed differences between high power broadcast low power telecommunication technologies, and adjusted the approval process, benefiting the public, the industry and the county.

This 2004 plan amendment distinguishes personal wireless service communication from other telecommunication technologies and establishes policies that deal with issues of demand, visual mitigation, noise, engineering, residential impacts, health, and facility siting. This plan amendment supersedes all the references to low power mobile radio services found in the current Telecommunications Land Use Plan as they apply to what are now classified as personal wireless services. Conflicts between this plan and any existing Special Plans and Community Plans shall be resolved on a case by case basis. With the adoption of this amendment, corresponding changes should be made to the Jefferson County Zoning Resolution to institute the policies and recommendations of this plan amendment.

## Goals

- To provide clarity, consistency and predictability in processing telecommunications land use applications.
- To promote a Telecommunications Land Use Plan (TLUP) and Zoning Resolution consistent with Federal and State law and regulations and adaptive to trends in the market place and technology.
- To promote a high level of service, reflective of the community's needs and values, by fostering competition among providers and facilitating the development of personal wireless facilities throughout the County.
- To provide clear guidance to ensure land-use decisions protect the health, safety and welfare of the community as a whole.

## Policies

### A. General

1. There should be open communication between the county and the community, to include citizens, interest groups and industry representatives, to ensure efficient management and equitable application of the TLUP policies and applicable zoning regulations.
2. The County should develop an overall telecommunications policy to guide and manage all aspects of telecommunications service within Jefferson County. The TLUP should be but one component of this policy. As part of this comprehensive approach, coordinated planning and management of regional telecommunications issues should be encouraged at the federal, state, county and municipal levels.
3. The Planning and Zoning Department should update the TLUP at least every five years to reflect changes in technology as they effect land use within Jefferson County. This plan and associated zoning regulations should also immediately be updated whenever any relevant federal or state telecommunications laws or regulations are promulgated which would effect the recommendations of this plan or the requirements of the zoning resolution.

## **B. Process**

1. Time frames and procedures for processing land use applications for telecommunications facilities should match those for land use applications of similar type, complexity and level of controversy.
2. Precise zoning regulations and land development criteria should be adopted to ensure consistent application of standards.
3. To facilitate deployment and ensure adequate service, administrative review should be encouraged for telecommunications land use applications in all but the most sensitive areas. Applicant should demonstrate conformance with the appropriate siting and design criteria to qualify for administrative review.
4. Policies and Regulations should conform to applicable state and federal laws and regulations. Terms used in the TLUP and zoning resolution should match those in federal regulations for consistency and clarity.

## **C. Siting and Design**

### **General Policies for Site Selection**

1. **Site selection**  
Site selection should be made in compliance with the Personal Wireless Service Telecommunication Facilities Recommended Zone District Allowances, which are set forth in the chart that appears within this section. Community and neighborhood visual concerns should be considered paramount in the consideration 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.
2. **Growth**  
Community members expressed concern with the possible implications of a rapid increase in telecommunications facilities. As more people desire to take advantage of these technologies we expect to see a corresponding increase in land use applications to allow the construction of supporting facilities. Unguided, these facilities could have a deleterious effect on the community. Compliance with the policies and recommendations of this Plan and adherence to the siting and design standards should minimize adverse effects on surrounding properties. Telecommunications growth, well designed and placed, should benefit the residents and businesses of Jefferson County by providing increased access to existing and projected services.
3. **Residential Property Values and Community Character**  
Personal Wireless facilities should be located and designed to minimize adverse effects on residential property values and existing community character. Strict compliance with the policies and recommendations of this Plan and adherence to the siting and design standards outlined in the zoning resolution should minimize any adverse effects.

## Site Selection Policies

- A. Least obtrusive facilities are preferred.
- B. Industrial and large commercial areas are preferred for freestanding facilities that do not meet the concealment, camouflage or compatibility criteria of the Highest Design Standards (see the visual mitigation policies in the following section).
- C. Sites in commercial or industrial zones should be located to minimize the impact of the facility on the surrounding uses, particularly any adjacent residential neighborhood or open space area / park.
- D. Facilities should be located to avoid a dominant silhouette on ridge lines.
- E. View corridors within surrounding residential developments or areas zoned residential should be preserved.
- F. Within any zone district, sites should be located in the following order of preference:
  - 1. On existing structures such as buildings, communication towers, utility poles and towers, water towers, and smokestacks.
  - 2. In locations where the existing topography, vegetation, buildings, or other structures provide the greatest amount of screening.
  - 3. In dedicated rights of way of streets dedicated to the county.
  - 4. 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).
- G. The facility should be architecturally and visually (color, bulk, size) compatible with surrounding existing buildings, structures, vegetation, and/or uses in the area or those likely under existing zoning. All relevant Zoning Resolution requirements not specifically addressed in the written restrictions of a planned development should apply to the proposed land use.
- H. Dispersal of PWS telecommunications facilities should be promoted, provided they are planned and designed so as to mitigate impacts to the community. Co-location should be promoted, however, when telecommunications facilities can locate on existing telecommunications structures with available antenna capacity, and co-location on a structure or at a site would result in less visual impact than without co-location. In requiring co-location on existing structures with available space, anti-trust laws should be considered.
- I. Rights of Way (ROW): The county retains the right of consent for any proposed use of dedicated ROW. County consent for use of Right of Way should only be given under the following conditions:
  - 1. Facilities do not create safety hazards, such as within a vision clearance triangle or blocking site distance.
  - 2. Facilities are not co-located on traffic signal poles,
  - 3. Above ground ancillary equipment is located as far from the road surface as possible, preferably buried in vaults,
  - 4. Facilities meet the criteria for “highest design standards”,
  - 5. Re-location of facilities for widening / improvement projects in the ROW would be at the telecommunications facility owner’s expense, and
  - 6. Facilities locate on existing infrastructure (light poles, telephone poles, etc.) whenever possible, rather than installing new infrastructure.
- J. PWS facilities should be allowed to locate on fire district and sheriff facilities or church properties within single family residential areas, but only if they comply with “highest design standards”.

- K. Applicants seeking to locate on Jefferson County Open Space property should be allowed to do so only if conditions established by the Jefferson County Open Space Department can be met.
- L. Where zoning does not permit PWS, the applicant may propose to rezone a site to a planned development to include such use. Planned development proposals for PWS allowances within single family residential areas should generally be discouraged. Unique situations / proposals for rezoning within single family residential areas that have public support may be acceptable, but should at least require compliance with “highest design standards”.
- M. Certain types of PWS 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 allowances contained in the following chart provide recommendations for modifications to the Zoning Resolution based upon suitability of zone districts to accommodate the various types of PWS facilities. In addition to the chart, the TLUP has established uniform siting, design and visual impact mitigation recommendations applicable to the various types of facilities and zone districts. These policies balance PWS industry and homeowner concerns and are based on the specific impacts of the different types of PWS facilities in relation to the character of land uses found in the County's zone districts.

**Personal Wireless Service Telecommunication Facilities:  
Recommended Zone District Allowances.**

Facility Type			
Zone District	Roof and/or Building Mount	Freestanding Facility	Facilities meeting Highest Design Standards
SF Residential			
R-3 (Multifamily)			P
R-3A (Multifamily)			P
R-4 (Multifamily)			P
C-1 (Convenience)			P
C-1 (Neighborhood)			P
C-1 (Community)	P	P	P
C-1 (Regional)	P	P	P
C-2	P	P	P
RC-1			P
I-1	P	P	P
I-2	P	P	P
I-3	P	P	P
I-4	P	P	P
A-1	SU	SU	P
A-2	SU	SU	P
A-35	SU	SU	P
C-O			P
PD	*	*	*
Dedicated Rights Of Way (all zone districts)			P
<p>P = Permitted (Use by Right – administrative review) SU = Special Use</p> <p>* New Planned Developments will be evaluated on a case by case basis.</p> <p>Facilities under the Highest Design Standards (HDS) category may be freestanding, roof mount or building mount, but are held to more stringent design criteria in order to qualify for administrative review.</p>			

## Design Standards and Visual Impact and 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 PWS telecommunication facilities be sensitive to the setting in which they are placed. Visual concerns should impacts to the site itself and off site impacts to the surrounding area.

### Visual and Aesthetic Policies:

1. PWS facilities should be located and designed to minimize any adverse effect they may have on surrounding properties.
  - a. The design and siting of telecommunications facilities should 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.
  - b. Location and design of sites in commercial or industrial zones should limit the impact of the site on surrounding residential neighborhoods or open space.
  - c. Fencing should only be used for security reasons and should be of a design that blends with the character of the existing environment.
  - d. Freestanding facilities should be located to avoid a dominant silhouette on top of ridges.
  - e. Equipment cabinets in the rights of way of local streets and in visually sensitive areas should be buried in vaults whenever possible.
  - f. Graduated design criteria, least restrictive in industrial zones and most restrictive in or near residential zones, would be appropriate and should be incorporated into the zoning resolution.
2. Certain components of a site create a greater impact than other components. Design criteria should be applied to all physical elements of a telecommunications facility, including buildings, equipment storage, antennas and antenna mounting. For example, accessory buildings or equipment cabinets which may typically be part of a freestanding telecommunications facility may create a greater impact than a well designed and placed antenna panel. All components should be afforded maximum screening, using existing vegetation and/or topography to minimize visual impact on the surrounding community.
3. Site location and development should preserve the pre-existing character of the site as much as possible.
  - a. Existing vegetation should be preserved or improved. Disturbance of the existing topography of the site should be minimized, unless such disturbance would result in less visual impact on the surrounding area.
  - b. The effectiveness of visual mitigation techniques should be evaluated, taking into consideration the site as built.
  - c. Trees and other vegetation on an adjacent property should not be considered as providing screening on an applicant's property.
  - d. Screening should be maintained through the life of the facility.
4. Photo simulations should be provided at the time of application to clearly demonstrate the presence or absence of visual impact.

5. Roof and/or Building Mount Facility

Antennas on the rooftop or above a structure should be screened, constructed and/or colored to be compatible with the structure to which they are attached. Antennas mounted on the side of a building or structure should, at a minimum, be painted to match the color of the building or structure or the background against which they are most commonly seen. If an accessory equipment shelter is present, it should blend with the surrounding building(s) in architectural character and color.

6. Setbacks

Telecommunications facilities should be setback sufficiently from the property line, and at a minimum in accordance with zone district standards, so as to minimize impacts to adjacent properties. Setbacks should be greatest adjacent to residentially and agriculturally zoned properties.

Setbacks should not apply within rights of way dedicated to the county.

7. Proposals should be evaluated for potential traffic, noise and light impacts.

8. Highest Design Standards

Intent:

The intent of these standards is to ensure facilities provide minimal visual / aesthetic impact to the community.

Administrative Review:

PWS proposals should qualify for administrative review if they comply with the highest design standards in an allowed zone district.

Qualifications:

Telecommunications facilities that may be classified as meeting the highest design standards include freestanding, building or roof mount antennas, and all associated equipment, which by means of design and / or placement are obscured from public view or sufficiently blend with their surrounding environment.

Facilities qualify as meeting the classification of "Highest Design Standards" if they can be concealed or camouflaged.

Concealment means that a facility is completely hidden from view within some other structure, as within a church steeple or clock tower.

Effective camouflage telecommunications facilities meet one of the following:

1. Disguised (e.g. as a natural looking ponderosa pine).
2. Designed so that the facilities silhouette, mass and color are masked in such a way as to be virtually indistinguishable from their background.
3. Considered inherently compatible due to the facility's minimal size.

Compatibility by virtue of size should require not only that a facility be diminutive, but painted to match the structure to which it is mounted. The equipment should also be installed in proximity to few other diminutive pieces of equipment. (for example, one 8"x10" box painted to match its background might be considered compatible, but many of the same on one wall most likely would not.) If the equipment must not be painted for technical reasons, it should be screened by material that matches the background. If it can be demonstrated that the equipment can neither be screened nor painted but still meets the size requirements of "compatibility" the zoning administrator should have the authority to waive these painting / screening requirements on a case by case basis.

Fixed wireless equipment mounted on a residence and for in house use are exempt by federal regulation from the single family zoning exclusion, but must otherwise meet all Highest Design Standard criteria.

In every case, treatment must be compatible with the aesthetics of the surrounding environment (e.g. no faux ponderosas standing in an empty field, no “flagpole” concealment monopoles out of scale and proportion with “real” flagpoles.). Siting and design should take full advantage of all screening opportunities to render the facility unnoticeable, including topography, landscaping, and the preservation of existing tree cover. Design and placement of roof or wall mounted panels should appear integral to the architecture of the building.

These Highest Design Standards should be required for proposed facilities within all Rights of Way dedicated to Jefferson County and any allowed residential or conservation zoned property, as noted in the Recommended Zone District Allowances Chart for PWS facilities. These standards should be encouraged in all agricultural or commercial property.

The requirements for “highest design standards” does not abrogate an applicant’s responsibility to meet all other design recommendations of this plan or design requirements of the zoning resolution.

12. Pictorial examples of acceptable and unacceptable design in differing contexts, with explanations are located in appendix A.

## **D. Health and Safety**

### **Health Issues relating to RF Emissions**

1. The Federal Communications Commission (FCC) has adopted the American National Standards Institute (ANSI) standards for radio frequency (RF) emissions as outlined in FCC OET Bulletin No. 65. The Telecommunications Act of 1996 regarding personal wireless services preclude local jurisdictions from basing land use decisions on potential environmental effects, including health effects. The county, in its role of protecting the health, safety and welfare of its citizens, should be provided evidence at the time of application that all RF levels will comply with those standards set forth in OET Bulletin No. 65 and ANSI standard C95.1., or any revisions thereto.

### **Safety Issues**

1. A letter from the applicant should be provided at the time of rezoning or special use certifying that a proposed facility will meet the requirements of the latest revision of TIA/EIA –RS 222.
2. The applicant should demonstrate at the time of permit application, with reference to the latest revision of TIA/EIA –RS 222 for telecommunications facilities, that the structural capacity of a proposed telecommunications facility can accommodate the planned equipment.

## **E. Electromagnetic Interference**

1. The Telecommunications Act of 1996 regarding personal wireless services precluded local jurisdictions from basing land use decisions on potential environmental effects, including interference effects. Providers, however, should make every effort to site facilities so as not to interfere with other equipment, particularly those that operate in frequencies close to those reserved for emergency services providers. Applicants should coordinate with emergency service providers to determine whether interference may be a problem so that they may address the issue in advance.
2. The FCC has established regulations governing interference that state it is the responsibility of the carrier to promptly resolve any electromagnetic interference problems created between licensed transmitters. Interference from PWS to consumer electronics is subject to FCC regulation.

## **F. Future Service Demand and Unanticipated Changes in Technology**

1. The intent of the plan is to establish policies and recommendations which promote adequate PWS county wide, while minimizing associated impacts to the community.
2. Neither the TLUP nor the Zoning Resolution should inadvertently stand as obstacles to the goal of providing a state of the art Telecommunications Land Use Plan and Zoning Resolution, adaptive to trends in the market place and technology. The Zoning Administrator should therefor have the authority, within the limits of federal and state law and consistent with county regulations, to make reasonable allowances to evaluate new technologies and recommend approval or denial based on their similarity to current telecommunication services.

## **G. Emergency Services**

1. The relationship between telecommunications and the provision of emergency services is of vital importance, especially in the mountains where service may be limited. Telecommunications service, that complies with all other policies and recommendations of this plan, should be encouraged in under served areas of the county.
2. Co-location of PWS at emergency service provider sites may be acceptable, but should be within existing site capacity and should meet all other policies of the TLUP and Zoning Resolution.

## **H. Plan Implementation**

### **Community Notification**

1. Notification of any proposed change in allowed land use should be given to affected property owners and relevant home owners associations and interest groups in compliance with existing county regulations.
2. An applicant for rezoning or special use should meet informally with community groups and interested individuals at least in accordance with the requirements of county policy, and more frequently for controversial cases, 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 should make a concerted effort to incorporate the community suggestions for impact mitigation generated by these meetings and report on their efforts in the hearings.

### **Third Party Review**

The PWS industry uses various methodologies and analysis tools, including geographically based computer software, to determine the specific technical parameters of a PWS 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 third parties of the technical data submitted by the PWS provider. Planning staff, the Planning Commission and/or the Board of County Commissioners should be authorized to require such a technical review, to be paid for by the applicant for the PWS 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 PWS facility and not a subjective review of the site selection. If required, and to the extent allowed by law, the review should consider the following:

1. Issues of RF emissions compliance, (such as determining if radiation levels at co-location sites exceed standards),
2. Issues of safety, (such as structural engineering), and
3. Issues of visual impact related to structural requirements (such as confirming whether a requested tower height is excessive for the facility proposed).

The review should be referred to all appropriate agencies and departments for comment. Based on the results of the third party review, the County should be authorized to require changes to the application for the PWS facility to ensure the application complies with the recommendations of the third party review.

The expert review of technical submission should address the following:

1. The accuracy and completeness of submissions;
2. The applicability of analysis techniques and methodologies;
3. The validity of conclusions reached; and
4. Any specific technical issues designated by the Planning Commission or the Board of County Commissioners.

### **Abandonment**

PWS facilities no longer used for the purpose for which they were installed should be removed. This removal should occur promptly after the use ceases. Upon removal of freestanding facilities, the site should be revegetated to blend with the existing surrounding vegetation.

If a legal nonconforming use is discontinued, any future use of the land, building or structure should conform with the provisions of the Zoning Resolution.

### **Inventory**

Planning and Zoning should create and maintain an inventory of all telecommunications facilities, including PWS facilities, permitted within Jefferson County. The purpose of such an inventory would be to aid in evaluating sites that do not meet highest design standards for collocation and to ensure compliance with county regulations.

## Zoning Enforcement

1. Zoning enforcement in general is done on a complaint basis. The county dispatches zoning enforcement officers to investigate and resolve community reported issues regarding land use concerns. The county should expeditiously investigate all reports of zoning violations, including those at telecommunications sites.

## RF Measurement

1. If a site is categorically excluded by the FCC from RF reporting, or by virtue of an RF report it can be demonstrated that federal emission standards cannot be exceeded, monitoring should not be necessary. RF reports should be required whenever a proposed site might exceed the county's low power threshold of 1,000 watts effective radiated power. A checklist to determine whether a facility is categorically excluded is contained within the FCC publication, [A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules Procedures, and Practical Guidance.](#)

In all other cases, the county should determine whether to require RF measurements to verify that federal standards have not been exceeded. If a PWS site is not categorically excluded or cannot demonstrate by calculations that RF emission standards will be met and there is some indication that a site may in fact exceed emission standards, the county should require RF measurements. (Indications that such a facility might exceed RF emissions standards might include, but is not limited to, a roof mount that is accessible by building maintenance personnel, or an antenna that might cause a facility to exceed standards when emissions are collectively considered on a collocated site). If the results of such measurements indicate emissions are in violation of accepted standards, the county should notify the FCC, the licensee and the landowner of the zoning violation and process the offense in accordance with county policy.

## **Supplemental Information**

The following sections are intended to provide general background information regarding issues of technology, community and industry concerns and a glossary of terms. These should be considered snapshots of some of the key issue areas addressed in developing this amendment's goals and policies recommendations.

### **Personal Wireless Service (PWS) Technology Overview:**

PWS communication generally works this way: A transceiver, such as a cell phone, pager or Personal Digital Assistant (PDA) with wireless internet capability, transmits a signal from a caller to a site antenna. The call is then relayed from the site antenna via a land based telecommunications 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 telephone)] or sending it back to a different cell site to be transmitted to another Personal Wireless Service appliance. If a PWS user is mobile, then as he or she 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 user remains connected for continued voice or data transmission.

For the most part, PWS employs a cellular-like technology. An initial network provides coverage for a 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 (coverage sites). In areas where demand for service is high or an application is intended by design to service only a limited area, the site will cover a small geographic area and use lower, shorter facilities (capacity sites). Each site has a maximum number of 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 for each new site to cover smaller geographic areas, but collectively 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.

Increasingly, wireless data transmission, Wireless fidelity (WIFI), and some Personal Communication Services (PCS) applications occupy unlicensed spectrum. The use of unlicensed spectrum increases the chances that these PWS applications will have problems with cross channel interference. Dispersed deployment of facilities operating at low power may help alleviate this problem.

To maintain solid uninterrupted communications, PWS sites are engineered, where possible, to have a line-of-sight (LOS) between the provider and user antennas by elevating cell site antennas. Even though a cell antenna is elevated, there is a compromise of the antenna height because some of the radio waves are attenuated by passing through, refracting around or reflecting off natural and man-made structures or vegetation in the vicinity. Best communications efficiency is established by a trade-off of the subscriber's transmission parameters and the cell site antenna height and gain.

As the personal wireless service industry evolves, technological changes are expected that will increase demand for services and also alter the design of PWS facilities. PWS will increasingly do more than provide voice transmission, they will increasingly be relied on for data transmission, video transmission, paging systems, text messaging services and broadband wireless access.

In addition, advances are anticipated that will increase capacity without major additions to the existing physical systems. Where new facilities will be required, transmitters, receivers, equipment cabinets and support structures will likely continue to diminish in size. "Micro-cells," linked in parallel by fiber optic cable or other means of transmitting voice and/or data from the main site offer designers additional application

options. Although the number of sites may increase significantly, the physical characteristics of the new, smaller equipment that industry anticipates, coupled with stringent design standards, should lead to diminishing visual impacts.

## Future Demand

The Personal Wireless Service industry has experienced rapid growth since its inception. Growth within this industry is fueled by a number of factors such as lower cost of telephones and services, expanding areas of coverage, new advances in technologies, expanded services, and an expansion of the customer base. Wireless is already the dominant form of voice communication and is predicted to become the dominant form of internet communication by the end of the decade.

In unincorporated Jefferson County, the number of sites is expected to grow steadily as anticipated growth occurs in the following areas:

1. **Cellular and PCS Narrowband Services** - (800 MHz and 1900 MHz GHz) Services for voice (telephone), radio dispatch services, short messaging and wireless internet services will continue to grow. As cells outgrow their capacities they will split into more cells requiring additional facility sites and infrastructure. This growth should lead to lower antenna heights to prevent frequency reuse in other cells. The third generation of wireless phones (3G), just starting deployment in the U.S., is used in Japan and the Scandinavian countries and is in great demand there. 3G operates in higher bandwidths and transmits much higher amounts of data. 3G will require new infrastructure, but lower antenna heights and smaller antenna sizes are anticipated.

2. **Special Mobile Radio Services (SMR)** - (800 MHz) Services for commercial use as provided by Nextel and others are used for radio telephone services, voice services as well as two-way dispatch. Many of these services are using cellular radio systems which allow for cell division to expand capacity, thus, SMR services will require additional radio and tower facilities. One of the attributes of SMR systems is the ability to provide private dispatch services to commercial enterprises, and in some instances to public safety providers including police and perhaps, future homeland security agencies.

3. **Broadband PCS and Commercial Facilities** - (2 GHz and 5 GHz) Broadband (wideband) facilities are being constructed for video surveillance for commercial enterprises, shopping malls, street corners, etc. Many power plants, hotels, security companies and banks already utilize video cameras for security watches. Wireless transmission of video is dropping in price and will require additional radio facilities for both point-to-point and point-to-multipoint facilities.

4. **Wireless Internet Connections** - The use of fixed and mobile wireless networks as well as wireless wide area networks using IEEE 802.11 protocols (WIFI) are growing rapidly. These services require narrowband and wideband services depending on the speed and size of files to be transferred. Wireless Personal Digital Assistant (PDA) use will continue to expand and the use of wireless laptop and tablet computers will increase for field use as commercial enterprises continue to make more complex measurements in real time. This is likely to be of great importance in providing broadband internet access for homes and businesses in the county not served by DSL.

Based upon the anticipated demand for PWS 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 PWS. 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 likely along major transportation corridors and even within local dedicated rights of way throughout the County.

## 3. Areas of Variable Topography

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

Predicting the growth of PWS telecommunications, and, more specifically, the number and locations of new sites that will be required by PWS providers is virtually impossible. The technology and demand for services continues to change far too rapidly.

### **SPECTRUM ALLOCATION FOR MOST LIKELY LOW POWER FREQUENCIES AND USERS**

<b><u>Name</u></b>	<b><u>Users</u></b>	<b><u>Frequency(MHz)</u></b>
VHF Low Band	Industrial/Business Pool/Public Safety Pool	25-50
VHF High Band	Same as Above	72-76 150-170
UHF	Same as Above	450-470
UHF - T	Same as Above but shared with TV Chan. 14-20	470-512
UHF	Same as Above Plus Trunked Radio, Industrial Scientific, Medical, etc.	800-900
UHF	Cellular Radio Service	824-894
UHF	PCS (Narrow Band)	901-902 930-931 940-941
UHF	unlicensed (WiFi, fixed wireless, Part 15, etc.)	900/1000
UHF	PCS (Wide Band)	1850-1990
UHF	Multipoint Distribution Service	2150-2162
UHF	Misc. Wireless Communications Service	2305-2320
	Misc. Wireless Communications Service	2345-2360
UHF	Unlicensed PCS Service	2390-2400
UHF	Multipoint Distribution Service	2596-2644
UHF	WiFi	5800

## Types of Facilities

PWS facilities incorporate some or all of the components listed below. **Roof and/or Building Mounted Facilities** occur when PWS 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. **Repeater Facilities** are used to extend PWS 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 PWS 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.

### 2. Antennas

a. Omni-directional 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 point-to-point line-of site (LOS) telecommunication facilities together. The antenna reflectors are typically parabolic in shape and can be solid or grid depending upon their frequency of operation.

### 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 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 accessory structures may be fenced with security fencing.

## Federal, State, & Local Regulations

### 1. Telecommunications Act of 1996.

This Act is designed to remove regulatory barriers and encourage competition among all types of communications companies. Regarding local government control, Section 704 of the Telecommunications Act of 1996 generally preserves local zoning and land use authority over tower and antenna siting for PWS, including their placement, construction and modification. Land development regulations and health and safety laws relating to placement, construction and modification are also preserved.

Conditions of the Telecommunications Act of 1996 that affect Local Zoning :

A. Jurisdiction cannot "unreasonably discriminate" among "providers of functionally equivalent services"

• May treat facilities that create different, visual, aesthetic or safety concerns differently to the extent permitted by enabling legislation or zoning resolution.

- B. Cannot prohibit or have the effect of prohibiting the provision of wireless telecommunication service.
- This requirement is designed to prevent an outright ban on wireless telecommunications services. Jurisdictions may limit number and placement of facilities so long as those limits do not prohibit or have the effect of prohibiting a wireless telecommunications provider's ability to offer service. This provision does not mean that a provider may claim a right to build any tower it chooses anywhere; *de minimis* gaps in service are allowed.
- C. Must act in a reasonable period of time on requests for permission to place or construct wireless telecommunications facilities.
- Generally in accordance with state and local law, if applicable, and should take no longer than the time the jurisdiction typically takes to process other development applications of a similar magnitude.
- D. County denials must be in writing, and supported by substantial evidence in the written record.
- E. Jurisdictions cannot deny applications or regulate cellular antennas due to environmental concerns about their radio emissions if the antennas comply with FCC rules on radio emissions (47C.F.R. § 1.1310). The county does, however, retain the legal authority to ensure compliance with federal requirements as outlined below:
- County may require an RF report on projected radiation for a proposed facility and how it does or does not meet FCC standards for categorical exclusion.
  - County may require provider to explain its RF study for the site so as to ensure FCC's emission standards are met.
  - County may require periodic measurement of RF Radiation from antennas, thereby providing a basis to address community concerns. Monitoring would not be necessary and would not be required for low power telecommunications facilities that can demonstrate by means of an RF report that emissions at a site will not exceed federal standards. As a matter of policy, the county may require RF monitoring on a complaint basis for sites that could not demonstrate their inability to exceed federal standards.
  - County may establish predetermined actions to be taken if FCC radiation limits are exceeded.

Dispute Resolution:

- If a wireless provider claims that a local government has violated any of the first four conditions, that provider must seek relief in a state or federal court, not the FCC.

**2. Factors that may be considered by local governments in making land use decisions for wireless telecommunications applications:**

1. Aesthetics
2. Property values
3. Quality of service
4. Citizen testimony
5. Number and height of towers
6. Impacts on historic sites / districts
7. Safety (e.g. risk of collapse, risks to aviation, risk of public climbing, setback / fall zone requirements.)
8. Land development impacts (e.g. ridgeline impact, cut and fill requirements, minimum road grade, community's environmental protection goals)
9. Compliance with pertinent federal regulations (e.g. FAA requirements, environmental / historic preservation laws)
10. Compatibility with community character.
11. Bankruptcy protection and abandonment mitigation.

### **3. Federal Aviation Administration (FAA)**

Under authority granted in the Federal Aviation Act, the FAA reviews the location and height of proposed towers to prevent the creation of a hazard to 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.

### **4. State and Local Regulation**

Personal Wireless service telecommunications 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, Personal Wireless service telecommunication companies are considered private enterprises subject to applicable local zoning controls, to the extent not otherwise preempted by state and federal laws.

## **Site Selection**

### **Industry Site Selection Criteria**

In siting a new tower 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 and capacity, 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 identified the following criteria in the 1993 amendment as concerns that should be addressed through the site selection process (not listed in any order of priority):

1. Certain types of PWS 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 adjacent to 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.

## **2003 Community Concerns and Issue Discussion**

Despite enthusiastic response of Jefferson County citizens to PWS, strong objections have been raised to the presence of PWS 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 that are zoned as agricultural, but which are actually used as residential property. This amendment recognizes that certain types and placements of PWS facilities are inappropriate in areas of single-family residential development. Specific areas of concern voiced by community members include the following:

### **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 PWS facilities, possible interference to household appliances such as radios, television and cordless telephones for nearby residents should 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 between carriers, but not to consumer electronics.

### **2. Residential Property Values**

PWS 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.

### **3. Health Issues**

The level of radio frequency (RF) radiation emitted from PWS transmissions are generally far below the level known to the federal government 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 PWS transmitter. Based on federal standards, there are no expected negative health effects from exposure to a properly functioning PWS telecommunications facility.

### **4. Aesthetics**

PWS telecommunications facilities should be sited and designed to minimize visual impact to adjacent property and view corridors. 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. Photo simulations should be provided at the time of application to clearly demonstrate the presence or absence of visual impact. Community concerns are primarily with the aesthetic impacts in or near residential areas. Graduated design criteria, least restrictive in industrial zones and most restrictive in or near residential zones would be appropriate.

### **5. Zoning Enforcement**

Zoning enforcement in general is done on a complaint basis. The county dispatches zoning enforcement officers to investigate and resolve community reported issues regarding land use concerns.

### **6. Monitoring**

Some community members voiced a desire for RF monitoring. If a site is categorically excluded by the FCC from RF reporting, or by virtue of an RF report it can be demonstrated that federal emission standards cannot be exceeded, monitoring should not be necessary. In all other cases the county may require monitoring in response to a community complaint to verify that federal standards have not been exceeded.

## **7. Proliferation**

Some community members expressed concern with the implications of a proliferation of telecommunications facilities. As more people desire to take advantage of these technologies we will see a corresponding increase in applications to allow the construction of supporting facilities. Unguided these facilities could have a deleterious effect on the community. Strict compliance to the policies and recommendations of this Plan and adherence to the siting and design standards should minimize adverse effects on surrounding properties. Proliferation, well designed and placed, should benefit residents and businesses of Jefferson County by providing increased access to existing and projected services.

## **8. Emergency Services**

The relationship between telecommunications and the provision of emergency services is of vital importance, especially in the mountains where service may be limited. Telecommunications service, that complies with all other policies and recommendations of this plan, should be encouraged in under served areas of the county.

## **9. Abandonment**

Community members expressed fear that telecommunications facilities might be abandoned if a company went bankrupt. Strict compliance to the policies and recommendations of this Plan and adherence to current zoning resolution requirements should provide for removal of facilities and rehabilitation of a site as necessary.

## **10. Notification**

Notification of any proposed change in land use should be given to affected property owners and relevant home owners associations and interest groups in full compliance with existing county regulations.

## **11. Community Character**

Placement of PWS telecommunications facilities should not compromise existing community character. 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.

## **12. Collocation**

To reduce the adverse effects of proliferation, community members expressed the desire for co-location of telecommunications facilities whenever freestanding mounts (towers, mono-poles, etc) are necessary.

# Glossary

**Antenna:** Any structure or device used to collect or radiate electromagnetic waves.

**Band:** The frequency spectrum between two defined limits.

**Categorical Exclusion:** Wireless facilities determined by the FCC as unlikely to cause human exposures in excess of RF exposure guidelines. Operators of these facilities are exempt from routinely having to determine their compliance.

**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.

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

**Effective Radiated Power (ERP):** The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

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

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

**Fixed Wireless :** Wireless radio communications service between specified fixed points. Currently associated primarily with wireless broadband internet access and data transmission and as a connection to cell sites.

**Frequency:** A measurement of the number of electromagnetic waves that pass a given point in a given period of time. It is equal to the speed of light divided by wavelengths, and is expressed in Hertz (cycles per second).

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

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

**MHZ:** Megahertz or 1,000,000 Hz.

**Mobile Wireless:** Wireless radio communications service between mobile and fixed points.

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

**MW/cm<sup>2</sup>:** A unit of power density often used to measure radio frequency radiation.

**Nonionizing Electromagnetic Radiation:** Radiation which does not cause electrons to be added or subtracted from molecules.

**“OTARD” Over the Air Reception Device:** Telecommunications equipment used on a residential consumer’s premises which are specifically exempt by federal regulation from local regulatory restriction. These include such equipment as satellite receiver dish less than one meter in diameter.

**Personal Wireless Service (PWS) See attached FCC definitions**

**Personal Wireless Service 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).

**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 non-thermal effects.

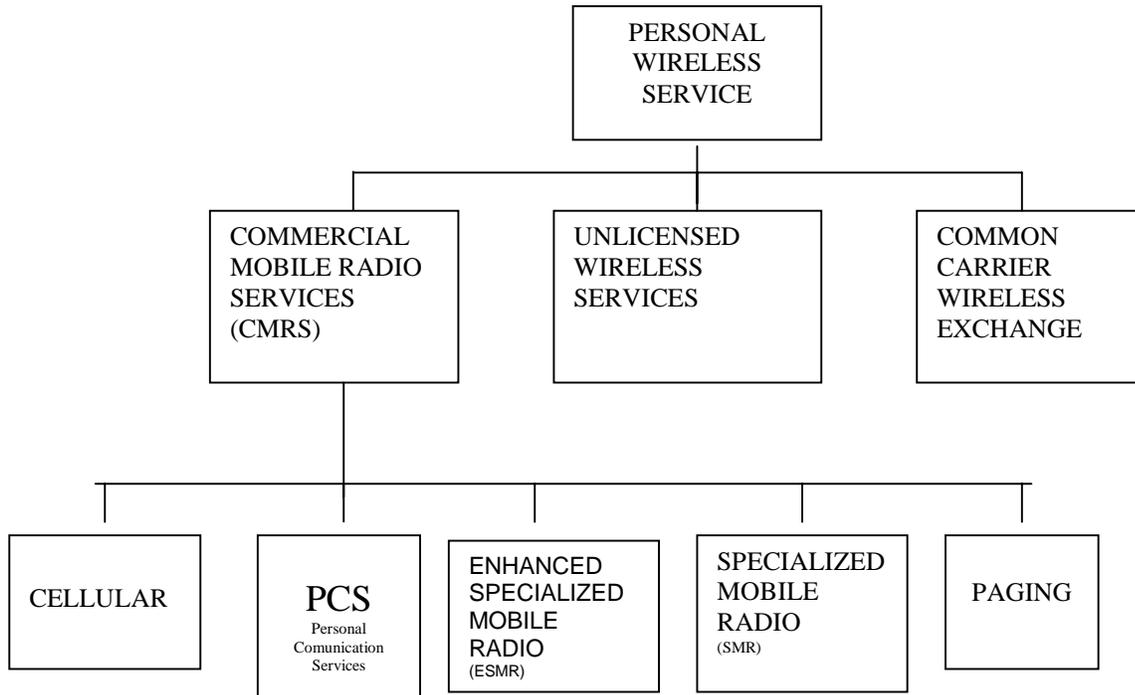
**Transmitter:** Equipment that generates radio signals for transmission via antenna.

**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/cm<sup>2</sup>:** (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 are omni-directional. Their size varies based upon the frequency and gain for which they are designed.



**Categories of PWS relevant to Jefferson County land use review.**

# **Federal Definitions**

## **Personal Wireless Services**

“(C) DEFINITIONS- For purposes of this paragraph--  
(i) the term `personal wireless services' means commercial mobile services, unlicensed wireless services, and common carrier wireless exchange access services;  
(ii) the term `personal wireless service facilities' means facilities for the provision of personal wireless services; and  
(iii) the term `unlicensed wireless service' means the offering of telecommunications services using duly authorized devices which do not require individual licenses, but does not mean the provision of direct-to-home satellite services (as defined in section 303(v)).”

### **A. Commercial Mobile Radio Service**

Commercial Mobile Radio Service (CMRS) is, 1) provided for profit, 2) interconnected to the public switched network, and 3) available to the public. Of the services listed in the definition, the following apply to Jefferson County telecommunications policies and regulations:

#### **A.1 Cellular Services**

Licensees use cellular radiotelephone service (commonly referred to as cellular) spectrum to provide a mobile telecommunications service for hire to the general public using cellular systems. Cellular licensees may operate using either analog or digital networks, or both. Cellular licensees that operate digital networks may also offer advanced two-way data services. The Commission and other wireless industry representatives often refer to these services as "Mobile Telephone Services" and "Mobile Data Services."

#### **A.2 Personal Communication Services (PCS)**

Personal Communications Service (PCS) encompasses a wide variety of mobile, portable and ancillary communications services to individuals and businesses. The Commission broadly defined PCS as mobile and fixed communications offerings that serve individuals and businesses, and can be integrated with a variety of competing networks. The spectrum allocated to PCS is divided into three major categories: (1) broadband, (2) narrowband, and (3) unlicensed.

##### **A.2.a Broadband PCS**

Licensees use broadband Personal Communications Service (PCS) spectrum for a variety of mobile and fixed radio services, also called wireless services. Mobile broadband PCS services include both voice and advanced two-way data capabilities that are generally available on small, mobile multifunction devices. The Commission and other wireless industry representatives often refer to these services as "Mobile Telephone Services" and "Mobile Data Services." Many broadband PCS licensees offer these services in competition with existing cellular and SMR licensees. Examples of entities holding a significant amount of broadband PCS spectrum include AT&T Wireless and Sprint PCS.

##### **A.2.b Narrowband PCS**

Narrowband PCS uses a smaller portion of the spectrum than broadband PCS. Narrowband PCS licenses are used to provide such services as two-way paging and other text-based services. For example, licensees offer services using devices that come equipped with a small keyboard allowing a

subscriber to both retrieve and send complete messages through microwave signals (e.g. wireless e-mail). Licensees also use the spectrum to offer wireless telemetry which is the monitoring of mobile or fixed equipment in a remote location. For example, a licensee may remotely monitor utility meters of energy companies (this is called automatic meter reading or "AMR").

Narrowband PCS operates in the 901-902 MHz, 930-931 MHz, and 940-941 MHz bands and is licensed based on nationwide, regional, and MTA market designations.

### **A.3 Industrial/Business Pool**

Licensees in the Industrial/Business Radio Pool use radio to support business operations. Their communications systems are used for support of day-to-day business activities, such as dispatching and diverting personnel or work vehicles, coordinating the activities of workers and machines on location, or remotely monitoring and controlling equipment. They may qualify as CMRS if interconnected to the public switched network.

Industrial/Business radio systems serve a great variety of communications needs. Companies, large and small, use their radio systems to support their business operations, safety and emergency needs. Although each licensee uses their system to serve specific requirements that vary from entity to entity, there is one characteristic that all these private wireless licensees share that differentiates them from commercial use. They use radio communications as a tool, as they would any other tool or machine, to contribute to the production of some other good or service in the most efficient way possible. For commercial wireless service providers, by contrast, the services offered over the radio system are the end product.

### **A.4 Specialized Mobile Radio Service**

The Specialized Mobile Radio (SMR) service was first established by the Commission in 1979 to provide land mobile communications on a commercial (i.e., for profit) basis. A traditional SMR system consists of one or more base station transmitters, one or more antennas, and end user radio equipment that usually consists of a mobile radio unit either provided by the end user or obtained from the SMR operator for a fee. SMR end users may operate in either an "interconnected" mode or a "dispatch" mode.

Interconnected mode interconnects mobile radio units with the public switched telephone network (PSTN). An end user may thus transmit a message with its mobile radio unit to the SMR base station. The call will then be routed to the local PSTN. This allows the mobile radio unit to function as a mobile telephone. Dispatch mode allows two-way, over the air, voice communications between two or more mobile units (e.g., between a car and a truck) or between mobile units and fixed units (e.g., between the end user's office and a truck). Typical SMR customers using dispatch communications include construction companies with several trucks at different jobs or on the road, with a dispatch operation in a central office.

SMR systems consist of two distinct types: conventional and trunked systems. A conventional system allows an end user the use of only one channel. If someone else is already using that end user's assigned channel, the end user must wait until the channel is available. In contrast, a trunked system combines channels and contains microprocessing capabilities that automatically search for an open channel. This search capability allows more users to be served at any one time. A majority of the current SMR systems are trunked systems.

Although SMRs are primarily used for voice communications, systems are also being developed for data and facsimile services. Additionally, the development of a digital, rather than analog, SMR marketplace is allowing new features and services, such as two-way acknowledgment paging and inventory tracking, credit card authorization, automatic vehicle location, fleet management, inventory tracking, remote database access, and voicemail. The growth of SMRs has been significant due to these new developments

### **A.5 Paging**

Traditional commercial paging service consists of one-way data communications sent to a mobile device that alerts the user when it arrives. The communication could consist of a phone number for the user to call, a short message, or an information update. Other licensees in addition to paging carriers offer paging

services. For instance, most digital mobile telephone handsets include a paging component or Caller ID feature that allows users to view the phone number of someone who has called them. Narrowband PCS licensees offer more advanced two-way paging type services.

Commercial paging may operate in the 35-36, 43-44, 152-159, and 454-460 MHz bands (referred to as the "Lower Band") and the 929 and 931 MHz bands (referred to as the "Upper Band")

#### **A.6 Private Land Mobile Radio Services on 220-222 Mhz**

Private land mobile radio systems are used by companies, local governments, and other organizations to meet a wide range of communication requirements, including coordination of people and materials, important safety and security needs, and quick response in times of emergency. These systems, which often share frequencies with other private users, make possible many day-to-day activities that people across the United States have come to rely on, whether directly or indirectly. Public safety agencies, utilities, railroads, manufacturers, and a wide variety of other businesses - from delivery companies to landscapers to building maintenance firms - rely on their business radio systems every day. The services included in Private Land Mobile are Public Safety, Industrial/Business, Private Land Mobile Paging, and Radio-location. They may qualify as CMRS if interconnected to the public switched network.

#### **A.7 Unlicensed Wireless Service**

The term 'unlicensed wireless service' means the offering of telecommunications services using duly authorized devices which do not require individual licenses, but does not mean the provision of direct-to-home satellite services (as defined in section 303(v)."

#### **A.8 Common Carrier Microwave**

Common Carrier microwave stations are generally used in a point-to-point configuration for long-haul backbone connections or to connect points on the telephone network which cannot be connected using standard wire line or fiber optic because of cost or terrain. These systems are also used to connect cellular sites to the telephone network, and to relay television signals.

Common Carrier microwave stations are licensed to applicants who intend to provide communications service to the public. Whereas, Private Operational Fixed stations are licensed to applicants for their own internal communications requirements.

## **Photo Examples of PWS Sites with Design Critique**



(Need copyright authority for both)

Top: outstanding example of HDS, acceptable in all allowed zone districts

Bottom: Good example of monopole disguised as flagpole. Flag is in scale with pole, and pole is in scale with surrounding context. Should qualify as meeting HDS.



Both photos: PWS facilities fully concealed, but would not meet definition of highest design standards because huts are not in context with their surroundings. Though concealed, the facilities draw attention to themselves (P&Z has been asked if they are bathrooms). If these were in an area of similar architecture or otherwise integrated into the context, they might then qualify as HDS. Context should be at least as important as design elements.



Top photo: Meets HDS. PWS facilities are concealed within a feature that is architecturally compatible with the site.

Bottom photo: Excellent design for a large commercial development. However, attaching a light standard to a monopole should not qualify this as meeting HDS for convenience or neighborhood level commercial sites. For HDS the goal should be to make it look like a light pole with an antenna on it, not a PWS monopole with a light attached.



This design should qualify as meeting general design standards for “building mount” in industrial or large commercial areas, for example, but should not qualify as meeting HDS. Panels should be internal to the structure or appear elemental to the design. Accessory equipment structure is excellent because it completely conceals equipment and matches the surrounding context in architecture and scale.



Top: Excellent example of light pole application for use in all rights of way. Panel is flush mounted painted to match and keeps the light pole in scale .  
Middle and Bottom: Size may be appropriate along arterial roads or larger, but out of scale (too large) for local or collector street applications



Top and Middle: Good example. “Tree” is in scale with surrounding trees (generally equal in height with the tree line). Would be even better if antennas were internal to the canopy.

Bottom: Could be better. Both trees stand too tall above the tree line, tree on left painted with reflective (non-matte finish) paint, unnatural colored branches and external antenna. In forested context such as this, goal should not necessarily be to create an exact duplicate of a tree, but design it to blend into the background.



Top: Good example for facility near residential area. Architecture in context with neighborhood,

Bottom: Roof mounted panels such as these should be considered unacceptable in all zone districts. These are visually obtrusive and should be screened or constructed to match the building.



Good location, but this is an example of too many facilities in one location causing the entire site to become visually obtrusive. Situation could be improved by integrating antennas with light poles and screening or burying equipment boxes.



Outstanding example of Site that meets HDS for all allowed zone districts. Panel is building mounted in a highly visible location, but the patterned painting renders it unnoticeable.



May generally be appropriate in industrial zone districts, but standard arrays such should not be located in proximity to residential areas such as this.



Should be considered unacceptable as is. Monopoles should be painted non-reflective color matching background and tree buffer should be maintained or new buffer planted in front



Generally good, but could be improved. Facility should qualify as HDS if it was painted in a non-reflective paint of a color more closely matching the background.



Top and middle: good example of HDS building mount, but could be improved by flush mounting the panels and either having fewer of them or spacing them along the face so as to appear part of the architecture.  
Bottom: excellent example of a building mount installation that required little in the way of design, Standard white panels are installed to appear as part of the architecture and are thus “hidden in plain sight”.



Panels match the industrial appearance of the transmission tower and by virtue of their relative size and coloring, are rendered unnoticeable. Should qualify as HDS.



Panels match the industrial appearance of the transmission tower and by virtue of their relative size and coloring, are rendered unnoticeable. Equipment enclosure façade matches the brick of the retaining wall. Small dish antenna should be painted gray, but otherwise this installation should qualify as HDS.



Acceptable as general roof mount, but should not qualify as HDS. Better if mounted on the face of the building or installed behind RF translucent screening.



Top: Excellent example of concealment. Architecturally in context and in scale with the building.

Bottom: demonstration of the relative visual impacts on a neighborhood of a monopole on the left and a standard array on the right. These are situated approximately 100 yards south of the facility in the top photo.



photos demonstrate poor examples of roof mounted facilities. Screening or integrated construction necessary for standard roof mount. Building mounted panels in middle photo should be smaller and painted to match the building.



Good example of panels painted to match the building. Would be better if flush mounted to prevent shadowing at different times of the day.



Unacceptable collection of roof mounted facilities. Cluttered and visually obtrusive.



Excellent example of concealment meeting HDS, acceptable in all allowed zone districts



Excellent example of roof mount screening / concealment that would meet HDS requirements. Architecturally compatible with context, appears in scale with the building, essentially unnoticeable.



Excellent example of roof mount screening / concealment that would meet HDS requirements. Architecturally compatible with context, appears in scale with the building, essentially unnoticeable.



Examples of fixed wireless antennas exempt from local land use control.