MARIN COUNTY

TELECOMMUNICATIONS FACILITIES POLICY PLAN

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The Marin County
Community Development Agency

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EXECUTIVE SUMMARY

This Telecommunications Facilities Policy Plan (Telecommunications Plan) provides guidance for allowing the efficient and effective development of telecommunications facilities while protecting the natural resources, communities, and other land uses of Marin County. The first Telecommunications Plan was adopted in 1990 in anticipation of future requests to site and expand major telecommunications facilities in Marin County. The present update builds on the foundation of the 1990 plan and uses information regarding current technology to set forth a comprehensive package of policies and programs that also address the recent proliferation of smaller commercial wireless radiotelephone facilities (hereafter referred to as commercial wireless facilities).

The Telecommunications Plan acts in concert with the Countywide Plan, specific community plans, Local Coastal Programs, and County Zoning Ordinance (Title 22). Together, these land use plans govern how Marin County's unique resources should be protected while accommodating a reasonable amount of new development, including open access to a broad range of competitive telecommunications services for businesses, residents, visitors, and public agencies in Marin County.

The goals of the Telecommunications Plan reflect the overall goals of the Countywide Plan as they relate to development of telecommunications facilities. The goals are intended to:

- Provide decision makers and the public with a general understanding of the technology and trends in the telecommunications industry;
- Describe the impact of federal and state law on the scope and nature of local jurisdiction over telecommunications facilities;
- Describe existing and future major and minor telecommunications facility sites and potential siting needs for new facilities;
- Balance the need and convenience of telecommunications services with the public interest regarding the location, design, and operation of wireless communication facilities;
- Describe potential adverse land use effects that could be caused by new telecommunications facilities, and to recommend policies and programs within the jurisdiction of local governments in Marin County to reduce or avoid those impacts; and
- Promote a common policy rationale for local regulation of telecommunications facility siting that all of the jurisdictions in Marin County can choose to adopt.

BACKGROUND

Expected Growth

The recent growth in telecommunications technology and changes in federal telecommunications law have created a considerable expansion of commercial wireless communications services and the potential for continued growth. When the 1990 Telecommunications Plan was adopted there were approximately six commercial wireless facility sites located primarily on ridgelines in Marin County (i.e., unincorporated and incorporated areas). Today there are about 100 sites approved throughout Marin County and 25,000 commercial wireless sites in the United States. The number of commercial wireless facility sites is expected to increase to 100,000 nationwide due in large part to the Federal Communications Commission issuance of licenses for Personal Communications Services (PCS) in each of the major telecommunications markets in the United States.

Other forms of telecommunications are expected to grow but at an overall slower pace than commercial wireless services, except for new broadcast facilities for digital television service. The potential large profits for television and radio stations may also put pressure on development of another broadcast telecommunications facility in the northern part of Marin County. It is unlikely that another high-power television broadcast facility will be located in southern Marin County due to potential interference with broadcast facilities to the south. Most of the existing major telecommunications facility sites in Marin County are likely to undergo continued redevelopment as transmitters, antennas and other equipment are upgraded to keep pace with new technology and market competition.

Regulatory Context

Telecommunications facilities are regulated by Federal, State, and local agencies, including the County, cities and towns in Marin. The Federal Government has principal regulatory power over telecommunications facilities through its authority to control interstate commerce, the issuance, renewal and modification of licenses to operate telecommunications systems, and declaratory orders and rules pursuant to the Telecommunications Act of 1996 (Telecom Act).

Local governments have authority, however, to regulate the placement, construction, and design of telecommunications facilities subject to several preemptive limitations established by the Telecommunications Act. In general, local agencies are preempted from taking actions on telecommunications proposals that would effectively prohibit telecommunications service or unreasonably discriminate among service providers. Local agencies are also preempted by federal law from denying a proposed telecommunications facilities or requiring site modifications based solely upon potential adverse health effects from exposure to electromagnetic field (EMF) emissions when the facility complies with the Federal standard for permissible human exposure to EMF. Local agency decisions that conflict with Federal preemptive authority regarding EMF emissions can be appealed by an aggrieved party directly to the FCC. Appeals regarding other aspects of a local agency decision are decided in a court of competent jurisdiction.

The California Public Utilities Commission (CPUC) regulates telecommunications that are considered public utilities, such as commercial wireless telephone services, to implement the goal of deploying an innovative telecommunications network in California. Most telecommunications services require a CPUC license to operate the system as a whole. The CPUC refrains, however, from regulating the siting of commercial wireless facilities and delegates this responsibility and related procedural requirements to local agencies. The CPUC prefers this hands-off approach because local citizens and governmental agencies are usually in a better position to make decisions on facility siting due to their proximity to the affected area and knowledge of local land use and environmental issues. The CPUC can preempt a local decision on a telecommunications facility when it finds that the CPUC's goals are not being met.

Major Policy Issues

The 1990 Telecommunications Plan focused on public policy issues related to development of major telecommunications facilities on ridgetops and their potential for conflicts with Ridge and Upland Greenbelt policies of the Countywide Plan. These issues remain important as the protection of Ridge and Upland Greenbelt areas continues to be a principal public policy objective. Since adoption of the 1990 Telecommunications Plan, the proliferation of commercial wireless services in Marin County has given rise to a number of land use issues relating to development of telecommunications networks comprised of numerous smaller facilities, particularly those located in close proximity to developed areas of Marin County.

The County supports the State and Federal goals of developing an innovative and efficient telecommunications system that benefits the businesses, citizens, and public agencies of Marin County. Many residents of Marin County have concerns, however, about their adverse visual effects, land use compatibility, health effects from exposure to electromagnetic field (EMF) emissions and other issues. At the overall crux of the major issues addressed in this Telecommunications Plan is the recognition that the County must balance the objective of facilitating the deployment of new telecommunications services while effectively upholding the public interest in maintaining and enhancing the quality of life, natural environment, and public health, safety, and welfare.

The major public policy considerations discussed in this Telecommunications Plan are:

- Land Use Compatibility;
- Visual and Aesthetic Compatibility;
- Electromagnetic Fields (EMF) Emissions;
- Public Safety, with respect to telecommunications facility design; and
- Operational Effects

The major issues listed above apply to both major and minor telecommunications facilities. In addition, this Telecommunications Plan addresses policy issues for commercial wireless facilities as follows:

- Facility distribution;
- Growth trends in the telecommunications industry;
- Federal preemption of local regulatory control;
- Location and design measures to avoid or minimize unwanted effects; and
- Interjurisdictional consistency and coordination in regulating new facilities.

SUMMARY OF POLICIES AND PROGRAMS

POLICIES FOR LAND USE COMPATIBILITY

Objective LU 1: To ensure that the siting of telecommunications facilities is compatible with other land uses.

Policy LU 1.1. New telecommunications facilities should not be permitted in Ridge and Upland Greenbelt areas unless no other technically feasible and available site exists, provided, wireless communications facilities should be permitted in ridge and upland greenbelt areas where they are co-located with existing structures consistent with the policies and programs of this Telecommunications Plan.

Program LU 1.1.1: Development of new telecommunications facilities in Ridge and Upland Greenbelt areas should be minimized through stringent tests of need for development of new ridgetop telecommunications sites. Such tests shall be provided by the applicant for a new ridgetop telecommunications site and include technical information prepared by qualified professionals that sufficiently demonstrates to the satisfaction of the County that no other technically feasible site is available to provide adequate coverage.

Program LU 1.1.2: New or expanded sites should ensure co-location and other efficient use of facilities to minimize the need for new sites, particularly on ridgeline locations, without imposing unreasonable burdens on telecommunications service providers or operators.

Program LU 1.1.3: Site users and operators should be encouraged to share and/or consolidate facilities to the greatest extent possible. Facilities that may be shared may include buildings, access roads, parking areas, utilities, transmitters, towers and other structures, and antennas.

Program LU 1.1.4: New ridgetop or upland sites shall not be approved by the County where technically feasible non-ridge sites are available, or when capacity exists and is available for the proposed use at existing sites.

Program LU 1.1.5: New telecommunications facilities proposed on parcels restricted by agricultural, open space, scenic or other public easement or restriction will only be permitted in accordance with the terms of such public easement or restriction.

Program LU 1.1.6: Applications for new or expanded major telecommunications facilities shall contain long range plans which project market demand and long-range facility expansion needs. Where three or more of the facilities are located along the same ridgeline, service providers shall prepare a Ridgeline Facility Plan to coordinate access, non-interference, and consolidation issues for the respective sites. In conjunction with submittal of a discretionary permit application for the third facility, the property owner, in cooperation with the service providers shall prepare and submit a Ridgeline Facilities Plan to promote coordination, non-interference, and consolidation.

Policy LU 1.2. The policy of the County shall be to reduce the number of ridge top telecommunications sites wherever possible.

Policy LU 1.3. Telecommunications facilities in ridgetop areas shall be sited in areas already in use for telecommunications to preserve the aesthetic and scenic value of undeveloped ridge lines in the County.

Policy LU 1.4. New construction or substantial expansion of telecommunications facilities should not occur in or near areas where they will cause land use conflicts, particularly in residential areas, unless there are no other suitable and available sites in more suitable areas.

Program LU 1.4.1: Where a major telecommunications facility must be located in or close to a residential area, the facility shall be located to reduce its visual obtrusiveness and aesthetic contrast with the surrounding area.

Program LU 1.4.2: New commercial wireless systems and other minor facilities should be co-located or clustered, as further specified in Policy LU 2.1 below, and adhere to the preferred locations, as generally prioritized below, unless a priority site does not exist within the coverage area, or requiring the priority location within the coverage area would prohibit or have the effect of prohibiting wireless service or result in adverse land use effects that would otherwise be avoided or reduced to an acceptable level at another location:

1) Industrial sites
2) Commercial sites
3) Public facilities sites
4) Agricultural sites
5) Mixed use sites (e.g., commercial and residential area)
6) Open space and recreational sites
7) Residential sites

New facilities should be approved in these locations when they are sited, designed, operated, and maintained in a manner that avoids or minimizes potential land use effects to an acceptable level and is otherwise compatible with the predominant land use character of the affected area. In general, service providers should consider selecting proposed facility sites as advised by Policy EMF 1.1.

Program LU 1.4.3: To evaluate whether a proposed facility conforms to the location standards contained in this Telecommunications Plan, service providers shall submit with their development applications an updated network facilities plan consisting of the following:

a. A written description of the type of technology and consumer services that will be provided to customers;

b. A list enumerating the service providers' facilities sites, including existing sites (operative and abandoned), approved sites, proposed sites (i.e., applications pending), and planned site (i.e., sites that can be reasonably predicted but have not been formally proposed by the filing of development applications);

c. A map depicting the geographic location and boundaries of all coverage areas or search rings existing or planned by the service provider and the approximate location of service providers' facility sites within each coverage area;

d. A coverage area map for the proposed facility site including the information described in item B above as it pertains to the individual coverage area. Note: The coverage area map may be combined with the network facilities map so long as the scale of the map is large enough to provide for detailed analysis of proposed and potential facilities sites within the coverage area.

Program LU 1.4.4: To evaluate whether a proposed facility conforms to the location preferred standards contained in this Telecommunications Plan, applicants shall submit an analysis of alternative facility sites when determined necessary. The analysis shall include enough information to provide adequate consideration of technically feasible alternative sites and/or facility designs that would avoid or minimize adverse land use and other effects included in this Telecommunications Plan. The analysis shall include in writing the specific factors considered by the service provider for selecting the proposed facility site over alternative sites. In particular, proposed facilities that are not co-located or clustered at existing telecommunications sites shall provide information substantiating the unfeasibility of such sites.

Program LU 1.4.5: Proposals for new or modified telecommunications facilities within the environs of the Marin County Airport (Gnoss Field) shall be reviewed for conformance with the Marin County Airport Land Use Plan.

Policy LU 1.5. Development of telecommunications facilities in areas identified for conservation in the Marin Countywide Plan, which include, but are not limited to Stream and Creekside Conservation Areas, the Bayfront Conservation Zone, Ridge and Upland Greenbelt Areas, and the Coastal Recreational Corridor, should conform to the development policies of the Environmental Quality Element of the Countywide Plan.

Policy LU 1.6. Locating telecommunications facilities on sites where they cause the loss of important natural or cultural (i.e., prehistoric or historic) resources or on sites designated by the County for other kinds of land uses that may be precluded or impeded by development of a telecommunications facility should be discouraged.

Program LU 1.6.1: Proposed sites may be denied where there are alternative sites available which reduce or eliminate potential significant adverse effects on natural or cultural resources, or reduce impediments to the implementation of Countywide Plan and specific plan land use policies.

Program LU 1.6.2: The size of telecommunications sites should be limited to the minimum required to provide the proposed telecommunications services, while allowing for the possibility of future co-location and clustering, particularly for sensitive locations in terms of natural resources or implementation of Countywide and specific plan land use objectives.

Policy LU 1.7. Telecommunications sites in proximity to existing or proposed recreational trails or open space lands should be subject to requirements to ensure that these public uses are not adversely affected.

Program LU 1.7.1: Telecommunications sites in the vicinity of existing or proposed recreational trails or open space areas should be sited and designed to preserve the continuity of public access and ease of public use.

Program LU 1.7.2: Telecommunications sites should be selected and designed to minimize the visual effects for nearby recreational trails and open space areas.

Program LU 1.7.3: Development guidelines for telecommunications sites shall ensure that users of recreational trails and open space areas will not be exposed to radio frequency energy in excess of FCC limits.

Program LU 1.7.4: Existing roads should be used for access to telecommunications sites whenever possible to prevent the disturbance of ridge and open space lands.

Policy LU 1.8. New construction or expansion of telecommunications facilities on Mt. Tamalpais shall be discouraged. However, if new facilities must be constructed and/or existing facilities will remain, then the County should consider consolidation of Mt. Tamalpais facilities onto a single peak.

Program LU 1.8.1: The County shall use its best efforts, including correspondence, lobbying, and contacting legislative representatives, to strongly discourage federal, state and local agencies not subject to County land use controls from expanding the number of telecommunications facilities on Mt. Tamalpais and to encourage the removal or consolidation of existing facilities.

Program LU 1.8.2: The County should discourage the expansion or new construction of telecommunications facilities on Mt. Tamalpais and encourage the consolidation of facilities.

Program LU 1.8.3: The County may allow new or existing commercial wireless systems to be co-located on existing structures on Mt. Tamalpais if such co-located antennas do not significantly increase adverse visual effects from the facility and promotes consolidation.

Objective LU 2: To minimize the number of stand-alone commercial wireless and other minor facility sites.

Policy LU 2.1. New commercial wireless facility sites should be co-located or clustered at an existing or planned telecommunications site unless requiring the proposed facility to be located at another stand-alone location would either prohibit service or have the effect of prohibiting wireless service, or result in adverse land use effects that would otherwise be avoided or minimized to an acceptable level.

Program LU 2.1.1: If the County approves a new commercial wireless facility site, that site shall accommodate co-location or clustering in the future if additional use is reasonably likely and co-location or clustering will not be incompatible with surrounding land uses.

Program LU 2.1.2: The County shall identify County-owned property where co-located or clustered commercial wireless communications facilities could be accommodated without creating significant adverse effects, and shall encourage wireless communications facilities to locate at those sites.

Program LU 2.1.3: The County shall allow innovative design solutions to siting wireless communications facilities where they are not obtrusive, such as on light poles and other structures in the public right of way.

Objective LU 3: To ensure that the siting or expansion of telecommunications facilities does not significantly adversely affect plant or animal species.

Policy LU 3.1. The construction or expansion of a telecommunications facility shall be denied if it creates a significant threat to the health and survival of threatened or endangered species or species of migratory birds.

Policy LU 3.2. Environmental review for the proposed construction or expansion of a telecommunications facility shall evaluate the potential for significant adverse effects on plants or animal species, including, but not limited to telecommunications towers that have the potential to interfere with the migratory flyway or flight paths used by resident bird species, where facilities could affect sensitive resource areas, and where clearing native vegetation is required

for facility construction or expansion. Where potential significant effects are identified, the environmental review shall also identify appropriate mitigations including re-siting, changes in the design of the facility and/or techniques found to be effective and acceptable to discourage birds from approaching the tower area, and monitoring studies of bird strikes.

POLICIES FOR VISUAL AND AESTHETIC COMPATIBILITY

Objective VIS 1: To protect the visual quality of the County by regulating the number, location, and design of telecommunications facilities so that adverse visual effects are eliminated or reduced to the maximum extent possible while allowing for adequate telecommunications services.

Policy VIS 1.1. The cumulative visual effect of telecommunications facilities can be minimized by encouraging the most efficient use of existing sites and facilities and thereby postponing the need to develop new sites.

Program VIS 1.1.1: New sites should be permitted only upon clear demonstration of need, the impracticality of upgrading or expanding an existing site or co-locating on an existing telecommunications structure, and subject to conditions to ensure the new facility minimizes adverse visual effects. The necessity of the proposed facility should be assessed by reviewing the wireless communications site inventory contained in Appendix A, and evaluating a service providers network facilities plan and, if determined necessary, an alternative sites analysis (refer to Program LU 1.4.3 and LU 1.4.4).

Program VIS 1.1.2: Wherever possible, new telecommunications devices should be co-located or clustered at existing facilities and multiple devices consolidated in the course of facility renovation, unless co-location or clustering will result in significant adverse visual effects that could be avoided or minimized by alternative facility locations and/or design.

Program VIS 1.1.3: New facilities or modifications to existing facilities should be reviewed for potential consolidation or co-location of existing and proposed antennas, towers or tower sites, sharing of ancillary facilities and/or use of engineering techniques to make the most efficient use of transmitters, towers and antennas. The potential for co-locating a proposed facility should be assessed by reviewing the wireless communications site inventory contained in Appendix A, and evaluating a service providers network facilities plan, and, if determined necessary, an alternative sites analysis (refer to Program LU 1.4.3 and LU 1.4.4).

Program VIS 1.1.4: To minimize visual effect, service providers should be encouraged to share facilities to the greatest extent possible. Joint use should be strongly encouraged within multiple antenna sites, including buildings, access roads, parking areas, utilities, towers and antennas.

Objective VIS 2: To ensure that new telecommunications facilities or modification of existing facilities are sited, designed and built in a manner which minimizes visual effects to surrounding areas.

Policy VIS 2.1. The sites of new telecommunications facilities or substantially modified ones should be selected to minimize potential visual effects.

Program VIS 2.1.1: To the greatest extent feasible, all telecommunications facilities should be sited below visually prominent ridgelines. If determined necessary by the County review authority, an alternative sites analysis should be used to evaluate potential telecommunications sites situated below visually prominent ridgelines (refer to Program LU 1.4.4).

Program VIS 2.1.2: Multiple telecommunications facilities including buildings, towers and antennas should be co-located or clustered rather than scattered along a ridgetop or hillside to the extent feasible given the need to minimize radio frequency interference. In wooded hillside areas, a greater scattering of facilities may be appropriate to minimize the visibility of a larger co-location facility or cluster of multiple facilities (e.g., antenna farm).

Program VIS 2.1.3: A visual analysis of telecommunications facilities that could have a significant adverse visual effect shall be submitted with the application materials to assess the proposed facility at design capacity. The visual analysis shall include a photo-montage or photo-simulation, and/or poles or other similar device erected at the proposed facility site. The visual analysis shall address views of the proposed facility from public vantage points and private property if determined necessary by the County review authority. The visual analysis shall also depict cumulative conditions by including information on existing, approved, and proposed telecommunications facilities that will or may eventually be approved at the proposed site. The visual analysis may be expanded to address alternative locations within the coverage area.

Policy VIS 2.2. Buildings, towers and antennas should be located on each site and designed in a manner which minimizes visual effects.

Program VIS 2.2.1: Telecommunications support facilities such as vaults and equipment rooms, utilities and other support structures should be placed underground, depressed, earth bermed, or sited below ridgelines or other significant public line of sight to the greatest extent feasible particularly in areas of high visibility where other visual screening techniques are inappropriate to the project area or cannot be successfully implemented. Earth berming and other topographic alterations should be compatible with the surrounding natural topography and not block significant public views. All facilities should visually blend with the surrounding natural and built environments.

Program VIS 2.2.2: Due to their high visibility, dish and parabolic antennas should be located at as low an elevation as possible without compromising the function of the device, preferably on the sides of buildings or ground mounted on slopes below the ridgeline wherever possible, rather than elevated on towers.

Program VIS 2.2.3: Utilities extended to service telecommunications sites shall be undergrounded or placed within existing or proposed structures to eliminate their visibility.

Program VIS 2.2.4: Telecommunications facilities, particularly equipment buildings, should be located below the ridgeline or other significant public line of sight wherever possible.

Program VIS 2.2.5: Telecommunications towers should be the minimum height required to permit the services proposed for that location and services that could co-locate at that location in the future without causing significant adverse visual effects. The proposed maximum height of a tower, monopole or other support structure may be confirmed through an independent analysis or peer review of technical information submitted by the service provider.

Program VIS 2.2.6: Microwave dishes within the regulatory purview of the County should be closely regulated, particularly in urban areas, to minimize their visual effects through appropriate siting, design, materials, and colors as recommended herein.

Program VIS 2.2.7: In order to minimize visual effects, guyed towers for major telecommunications facilities should be used instead of self-supported towers to minimize the size of the site, to minimize the need for screening from adjacent properties, or to reduce the potential for bird strikes in migratory pathways or significant flight paths used by local bird populations, except where self-supported towers are required to provide the height and/or capacity necessary for the proposed telecommunications uses.

Program VIS 2.2.8: The placement of towers, equipment buildings, etc. within a particular site should avoid or minimize encroachment into scenic views or otherwise cause adverse visual effects, particularly from any adjacent residential development or public viewpoint.

Program VIS 2.2.9: Antennas and other equipment should be integrated into an existing or proposed non-communications structure or co-located on an existing structure rather than on a new stand-alone structure whenever possible, provided that it does not significantly increase adverse visual effects of the facility.

Program VIS 2.2.10: When a new stand-alone structure is necessary, a monopole should be used for commercial wireless and other minor telecommunication facilities except where another type of support structure (e.g., lattice or guyed tower) must be used to

provide necessary structural support or to minimize adverse visual effects. The height of the monopole or tower should be the minimum necessary for the proposed service and for other services that could co-locate on the tower. In appropriate situations, a monopole or tower could be required to resemble a natural feature or less obtrusive built feature that is consistent with the visual character of the surroundings.

Program VIS 2.2.11: Telecommunications facilities located on or adjacent to water tanks and other public utility or public service facilities shall be sited to minimize their visibility to the maximum extent feasible, particularly where existing public utility/service structures are sited within or adjacent to designated open space or other scenic areas. Public utility and other existing structures should be used to screen the telecommunications facility from off-site vantage points. Telecommunications facilities should be clustered and designed to appear as part of the existing public utility/service structure, including but not limited to materials and colors that visually blend with the predominant visual backdrop. Where appropriate, other site-specific development standards should be implemented in connection with Design Review for a proposed telecommunications facility site.

Program VIS 2.2.12: Building-mounted telecommunications facilities shall be sited and designed to appear as an integral part of the structure or otherwise minimize their appearance, such as by being screened from view or being placed above the pedestrian line-of-sight on a secondary facade. Roof-mounted facilities should be clustered in one area and set back from the edge of the roof, unless an alternative facility design will further minimize visual impacts, or hidden behind a parapet or screen to minimize visibility from street-level locations.

Program VIS 2.2.13: The County shall encourage equipment for a wireless communications facility to be enclosed in an existing structure or placed underground.

Program VIS 2.2.14: Accessory structures containing equipment for wireless communications facilities shall reflect the predominant architectural style(s) of the surrounding area and shall visually blend with the natural and built environments. The materials, colors, and design of fences erected around the perimeter of the wireless site shall also reflect the natural and built environments of the surrounding area.

Program VIS 2.2.15: Wireless communications facilities should be permitted on historically or architecturally significant structures if there are no other available support structures or site locations that will avoid or reduce potential adverse visual effects and if the facilities are integrated with the structure or its setting so it is not visually inconsistent to a casual observer from a prominent vista or significant public corridor.

Policy VIS 2.3. The colors, materials, and lighting of towers, antennas and buildings shall be selected to minimize visibility as follows, unless specific colors or lighting are required by Federal or State agencies.

Program VIS 2.3.1: Materials used for equipment buildings and other telecommunications structures should be compatible with the surrounding natural and built environments. No advertising signage or logos shall be displayed on telecommunications facilities except for small identification plates used for emergency notification.

Program VIS 2.3.2: Telecommunication facilities should be painted to blend with the landscape or visual backdrop against which they will be seen.

Program VIS 2.3.3: Telecommunication facilities which will be primarily viewed against soils, trees or grasslands should be painted colors matching these landscapes.

Program VIS 2.3.4: Telecommunication facilities which rise above the horizon line should be painted in non-reflective blues or grays.

Program VIS 2.3.5: The mountings of antennas should be nonreflective and the appropriate color to blend with their background.

Program VIS 2.3.6: Microwave and satellite dishes within the regulatory purview of the County should be of mesh construction wherever possible.

Program VIS 2.3.7: The use of exterior lighting shall be permitted for safety purposes only and shall be manually operated (i.e., kept off except during nighttime maintenance activities), low wattage, hooded, and directed downward to minimized visual effects.

Program VIS 2.3.8: Tower lighting required by the FAA should, to the greatest extent feasible, be shielded or directed to minimize glare as viewed from off-site locations.

Policy VIS 2.4. Landscaping shall be used to minimize and mitigate visual effects of telecommunications facilities.

Program VIS 2.4.1: Vegetation adjacent to the disturbance area for a telecommunication facility shall be protected from construction effects by fencing. Applicants for telecommunications facilities may be required to submit a tree protection plan with construction permits to demonstrate compliance with this program. Vegetated areas disturbed during construction should be replanted to minimize erosion and to enhance the natural aesthetics of the site.

Program VIS 2.4.2: Landscaping to screen telecommunications buildings, towers and antennas should be required particularly for sites adjacent to or in developed areas. For a wireless communications site adjacent to residential uses, landscaping should be selected and situated to maximize screening of the site from those residences. However, the performance of antennas should not be impeded by plantings. This needs to be taken into consideration in the development, review and approval of landscape plans.

Program VIS 2.4.3: Applications for telecommunications facilities shall include a landscape plan that shows existing vegetation to remain and to be removed entirely or in part (i.e., trimming), and indicates the location, species type, and size of vegetation proposed for planting. Proposed landscaping shall be consistent with the predominant existing vegetation in the area and should consist of native, evergreen, and drought tolerant species unless other species are approved for the purpose of maximizing the amount of screening as soon as possible.

Program VIS 2.4.4: Applicants for telecommunications facilities may be required to enter into a landscape performance and maintenance agreement with the County to ensure the installation and long-term survival of required landscaping. The agreement shall include a financial security and shall be effective for a duration sufficient to ensure survival of the vegetation.

Policy VIS 2.5. The access roads to telecommunications facilities, particularly on ridgelines, should be subject to evaluation to minimize their visibility.

Program VIS 2.5.1: To the extent possible, new telecommunication sites should take access over existing fire roads or other existing roads or drives to avoid the visual effects of a new roadway.

Program VIS 2.5.2: The proposed access to expanded or new sites shall be evaluated to ensure that new roads are permitted only when no existing ones are available and suitable. New roads in agricultural and other rural areas should have the minimum width necessary to satisfy access and safety requirements.

Program VIS 2.5.3: Proposed repair and/or maintenance of the access roadway should be evaluated for potential visual effects and mitigations of these effects.

Program VIS 2.5.4: Whenever feasible, parking areas for telecommunications facilities should be shared by different service providers. Parking areas shall be no larger than required to accommodate reasonably likely post-construction traffic volume and shall be situated, designed and landscaped to minimize their visual effect.

POLICIES FOR ELECTROMAGNETIC FIELD (EMF) EMISSIONS

Objective EMF 1: To avoid or minimize community conflicts over the potential adverse health effects from new commercial wireless and other telecommunications facilities by the prudent avoidance of locating such facilities in close proximity to areas where persons will be exposed to pro-longed electromagnetic frequency (EMF) emissions.

Policy EMF 1.1. The County should regularly advise service providers that it is prudent to avoid siting new transmitting facilities where prolonged EMF exposure will be experienced in residential neighborhoods and other locations where persons may be immunologically compromised such as elementary schools, pre-schools, senior facilities, and hospitals. This advisory policy of "prudent avoidance" is intended to avoid or minimize the degree of community conflict that can arise when telecommunications facilitates are located in residential and other areas where prolonged exposure to EMF occurs. This advisory policy may also facilitate the approval of new commercial wireless and other telecommunications facilities by reducing or avoiding the potential for a protracted decision-making process that can occur as a result of the controversy over EMFs and non-thermal effects. This policy is advisory only and is not intended to regulate the location of new facilities, deny a proposed facility, require site modifications or otherwise replace, modify or supplement the Maximum Permissible Exposure levels for electric and magnetic field strength and equivalent plane-wave power density in the EMF emission guidelines adopted by the FCC.[1]

Objective EMF 2: To ensure that new sites or modification of existing telecommunications facilities are sited, designed, and built in a manner which minimizes potential health risks from electromagnetic field (EMF) radiation.

Policy EMF 2.1. The County shall ensure a proposed new or modified telecommunications facility will not cause electromagnetic field (EMF) strengths or equivalent plane-wave power densities in excess of the Maximum Permitted Exposure levels for electric and magnetic field strength and equivalent plane-wave power density in the EMF emission guidelines adopted by the FCC.[6]

Program EMF 2.1.1: The County should apply the Federal Communications Commission's EMF emission guidelines[6] as the County standard for evaluating potential adverse health risks from EMFs unless and until the FCC and other appropriate Federal or State agency provides otherwise and the County adopts a different standard.

Program EMF 2.1.2: Applications for modifications that could increase EMF levels at existing telecommunications sites or the development of new sites shall include a site specific report on existing and predicted electric and magnetic field strengths or equivalent plane-wave power density levels for the relevant frequency range(s) at the closest point(s) of public access. The report shall demonstrate whether the proposed facility, in combination with other existing sources of EMF in the affected area, will not

[1] 47 CFR 1.1310.0. See Appendix D for a copy.

cause EMFs to exceed the Maximum Permitted Exposure level.

Program EMF 2.1.3: EMF reports shall be prepared by a qualified radio frequency engineer based upon superior methods of calculation of EMF levels as they may be improved in the future.

Program EMF 2.1.4: A Use Permit, Design Review, or other discretionary permit application for a new source of EMF should be denied where calculations show that the new source combined with existing sources would expose members of the general public to EMF in excess of the Maximum Permitted Exposure level. In the event the FCC adopts a more restrictive Maximum Permitted Exposure Level, or the County adopts a more restrictive EMF exposure standard if allowed by future changes in Federal law, the service provider shall be required to demonstrate compliance with the more restrictive standard unless such a requirement is preempted by State or Federal law. If the service providers cannot demonstrate compliance with the more restrictive standard, the discretionary permit should be revoked unless revocation is preempted by State or Federal law.

Program EMF 2.1.5: Where the actual or predicted level of EMF are more than one-third of a Maximum Permitted Exposure level (in the relevant frequency range) where the public has nearest access to the EMF-emitting equipment, or when changes in a facility not otherwise regulated by the County could increase EMF levels significantly, the County should require the independent preparation or peer review of the following information: a) measurements of the predicted and/or actual EMF levels at the closest point to which the public has access to a facility before taking discretionary action on the permit request; b) measurements of the actual EMF levels at the closest point to which the public has access to a facility after the facility is constructed but before it becomes operational on a permanent basis; and c) periodic EMF monitoring reports after the approved facility is constructed and operational to verify ongoing compliance with applicable EMF standards.

Program EMF 2.1.6: Safety standards shall be required, where appropriate, to protect persons working in areas that are not accessible to the general public who might be exposed to EMF levels in excess of the Maximum Permitted Exposure Level adopted herein. Such standards may include restricted access to telecommunications facilities, temporarily ceasing operating of the facility for work required within specified distances of antennas, and posting safety signage in compliance with FCC requirements. Safety standards shall be recommended in EMF reports required by Policy EMF 2.1.2 above.

Program EMF 2.1.7: Signage notifying persons about the presence of EMF-emitting telecommunications facilities should be required in open space areas accessible to the public where such facilities may be inconspicuously sited and/or designed and unnoticeable to the casual observer. Signage shall be subject to review and approval by the County in consultation with the Marin County Open Space District staff where appropriate.

POLICIES FOR PUBLIC SAFETY

Objective PS 1: To ensure that new facilities or modifications of existing telecommunications facilities provide adequate structural integrity as well as protection from fire hazards and vandalism.

Policy PS 1.1. Telecommunications facilities should be designed and built in compliance with applicable building code and TIA/EIA-222-F "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures" and its amendments and revisions.

Program PS 1.1.1: Service providers should be required to submit a report from a professional engineer describing the tower structure, including the number and type of antennas it is designed to accommodate and the basis for calculation of capacity, and demonstrating that it complies with applicable structural standards. This information should be submitted with applications for building permit.

Policy PS 1.2. Each site shall be designed and constructed to prevent unauthorized access and vandalism.

Program PS1.2.1. The design of telecommunications sites should include specific features to prevent unauthorized access and vandalism. Such features may include, but not be limited to fencing, anti-climbing devices, elevated tower ladders, and security monitoring by electronic means or personnel.

Policy PS 1.3. Towers should be regularly checked and maintained by service providers to keep them in a sound and safe condition until the towers are dismantled and removed from the site.

Policy PS 1.4. The towers should be designed so that in the event of failure they will fall within the fenced portion of the site and/or away from adjacent development to the extent feasible.

Program PS 1.4.1: Structures should be set back from nearby towers and from adjacent parcels or public property or street to the extent feasible.

Policy PS 1.5. Towers should be adequately spaced so that the failure of one tower will not cause adjacent towers to fall, provided that clustering of more than one tower is appropriate pursuant to policies of this Telecommunications Plan.

Policy PS 1.6. Fire and safety hazard reduction around the facility should be accomplished in accordance with applicable laws, regulations, orders, and ordinances.

Program PS 1.6.1: Buildings should be equipped with a fire suppression system to prevent the spread of fire in the hillsides.

Program PS 1.6.2: Telecommunications sites should be landscaped with drought, wind and fire resistant plants. Applications for new and/or expanded facilities shall provide landscaping plans that detail planting and indicate how landscaping will be watered until it is established. Refer also to landscape plan requirements in Policy VIS 2.4.

Program PS 1.6.3: Service providers and owners of property on which telecommunications facilities are located should be required to dismantle and remove antennas, towers and accessory structures which have been inoperative or abandoned for one year unless the service provider requests an extension of time to propose or allow future reuse of the inoperative site for a future telecommunications facility. Service providers may be required to post a bond or other suitable security as a condition of a County permit in order to guarantee removal of abandoned structures.

Program PS 1.6.4: Applications should be conditioned to prohibit smoking and require proper disposal of smoking materials at telecommunications facilities in fire hazardous or wildland areas.

Program PS 1.6.5: Applicants for facilities in fire hazard or wildland areas shall be required to submit a lands management plan detailing proposals for removing and controlling brush at a telecommunications site.

Policy PS 1.7. Earthquake standards for telecommunications facilities shall ensure that communications will be maintained in the event of an earthquake.

POLICIES FOR TELECOMMUNICATIONS FACILITY OPERATION

Objective OI 1: To ensure that the potential effects from the operation of a telecommunications facility for adjacent uses or other telecommunications facilities are minimized.

Policy OI 1.1. Development approval for expansion or establishment of new sites should include mitigation for traffic and noise effects.

Program OI 1.1.1: Adequate employee parking should be provided within the telecommunications site.

Program OI 1.1.2: The siting and design of telecommunications facilities shall be consistent with the objectives, policies, and programs of the Countywide Plan Noise Element. In particular, noise producing equipment should be sited and/or insulated to minimize noise effects on adjacent properties consistent with the guidelines in the Countywide Noise Plan Element.

Program OI 1.1.3: Guyed towers or lattice towers should not be located in close proximity to residential areas if the noise generated by wind blowing through the tower will exceed the guidelines in the Countywide Plan Noise Element.

Program OI 1.1.4: The County may require a noise assessment, if determined necessary, to verify whether the location, design, or operation of telecommunications facilities will comply with the Countywide Plan Noise Element.

Program OI 1.1.5: In residential areas, traffic to and from telecommunications sites should be limited to the minimum number of vehicle trips required for routine maintenance, testing, and emergency repairs. The number of vehicle trips associated with routine maintenance and testing may be prescribed a condition of project approval.

Policy OI 1.2. The County should encourage efforts, such as the non-interference agreement being promoted among the Big Rock Ridge operators, to reduce radio frequency interference and encourage site operators to cooperate in such agreements where sites are located near one another.

POLICIES FOR THE REVIEW PROCESS

Objective RP 1: To establish an effective planning and permitting review process for telecommunications facilities which accords a greater level of review to projects with potentially greater impacts.

Policy RP 1.1. Prior to making a decision on a site-specific telecommunications proposal that is part of a larger network or system, the service provider shall submit to the County information that sufficiently describes the nature of the proposed telecommunications service and technology and a long-range network facilities plan showing the existing, proposed, and planned future facility sites and separate coverage areas for such sites as can be reasonably predicted (refer to Program LU 1.4.3). This information should be considered by the appropriate decisionmaking body prior to acting on a permit request for a site-specific facility that is part of the overall network or system.

Policy RP 1.2. Telecommunications facilities should be regulated using uniform procedures and development standards throughout the unincorporated area of Marin County regardless of the zoning districts where the facilities are located, provided that proposals for telecommunications facilities may be subject to different review processes and/or standards depending upon project-specific factors pertaining to the proposed facility site, facility design and location, intensity of use, and degree of compatibility with surrounding land uses

Policy RP 1.3. The level of discretionary review for a proposed telecommunications proposal should correspond to the degree of potential impact and the significance of land use issues arising from the proposal. Incentives for telecommunications proposals that implement the location and design policies of this Telecommunications Plan should be provided by limiting the administrative processing time and permit fees for such proposals. The level of discretionary review shall be determined by the Community Development Director or other appropriate County decisionmaking authority.

Program RP 1.3.1: Unless otherwise specified by Program RP 1.3.2 or RP 1.3.3 below, proposed telecommunications facilities shall be subject to Master Plan or Use Permit with concurrent Design Review requirements in order to provide sufficient discretionary review and a mechanism of imposing conditions of approval and necessary mitigation measures.

Program RP 1.3.2: Design Review only (i.e., Master Plan or Use Permit waived) should be required for proposed telecommunications projects that implement the following policy objectives:

a. Co-location;

b. Locating new minor telecommunications facilities at preferred commercial or industrial sites; and

c. Implementing stealth design for a new minor telecommunications facility.

Design Review should be required for these types of proposals to determine compliance with discretionary development standards such as siting, landscaping, colors, etc., and to solicit community input on the proposal prior to the County's decision on the permit application. The determination regarding whether a particular telecommunications proposal qualifies for Master Plan or Use Permit waiver (i.e., only Design Review required) should be made by the Community Development Director after initial review of a complete development application. This determination should also be based on the extent to which the service provider has consulted with the affected community prior to submittal of the Design Review application as recommended by Policy RP 4.3.

Program RP 1.3.3: Telecommunications facility proposals that have little or no potential for impacts should be exempt from discretionary review, including but not necessarily limited to replacement of existing approved antennas, transmitters, or other equipment with new or upgraded technology that is substantially consistent with the scale and design of the existing approved facility and does not result in new adverse effects or significant land use issues. The determination regarding whether a particular telecommunications proposal is exempt from discretionary review should be made through a Design Review exemption request by the service provider.

Program RP 1.3.4: The County should amend Title 22, the Zoning Ordinance, to establish review processes for telecommunications projects, including wireless communications facilities, consistent with Policy RP 1.3 and Programs RP 1.3.1-1.3.3 above.

Policy RP 1.4. Applications for telecommunications facilities shall be required to include information sufficient to address the policies and programs of this Telecommunications Plan in addition to permit application submittal requirements and environmental review pursuant to CEQA. For commercial wireless facilities, service providers should be required to provide the

information listed in the Community Development Agency "Guide to The Marin County Telecommunications Facilities Policy Plan" (refer to Appendix E), including, but not limited to network system plans, facility coverage area maps, EMF reports, and visual analysis, and other information as determined by the County to properly evaluate such proposals for conformance with County policy and CEQA.

Program RP 1.4.1: The County may require peer review or the independent preparation of any technical information submitted with permit applications for telecommunications facilities, such as the feasibility of alternative facility sites and/or facility designs, or to verify the predicted and actual EMF emissions from an approved facility for compliance with the EMF emissions standard adopted in this Telecommunications Plan.

Objective RP 2: To promote interjurisdictional review of telecommunications proposals by establishing uniform policies and procedures and coordinating permit review of facility siting.

Policy RP 2.1. Incorporated cities and towns in Marin County should consider adopting rules and regulations similar to those in this Telecommunications Plan with respect to regulating telecommunications within their jurisdictions.

Policy RP 2.2. The County, cities, and towns should consider land use and environmental issues on an interjurisdictional level.

Program RP 2.2.1: The County, cities, and towns should transmit development applications for proposed telecommunications facilities to jurisdictions that are located adjacent to or within the coverage area of the proposed facility to evaluate facility site and design opportunities that further conformance with the policies and standards of the affected jurisdictions. In this regard, jurisdictions within Marin County should review network system plans and coverage area maps during the initial stages of permit processing.

Objective RP 3: To maintain a periodic review procedure for evaluating the compliance of telecommunications facilities with this Telecommunications Plan and with conditions of project approval and new telecommunications technology that may further the objectives and policies of this Telecommunications Plan.

Policy RP 3.1. All discretionary permit approvals granted by the County for telecommunications facilities shall be reviewed at least every 10 years, or more frequently, as specified by the conditions of a project approval. When reviewing requests for permit renewal, the County should work with service providers to evaluate the feasibility and practicality of replacing existing facilities (or components thereof) with new technology that would minimize visual or other land use effects addressed in this Telecommunications Plan.

Policy RP 3.2. Telecommunications facilities that are abandoned or inoperative for a minimum two year period shall be removed from the site by the service provider and property owner. As a condition of permit approval, the County shall require a performance agreement with financial security to ensure the removal of an abandoned or inoperative facility.

Policy RP 3.3. The County shall establish and maintain a data base of existing and potential co-location sites for telecommunications facilities and provide information about them to service providers and other interested parties (refer to Appendix A).

Objective RP 4: To utilize opportunities for advisory or environmental review comments on telecommunications facilities to pursue implementation of this Telecommunications Plan's objectives where the County's land use control is preempted and to use other non-regulatory approaches to promote such objectives.

Policy RP 4.1. The County should request Federal and State agencies, particularly the FCC and CPUC, to notify the County of proposed telecommunications facilities, especially those which may be exempted from local land use control.

Policy RP 4.2. The County should use opportunities for commenting on environmental review documents to recommend compliance with the policies of this Telecommunications Plan as mitigations for various environmental impacts.

Policy RP 4.3. Prior to filing development applications with the County, service providers are encouraged to meet with community organizations (i.e., homeowners associates, local design review boards, etc.) and affected residents within the area of their proposed telecommunications facilities to present the proposal, solicit input, and consider possible site or design modifications to address community concerns.

I. INTRODUCTION

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1. BACKGROUND

Telecommunications services have expanded rapidly in the face of growing demand, innovative technologies, and federal actions to deregulate telecommunications services. The Federal Communications Commission (FCC) projects very rapid growth in non-broadcast services (commercial mobile radio services, microwave systems, and amateur radio), and continued growth in broadcast services (television and AM and FM radio), particularly digital television. Emergency service and public agency networks also are growing rapidly. This expansion has had important land use implications for Marin County.

The County has a long tradition of protecting its important and defining natural and built environments. To this end, the County has adopted a Countywide Plan and implementing specific plans that guide how the County will provide for housing and economic development, natural and scenic resource conservation, and public health and safety.

In the late 1980's, the County responded to a heightened public awareness of telecommunications facilities by undertaking a review of existing, proposed, and anticipated facilities, and how the future development of telecommunications projects would affect the implementation of the County's land use planning goals. That study culminated in 1990 with the adoption of the Marin County Telecommunications Facilities Policy Plan (the 1990 Telecommunications Plan).

The 1990 Telecommunications Plan amended the Communitywide Plan by establishing policies and programs that address land use issues and community concerns about the siting and design of telecommunications facilities. The 1990 Telecommunications Plan largely focused on then-existing facilities and their expansion. Most attention was given to major facility sites on Mt. Tamalpais, Wolfback Ridge, Big Rock and Mt. Burdell. Minor facility sites were identified or characterized generally, but the County concluded that their more widespread locations, diverse characteristics, and relatively small impacts made them less suited for more detailed regulation and review than major facility sites.

In 1996, local jurisdictions in Marin County began to experience a rapid increase in permit requests for commercial wireless facilities that was prompted by growth in telecommunications technology, changes in federal telecommunications law, and expansion in wireless communications markets. The Board of Supervisors responded to this trend by initiating the following update to the 1990 Telecommunications Plan. The Board of Supervisors also approved Interim Standards and Criteria for Wireless Communications Facilities (Interim Standards) to provide guidelines for the efficient and effective processing of permit requests for commercial wireless sites until this plan update is adopted. The Interim Standards were prepared with input from cities and towns, representatives from the telecommunications industry, and members of the public.

This plan update will integrate the 1990 Telecommunications Plan with the 1996 Interim Standards and provide additional research and assessment concerning commercial wireless services. The update of this Telecommunications Plan focuses on three predominant types of commercial wireless services:

- Cellular Radiotelephone Services (CRS);
- Personal Communications Systems (PCS); and
- Specialized Mobile Radio System (SMR) and Enhanced Specialized Mobile Radio Systems (ESMR).

The 1990 Plan distinguished between "major" and "minor" facility sites. That general distinction, with certain refinements, continues to be relevant in this update of the Telecommunications Plan as discussed below.

Major Facilities: Major facility sites are typically characterized by large towers (75 feet to 200 feet in height) with antennas operated by numerous service providers. Most major facility sites in the County are located on prominent ridgetop areas, such as Mt. Tamalpais, Wolfback Ridge, Big Rock, and Mt. Burdell. These visually prominent areas constitute major ridge and upland greenbelt areas which separate urban communities and are designated for protection in the Marin Countywide Plan.

Policies of this Telecommunications Plan assure that the expansion or establishment of major facilities, particularly in ridge and upland greenbelt areas, is:

- Allowed only when no other alternative siting will fulfill telecommunications needs;
- Consistent with the Marin Countywide Plan environmental quality policies, especially those for ridge and upland greenbelt areas; and
- Designed in accordance with site development criteria formulated to control the potential impacts from major transmitter tower sites such as incompatible land use, adverse visual effects, hazardous radio frequency energy levels and public safety issues related to tower failure or vandalism.

Minor Facilities: In comparison, minor facility sites normally consist of smaller antenna support structures (less than 75 feet in height) with less capacity for multiple service providers. Minor facility sites are also commonly found in lower elevation areas with greater proximity to roadways and developed areas.

Minor telecommunications facilities cause fewer potentially significant land use and environmental effects individually due to their smaller size. However, even an individual minor facility, such as an antenna for two-way radio communications, a satellite earth station or point-to-point microwave communications, can be visually obtrusive or result in other types of

unwanted effects that can be avoided or mitigated through local siting and design regulations. The cumulative effects of multiple commercial wireless facility sites or other types of minor facilities within a given area of the County may be more significant than the incremental effects associated with an individual facility. Accordingly, updated policies of this Telecommunications Plan assure that commercial wireless facilities and other minor facility sites meet the following standards:

- Cause the fewest practicable adverse land use and visual impacts;
- Mitigate those adverse effects that are unavoidable to the extent practicable consistent with the County's jurisdiction; and
- Make efficient use of available existing antenna sites and other sites that reduce the total adverse impact of all such systems in the County.

Until recently, commercial wireless systems included traditional two-way radio systems and analog-based CRS. The basic CRS infrastructure has been built-out in Marin County. More CRS facility sites will be needed, however, as consumer demand exceeds the capacity of the existing cell sites, and service providers fill-in gaps in coverage, improve service quality, or replace analog with digital technology.

The Telecommunications Act of 1996 (Telecom Act) directed the Federal Communications Commission (FCC) to license up to six PCS providers in each market area throughout the United States. This will increase substantially the number of antennas for commercial wireless systems in Marin County. The primary mandate of the Telecom Act is to ensure the rapid dissemination of commercial wireless services while also encouraging the sharing and co-location of facility sites, promoting use of antenna sites owned by federal and state governments, and recognizing local government jurisdiction over most land use-related aspects of facility siting.

Personal Communications Systems (PCS) will develop even more rapidly than did CRS systems, because FCC rules require each PCS licensee to achieve at least a minimum service level over their coverage area in fewer than five years and to achieve increasing coverage over time. This federal mandate puts pressure on licensees to site antennas quickly and on the County to approve applications for those sites.

In fact, since 1994, applications for about 60 commercial wireless facility sites have been proposed in the unincorporated and incorporated areas of the County. This is a substantial increase in applications for telecommunications facilities compared to the past, but it is typical for urban areas throughout the United States due to the Telecom Act and related market expansion.

The number of applications and increasing public awareness of commercial wireless services have made the local permit process controversial. The 1996 Interim Standards responded to public concerns about the proliferation of permit requests for new commercial wireless facilities and the extent of regulatory control the siting and design of these facilities. This plan update

responds further to those concerns by providing a comprehensive and integrated series of policies and programs for all telecommunications facility siting within the County jurisdiction as well as a rationale for their adoption and implementation by the cities, towns, and other local jurisdictions of Marin.

2. GOALS OF THE PLAN UPDATE

The Marin County Community Development Agency has supervised preparation of this plan update to identify land use and design issues relevant to future development of telecommunications facilities and commercial wireless facilities in particular and to recommend appropriate policies, programs, standards and guidelines for their placement, design, and operation. The plan update is intended to serve the following goals:

- To provide decisionmakers with a general understanding of the technology and trends in the telecommunications industry;
- To describe the impact of federal and state law on the scope and nature of local jurisdiction over telecommunications facilities;
- To describe existing and future major and minor telecommunications facility sites and potential siting needs for new facilities;
- To balance the need and convenience of telecommunications services with the public interest regarding the location, design, and operation of wireless communication facilities;
- To describe potential adverse land use effects that could be caused by new telecommunications facilities, and to recommend policies and programs within the jurisdiction of local governments in Marin County to reduce or avoid those effects; and
- To promote a common policy rationale for local regulation of telecommunications facility siting that all of the jurisdictions in Marin County can choose to adopt.

Because of the recent growth of commercial wireless services, the plan update focuses on PCS, CRS, and SMR/ESMR systems. Less attention is given to paging services, private land mobile radio services and public safety radio services because they are typically less numerous or problematic insofar as potential land use and environmental effects are concerned. The plan update will integrate, but will not add to, the information in the 1990 Policy Plan for the following services:

- Services not found or likely in Marin County
- Microwave services[1]
- Amateur and similar personal and noncommercial radio services
- High power broadcast services including television and AM and FM radio[2]

3. SELECTED POLICY ISSUES

The 1990 Telecommunications Plan recognized two broad kinds of telecommunication facility sites, including: 1) large major facilities located on ridgelines and in upland areas; and 2) smaller minor facilities that were much less prevalent. Because the advent of commercial wireless technology and markets had yet to occur, most of the policy issues of that plan focused on major facilities on ridge and upland greenbelt areas. The following highlights key policy issues of the plan update in regulating telecommunications facility siting for both major and minor facilities with the focus being shifted to the expansion of commercial wireless systems.

- Ridgetop and Upland Locations. Most major telecommunications sites are located on a ridgetop or an upland area. Allowing more facilities on existing sites reduces the need to develop new sites elsewhere, but it can increase the visual effects of a tower or other support structure that is shared by more than one service provider or clustered. Increasing the number, size and visibility of telecommunications facilities can also conflict with policies to conserve and protect open spaces. Competing policy interests must be balanced to determine whether the trade-off (i.e., between more facilities at an existing ridgetop or greenbelt site, or a new facility elsewhere) is warranted.

- Facility Distribution. Most minor telecommunications sites, such as for a stand-alone commercial wireless facility, are not on ridgetops, because they operate at lower power over a smaller coverage area. Commercial wireless services typically are not as visible from numerous vantage points as major facilities due to their smaller size and less prominent locations. The greater number of commercial wireless facility sites can, however, create potentially adverse visual and other land use effects over the area. A key issue for local jurisdictions in Marin County is how to reduce and or avoid these effects through siting and design regulations.

- Growth Trends. Due to recent changes in federal telecommunications law and the evolution of digital telecommunications technologies, the number of commercial wireless facility antennas in Marin County is likely to increase substantially, particularly along highways, major roadway arterials, or where topography or buildings block signals. Most other forms of telecommunications will continue to

[1] The plan update addresses satellite earth stations and direct-to-consumer broadcast microwave systems to reflect changes resulting from recent federal legislation.

[2] Limited new information is included regarding digital television (DTV), an emerging technology in the US.

grow at slower rates, except for new sites and modifications associated with digital television. Local governments in Marin County can regulate that growth to avoid or reduce potential adverse effects in its jurisdiction, but cannot prevent or impede that growth if their actions conflict with preemptive federal telecommunications laws.

- Federal Jurisdiction. The federal government can preempt or supersede local regulations over telecommunications facilities. The FCC applies that power while acknowledging a legitimate local interest in siting regulation. Local policies and standards at the edge of the implementation envelope may, however, attract FCC attention. Local regulations need to be soundly based to deter or be defended in the face of scrutiny by the FCC. With a few exceptions, the FCC acts on a case-by-case basis in response to objections that local actions run afoul of federal jurisdiction over telecommunications..

- Interjurisdictional Issues. When telecommunications facilities are linked to other sites, such as for most commercial wireless systems, an interjurisdictional approach may be more effective at achieving a consistent and coordinated result. Jurisdictions can share information, expertise, and experience, and can forge common approaches to commercial wireless system design by one or more licensees. Common regulatory requirements also can reduce "forum shopping" by service providers. The plan update provides a framework for such an interjurisdictional approach to regulating telecommunications facilities.

- Sitting Efficiencies and Co-location. Generally the best way to avoid or reduce adverse impacts of new telecommunications facility sites is to make the most efficient use of existing sites and other structures that can support antennas. This can be accomplished by having multiple service providers use the same site (clustering) and/or the same tower (co-location), or attaching antennas to existing buildings or other structures (attached facilities). Whether such efficiencies can be achieved for a given facility depends on the facility, the system in which it operates, and the natural and built environments surrounding the site. However, these siting efficiencies may create unwanted land use or visual effects from combining too many facilities at one location. In these situations, design standards may be warranted to prevent cumulative adverse effects from occurring.

- Design Measures. Telecommunications facilities should create as small a visual impact as possible. For high power uses or large satellite facilities, that may not be practical. But commercial wireless facility antennas can be hidden in a structure (so-called "stealth" design) or subject to other design measures to reduce impacts that detract from land use and visual compatibility. A key issue for local jurisdictions in Marin County is what standards, guidelines and/or incentives are needed to facilitate stealth and low-impact designs for commercial wireless services.

- Electromagnetic Fields and Health. Potential human health impacts of electromagnetic field (EMF) emissions continues to evoke public concern. The FCC has largely preempted local governmental authority over regulating EMF emissions. The FCC has adopted EMF standards, and local governments are prohibited from denying or relocating a proposed telecommunications facility if the operator can show that the facility complies with those standards. There is considerable ongoing debate in Congress about federal preemption of local regulation of EMF emissions. Local governments in Marin County can continue to study the issue and should monitor any changes in federal rules that may affect their telecommunications policies and ordinances.

- Operational Impacts. Telecommunications facilities have relatively few potential significant operational impacts. They generate little traffic, although access to isolated sites can be problematic. Lights, signage and noise impacts are the most common operational considerations, but they can usually be regulated by siting and design measures to avoid or reduce them to an acceptable level. About the only operational impact that causes concerns that cannot be regulated *per se* is radio frequency (RF) interference with consumer devices. Because the FCC has exclusive authority over RF interference, local jurisdictions can, therefore, use non-regulatory approaches (e.g., information dissemination, alternative dispute resolution processes, etc.) to address RF interference.

II. TELECOMMUNICATIONS TECHNOLOGY AND REGULATION

II. TELECOMMUNICATIONS TECHNOLOGY & REGULATION

1. WHAT IS TELECOMMUNICATION?

Telecommunication is the transmission of information from one point to one or more other points using radio frequency signals. Antennas broadcast a radio frequency signal in a certain pattern which strikes a receiving device such as an antenna for a television, radio, cellular telephone, or pager. A radio frequency signal is commonly described by its frequency and strength.

The frequency of a signal is determined by the number of times the alternating electric current generating the signal changes from a maximum positive level through a maximum negative level and back to a maximum positive level in one second. Radio frequency signals are arranged in order of wavelengths referred to as the frequency spectrum. The unit of measurement is cycles per second, called Hertz, which is most often expressed in mega-hertz (MHz) for commercial wireless services. The current in the antenna generates electric and magnetic fields which radiate away from the transmitting antenna at nearly the speed of light.

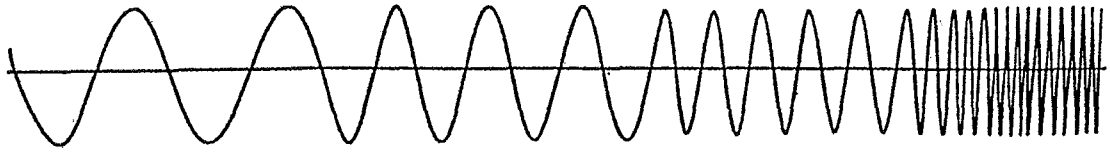
The strength of the signal is the energy of the electric and magnetic fields that radiate from the antenna. Signal strength is related to the product of the power used to generate the signal and the distance from the point of transmission. Power is expressed in watts. The strength of the signal decreases geometrically with the distance from the transmitter. As the distance doubles, the signal strength decreases to a quarter of what it was. The strength of a radio frequency signal at any point is called the power density and is expressed in terms of watts/unit area, most often as milliwatts/square centimeter (mw/cm^2) or microwatts/square centimeter (uw/cm^2).

The effective radiated power is the transmitted power from an antenna. Gain is an increase in effective radiated power that results from amplifying or shaping a radio signal to enhance its power in one direction.

2. TYPES OF TELECOMMUNICATIONS SERVICES

The FCC divides telecommunications services into two main categories for purposes of regulation: 1) broadcast services; and 2) non-broadcast services. Broadcast services primarily include commercial radio and television systems while non-broadcast services include wireless telephone and other types of voice transmissions. The FCC allocates frequency spectrum among all telecommunications services. See Figure 1, "Spectrum Allocation for Commercial Communications in the US."

FIGURE 1
SPECTRUM ALLOCATION FOR COMMERCIAL COMMUNICATIONS IN THE US



1000 kHz *70 MHz* *100 MHz* *450 MHz* *850 MHz* *900 MHz* *930 MHz* *1900 MHz*

AM radio **FM radio** **Cellular** **Paging**

Television **Two-way mobile** **Narrow band PCS** **Broadband PCS**

Broadcast services include AM radio, FM radio, high and low power television. High power television includes digital television. Digital TV (DTV) is a new technology for delivering digital television signals and will require both additional transmission towers and the upgrading of existing towers. Low power television operates on the same frequencies as UHF and VHF television, but transmits at lower power and in a smaller geographic area. Subscriber and cable television are considered a form of broadcast service even though access is limited to those who pay for it.

Non-broadcast services require special equipment for transmission and/or reception and serve specific users. Such services include commercial wireless CRS, ESMR, PCS, fixed-point microwave and satellite services, private land mobile radio services, public safety radio systems and amateur users.

Telecommunications facilities can also be classified by their users, the frequencies at which they transmit, the power with which they transmit, the kinds of sites and structures they need, and their capacity for sharing facilities. The various classes of service and their associated characteristics are summarized in Table 1, "Characteristics of Selected Telecommunications Services."

TABLE 1
CHARACTERISTICS OF SELECTED TELECOMMUNICATIONS SERVICES

FEATURE	AM RADIO	FM RADIO TELEVISION	LAND MOBILE SYSTEMS	FIXED POINT MICROWAVE
USERS	• Radio stations on AM band	• Radio stations on FM band • Television stations • Common carriers	• Private businesses • Public agencies	• Private businesses • Public agencies
FREQUENCY	• Medium (0.5-1.6 MHz)	• VHF-TV (54-216 Mhz) • FM radio (88-108 Mhz) • UHF-TV (470-890 MHz)	• Very high (25-220 Mhz) • Ultra high (420-512 and 806-940 MHz)	• Ultra high (900+ MHz)
POWER	• 50,000 watts	• FM radio: 100,000 watts • VHF-TV channels 2-6: 100,000 watts • VHF-TV channels 7-13: 316,000 watts • UHF-TV: 5,000,000 watts • LPTV: 100-1000 watts	• 350 watts maximum • 60-100 watts typical	• 10 watts typical
OPTIMAL LOCATION	Wet soils to facilitate transmission of ground waves	Highest elevation in service area	Highest elevation in service area	Adequate elevation to ensure unobstructed line-of-sight
TOWERS	Up to four or more towers in various configurations	One tower up to 2000 feet high; less for FM radio	One tower typically 60 to 150 feet high	One self-supporting tower usually less than 150 feet tall
SITE CRITERIA	Large area to accommodate multiple tower arrays	Large area to accommodate tall tower and setbacks	Generally small site separated from other towers/anetnnas	Generally small site
SHARED USE POTENTIAL	Technically feasible but locations often unsuitable for other uses	• Limited capacity for shared use with other TV and FM antennas, because of size and weight of antennas • Capacity for shared use with land mobile services	Technical capacity to share space on TV and FM radio towers; some antennas and transmitters can be shared	Capacity for shared use, particularly with land mobile services

TABLE 1

CHARACTERISTICS OF SELECTED TELECOMMUNICATIONS SERVICES

FEATURE	COMMERCIAL MOBILE RADIO SERVICE		
	CELLULAR	PCS	ESMR/SMR
USERS	Government and public safety Private businesses Individuals	Government and public safety Private businesses Individuals	Government Private businesses Individuals
FREQUENCY	824 to 849 MHz (mobiles) and 869 to 894 MHz (base stations)	Broadband: 1850 to 1990 MHz Narrowband: 901 to 902 MHz, 930 to 931 MHz and 940 to 941 MHz	806 to 821 MHz, 851 to 866 MHz, 896 to 901 MHz and 935 to 940 MHz
POWER*	500 watts (maximum) 100 to 200 watts (typical)	Broadband: 1000 watts (maximum) 50 to 200 watts (typical) Narrowband: 3500 watts (max)	500 watts
OPTIMAL LOCATION	Unobstructed line-of-sight location is desirable for all wireless services		
	Sites 1 to 5 miles apart along highway depending on user density and physical or RF constraints	Sites 1/2 to 2 miles apart along highway depending on user density and physical or RF constraints	Highest elevation to serve the largest area with the fewest sites but with fill-in sites as needed
TOWERS**	20 to 100 feet	15 to 80 feet	40 to 200 feet
SITE CRITERIA	Small area for a single support structure (monopole or lattice) and equipment building		
SHARED USE POTENTIAL	High potential limited by a given operator's coverage area or grid, potential interference from out of band emissions, height and loading limits and the competitive nature of the business		
FCC RULE	Part 22, Subpart H	Part 24, Subparts A - E	Part 90, Subpart S

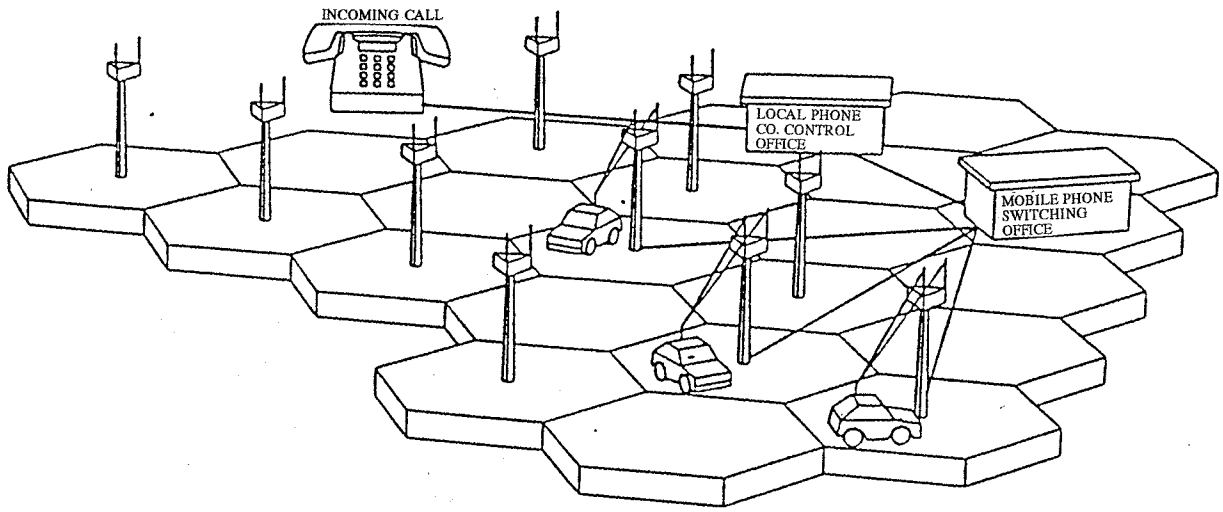
* All values are Effective Radiated Power (ERP) per base channel.

** Typical height above ground level.

The 1996 Telecommunications Act (Telecom Act) addresses several kinds of telecommunications services. The most affected services are CRS and PCS. These services are operated by for-profit entities and allow subscribers to access or receive calls from the public telephone network.

- Cellular Radiotelephone Service (CRS) was the first widely used commercial mobile radio service. AT&T Bell Laboratories developed the theory of cellular radio communications in 1947. However, it was 1981 before the FCC adopted rules creating a commercial CRS service. The first cellular system began operation in October, 1983. Figure 2 illustrates how a CRS system works.

FIGURE 2
HOW A CELLULAR SYSTEM WORKS



A user in a given cell turns on their handset. It transmits a signal to the antenna in that cell from which it is transferred by land lines to a base station which sends it back out to the person called elsewhere in the same network or interconnects with the public telephone network that routes the call to the intended party. As a user moves across cells, the base station will switch the call to the antenna in a new cell which continues the transmission at a slightly different frequency on an available channel in the new cell. This is called a "hand off." If the adjacent cell has no available channel, the call is "dropped." A licensee controls the switching between the public telephone network and the cell sites using what is called a Mobile Telephone Switching Office (MTSO), to which all of the cells connect by landline, fiber-optic cable or microwave link.

CRS markets are licensed by geographic service areas. There are a total of 734 such areas in the United States and its possessions and territories. The FCC licensed two CRS systems in each market, including Cellular One/Three Sisters Cell Company and GTE Mobilnet/Three Guys Cell Communication for Marin County.

The FCC allocated spectrum for CRS systems in the 824-849 and the 869-894 MHz ranges, with the lower range assigned to mobile users, (e.g., for a cellular telephone in the field) and the upper range assigned to fixed base station transmitters, (e.g., for the antenna at a cell site that conveys the signal from the public telephone network to a subscriber in the field). The FCC generally requires CRS providers to license only the tower locations that make up their outer service area contour.[1]

The Code of Federal Regulations contains rules for the development and provision of CRS systems. The rules are intended to ensure CRS systems are developed quickly, that competition is fostered in the industry, and that systems function without conflicting with other FCC licensees. Cellular radiotelephone service (CRS) providers are required by the FCC to "provide cellular mobile radiotelephone service upon request to all cellular subscribers . . . while such subscribers are located within any portion of the authorized geographic services area where facilities have been constructed and service to subscribers has commenced." (Federal Regulations Volume 47, Part 22 [22.901]). This means that CRS providers will consistently work to maintain or expand the systems' coverage by increasing the number of antennas and support facilities and using new technologies.

Cells are generally circular, although hexagons are typically used to depict them in maps and diagrams. This is because the conventional arrangement of transmitters has each tower surrounded by six others, expanding outward. Representing this on a map where the towers are all evenly spaced creates a six-sided configuration for each cell. Actual cell shape is affected by the surrounding terrain and other objects that could obstruct, distort or re-radiate a signal.

Cell shape also can be affected by capacity or service issues. For instance, if there is a location or corridor with very high call volume (such as along Highway 101), cells may need to be smaller and more numerous to provide enough capacity to avoid dropped calls or poor service quality. If there is a location with high call volume and many obstacles, such as in a dense urban setting or along a highway through a mountainous area, cells may need to be smaller.

At the power levels used by CRS, as well as PCS systems, there is not enough frequency spectrum available to fulfill the demand for services unless frequencies are re-used. Frequency re-use takes place when a large geographical service area is divided into cells (as shown in Figure 2) and the same frequencies are assigned to multiple, nonadjacent cells. Assigning the same frequencies in this manner economizes the use of available spectrum.

[1] The FCC does not require a CRS licensee to apply for or receive approval of additional tower locations within an approved and licensed service area or of a modification to such a site unless required under the National Environmental Policy Act (NEPA) or under rules for marking and lighting towers. Thus the station license database maintained by the FCC does not include a comprehensive listing of all CRS transmitter sites.

Even with frequency re-use, there is a finite number of concurrent conversations or calls that can be accommodated by a given cell. The capacity of a given cell to accommodate calls or conversations depends upon the number of radios or channel frequencies provided at the base station for the facility site and the type of technology used. For example, an analog-based CRS system can accommodate fewer calls at one time than for a digital-based CRS or PCS system.

- Personal Communications Services (PCS) have significantly expanded commercial wireless systems. Beginning in 1995, the FCC held auctions to sell radio frequency spectrum for two kinds of PCS systems: broadband and narrowband. Broadband PCS systems operate at 1850-1990 MHz, and narrowband PCS systems operate in the 901-902, 930-931 and 940-941 MHz bands. Broadband PCS systems primarily offer two-way digital voice (e.g., wireless telephone) service. Narrowband PCS systems offer primarily one- and two-way messaging (e.g., paging, internet access) services.

  Broadband PCS. The FCC has divided the United States into overlapping geographic areas for allocating spectrum to broadband PCS systems.[2] A given location may be served by as many as six broadband PCS systems. However, the FCC expects fewer than that number to serve a given area because a service provider can receive more than one PCS license for an area. The consolidation of licensees through the merger and acquisition among commercial wireless companies is also likely to reduce the number of licensees over time. There are six licensed broadband PCS providers for Marin County, including Sprint PCS, Pacific Bell Mobile, GWI PCS, AT&T Wireless PCS, Western PCS, and NextWave Power Partners.

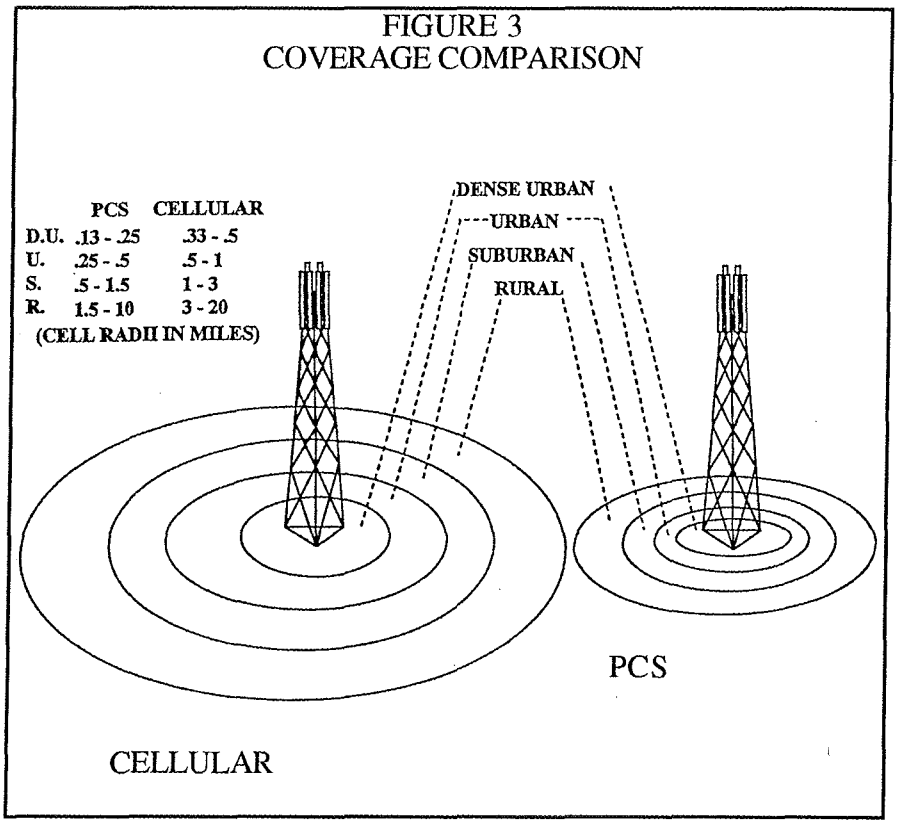
  Depending upon the specific terms of the FCC license, broadband PCS providers generally must provide adequate service to at least one-quarter to one-third of the population in their licensed area within five years of being licensed, and to two-thirds of the population in the licensed area within ten years of being licensed. Failure of the service provider to fulfill these service requirements results in forfeiture of the license, and the service provider may not re-apply for it. This means that PCS providers will need to build their initial systems more quickly than CRS providers.

  As with CRS systems, a PCS license is for their entire market area. Unlike CRS systems, however, a PCS provider is not required to submit applications to license any PCS facility sites, even those on the perimeter of a service area, unless required under the National Environmental Policy Act (NEPA) or under rules for marking and lighting towers.

[2] The FCC used the Rand McNally "1992 Commercial Atlas and Marketing Guide, 123rd Edition", as a starting point to define 51 Market Trading Areas (MTAs) and 493 Basic Trading Areas (BTAs) in the US and its possessions and territories. For the purposes of the Policy Plan, it is sufficient to note that Marin County falls entirely within the San Francisco/Oakland/San Jose MTA No. 4 and the similarly-defined BTA No. 404.

Personal communications services providers are like CRS systems in that a given service area is divided into cells in each of which is a base station that connects to a central processing facility and, hence, to the public telephone network. However, PCS systems operate at higher frequencies than CRS systems. At a given output power, signals at higher frequencies do not travel as far as those at lower frequencies. Therefore, PCS systems require more antenna structures than CRS systems to provide equal coverage. See Figure 3, "Coverage Comparison."

FIGURE 3
COVERAGE COMPARISON



This means PCS antenna sites will be more numerous at initial build-out than were CRS system sites, but will ultimately reduce the need to provide additional sites in the future to improve coverage or reliability. Also, because PCS systems are digital, each PCS site has much more capacity to handle signals than does an analog-based CRS system site, thus reducing the potential need for additional PCS sites as the number of subscribers to the PCS service grows. In contrast, additional CRS sites will be needed as each cell in an analog-based CRS system reaches its capacity because of subscriber growth.[3]

[3] CRS systems initially were designed and built without anticipating the intense future demand for mobile two-way voice communications. Thus, the first CRS facilities were placed at high elevations to maximize coverage area using as few transmitters as possible. As the number of CRS subscribers increased dramatically, the initial high-elevation sites were overloaded, because they could not process the number of signals. CRS operators had to increase system capacity by building new "in-fill" sites at lower elevations and closer to high-demand areas, such as along Highway 101 and major arterial roadways, to fill-in coverage areas. Newer service providers, such as PCS licensees, are designing and building their systems with a much better appreciation for the substantial public demand for

Narrowband PCS. Narrowband PCS systems are used principally for one-way paging services, although spectrum is available for two-way response paging. These PCS systems operate in the 901-902 MHz, 930-931 MHz and 940-941 MHz bands. A total of 26 narrowband PCS systems will be licensed nationwide, regionally or subregionally (i.e., based on MTAs and BTAs). There are seven narrowband PCS providers licensed to operate in Marin County, including Paging Network of Virginia, KDM Messaging Company, Nationwide Wireless Network, Airtouch Paging, BellSouth, Pagemart II, and Conxus Prop.

Because they operate at lower frequencies than broadband PCS systems and primarily transmit one-way messaging information, narrowband PCS facilities are fewer and more widely spaced than other PCS facilities. Initially, narrowband PCS facilities may function best if situated on ridgetop locations with expansive lines-of-sight. FCC service requirements for narrowband PCS systems vary with the size of the area licensed. Narrowband PCS providers licensed to serve a BTA are required only to build one base station within one year of licensing. Licensees of larger areas (e.g., MTAs) have greater service requirements.

- Specialized Mobile Radio/Enhanced Specialized Mobile Radio (SMR/ESMR) systems provide land mobile communications on a private or subscriber basis. SMR systems generally are private, (i.e., they serve only the licensee) and ESMR systems generally are public (i.e., they serve subscribers). In general, only ESMR systems are capable of offering cellular-like mobile telephone services to the public. An ESMR system consists of multiple base station transmitter sites deployed in a cellular configuration. Each site employs one or more antennas and multiple transmitters which are interconnected to the public telephone network. End-user mobile radio equipment consists of a vehicle-mounted transceiver or a handheld portable which is similar to a portable cellular phone.

  Enhanced specialized mobile radio (ESMR) systems operate at 806-821 and 851-866 MHz, and at 896-901 and 935-940 MHz. For each system, the mobile and base station frequencies are separated by 45 MHz, with the lower ranges assigned to mobile users (e.g., subscribers in the field), and the upper ranges assigned to fixed base station transmitters (e.g., where signals are transferred from the public telephone system to the subscriber in the field). Enhanced specialized mobile radio (ESMR) systems in the 800 MHz band are licensed by the FCC on a site-by-site basis; each antenna site must be licensed separately. ESMR systems in the 900 MHz band are licensed on an area-wide market (i.e., BTA or MTA) approach. There are two ESMR service providers licensed for Marin County, including Nextel Communications (800 MHz band) and Power Spectrum/FCI (900 MHz band).

commercial wireless services. These systems are being developed with far more transmitter sites initially than pioneer CRS systems. Thus, they will not need as many fill-in sites as CRS systems.

- Paging services are licensed as a commercial wireless service if they are offered to the public (e.g., in contrast to private services). The FCC currently licenses paging systems by transmitter and site location, and each transmitter is subject to a separate license. Commercial paging operates within 35, 43, 152, 158, 454 and 931 MHz bands.

  The basic function of paging systems is to provide one- or two-way message delivery services to subscribers. The message can be an audible tone or voice, or readable text in numeric or alphanumeric format. Paging systems use either analog or digital wireless transmissions to deliver messages to a portable "pager" carried by the subscriber. Two-way pagers have the capability of transmitting a low-power response message back to the paging system.

  One-way paging services tend to utilize high-power transmitters sited at higher elevations. These high-power facilities have the potential of causing interference to nearby commercial wireless services and consumer receivers. However, with proper engineering, high-powered paging facilities can often be successfully co-located with other commercial wireless services.

  Two-way paging facilities must be located close enough to subscribers to be able to receive low-power response messages from subscriber's pagers. Thus, it is expected that two-way paging service providers (e.g., ESMR and narrowband PCS providers) will build-out their systems with sites at lower elevations and close to high-demand areas.

- Land mobile communications systems are characterized by a fixed base station with one or more mobile units. Common carriers provide similar one-way telephone and two-way paging services.

- Fixed-point microwave systems use microwave frequencies to transmit sound and visual images between two or more fixed points. A satellite system is similar except that the signal is routed through or bounced off a satellite between the fixed transmitting and receiving points.

- Amateur radios are operated by private individuals using low power transmitters (=1500 watts).

3. COMPONENTS OF TELECOMMUNICATIONS SYSTEMS

A telecommunications system consists of a transmitter to originate a radio frequency signal, a transmission line to connect the transmitter to an antenna, usually mounted on a tower or other support structure, which radiates the signal. A receiving device such as an antenna, radio or car phone completes the system. Each of these components to a telecommunications system - towers, transmitters, transmission lines, and transmitting and receiving antennas - are described in the following sections. Photographs of telecommunications facility sites in Marin County are provided in Appendix B.

Transmitters

Transmitters are the most important component of telecommunications facilities because they generate the signal that is received by the person using the telecommunications system. A transmitter generates the signal at the frequency and power authorized by a FCC license. All major and most minor telecommunications facilities in Marin County have one or more transmitters, with the possible exception of those cable television facilities which are designed exclusively for the reception of off-the-air broadcast signals.

Transmitters that are permanently installed (i.e., fixed) at telecommunications facility sites provide communications to other fixed or mobile stations or provide point-to-point communication links to other fixed stations. Satellite earth station transmitters also provide communication links to geostationary satellites which are "fixed" at a point in space.

Fixed transmitters that serve mobile stations are called base stations. Base stations provide communications between a dispatch point and a mobile station or between two or more mobile stations. The mobile stations can be mounted in a vehicle or hand carried. A mobile station is either a transceiver (i.e., it both receives and transmits signals, such as a cellular or PCS "telephone") or receive-only device (e.g., a pager).

Transmitters are rated by their transmitter power output. Microwave transmitters have a typical power output of 10 watts or less. Most broadcast stations in Marin County have power outputs of 20 kilowatts (kW) or more. The majority of transmitters in Marin County are rated at less than 500 watts.

The size and input power needs of transmitters vary greatly. Transmitters rated at 10 watts or less may be as small as 5 inches across and draw less power than a 25 watt light bulb. Broadcast transmitters require at least as much space as one entire equipment rack (the size of a household refrigerator) and input power equal to approximately twice the transmitter power output.

Most broadcast transmitter installations require additional floor space and electrical service for cooling units, receivers and other ancillary equipment. The area occupied by back-up or emergency stand-by transmitters can double transmitter space requirements.

The transmission components used by commercial wireless facilities are generally smaller and more integrated than those of other telecommunications facilities. This is due to the low radio frequency power levels employed at the facility base stations. Also, to conserve energy and space, the industry has worked to miniaturize logic, switching and other non-radio frequency circuits in commercial wireless installations. Typical equipment cabinets are about the size of a household refrigerator. Cabinets for microcell applications can have a volume of less than two cubic feet.[4]

Transmission Lines

Transmission lines connect the transmitters and receivers to the antennas that propagate or receive radio frequency signals. Transmission lines also allow for separation between sheltered transmitter/receiver equipment, usually contained in an equipment building below the antenna or tower, and the exposed antennas that may be mounted on a tower, building or other support structure.

Transmission lines may have considerable size and weight. At their largest, transmission lines can be several hundreds of feet in length and greater than six inches in width. High power transmitting facilities and installations, where antennas are located far from other equipment, generally require larger lines. Larger lines handle greater power and have lower energy losses. Usually, a separate transmission line powers each antenna on a tower. Thus, a tower designed for shared use must support a much greater mechanical load because of the added weight and wind-loading for extra transmission lines.

Many facilities place transmission lines underground for protection or aesthetic considerations. Although some types of transmission lines are designed for direct burial, most facility designers prefer to install underground conduits for line routing. Conduits provide for greater flexibility in that underground lines can be installed or removed without digging. However, the size of the conduit limits the number and type of transmission lines which can be routed. Facility growth can be hindered by insufficient conduit space if every new user requires a separate transmission line and antenna.

Transmitter sharing and combining reduce the number of transmission lines at telecommunications facilities. This may reduce tower loading and conduit bottlenecks. However, combining does increase the amount of power handled by transmission lines; thus larger lines are necessary for combined transmitter operation. The facility designer must consider the trade-offs involved between the installation of a large number of small lines for a non-combined operation versus the installation of a single large line for a combined operation.

[4] A microcell is a small commercial wireless facility which has limited power and coverage. Microcells are primarily used to fill-in relatively small areas where coverage is obstructed from other facility sites by buildings or topography or to cover an indoor area.

Antennas- General

Transmitting antennas convert the guided radio frequency energy supplied to the antenna by a transmission line into a free-space propagating radio frequency signal. Receiving antennas reverse this process. Antennas are generally divided into two types of design: monopole/dipole antennas and parabolic antennas.

Monopole and Dipole antennas are also referred to as "pole" antennas for short. The basic design of a monopole antenna is a single linear conductor, like a car antenna, while a dipole antennas uses two conductors. Sometimes to improve function, other elements are added to a pole antenna. These include:

> Panel antenna - a rectangular panel which serves to direct a transmitted signal or to screen a receiving antenna from interference from other sources.
>
> Yagi antenna - a dipole antenna supplemented by several parallel reflector and director elements to improve function. A common type of yagi is the residential television antenna.

Parabolic antennas such as microwave dishes or horns are specialized antenna used to transmit and receive signals in the microwave portion of the radio frequency spectrum. Microwave dishes and horns vary considerably in diameter (or aperture) and in locational needs depending on their purpose. Typical dishes for home and industry use are 8 to 12 feet in diameter. They can be made of metal, spun aluminum, fiberglass (with embedded metal foil) or spun metal with either a solid or mesh design; although mesh dishes offer less wind resistance and are less visible than solid dishes. Dishes may be painted any color, provided the paint is not lead based. However, the use of dark colors on large dish antennas may result in unacceptable temperatures as the dish shape focuses radiant-heat. Often a material that does not affect telecommunications signals, such as plastic or ceramic, is used to cover a dish, reducing its wind loading and potentially its visual obtrusiveness.

One or more dishes for point to point communications can be placed on a transmission tower or similar structures if there is an unobstructed line-of-sight between the device and the facility transmitting to or receiving from it. Because a microwave signal must be sent precisely from point to point, microwave dishes are usually mounted on self-supporting towers or on buildings, which provide a more stable platform for the precisely aimed dishes than would guyed towers.

Larger microwave dishes are used commonly as earth stations for satellite communications. They can be as large as 12 meters (about 40 feet) in diameter. Large earth station dishes typically are placed on a cradle-like structure on a building or ground rather than on a tower. The structure is attached to a concrete base on or below grade (to minimize potential interference), with a line-of-sight between transmitter and receiver.

Antennas cannot be miniaturized as easily as other electronic equipment because their performance is directly dependent on their size and operating frequency. As a general rule, antenna size increases with power and decreases with frequency. However, larger antennas may be required at higher frequencies if propagation and transmission line losses are great. This may prevent or limit reductions in antenna size due to the higher operating frequency.

Generally, antennas must be separated from each other to avoid interaction and interference. Antennas that are not highly directional, particularly those that are at the same height above ground level and operate in the same frequency band, should be spaced as far apart horizontally as possible. This is necessary to reduce interference in the horizontal plane, which is the desired direction of transmission to serve the widest geographic area. When tower space allows, antennas should be vertically separated when operated from a shared site. Vertical separation usually reduces interference more effectively than horizontal separation.

Towers

Towers are typically large structures used for mounting antennas at major facilities. The two basic kinds of transmission towers are guyed-mast and self-supporting. Guyed-mast towers are typically built of steel lattice or tubular steel and held in place by guy wires. As a general rule, guy wires extend outward from the base of the tower 1/3 to 2/3 the height of the tower.

Self-supporting towers are usually square, triangular, or pyramidal in cross-section and built of steel lattice, tubular steel, reinforced concrete or wood. Usually such a tower has a larger base and bulkier members than a guyed tower that supports the same devices, but requires a much smaller total site area, because no guy wires are required.

AM radio transmission systems require multiple towers and underground wire systems. As many as twelve towers may serve one AM station. The height, number and spacing of AM towers depend on the frequency, signal strength, and direction of transmission. Towers used exclusively by land-mobile antennas can be either guyed or self-supporting. They also can be mounted on buildings, utility poles or other similar structures. Depending on height, a tower can accommodate 20 or more relatively small, light weight land-mobile antennas. Land-mobile antennas also can be placed on TV, FM radio, and microwave towers.

Some towers are built with cross bars to provide two, three or more top-mounting positions. Sutro Tower in San Francisco provides three top positions. This type of tower design allows users to have equal height and maximum coverage. Since the horizontal separation between antennas is usually small with this arrangement, pattern distortion and interference may exist.

Antennas can also be installed on the sides of towers. If the tower is steel or aluminum, side-mounted antennas may suffer pattern distortion due to the presence of nearby tower elements. Sometimes this distortion is useful if it increases signal transmission in desired directions. FM broadcasters, who normally use side-mounted antennas, often optimize pattern distortion to improve their station's signal into populated areas.

Antennas for Commercial Wireless Facilities

A typical commercial wireless facility site will have 2 to 12 antennas of various types depending on system design and coverage needs. Panel and omnidirectional antennas are the most common.

Panel antennas are shaped like rectangular boxes with cable attachments on the backside or end. The panel width is roughly 1/2 to 2 feet and the thickness is 3 to 11 inches. The typical length will vary from 1 to 4 feet for urban sites, and 4 to 6 feet for suburban and rural sites; 8- to 11-foot long models exist for specialized high-gain applications. All panel antennas are directional, meaning that most power is transmitted away from the face of the panel in a certain direction (e.g., perpendicular to the face of the panel), and less power is transmitted in other directions (e.g., downward or to the side). Most commercial wireless systems in Marin County use panel antennas.

Omnidirectional antennas are shaped like long narrow cylinders. They are often called "whip" antenna. Omnidirectional antennas range in diameter from 1 to 9 inches, and their lengths vary from 2 to 25 feet. For a given application, an omnidirectional antenna will be thinner and longer than an equivalent panel antenna.

Commercial wireless facility sites may have 3 to 6 omnidirectional antennas, 6 to 9 panels, or combinations of both. The antennas may be arrayed in a square or triangular configuration to allow for horizontal separation between antennas.

Antenna Support Structures for Commercial Wireless Facilities

Commercial wireless service providers will attempt to mount antennas on existing structures, such as buildings or existing towers, when it is technically feasible to do so. This generally is less expensive for the operator and may be encouraged by local government design standards and an expedited permit process. Whether it reduces potential impacts depends on the particular circumstances of the specific facility and its surroundings. See the discussion of visual impacts in Chapter 4 regarding alternative and "stealth" support structures.

Self-supporting monopoles are the most common antenna support structure for new commercial wireless facility sites, particularly those along highways in non-urban areas where other suitably-situated structures may not be available to support antennas. Monopoles typically are 30 to 75 feet above ground level.

4. TRANSMITTER SITING CONSIDERATIONS

General Rule

A licensee generally selects a transmitter facility site to provide the necessary signal strength over the applicable coverage area with the least radio frequency interference at the lowest cost in the least time.

Line-of-Sight and Elevation

Most telecommunications services require an unobstructed line-of-sight between a transmitting device (e.g., antennas) and its receiving device(s) (e.g., mobile telephone). Areas that cannot receive signals at all or that receive them poorly due to intervening obstructions are said to be "in shadow."

Elevating an antenna on a tower, monopole, building or other structure is generally the most efficient way to deliver telecommunications services at high power over a large area (e.g., broadcast services such as television and radio) inasmuch as it reduces the number of sites needed to provide the requisite service. Elevating an antenna also may be the most economical way to relay information from one or more specific sources to one or more specific receptors, even at low power levels used for point-to-point microwave systems and for some commercial wireless services (i.e., CRS, PCS and SMR/ESMR).

Elevating antennas is less important if transmissions are sent and received from highly elevated sources, such as a satellite, if a facility only receives transmissions, or if the service area is small. Such is the case for CRS and PCS systems. These systems break-up a geographic service area into small "cells." Each cell ranges from 0.5 to 20 miles in radius with an antenna situated at or near the center of the cell.[5] The antenna will typically be 15 to 80 feet above the ground, which is usually less than 500 feet above mean sea level in densely populated areas of Marin County.

In some cases a lower elevation site may actually be desirable. For instance, if the potential for radio frequency interference is high, or if a facility uses highly directional or low power devices, low elevation sites that are "shadowed" may aid a telecommunications facility by blocking signals that could interfere with desired transmissions.

In many cases a signal can be received and re-transmitted over or around obstacles by a series of "repeaters." Repeaters are receivers and transmitters which can mitigate poor signal quality in areas that do not have an unobstructed line-of-sight from the main transmitter.

AM radio is an exception to the line-of-sight rule, because its signals are conducted primarily along the ground and, thus, do not require an elevated site. An AM signal is transmitted by a tower with radiating underground wires which improve ground transmission. AM radio facilities are usually situated in damp lowland soils to facilitate ground-wave transmission.

Directionality

Some telecommunications facilities, including those for most TV and radio stations, are omnidirectional, which means they transmit in all directions. The area within which the signal can be received is a function of the height of the antenna, the frequency and strength of the signal, effects of other transmitters, and the surrounding terrain. These services will tend to site

[5] In a fully developed cellular system where cells are 2 miles in diameter, industry calculations show an antenna must be situated within a distance of only 760 feet from the center of the cell.

facilities so they have an expansive line-of-sight. Most of the broadcast transmission facilities in Marin County are located at major facility sites in ridge and upland areas.

Other telecommunications facilities transmit in a directional or constrained manner. Directional transmissions can be one-way (e.g., paging) or two-way (e.g., commercial wireless systems and public safety communications). Directionality can be achieved in the design of an antenna or by shaping the power output from the antenna (i.e., by using the concept of gain).

Microwave transmissions are highly directional. A microwave signal is beamed between two specific points in a narrow route usually inches in diameter (i.e., point-to-point). Since the signal transmitted is highly focused, microwave transmitters use less power than other kinds of telecommunications.

Directional antennas are used to prevent a new transmission source from interfering with an existing source with higher priority under FCC rules, to protect a new facility from interference from an existing facility, or to cover an irregularly-shaped market. Thus, sometimes television and radio transmissions can also be directional.

An elevated site may not be as important for a directional transmission as it is for an omnidirectional one. The essential factor for directional transmission is the line-of-sight between the specific transmission source and its intended receiver(s) or coverage area. Thus, highly directional antennas may be sited almost anywhere in Marin County to serve the specific needs of a given service provider.

5. EXPECTED DEMAND FOR FACILITIES AND FUTURE TRENDS

Broadcast Services

It is inevitable that the large potential profits for broadcast stations (AM, FM, and television, especially digital television) will lead to a market demand for more broadcast facilities in Marin County. Demand for alternative sites in the northern area of Marin County has increased due to the fact that San Francisco's Sutro Tower has no additional capacity for television antennas. Since adoption of the 1990 Telecommunications Plan, the County has approved a new television broadcast facility on Mount Burdell in the unincorporated Novato area. There also is spectrum available for another AM radio station in Marin County.

It is unlikely a television facility will be proposed in the southern part of Marin County, because a high power television facility is likely to interfere with television stations in San Jose and other stations to the south.

Broadcasting services, other than AM radio, will continue to have sites located on the highest hills and ridgetops, at greater than 1,000 feet above mean sea level when possible.

Private Land Mobile Radio Systems

Elevated sites that maximize the range within which such signals can be received will continue to be important for private land mobile radio systems. However, many of the licensees or subscribers for these types of systems do not need broad coverage. Some facilities are likely to be proposed throughout Marin County, particularly in the city-center corridor where most population growth and economic development is planned.

Point-to-Point Microwave Systems

Point-to-point microwave systems also are expected to grow rapidly for many of the same reasons as land mobile facilities. Most large corporations and government agencies with a regional base of operations use point-to-point microwave systems to transmit data and voice communications. As with land mobile facilities, elevated sites that provide a line-of-sight to major markets outside Marin County will be desired for most new microwave facilities, while others with more specific applications may be distributed throughout the developing parts of the County.

Satellite Systems

Satellite uplinks and downlinks are another form of microwave facility that is likely to grow significantly in the near future as technologic advances reduces their cost and satellite systems increase in number. Unlike land mobile and point-to-point microwave facilities, most uplink transmitters are likely to be proposed in topographically isolated areas of the County where they are less likely to be affected by interference from other radio frequency sources. Satellite receiving devices are likely to be spread throughout developed areas of Marin County for entertainment in hotels, restaurants, taverns, and homes, particularly where cable service is not available.

CRS, PCS and SMR/ESMR Systems

The CRS system in the County is the most mature of the commercial wireless systems. Each CRS licensee has about 12 facilities in the unincorporated and incorporated areas. Increased service will require subdividing existing cells with more numerous, lower power and lower elevation transmitters and antennas. Cells could be as small as 1 to 2 miles in diameter, which will require antennas in commercial areas and possibly some residential neighborhoods.

The emerging narrowband PCS and 900 MHz ESMR services will locate a few transmitters at high elevations, because that is the best way to serve a small number of initial users spread over a large coverage area. As demand for these services increases, they will develop additional transmitter sites at lower elevations and may no longer need higher elevation sites depending upon how specific systems are developed in the future.

The six broadband PCS licensees average more than 20 facility sites apiece in the unincorporated and incorporated areas of the County. The number of PCS facilities will grow until there is approximately one facility per provider every half mile along the Highway 101 corridor.[6]

Private business (e.g., SMR) and public safety systems will continue to locate at medium to high elevation sites at major and minor facility sites. These systems typically provide service to a small number of mobile users in vehicles. These vehicles usually have highly directional antennas attached to large, relatively high-powered transceivers powered by the vehicle's battery. The efficiencies of vehicle-mounted transceivers, as compared to handheld portables, allows one or two base stations to cover a large area from elevations of 500 to 1,000 feet above mean sea level.

Most 800 MHz ESMR systems started out as SMR systems with a few base stations on major ridgetop sites. One ESMR provider in Marin, Nextel Communications, actively markets its digital cellular-like services with portable transceivers to business users in vehicles and to the general public. As Nextel continues to add users, it will also add transmitters located at low elevations (i.e., generally not exceeding 500 feet above mean sea level).

For rural village areas, such as Stinson Beach, Bolinas and Point Reyes, only one facility for each service provider is necessary to cover the small population centers. Often the facilities of several commercial wireless service providers are co-located in such a setting because there may only be one practical central location in which to place antennas to serve the population, and there may already be a telecommunications site at that location (e.g. a public safety facility such as a fire house or police station).

The highest demand for commercial wireless services in Marin County is along Highway 101 where service providers endeavor to provide seamless coverage of vehicular traffic with no "dead spots" or areas of low signal levels. For CRS and ESMR systems, this interval typically is two to five miles along flat stretches between intervening hillsides. For broadband PCS systems, it is typically one-half to two miles. The hillsides along Highway 101 and elsewhere provide opportunities to elevate transmitter sites for coverage between the intervening flatland portions of the highway and adjacent developed areas. The hillsides also limit the range of coverage areas because they can block the transmission of radio frequency signals. Similarly, hillside areas located outside of the immediate Highway 101 corridor may provide elevated transmitter sites for arterial roadways, surrounding residential neighborhoods, and coastal villages.

Additional sites are expected to be proposed commensurate with the increase in demand occurring along major arterial roadways serving developed areas of the County, such as Sir Francis Drake Boulevard. The density of traffic, topography, and the population of adjacent areas will determine the optimum spacing of facility sites. When new facility sites are added to

[6] Information on wireless communications technology provided by the Association of Bay Area Governments indicates the coverage area for an individual PCS antenna facility can be as small as 0.5 miles or less in urban and suburban areas depending on topography, tree cover, and the population density of the area being served. Staff review of proposed network maps submitted to the Marin County Community Development Agency shows that antenna sites are generally proposed 0.5 to 1.0 miles apart along the Highway 101 corridor.

"fill-in" areas of deficient coverage, the location of existing sites will be the greatest determinant in the location of the new site.

6. FACILITY SHARING AND ENGINEERING EFFICIENCIES[7]

Sharing facility sites can improve efficiency and effective capacity. However, economic and legal factors often complicate sharing. Because the electromagnetic spectrum is a limited and valuable resource, facility users can be very competitive. Often this competition inhibits the cooperation among users necessary for facility sharing.

The major components of facilities which can be shared are:

- Towers and tower sites;
- Transmission lines and antennas; and
- Transmitters and transceivers.

Transmitter Sharing

The transmission process can be described as a stream. The stream originates at the point the signal starts, such as a microphone. It then travels "down stream" through a transmitter, transmission line, filters, and antennas.

If a transmitter is shared, then all the downstream devices attached to it (upstream of the receiving device) also are shared. This increases facility-use efficiency, but can also increase technical difficulties and consequently restrict the potential for widespread transmitter sharing. All devices attached to a shared transmitter must be compatible with all sharing parties. The transmitting antenna pattern, for example, must provide area coverage which is acceptable to every user. In addition, all transmitter users must employ the same output channel(s).

A transmitter that serves more than one user is shared by all users no matter how the transmitter is operated or licensed. Thus, a base station in a CRS system is considered shared by all members of the public who use it even though the base station is licensed to a single common carrier.

Transmitter sharing is usually accomplished by time-sharing the transmitter among users. This technique, which is also known as time-multiplexing, has been used for many years by AT&T and others who employ fixed microwave transmitter links to carry large amounts of information over long distances. Satellite users also employ this technique because space-based transmitters are expensive and available on a limited basis.

[7] The following is adapted from the 1990 Policy Plan without significant new research.

Time-multiplexing technology, combined with digital modulation techniques, have become a common transmission method in PCS systems. Transmitter time-multiplexing also is used by paging systems. All subscribers have their receivers tuned to a single transmitter frequency. Any of one of thousands of pager-receivers can be activated by audible tones or digital signals lasting less than a second from a given transmitter. These are highly efficient systems because only a small amount of transmission time is required for each message.

A typical land mobile two-way transmission, by comparison, may consist of several exchanges between a base and mobile station and may last as long as necessary for a given conversation. This does not mean that one-way paging is more efficient than two-way land mobile operators, but shows the difference in transmission times for these two different types of services which, in turn, can affect sharing potential and techniques.

Certain radio services allow licensees to operate several base transmitters as a group and thereby provide telecommunications service to multi-channel mobile transceivers. These transmitters can operate on different but closely spaced frequencies and share a combiner, transmission line, and antenna or antenna array. This type of operation is called trunking. All forms of trunking employ time-multiplexing in that a limited number of transmitters are shared by a larger number of subscribers or mobile operators. Cellular radiotelephone services (CRS) and SMR/ESMR systems rely on trunking, although CRS systems use less transmitter power and lower antenna heights than other trunked systems and may use more than 300 channels, whereas a typical conventional trunked system uses 5 to 20 channels.

The essential feature of trunked radio systems is that each mobile unit can automatically gain access to any of the transmitters not in use. Trunking is more effective than other transmitter sharing techniques because the mobile unit called does not have to wait until a given channel is free. If one channel is busy, the mobile transceiver will switch automatically to an unused channel. Such a system can handle several times the number of subscribers than a non-trunked system can with the same number of channels. Trunking works most efficiently where:

- Each station requires a channel for a short time;
- The probability is small that many stations will seek access simultaneously to more transmitters than are available; and
- The number of mobile units is much more than the number of available channels.

CRS systems require more base stations than other types of trunked systems or conventional systems to cover a given geographic area. Also, as the number of subscribers increases and existing systems reach capacity, more base stations must be built. Base stations cannot share the same telecommunications facility in the same system.

Other techniques and technologies that support transmitter sharing include:

- "Subcarrier operation" (i.e. frequency multiplexing as opposed to time-multiplexing) is in limited use, primarily in the radio services where channel bandwidths are wide (fixed microwave, satellite, and broadcasting); and

- "Packet switching" is a specialized form of time-sharing use for the transmission of digital information.

Time multiplexing and frequency multiplexing techniques can be combined to provide even greater efficiencies than can be achieved with either technique alone.

Sharing Transmission Lines and Antennas

Combiners allow antennas and transmission lines to be shared by transmitters or transceivers. This type of sharing is called combining.

Combining is not as efficient as transmitter sharing, because it may not reduce the total amount of equipment housed in transmitter tower buildings. However, combining is less restrictive than transmitter sharing because there are few, if any, FCC prohibitions against it. Also, the sharing parties do not have to use the same frequencies, although all frequencies must be within the usable frequency range of the shared antenna and transmission lines.

The size and cost of combining equipment varies greatly. Low power, two-transmitter combiners with relatively high losses can occupy less than five inches of standard rack space and cost about $1,000. A custom built low-loss combiner which can handle eight or more 20 kW FM broadcast stations can occupy over a thousand square feet of floor space and costs over $100,000.

Receiving antennas also can be shared. Combiners that are used for this purpose are called multicouplers. Multicouplers are smaller and less expensive than transmitter combiners because they do not have to handle large amounts of radio frequency power. Commercially available multicouplers allow up to 32 receivers to share a single antenna.

Duplexers are specialized combiners that allow a transceiver to use a single antenna for transmitting and receiving. Many transceivers designed for this type of operation have built-in duplexers.

Highly directional antennas used in point-to-point microwave and satellite services can be shared only by those users who communicate with the same point, (i.e., another land-based telecommunications facility or a satellite). At least one antenna for each communications path is necessary. The number of antennas required for each path can be minimized if transmitter sharing is employed. Path users could share a single transmitter if all their messages were time- or frequency-multiplexed onto a single channel. Minimizing the number of microwave and satellite antennas would minimize the facility's visual impact and the use of tower space.

Directional antennas used in the AM, FM and TV broadcast services generally cannot be shared because their patterns are tailored to the coverage and interference requirements of a particular licensee. Omnidirectional antennas used by broadcasters can be shared through combining, although the antenna must have the proper height above ground and power rating to meet the needs of all sharing parties.

Combiners promote efficient land-use because they reduce the visual impact of a facility by minimizing the number of installed antennas and their support structures. But combiners consume facility resources and require rack or floor space within transmitter shelters. Because combiners create heat due to power loss, they may require that additional air-conditioning or fans be installed. In the County, combining is utilized at the two most congested facilities: Mt. Tamalpais (middle peak) and Big Rock Ridge.

Sharing Towers (Co-location) and Facility Sites (Clustering)

A given structure can support more than one antenna. This is called co-location. The top of a structure typically is the optimum location, but antennas can also be attached to the sides or on cross bars of a tower or on a roof, building facade, or other structures until they are so low that surrounding terrain or structures may obstruct the necessary line-of-sight for transmission of signals. The number of antennas a structure can support depends on structure height, load, and design, as well as the effects of wind and signal compatibility.

Antennas and the transmission lines that connect them to a high power source are heavy. A typical television or FM radio antenna weighs one to ten thousand pounds. A coaxial cable that connects the antenna to the system weighs 5 to 10 pounds per linear foot. For this reason, a tower designed for shared use (i.e., co-location) has to accommodate many more times the load of a single user. Antenna sharing can, however, reduce tower loading.

A site for one user may not be situated to best serve the needs of another user. For example, an AM tower may be unsuited for sharing, because a typical low-lying AM tower site does not always provide a line-of-sight pathway for a large area.

Sharing towers may increase problems with radio frequency (RF) interference. Commercial wireless antennas near a high-powered broadcast antenna may be subject to severe radio frequency interference. Interference can be reduced by providing vertical and horizontal spacing between antennas on a tower, insulating equipment properly, using antennas that transmit in a confined pattern, or installing special filters on transmission or reception equipment. Commercial wireless antennas can be placed on TV or AM radio towers, but the cost of measures to prevent interference may not be economical.

A microwave system can share space on towers built for other kinds of antenna or can be mounted on buildings. Because a microwave beam is tightly focused and transmits at a much higher frequency than other systems, a microwave system is not easily affected by RF interference.

In order for a telecommunications tower to be effectively shared, it may need to be reinforced which would make it bulkier and more visible. It may also need to be increased in height to provide for sufficient antenna separation, which can also increase the tower's visibility. The visual impacts from co-location have to be weighed against the comparative impacts from a new stand-alone tower or other support structure.

Tower sites themselves can also be shared by developing more than one tower per site. This is called clustering. Clustered telecommunications structures may have less visual impact than the same number of structures spread along a ridgeline. Clustering of antennas is generally desirable when it will reduce visual impacts that might otherwise occur from tall co-location towers or monopoles, although it can increase EMF levels and RF interference.

In summary, there are engineering techniques which permit more efficient facility use such as antenna sharing, transmitter sharing, co-location (multiple antennas on a tower), and clustering (multiple towers on a site). Their suitability in any given instance depends on the characteristics of the services, technologies, physical circumstances, and operators at that site. Each of these techniques requires careful engineering design to prevent RF interference and maintain structural integrity. Some techniques may require significant capital investment for transmitters, combiners, filters, or tower construction. However, these investments can provide improved services and allow additional users and greater efficiencies.

7. REGULATION OF TELECOMMUNICATIONS FACILITIES

Generally. The County should accommodate and regulate telecommunications facilities to balance two basic objectives.

First, telecommunications facilities provide important emergency, business, educational, and personal communications links throughout Marin County. The services provided by telecommunications facilities range from television and radio to communication with emergency response vehicles. Major telecommunications facilities that have the greatest potential for adverse impacts also are necessary for the provision of a wide range of critical telecommunications services. Outright prohibition of certain kinds of telecommunications facilities would impair the quality of life, public safety, and economic development in Marin County.

Second, the state and the federal governments regulate the development of telecommunications facilities, but allow local agencies to exercise zoning and land use authority subject to preemption of certain types of local regulation in the telecommunications field. These preemptive powers ensure that local governments do not impede development of telecommunications facilities to meet public demand, do not discriminate against types of technologies or users, and do not pose a hazard to public health and safety. One state agency --- the California Public Utilities Commission (CPUC) --- and two federal agencies --- the Federal Communications Commission (FCC) and the Federal Aviation Administration (FAA) --- play the most important roles in regulating telecommunications.

In developing local regulations for telecommunications facilities in Marin County, it is important to keep in mind the regulatory framework into which they must fit.

Local Regulation

Local agencies in Marin County regulate the development of new telecommunications sites and modifications to existing sites through a discretionary permit process that may include Use Permit, Design Review, or other similar zoning and development applications. Discretionary review by local agencies typically focuses on whether the telecommunications proposal is consistent with the governing land use designations and development standards addressing such factors as community compatibility, visual and aesthetic resources, building height, property line setbacks, EMF and noise emissions, site access, landscaping, and exterior materials and colors. Local agencies in Marin County also conduct environmental review to evaluate the potential environmental effects of a telecommunications proposal as required by the California Environmental Quality Act (CEQA). The environmental review process is conducted in conjunction with the discretionary permit review.

Proposals for new or modified telecommunications facilities within the environs of the Marin County Airport (Gnoss Field) are subject to regulations set forth in the Marin County Airport Land Use Plan. The principal objectives of the Airport Land Use Plan, as they pertain to telecommunications facilities, are to ensure that towers and other support structures are located and designed in a manner that does not interfere with airport operations, such as the departure or arrival of aircraft, or the planned expansion of the airport. The Airport Land Use Plan includes specific location and height standards for new structures to implement these objectives.

Where local land use control is preempted in whole or in part by State or Federal agencies, local agencies in Marin County may be able to pursue its objectives through informal means. These include reviewing and commenting on applications before the CPUC or FCC, and reviewing and commenting on environmental impact documents prepared under the CEQA or the National Environmental Protection Act (NEPA). Refer to Chapter 5, "Implementation of this Policy Plan", for further discussion about the County's permit process.

State Regulation

The California State Public Utilities Commission (CPUC) regulates commercial wireless services and other telecommunications which are also considered public utilities. The CPUC's charge under the California Constitution and the State Resources Code is to guarantee the equitable provision of public utilities to meet public demand. Most telecommunications services, including commercial wireless services, require a CPUC license. Telecommunications services which are not available to the general public and are not defined as public utilities, such as microwave transmissions of computer data among various bank locations, may not require a CPUC license.

In the past, commercial wireless service companies were required to obtain authorization from the CPUC to construct new facilities. This requirement was eliminated in 1996 in favor of a

more streamlined regulatory process that delegates most of the CPUC's responsibilities to local agencies. The CPUC refrains from regulating facility sites by deferring the procedural requirements for public notice and compliance with CEQA to local agencies. Service providers need only provide notice to the CPUC that they have obtained the required land use approvals from local agencies for their planned facilities. The CPUC prefers this hands-off approach because local citizens and governmental agencies are often in a better position to make decisions on facility siting due to proximity to the area and knowledge of local land use issues and concerns.

However, to balance statewide interest in deploying an innovative telecommunications network in California, the CPUC also reserves the right to intervene should local policies and decisions on facility sites conflict with the CPUC's statewide policy. Therefore, a service provider may file an application for a preemptive order to construct a facility when it believes that the CPUC's goals are not being implemented at the local level.

Federal Regulation

The Federal Communications Commission (FCC) has primary regulatory control over telecommunications facilities through its powers to control interstate commerce and specifically through the Federal Communications Act of 1934, which established the FCC to provide a comprehensive national system of regulating radio frequency transmissions and related facilities. The FCC's purpose is to ensure the provision of adequate facilities for rapid and efficient means of communications with minimal signal interference problems. The FCC exercises its regulatory authority through the issuance, renewal, and modification of licenses, declaratory orders, and rules.

A licensee under the FCC is the entity which provides telecommunications services, such as a radio station or paging service. There may be several licensees operating from a particular site, each with a separate FCC license. It is not uncommon for the site operator, who leases the telecommunications tower facilities to individual users and service providers, not to have or need a FCC license. The FCC also regulates telecommunications by assigning radio frequencies to each user. The FCC requires certain frequencies only for public safety users to ensure sufficient frequency capacity for health and safety services.

Some telecommunications services which do not serve an interstate market, such as small companies providing very local services, may not require a FCC license. In general, telecommunications transmitters require FCC licensing.

Because telecommunications facilities are regarded as necessary for the public good, federal law and FCC regulations prohibit state and local jurisdictions from impeding their development, imposing requirements which unreasonably limit or impose excessive costs on them, or improperly discriminate among types of telecommunications facilities. The FCC has the power to override state and local regulations by issuing declaratory orders with the force of law. Local government regulations that violate FCC orders also can be overturned in the court system through litigation. FCC rulemaking will continue to further define the limits of local authority.

The FCC and the courts have found local regulation of telecommunications facilities, even limited moratoria, consistent with federal statutes and FCC regulations when they are not overly restrictive and are reasonably related to permitted government purposes, such as when they:

- Promote efficient use of land resources;
- Achieve aesthetic and other community values; or
- Prevent safety hazards and incompatibility between land uses.

Some examples of regulations that would meet these criteria include the following:

- Regulations prohibiting a telecommunications facility at a particular location, provided that there is another suitable and available location for the proposed facility and a land use rationale for the prohibition consistent with a permitted public purpose;
- Regulation of height, setbacks, landscaping, color, access, parking, etc., provided the regulations do not prevent a telecommunications service for which a federal license has been issued or discriminate against a telecommunications service or technology;
- Regulations for receive-only satellite dish antennas which are not required of other antennas are permissible under FCC regulations, provided that the regulations protect a legitimate health, safety, or aesthetic objective, they do not interfere with the performance of the dish antennas, and do not impose unreasonable costs.

The FCC totally preempts local regulation of radio frequency interference and local regulations that discriminate against satellite dishes and effectively prohibit amateur radio antennas. The FCC has also been active in advising and educating local governments about limitations on local authority following adoption of the 1996 Telecommunications Act (Telecom Act).

Telecommunications Act of 1996 (the Telecom Act). The Telecom Act was the first comprehensive rewrite of federal statutes regulating telecommunications since 1934. The Telecom Act establishes a policy of promoting full and open competition in all sectors of the telecommunications industry, while also protecting against unfair competition and assuring the continued availability of universal service to all. The Telecom Act further preserves and affirms local authority over the placement, construction and modification of commercial wireless services subject to several preemptive limitations. In particular, Section 704 of the Telecom Act authorizes the FCC to supersede local governments under the following circumstances:

- The local government unreasonably discriminates between providers of wireless services;
- The local government prohibits or has the effect of prohibiting the provision of wireless services;

- The local government bans the construction, modification or placement of wireless services facilities in a particular jurisdiction, beyond a temporary moratorium;

- The local government takes an unreasonable time to process a commercial wireless facility application;[8]

- The local government denies a wireless service application without a written decision or without substantial evidence in the record to support that decision; or

- The local government regulates a wireless service facility based solely on EMF emissions, where the facility complies with FCC standards regarding such emissions.

In conjunction with limiting local regulation of EMF emissions, the Telecom Act required the FCC to prescribe new rules regarding the environmental effects of radio frequency emissions within 180 days of the adoption of the Telecom Act. The FCC adopted those rules on August 7, 1996, and they became effective for most wireless services on January 1, 1997.

Claims that a local agency has violated the preemptive provisions of the Telecom Act will be adjudicated by the appropriate state or federal court. The only appeal that can be brought directly before the FCC is a claim that the local agency improperly denied an application based on the harmful effects of radio frequency emissions where the proposed facility meets the EMF standards promulgated by the FCC.

The Telecom Act also addresses the regulation of private television satellite dishes, but differently than it does for commercial wireless services. These regulations deal generally with large satellite dishes (also known as C-band dishes) that are typically 6-10 feet in diameter and smaller direct broadcast satellite (DBS) dishes measuring 18 inches to 3 feet in diameter that are normally attached to a structure such as a residence. The FCC rules generally allow local agencies to regulate the placement of satellite antenna so long as the regulation is based upon a legitimate public health, safety, or aesthetic objective and the regulation does not:

- Interfere with the performance of the antenna (i.e., cause poor reception quality);

- Impose unreasonable cost in the installation, use, or maintenance of the antenna; or

- Impose unreasonable delay in the installation, use, or maintenance of the antenna.

Provisions of the Telecom Act have been refined on a case-by-case basis, including the

[8] What is 'reasonable' depends on the nature and scope of the application. The Congressional Conference Report accompanying section 704 of the Telecom Act explains that:

> "If a request for placement of a personal wireless facility involves a zoning variance or a public hearing or comment process, the time period for rendering a decision will be the usual period under such circumstances. It is not the intent of this provision to give preferential treatment to the personal wireless service industry in the processing of requests, or to subject their requests to any but the generally applicable time frame for zoning decisions."

relationship of the Telecom Act to local government moratoria,[9] what a written decision must contain,[10] the nature of substantial evidence[11] and unreasonable discrimination,[12] and what information a local government can request from an applicant regarding compliance with the FCC standards for EMF emission.[13]

The essential relationship between local governments and the FCC remains unchanged by the Telecom Act. In summary, local governments continue to have authority under the police power to regulate wireless communication facility siting and design subject to FCC preemption over a few subjects (e.g., radio frequency interference and EMF emissions) and to FCC authority over regulations and decisions that preclude, discriminate against, or substantially impede delivery of telecommunications services. Because the FCC licenses commercial wireless systems on an individual site or a geographical coverage basis, all commercial wireless facilities, regardless of how they are licensed, are regulated by FCC rules. Thus, any commercial wireless service provider can petition the FCC or federal courts for relief from certain local government rulings concerning a proposed or existing facility.

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[9] In *Sprint Spectrum L.P. v. City of Medina*, 924 F. Supp. 1036 (W.D. Wash. 1997), the court upheld a six month moratorium, concluding it is not a prohibition on service nor an unreasonable delay, recognizing the efforts the city was making to address the reason for the moratorium, (i.e., the lack of standards for siting commercial wireless facilities). The city subsequently adopted and has applied policies and regulations specifically regulating wireless facility siting. Several facilities have been approved and denied under those regulations.

[10] In *Seattle SMSA Ltd. v. San Juan County*, (DC, Wash., No. C96-1521Z, April 11, 1997), the federal district court concluded two decisions by the county denying conditional use permit applications for two proposed cellular communications towers were not supported by an adequate statement of the basis for the decision. That is the written decision was not complete enough for the court to determine whether the county based its decision on radio frequency energy emissions contrary to the Act. Therefore, the court remanded the matter to the county for further findings. The court denied a claim that the county's action discriminated among providers of cellular service. The court also denied a claim that the denial of the permit amounted to a prohibition on the provision of cellular services, contrary to the Act. Following the remand, the county approved both towers.

[11] In *Bellsouth Mobility Inc. v. Gwinnett County*, 944 F. Supp. 923, 928 (ND Ga. 1996), the decision states that evidence is "substantial" if it would convince a reasonable and unprejudiced mind of the truth of the conclusion. Also see, *Hansen v. Chelan County*, 81 Wash. App. 133, 137-138 (1996).

[12] In *Westel-Milwaukee Co. v. Walworth County*, Wis. Ct. App., No. 95-2097, Sept. 4, 1996, the court opined that there is an expectation that state and local governments will endeavor to avoid making land use decisions that give one personal wireless service provider a competitive advantage over another.

[13] Under proposed rules, if FCC rules classify a proposed commercial wireless facility as categorically exempt from review of the issue under NEPA, local governments can request only that an applicant certify in writing that its proposed facility will comply with FCC EMF emission standards (i.e., it cannot require additional proof of compliance). If a proposed commercial wireless facility is not exempt under FCC NEPA rules, local governments can require an applicant to submit copies of all documents the applicant submitted to the FCC regarding the issue, but cannot require an applicant to undertake additional research unless the local government rebuts a presumption that the facility complies with the FCC EMF emission standard based only on information required by the FCC. WT Docket No. 97-192, (August 25, 1997), ¶¶ 143 and 151.

The Federal Aviation Administration (FAA) has a limited role in the regulation of telecommunications sites. Their review focuses on the height and location of towers to prevent interference with aircraft operations. The FAA requires towers over 200 feet in elevation or located near airports to be specially lit and painted to make them visible to aircraft. The FAA prefers that the towers not be located in the flight path for an airport and that they be clustered to make them easier to identify on navigational maps and for aircraft to avoid.

III. TELECOMMUNICATIONS FACILITY SITES IN MARIN COUNTY

III. TELECOMMUNICATIONS FACILITY SITES IN MARIN COUNTY

1. INTRODUCTION

Marin's rugged topography and land use patterns present special problems and opportunities for telecommunications facility operators. About ninety percent of Marin County's land area consists of the steep hills and small valleys of the Coast Range. Virtually all of Marin's homes and jobs are concentrated into the remaining Bay Plain area of level land and relatively gentle grades. Ridges further segment the urbanized area into sub-areas such as Richardson Bay, the Tiburon Peninsula, Upper and Lower Ross Valley and the Las Gallinas Valley. Preservation of the rural character of the West Marin hills and the ridges separating urban communities are major guiding principles of Marin's land use planning policies. However, the highest ridgetops are attractive for fixed telecommunications facilities that operate at higher power or need lines-of-sight over large areas. Lower ridges and hillsides are attractive for facilities that operate at lower power or need lines-of-sight to the County's physically separated urban areas and major transportation routes.

Ten major telecommunications facility sites were identified in the survey conducted for the 1990 Telecommunications Plan. Six are located on ridges within the Ridge and Upland Greenbelt policy area of the Countywide Plan. The remaining sites include a lowland site for AM radio and two West Marin telephone repeater station sites. All sites are entirely within unincorporated areas except San Rafael Hill and San Pedro Ridge, which are partially in the County and partially in the City of San Rafael, and Cherry Hill which is located in the City of Novato. Most major sites contain facilities for more than one telecommunications service. Although there have been changes at major facility sites since the adoption of the 1990 Telecommunications Plan --- e.g., ownership and license changes and transmitter and antenna upgrades, modifications, additions and deletions --- those changes are relatively minor.

Since the last half of the 1980's, far-and-away the fastest growing segment of the telecommunications industry in Marin County has been commercial wireless services, particularly for CRS, PCS and ESMR services. In less than ten years, applications for 113 such facilities were made for sites in the unincorporated County, cities, and towns of Marin. Although a few of these applications were withdrawn, and numerous facilities were co-located on existing structures and at major sites where they have relatively little land use impact, the sheer growth in their numbers is significant.

Commercial wireless facilities have been sited throughout Marin County, with concentrations where demand for those services is greatest and where lines-of-site are most constrained. The guiding logic in their siting is the need to be optimally placed to reliably serve a particular area and to make a good "hand-off" to all adjoining areas. The area for each service provider differs with the system architecture and technology for that licensee and service, and thus the optimal site for a facility differs for each licensee.

Initially, sites for CRS and SMR systems often were concentrated at several high-elevation sites to provide coverage over a large area with relatively few subscribers. Over time, and particularly since the advent of PCS services since 1994, sites for many commercial wireless facilities are increasingly dispersed and at lower elevations. The variety of locations for these facilities makes it more difficult to generalize about their typical setting.

2. INVENTORIES OF EXISTING FACILITY SITES

MAJOR FACILITY SITES. The general locations and features of the major sites are described on Map 1 and Table 2 of Appendix A, both of which are titled "Major Telecommunications Sites in Marin County." A summary of the major telecommunications facility sites in Marin County is reproduced below without changes from the 1990 Telecommunications Plan. Photographs of the major telecommunications sites are provided in Appendix B.

1. Wolfback Ridge rises to an elevation of 1,117 above Mean Sea Level (MSL) feet from the Marin Headlands above Sausalito and Waldo Grade. Sundial Broadcasting owns and operates a five acre site surrounded by the Golden Gate National Recreation area (GGNRA), and about 250 feet from the nearest residence. Wolfback Ridge is a medium height facility dominated by FM broadcasters because of its proximity to the large San Francisco market.

There is high potential for radio frequency interference at this congested antenna site, with its four closely spaced towers supporting high power antennas at about the same level. Combining and/or tower sharing could reduce the number of towers and the possibility of interference at this site. The applicability of combining depends upon the directionality of the FM antennas and the broadcasters' willingness to cooperate. Tower sharing is possible if structural requirements are met and FAA height limits allow it.

2. Mt. Tamalpais, at 2,500-foot elevation, is the highest site in the County and visible for more than 30 miles. High visibility makes it a particularly important scenic vista for spectacular views of the Pacific Ocean, San Francisco, and the East Bay. Mt. Tamalpais is also an aesthetically sensitive open space site, located in the midst of the Mt. Tamalpais State Park and the Golden Gate National Recreation Area. Views of Mt. Tamalpais from San Francisco, the East Bay, and Marin provide residents of the greater bay area with a much needed glimpse of nature.

Mt. Tamalpais also is the best site in the County for most users who wish to maximize their wide area coverage, especially those who operate at higher power and frequencies where line-of-sight coverage is important. In addition, point-to-point microwave services can establish communication links from Mt. Tamalpais to almost every other site within a 50 mile radius.

There are three major sites on Mt. Tamalpais. Telecommunications Properties operates on a 10-acre site at Middle Peak owned by the Marin Municipal Water District. Its facilities include a 3,000 square foot building, eight 60-foot monopole antennas and 19 microwave dishes. The other two major sites on Mt. Tamalpais are operated by the Air Force and the Federal Aviation Authority. Their facilities include radar and telecommunications equipment for government agencies including the FAA, the Army Corps of Engineers, and the Air Force.

3. San Rafael Hill rises to 650 feet elevation immediately north of downtown San Rafael, providing good transmission pathways to San Rafael and the Las Gallinas Valley. There are two major sites on the hill, located off Robert Dollar Scenic Drive in the City of San Rafael.

United Radiophone System, a paging company, owns a 5,000 square foot site adjoining Boyd Park at an elevation of 630 feet. Their facilities include a 117-foot high self-supporting tower with antennas for nine clients in addition to their own repeater. All antennas are for land-mobile and paging services, with the exception of an antenna for an FM radio station.

The City of San Rafael maintains a second tower located several hundred yards east of the United Radiophone tower. This tower is a 40-foot high utility pole supporting monopole antennas for the City's fire, police and public works departments.

4. San Pedro Ridge is a continuation of the San Rafael Hill's ridge east of Highway 101. The site offers good local pathways to San Rafael and some East Bay locations. C & C Equipment Company operates a site at the head of Black Canyon at an elevation of 1,050 feet. Antennas are mounted on the transmitter building as well as a 60-foot wooden tripod tower facilities. Users include Cellular One, MCI, the County of Marin, and AC Transit. AT&T operates another site microwave repeater station on another peak approximately 400 feet from the C & C site.

5. Big Rock Ridge rises to 1,900 foot elevation north of Lucas Valley, and physically separates the Novato and San Rafael urban areas. It is an excellent site for serving these communities, mobile stations along Highway 101, and some East Bay locations. It is best suited to two-way users and point-to-point microwave users who do not require the line-of-sight coverage provided by Mt. Tamalpais. There are currently three major sites in operation on Big Rock Ridge, all located within 1/2-mile of each other about three miles west of Highway 101.

Motorola Communications and Engineering leases the western-most site from George Lucas, a 10,000 square foot site at 1,887 feet elevation. It includes two small buildings (975 square feet total); a 100-foot self-supporting steel tower; and thirteen microwave dishes, mounted on the tower, the building, or directly on the ground.

C & C Equipment Company leases the middle site from the Hill Ranch. The lease area is approximately 6,630 square feet in area. There are two communications buildings on site, the larger one was added in 1987. In the fall of 1989, the two existing guyed towers, approximately 80 feet tall, were removed and replaced with a 100-foot free-standing tower. Microwave antennas are also mounted on the roofs of the buildings and on a 25-foot tall microwave structure. The telecommunications services operated from this site include public utility paging, point-to-point microwave, and land mobile services.

Viacom Cablevision leases the eastern-most site from George Lucas. The site is approximately 28,000 square feet and houses a 600-square foot transmitter building. Antennas at the site include eleven 10-foot parabolic dishes, three 6-foot parabolic dishes, one 4-foot parabolic dish, two 5-meter satellite receiver dishes, and a number of smaller UHF and VHF antennas. All antennas are building-mounted except the two satellite receiver dishes which are ground mounted. All antennas are used to receive and/or relay television broadcast signals.

6. Mt. Burdell is immediately north of Novato and, at 1,558 feet, dominates not only Novato but the Petaluma and Cotati valleys. AT&T Communications owns a half-acre site surrounded by Marin County Open Space District land, where it operates a satellite ground station. Facilities include a small masonry building and a 91-foot self-supporting tower on which six antenna devices are mounted. Near the AT&T site, Telecommunications Properties has an approximately 60-foot tower and related structures for television broadcast, PLMRS, CMRS, and microwave services.

7. Northeast Novato has two major sites: an elevated cellular and television relay site, and a low-lying AM broadcast site.

Chambers Cable of Novato operates the elevated site, a 4,900 square foot leased parcel at the top of Cherry Hill (elevation 455 feet), between Atherton Avenue and Olive Avenue. Facilities include two large ground-mounted earth stations, a 40-foot metal tower and two 40-foot wooden poles. The tower supports 5 whip antennas used by GTE Mobilnet and several microwave dishes. The wooden poles support various VHF and UHF antennas for Chambers Cable Service.

CBS owns a 10-acre site one mile east of Gnoss Field in a marshy area north of Black John Slough. The surrounding area is privately owned ranchland. The site houses a 2,400-square foot transmitter building and four 500-foot guyed towers for AM radio antennas. The site is at capacity and no additional facilities are anticipated.

8. Three Peaks is a local range of hills adjacent to Soulajule Reservoir in a rural area north of Marshall-Petaluma Road in West Marin. The valley below these hills provides a site protected from ground-wave radio transmissions, ideal for a satellite earth station.

AT&T Communications owns and operates a 5.4-acre satellite ground station site with microwave links to Mt. Burdell. Facilities include a 218-foot self-supporting steel tower and an 8,000 square foot equipment building. Antennas include two 30-meter dishes, one 12-meter dish and one mini horn reflector. There are twelve active frequencies at the site for satellite and regional repeaters for telephone service.

9. Point Reyes Peninsula has two large telecommunications facility sites generally situated south of Abbotts Lagoon and west of Schooner Bay.

AT&T Communications owns a 522-acre site on which it operates a High Seas Radio Station, providing ship to shore radio telephone service. Facilities include six 221-foot high log periodic antenna towers, two 90-foot monopoles and fifteen rhombic antennas from 60 to 90 feet in height.

RCA Global Communications and RCA American Communications share a 20-acre site used as a satellite earth station. Facilities include a 5,000-square foot equipment building, several garage and support buildings, and three ground mounted dish antennas ranging in size from ten to thirteen meters in diameter. RCA also operates an antenna field on an adjacent 100-acre area leased from the National Park Service. The antenna field provides telecommunications reception for marine radio.

10. Bolinas has a large telecommunications facility site, including a number of towers, owned by the Federal Government and operated by MCI International/RCA Global Communications. MCI/RCA operates a ship-to-shore-Maritime Mobile Communications System at this site.

MINOR FACILITY SITES. Because of their greater number and variety, commercial wireless facilities and other minor facility sites cannot be described in as much detail as major sites. Selected facilities for cellular, PCS and SMR/ESMR systems are identified on a series of maps and inventories contained in Appendix A. Map 2 shows the general locations of commercial wireless facilities sites. They are also inventoried in Table 3 (Appendix A), "Selected Minor Telecommunications Sites in Unincorporated Marin County" and Table 4 (Appendix A), "Selected Minor Telecommunications Sites in Incorporated Cities." Table 5 (Appendix A), "Selected Minor Facility Sites By Service, Operator & Elevation", summarizes selected data about antenna location and height. The inventory of minor sites was prepared from FCC data and from records of local jurisdictions in Marin County. Table 6, "Summary of Minor Telecommunications Facility Data" below, summarizes the information from the inventory of selected commercial wireless facility sites. The number of facility sites shown in Table 6 below is somewhat higher than Table 3 (Appendix A) because it includes paging services that are included in the FCC data base. Appendix C contains additional information about the FCC database and raw data about sites listed in the tables.

TABLE 6: SUMMARY OF MINOR TELECOMMUNICATIONS FACILITY DATA

TYPE SERVICE	LICENSEE	SITES					
		Total no.	Number by jurisdiction		Number by site type*		
			Uninc county	City	COL	CLU	O
CRS	Cell One	18	11	7	5	6	8
	Three Sisters Cell Co.	1	1				1
	GTE Mobilnet (including Bay Area Cellular Inc.)	16	8	8		6	7
	Three Guys Cell Co.	1	1				1
PCS Narrowband	Paging Network of Virginia	5		5	1	2	2
	KDM Messaging Co.						
	Nationwide Wireless Network						
	Airtouch Paging						
	BellSouth						
	Pagemart II						
	Conxus Properties						
PCS Broadband	Sprint Spectrum LP & Sprint PCS	32	14	18	8	5	19
	Pacific Bell Mobile Services (in its various name forms)	24	6	18	6	8	10
	GWI PCS, Inc.						
	AT&T Wireless						
	Western PCS						
	NextWave Power Partners						
SMR/ESMR	Nextel (including SMART & Motorola sites)	12	10	2	4	2	2
	Power Spectrum, Inc.	1	1		1		
	FCI 900, Inc.	2	2		1		1

COL= Co-location facility site; CLU= Clustered facility site; O= Other type of facility site

* Site type was not available for all sites, so the numbers in these columns do not equal the total number of sites.

From the inventory tables, it is evident that many antennas for commercial wireless services that would be minor by themselves are sited with antennas for other services and service providers at most existing major telecommunications facility sites, including Wolfback Ridge, San Pedro Ridge, Big Rock Ridge, and Mt. Tamalpais. Other facilities are sited on or next to existing structures, particularly elevated structures, such as the lookout tower on Mt. Barnabe, water tanks in Marin City and Stinson Beach, and light and power poles in Sausalito. Of the 99 commercial wireless facility sites inventoried that have been installed or approved and identified with respect to their facility type, approximately half are co-located (18) or clustered (25). An additional 33 installed or approved facilities are attached to existing structures.

Where existing structures, co-location, or clustered sites have not been used (23 sites), commercial wireless facilities are typically placed on sites that also served other public functions, such as a water tank or fire or police stations; sites that occupied a relatively small area in parking lots and landscaped areas of shopping centers and office complexes; and sites on ranches.

3. EXPANSION OF EXISTING SITES & NEED FOR NEW SITES

Major sites

Most major telecommunications facility sites are likely to undergo continuing redevelopment as transmitters, antennas and other equipment are updated to keep pace with technology and competition. Most redevelopment is not likely to cause a significant increase in adverse impacts, because it will not substantially change the appearance or impact of relatively large structures and antennas that already characterize most such major sites. Some redevelopment could have a mix of impacts. For example, replacing one antenna with a taller antenna may increase visual impacts, but the added height and more up-to-date components in the antenna may reduce EMF emission levels on the ground.

Some commercial wireless licensees have yet to develop a system. For instance, ten PCS licensees have not built facilities in the County. If they develop like existing PCS systems, they would site antennas at existing major sites, (i.e., co-locate or share), to provide initial coverage over a large area. Over time, additional sites for those users would be needed at lower elevations and minor sites. If licensees merge, demand for new sites for those licensees will not increase as fast, if at all.

Pressure for new major sites or more significant changes at existing major sites may come from the development of digital television. The FCC is requiring broadcasters to switch from analog to digital television in a relatively brief time frame. This will free-up radiofrequency spectrum for the FCC to re-allocate.[1] As noted earlier in the report, it is possible that a new major facility could be proposed for a digital television antenna and smaller related antennas on an elevated site in the north part of Marin County or at an existing major site there (e.g., Mt. Burdell or Three Peaks).

Minor sites

There is considerable potential for expansion of existing commercial wireless facility sites and for creation of new sites. Ten PCS licensees have yet to build facilities in Marin County. Two ESMR licensees have only just started their systems' development. The more developed CRS systems (Cell One and GTE), PCS systems (Sprint and Pacific Bell), and ESMR system (Nextel) will be likely to continue to develop sites to fill-in gaps in service, but at a slower pace than in the mid-1990's.

[1] The FCC intends to reclaim 60 MHz of spectrum from television channels 60-69 (i.e., 746-806 MHz) for other services. The Commission plans to auction 36 MHz to fixed, mobile and broadcast services and make the remaining 24 MHz available for public safety uses. The 36 MHz block will likely be used to expand existing CMRS services and to introduce new services. The FCC intends to reclaim an additional 78 MHz from the TV spectrum once the transition to DTV is complete. It is uncertain how much spectrum will become available for services in Marin.

Commercial wireless facilities initially were placed at elevated sites to provide an unobstructed line-of-sight over a large service area with relatively few subscribers. As the number of subscribers increased, additional lower elevation facilities were sited to provide capacity and coverage. Increasingly, facilities are being sited along Highway 101 and major arterials in Marin County and in urban population centers. That trend will grow until the systems are fully built out.

As noted in the discussion of the Telecom Act, CRS and PCS licensees are under an obligation to provide service to a certain proportion of their coverage area within five and ten years after the license is issued. This will continue to mean that expanded and new sites will be proposed relatively rapidly to provide that coverage,[2] although technological innovation could alter the numbers and needs of future systems.

Licensees are unlikely to build more facilities than needed to provide the requisite service, because even the smallest facility is expensive to develop.

[2] What is adequate coverage for a wireless communications facility is a function of the FCC requirements and the RF propagation characteristics of the site in question and the system of which it is a part. It involves not only coverage *per se*, but also the quality of the service provided in terms of hand-offs and dropped calls. There currently is no standard for what is adequate.

IV. ISSUES, OBJECTIVES, POLICIES AND PROGRAMS

IV. ISSUES, OBJECTIVES, POLICIES AND PROGRAMS

1. INTRODUCTION

Because telecommunications are important to the provision of public and private services, and federal law promotes further development of and competition in the telecommunications industry, telecommunications facilities will continue to exist, expand, and be added at new locations in Marin in the future. Within certain limits, local agencies in Marin County can regulate telecommunications facility siting to reduce the potential for and significance of adverse effects caused by such facilities (refer to Chapter 2, Section 7). The purpose of this part of the document is to identify potential adverse effects, discuss methods to avoid or mitigate those effects, and provide for further implementation measures in the form of policies and programs that provide a framework for future local actions and regulations.

The major public policy considerations for the development of telecommunications facilities are:

- Land use compatibility;
- Visual and aesthetic compatibility;
- Electromagnetic field (EMF) emissions; and
- Public safety and operations.

The following text discusses each of these policy issues in turn.

Local agencies in Marin County can use policies and development standards to evaluate proposed telecommunications facility sites (or changes to existing telecommunications facility sites) and avoid or minimize the adverse effects of such proposals. As is some times the case in land use matters, policies may conflict or compete to greater or lesser degrees when applied to a given site or proposed use, and competing policies and standards may not be fully achieved for any specific site. For example:

- Strengthening a tower to ensure that communications will be maintained following a major earthquake may require more massive structural elements in the tower, thereby creating more significant visual effects.

- Requiring a tower to accommodate multiple service providers (i.e., co-location) is one way to reduce the number of new sites. It also may increase the height and cross-section of the tower needed to support the antennas, adding to the adverse visual effect of the facility. If co-located antennas are situated lower on a structure, it could increase level of EMF emissions at the ground.

However, conflicting or competing planning policies for a particular development must be assessed and balanced against each other on a case by case basis. Through the project review process, the significance of various effects for a particular telecommunications project will be identified, the project's compliance with the various policies and standards will be determined, and competing planning objectives can be reconciled.

The policies and programs presented later in this chapter are for the unincorporated County jurisdiction. They are based in large part upon the 1990 Telecommunications Plan, the 1996 Interim Standards previously approved by the Board of Supervisors, and further study of land use issues conducted in conjunction with this plan update. The policies and programs are intended, however, to implement the goal of establishing a common interjurisdictional regulatory approach for telecommunications facility development. In this regard, they provide a model that could be considered for adoption or approval by the cities, towns, and special districts that are involved in the decisionmaking process for telecommunications proposals. Other jurisdictions in Marin County may wish to refine or revise the policies or programs to reflect local policy, administrative processes, and physical circumstances.

2. LAND USE COMPATIBILITY

The principal land use compatibility issues related to wireless communications facilities include: consistency with land use policies, land and natural resource consumption, and conflicts with open space and recreational policies or needs.

a. Consistency with Land Use Policies

Consistency with land use policies depends on the scale and siting of a telecommunications facility and the physical setting of the proposal. A telecommunications facility that is accessory to a commercial use is usually of a scale and character that can be reasonably accommodated in developed areas. For example, relatively small pole antennas for land mobile radio systems are generally unobtrusive, require few maintenance calls, and are low-powered or do not transmit radio frequency signals (i.e., receive-only). Monopoles for multi-panel CRS and PCS facilities can have marginally greater land use effects as their height may exceed the typical height of other structures in the vicinity. Larger and bulkier tower structures, cinder block buildings and chainlink fences may be considered industrial in character, and somewhat incompatible with non-industrial uses.

Siting telecommunications facilities on ridgetops, adjacent to stream corridors, or within bayfront lands may avoid or reduce the land use effects of major telecommunications facilities located elsewhere, such as a residential neighborhood, but these are also scenic and natural resource areas which are normally protected under local regulations. For example, the County has adopted land use designations and policies in the Countywide Plan for the preservation and protection of ridge lands and community separators (Ridge and Upland Greenbelt), bayfront lands (Bayfront Conservation Zone), and streams and riparian areas (Stream and Creekside Conservation Area).

The policies of this Telecommunications Plan recognize that some telecommunications facilities require locations where current land use policies discourage development. The basic policy approach to evaluating these types of proposals include:

- Development of major telecommunications facilities or substantial modifications to existing facilities located in Ridge and Upland Greenbelt areas should be

avoided or minimized through stringent tests of need for such development, requirements for efficient use of existing sites to minimize the need for new stand-alone facilities, and the implementation of guidelines to reduce their adverse effects.

- Development of telecommunications facilities in other areas identified for conservation should conform to the conservation policies adopted in the general and specific plans of the local jurisdiction. Telecommunications proposals in the unincorporated County should conform to the Countywide Plan Environmental Quality Element, including but not limited to policies for Streamside and Creekside Conservation Areas, Bayfront Conservation Zones, Ridge and Upland Greenbelt Areas.

Although some major telecommunications facilities can be sited well below ridgelines, they may be located in proximity to existing developed areas. Such facilities may not conflict with the Ridge and Upland Greenbelt policies of the Countywide Plan or similar policies of cities and towns in Marin, but there will be land use policy issues regarding the locations where these telecommunications facilities are appropriate within neighborhoods and commercial areas given the perceived industrial character and potential adverse effects of such facilities. Their compatibility within a developed area will depend primarily on the scale and transmitter characteristics of the facility.

Given their potential land use effects, major telecommunications facilities are least appropriate in single family areas, particularly those with smaller minimum lot requirements. Yet there may be circumstances where the only available and workable sites are residential ones. In these situations, this Telecommunications Plan recommends the following approach:

- Regulations should be imposed to allow siting of telecommunications facilities, and particularly major facilities, in residential areas only when no suitable location in a commercial, industrial, or other non-residential area is available. Siting in lower density residential areas would affect fewer people with respect to close to intermediate range visual effects or radio frequency energy effects. However, the facilities may be less obtrusive in a more urban area where the number and scale of buildings and other structures are typically larger.

- Where telecommunications facilities are sited in proximity to developed areas, they should be subject to development requirements pertaining to location, design, and maintenance to reduce their adverse land use effects.

Commercial wireless and other minor telecommunications facilities (e.g., for CRS and PCS services) are usually sited near highway and arterial corridors and in urbanized areas of Marin County rather than on ridgetops. Where co-located on ridgetop sites, these types of facilities have little additional land use conflicts because they typically are unobtrusive compared to the other larger telecommunications facilities already situated there.

There are two principal means to avoid or minimize conflicts between minor telecommunications facilities and surrounding land uses: 1) location preference; and 2) co-location/clustering. Policies of this Telecommunications Plan encourage minor telecommunications facilities to be sited in preferred locations where they have the least potential land use incompatibility and discourage them where they may conflict with predominant character of the surrounding area. These policies reflect the overall objectives for avoiding or minimizing impacts of major facility sites, but are refined to address the siting pattern, facility design, and operational characteristics of commercial wireless systems. The location preferences recommended by this Telecommunications Plan are discussed below.

Location Preference

In Industrial areas, commercial wireless and other minor telecommunications facilities can be integrated into a developed site with few or no land use conflicts given the intensity of industrial use(s) typically occurring on the site, the absence of residential and other sensitive land uses in close proximity to the site, and the visual characteristics of the site. For these reasons, the policies of this Telecommunications Plan express a strong preference for locating new commercial wireless facilities in industrial zones. However, the potential for siting these facilities in industrial zones is limited due to the small percentage of land in the County which is zoned and/or used for industrial development. Also, the overall location of industrial land uses is not dispersed in a pattern that reflects the network of coverage areas for commercial wireless systems.

Commercial areas can also accommodate commercial wireless facilities in a manner that minimizes or avoids land use conflicts. This can be achieved by integrating the antennas and other equipment into the design of commercial structures, especially larger structures that provide an elevated location for transmission of a radio frequency signal and greater design opportunities to accommodate antennas.

While commercial zones are generally well suited for commercial wireless services, the development of a facility on a commercial property would be inappropriate if it detracts from the architectural qualities of the buildings and other structures on or adjacent to the site, detracts from aesthetic or scenic resources in the area, or results in visual clutter when combined with other existing or proposed facilities. Therefore, developing new commercial wireless and other minor facilities in commercial zones is encouraged when they are located and designed in a manner that does not substantially diminish the built and natural environments. The amount of commercially zoned property is also limited in the County, although more prevalent than industrial areas and dispersed over a broader area along Highway 101 and other arterial roadways where coverage areas exist. However, because a number of commercial areas are situated adjacent to residential areas, it is unlikely that all or even a large percentage of new commercial wireless facilities can be placed at locations distant from residential neighborhoods.

Agricultural areas are suited to commercial wireless facilities insofar as they are not densely populated and are large enough to provide opportunities to site facilities well away from residences. However, agricultural lands contribute to the rural character of Marin County and the

improper siting, concentration, or design of telecommunications facilities can diminish them. Therefore, agricultural lands may be preferred for new development of commercial wireless facilities when it does not detract from the area's agricultural and rural qualities and where a suitable industrial or commercial property does not exist in the coverage area.

Residential neighborhoods are generally more problematic than the other land use areas discussed above. There are usually few, if any, opportunities to integrate antenna and equipment facilities into existing residential structures without contrasting with the surrounding neighborhood. In addition, antenna towers can have an overbearing presence on smaller homes and create an industrial appearance that conflicts with predominant residential setting. New minor telecommunications facilities are, therefore, discouraged in residential areas. However, much of the County is zoned residential. Therefore, the County may have to approve new facility sites within or near such areas if suitable alternative locations are not available elsewhere, and siting and design measures minimize potential land use conflicts to an acceptable level.

Institutional campuses or public facilities, or publicly-owned land can also serve as minor telecommunications sites where the facilities are compatible with other structures. Most County-owned land is designated for open space use where telecommunications facilities and other development are generally discouraged. Therefore, simply because land is publicly-owned does not assure it is a suitable low-impact site for a telecommunications facility.

The operation of telecommunications facilities in the environs of the Marin County Airport (Gnoss Field) is generally compatible with aviation activities in terms of land use because the facilities do not result in the occupation of buildings or other human activities that may create a public safety threat to persons on the ground or expose people to noise nuisance from aircraft flying overhead. The principal issue raised by development of telecommunications facilities in the airport environs is whether antenna towers will obstruct airspace used by aircraft arriving and departing from the airport. Development applications for new telecommunications facilities should, therefore, be reviewed for conformance with the Airport Land Use Plan and particularly the height limit standards for determining whether a telecommunications tower will be an obstruction or hazard to aviation.

In some cases, a stealth design can be achieved by physically integrating antennas and other equipment with existing or proposed non-telecommunications structures so they are essentially invisible to the common observer. Stealth design techniques can reduce land use conflicts sufficient to allow a facility in almost any zone where it can be accomplished consistent with other structures and natural features in the area. Stealth design is discussed in greater detail in Section 3 of this chapter.

Co-Location and Clustering

A second way to address issues of land use compatibility is to encourage co-location and clustering and to discourage new stand-alone telecommunications facility sites and towers. Co-location means the use of the same tower or pole for a number of different kinds of telecommunications services and that a number of different service providers locate their

transmitting facilities together on the same tower or other support structure. Clustering involves the placement of separate towers and other telecommunications facilities in close proximity to each other at the same facilities site. Co-location and clustering are similar because they both result in concentrating telecommunications facilities at a given locale rather than dispersing them over a larger geographical area.

The proliferation of facility sites is one of the most significant adverse land use effects of commercial wireless systems insofar as a high concentration of sites in a given area can detract from the predominant character of surrounding land uses, particularly in residential neighborhoods, and diminish visual resources. This Telecommunications Plan encourages co-location and clustering over development of new telecommunications facility sites as the primary means of avoiding or minimizing the potential effects arising from the increasing numbers of new commercial wireless sites. Reducing the number of towers (or not adding additional towers) and new facility sites generally reduces or at least does not increase land use conflicts. Related visual compatibility issues are discussed in greater detail in Section 3 (Visual and Aesthetic Compatibility).

Implementing this approach requires the County to consider the design of each service provider's commercial wireless system, because the potential for co-location and clustering depends largely on whether existing antenna support structures (e.g., buildings and towers) are available within a limited radius of the service area defined by that system.

To evaluate the potential for co-location and clustering, the County requires an applicant to submit an updated network facilities plan, a specific coverage area map for the facility in question, and details about the service provided, future sites, and antennas and equipment at each site. The County also requires an applicant to identify all technically feasible sites within the coverage area of a proposed commercial wireless system that could accommodate the proposed facility. Each feasible site must be analyzed, and the applicant must explain why it was or was not selected. This information is useful in determining whether a proposed facility can and should be relocated to another preferred location that furthers the policies of this Telecommunications Plan.

Co-location can be difficult to achieve because service providers are competitors in an increasingly competitive marketplace and may not be willing to share tower space with each other. In addition, competing service providers may be reluctant to share their facilities network plans, particularly specific facility site locations, because they may consider these plans to be proprietary business information. The policies of this Telecommunications Plan that promote co-location and clustering will have to be aggressively implemented to maximize the consolidation of antennas and other equipment.

Co-location can, however, require antenna support structures that are larger, more visually obtrusive, and uncharacteristic with the predominant surrounding land uses than separate stand-alone telecommunications facilities. At some point the detriments from larger co-location structures begin to outweigh the land use compatibility benefits. Co-location is not required by this Telecommunications Plan when it creates or significantly increases adverse land use and

visual effects, such as when large towers and multiple equipment structures would contrast significantly with the surrounding area, would adversely affect the predominant visual character of an area, or would significantly diminish scenic or open space resource values. Generally a marginal increase in antenna or tower height does not significantly increase adverse land use effects when compared to the effect of multiple towers.

Clustering may not be appropriate where multiple facilities will stand out or have the appearance of clutter on a highly visible site. In these situations, a greater scattering of facilities at visually inconspicuous locations may be preferable. When sites are clustered, multiple telecommunication facility structures should be placed strategically to minimize their obtrusiveness from the locations that are most sensitive to such effects (e.g., dwellings and public spaces). Co-location and clustering also should not be required under the following circumstances:

- When it would prohibit or have the effect of prohibiting the provision of wireless service in a given service, or unreasonably discriminate among services or providers;

- When a potential site does not have the space or capacity and cannot be altered practicably to structurally accommodate proposed antenna and other components, or when an antenna at such a site does not provide adequate coverage over the service area in question or adequate reliability;

- When it would result in excessive radio frequency (RF) interference (although not within local agency jurisdiction to regulate); and

- When it would cause a site to violate federal or state provisions (e.g., the emission standards promulgated by the FCC).

If substantial evidence in the record of a particular application raises questions about the practicability of co-location or clustering in a given case, the County could refer the analysis of this issue to independent review.

The County can and should require new commercial wireless systems to accommodate co-location and clustering in their design and in facility site leases unless doing so precludes a service or is intended to give one service provider a competitive advantage over another service provider.

The extent to which the first commercial wireless facility in a given service area is required to accommodate co-located antennas may depend on the service area plans in the County's possession and other relevant information, such as service areas of other licensed service providers in the County whether or not their sites are built-out.

Land use compatibility and other effects of a given commercial wireless facility are warranted only when that facility is part of an operating system. If a given site is abandoned or otherwise

no longer is a useful part of a system, the facility should be required to be removed. If a telecommunications facility is abandoned, it should be removed in a timely manner, and the applicant for the facility should be required to post a bond or other acceptable means of security to assure removal of the facility and restoration of the project area if necessary.

b. Consumption of Land and Natural Resources

Land requirements for a telecommunications facility can range from no land (in the case of a building-mounted antenna) to multiple acres. A typical multi-user tower and equipment building will comprise an area of 5,000 square feet to one acre including guy wire areas. This area will generally be fenced off, precluding other uses of the site. A very tall guyed-structure may encompass as much as 50 acres, not all of which need be fenced off. Typically, the tower base and equipment building area and each guy anchor area are individually fenced off. Satellite earth stations such as the RCA and AT&T facilities in West Marin, are the most land-extensive sites, comprising hundreds of acres in some cases.

In comparison, a typical stand-alone commercial wireless system consumes a very small area, in the order of 200 to 500 square feet, plus land for parking, landscaping and other site improvements. Therefore, these types of minor facility sites generally do not have a potential significant adverse effect on land consumption. In cases where land consumption may be an issue due to project-specific factors, the adverse effects should be minimized by requiring a commercial wireless system site to be as small as it can be to accommodate the facility and accessory features. Consumption of any land for a minor telecommunications facility can be avoided altogether by co-locating antennas on an existing tower, monopole, or other structure.

The proposed sites of new telecommunications facilities may contain important natural resources or sites essential for other kinds of land use. The evaluation of proposed new sites should include consideration of any loss of natural resources or whether the proposed facility uses a site needed for other kinds of development, such as housing or economic activity, to implement Countywide Plan or specific plan policies. For proposed sites in sensitive locations, the size of the site should be limited to the minimum necessary to accommodate the telecommunications services found to be necessary.

Specific resource values of the land consumed for a facility also should be considered so that land with significant natural or cultural resource values can be preserved by appropriately locating and designing the proposed facility, including access roadways to the transmission equipment and antennas. The policies of this Telecommunications Plan encourage efficient use of land for telecommunications facilities and discourage use of land with significant resource values.

One potential alternative to consuming land for new facility sites is integrating antennas into public utility structures in public rights of way, such as light poles and high power electric line towers, where it provides adequate service. This alternative has not been used widely to date, but it should be explored to encourage alternatives to traditional stand-alone commercial wireless facility sites.

c. Conflicts with Open Space, Recreational, Plant, Animal, and Cultural Resources

Many of the ridge tops where major telecommunications facilities are sited are also the location of recreational trails or designated open space lands. The expansion of existing telecommunications facilities or the development of new facility sites have the potential to conflict with recreation or open space uses. Sites in proximity to such uses should be subject to regulations to ensure that the continuity and ease of use of trails and open space areas are not affected by telecommunications facilities, the visual effects of the telecommunications site are minimized for recreational areas, and that potential radio frequency energy will not pose a hazard to users of these areas.

Of all the County's ridge tops, Mt. Tamalpais is the most visible. Residents and visitors throughout the Bay Area cherish Mt. Tamalpais as an important, unspoiled natural feature. Mt. Tamalpais provides a glimpse of the natural environment to hundreds of thousands of Bay Area residents as the most visible peak for 30 miles. The importance of preserving the natural appearance of Mt. Tamalpais and its surroundings has been recognized by the state and federal governments which have created the Mt. Tamalpais State Park and the Golden Gate National Recreation Area to protect the area's natural features. Since Mt. Tamalpais is such an important aesthetic and natural resource to so many Bay Area residents and visitors, Marin County seeks to eliminate existing telecommunications facilities on Mt. Tamalpais.

Telecommunications facilities may affect plant and animal resources. The construction of a telecommunications facility may temporarily disrupt plant and animal communities as would any other construction process. Electromagnetic field (EMF) emissions may affect wildlife, but no reliable documentation on this subject exists. Like many forms of human development, telecommunications facilities may pose a threat to birds. Migratory bird strikes of telecommunications facilities are more likely to happen at night or during poor weather conditions such as rain or fog.

While there is no evidence to suggest that the presence of telecommunications facilities poses a threat to the continued survival and health of any species of bird, siting and design mitigations can reduce the potential hazards to birds within migratory flyways or in flight paths used by significant numbers of local birds, such as those between feeding areas and roosting areas Particular care should be taken to assess the potential risk of bird strikes in these areas by carefully reviewing the siting and design of the particular facility, and identifying appropriate design standards to minimize potential bird strikes. Such standards may include siting away from migration paths or local flight paths, reducing or eliminating the use of virtually invisible structural elements such as guy wires, use of recorded sounds to drive birds away, or such other techniques as may be found effective.

In comparison to major facilities, a commercial wireless system generally does not have as much potential for adversely affecting open space, recreational, and plant and wildlife resources because their smaller size reduces the amount of land area subject to disturbance and the visibility of the equipment from public vantage points. Nonetheless, commercial wireless systems and other minor facilities should be carefully sited and designed to avoid or minimize

potential conflicts with other natural resource values on and around the site. A commercial wireless facility may be located in an open space zone or where there are recreational resources or significant plant or animal species if adverse effects are comparatively lower than alternative sites elsewhere, if significant adverse effects can be mitigated, and if the use and enjoyment of the area will not be substantially diminished.

The Countywide Plan designates specific conservation areas where special development restrictions and standards are established to prevent environmental deterioration and provide for enhancement and restoration of the environment when telecommunications projects and other development is approved. The conservation areas of the Countywide Plan that are most relevant to telecommunications projects are the Stream and Creekside Conservation Area, Bayfront Conservation Zone, and Coastal Recreation Corridor.

Proposals for new or modified telecommunications projects, including major and minor facilities, should be reviewed for conformance with the policies and standards that apply in each of these conservation zones as well as other conservation policies and standards. Among the principal policy objectives that apply to telecommunications projects located in these conservation zones are:

- Maintain adequate buffer zones along natural water courses in the Stream and Creekside Conservation Area;

- Avoid dredging, filling, and other development activities that may affect wetlands, upland habitat, agriculture, and scenic resources in the Bayfront Conservation Zone; and

- Minimize or avoid development that will adversely affect wildlife habitat, scenic resources, recreational use and enjoyment of State and Federal Parklands, and historic community character in the Coastal Zone.

Potential conflicts between telecommunication facility sites and open space, recreational, and plant and animal resources can be avoided or minimized by:

- Requiring erosion control, landscaping and/or other methods to prevent long term soil erosion or instability and to protect plant and animal habitat off-site;

- Prohibiting new facility sites in designated open space and conservation areas (among others) unless there is no technically feasible alternative site available in the coverage area and the facility will not have or will minimize adverse effects related to land use compatibility, visual resources and public safety;

- Locating new facility sites in areas where special status species (i.e., species listed as rare, threatened or endangered by the State or Federal government) do not exist unless there is no technically feasible alternative site available in the coverage area and adequate mitigation of potential adverse effects on such species can be implemented;

- Locating new facility sites in areas devoid of important historic or prehistoric resources where development of the facility will damage or destroy such resources; and

- Requiring use of a monopole or other structure designed to minimize removal of vegetation and to reduce the potential for birds striking the structure.

POLICIES FOR LAND USE COMPATIBILITY

Objective LU 1: To ensure that the siting of telecommunications facilities is compatible with other land uses.

Policy LU 1.1. New telecommunications facilities should not be permitted in Ridge and Upland Greenbelt areas unless no other technically feasible and available site exists, provided, wireless communications facilities should be permitted in ridge and upland greenbelt areas where they are co-located with existing structures consistent with the policies and programs of this Telecommunications Plan.

Program LU 1.1.1: Development of new telecommunications facilities in Ridge and Upland Greenbelt areas should be minimized through stringent tests of need for development of new ridgetop telecommunications sites. Such tests shall be provided by the applicant for a new ridgetop telecommunications site and include technical information prepared by qualified professionals that sufficiently demonstrates to the satisfaction of the County that no other technically feasible site is available to provide adequate coverage.

Program LU 1.1.2: New or expanded sites should ensure co-location and other efficient use of facilities to minimize the need for new sites, particularly on ridgeline locations, without imposing unreasonable burdens on telecommunications service providers or operators.

Program LU 1.1.3: Site users and operators should be encouraged to share and/or consolidate facilities to the greatest extent possible. Facilities that may be shared may include buildings, access roads, parking areas, utilities, transmitters, towers and other structures, and antennas.

Program LU 1.1.4: New ridgetop or upland sites shall not be approved by the County where technically feasible non-ridge sites are available, or when capacity exists and is available for the proposed use at existing sites.

Program LU 1.1.5: New telecommunications facilities proposed on parcels restricted by agricultural, open space, scenic or other public easement or restriction will only be permitted in accordance with the terms of such public easement or restriction.

Program LU 1.1.6: Applications for new or expanded major telecommunications facilities shall contain long range plans which project market demand and long-range facility expansion needs. Where three or more of the facilities are located along the same ridgeline, service providers shall prepare a Ridgeline Facility Plan to coordinate access, non-interference, and consolidation issues for the respective sites. In conjunction with submittal of a discretionary permit application for the third facility, the property owner, in cooperation with the service providers shall prepare and submit a Ridgeline Facilities Plan to promote coordination, non-interference, and consolidation.

Policy LU 1.2. The policy of the County shall be to reduce the number of ridge top telecommunications sites wherever possible.

Policy LU 1.3. Telecommunications facilities in ridgetop areas shall be sited in areas already in use for telecommunications to preserve the aesthetic and scenic value of undeveloped ridge lines in the County.

Policy LU 1.4. New construction or substantial expansion of telecommunications facilities should not occur in or near areas where they will cause land use conflicts, particularly in residential areas, unless there are no other suitable and available sites in more suitable areas.

Program LU 1.4.1: Where a major telecommunications facility must be located in or close to a residential area, the facility shall be located to reduce its visual obtrusiveness and aesthetic contrast with the surrounding area.

Program LU 1.4.2: New commercial wireless systems and other minor facilities should be co-located or clustered, as further specified in Policy LU 2.1 below, and adhere to the preferred locations, as generally prioritized below, unless a priority site does not exist within the coverage area, or requiring the priority location within the coverage area would prohibit or have the effect of prohibiting wireless service or result in adverse land use effects that would otherwise be avoided or reduced to an acceptable level at another location:

1) Industrial sites
2) Commercial sites
3) Public facilities sites
4) Agricultural sites
5) Mixed use sites (e.g., commercial and residential area)
6) Open space and recreational sites
7) Residential sites

New facilities should be approved in these locations when they are sited, designed, operated, and maintained in a manner that avoids or minimizes potential land use effects to an acceptable level and is otherwise compatible with the predominant land use character of the affected area. In general, service providers should consider selecting proposed facility sites as advised by Policy EMF 1.1.

Program LU 1.4.3: To evaluate whether a proposed facility conforms to the location standards contained in this Telecommunications Plan, service providers shall submit with their development applications an updated network facilities plan consisting of the following:

a. A written description of the type of technology and consumer services that will be provided to customers;

b. A list enumerating the service providers' facilities sites, including existing sites (operative and abandoned), approved sites, proposed sites (i.e., applications pending), and planned site (i.e., sites that can be reasonably predicted but have not been formally proposed by the filing of development applications);

c. A map depicting the geographic location and boundaries of all coverage areas or search rings existing or planned by the service provider and the approximate location of service providers' facility sites within each coverage area;

d. A coverage area map for the proposed facility site including the information described in item B above as it pertains to the individual coverage area. Note: The coverage area map may be combined with the network facilities map so long as the scale of the map is large enough to provide for detailed analysis of proposed and potential facilities sites within the coverage area.

Program LU 1.4.4: To evaluate whether a proposed facility conforms to the location preferred standards contained in this Telecommunications Plan, applicants shall submit an analysis of alternative facility sites when determined necessary. The analysis shall include enough information to provide adequate consideration of technically feasible alternative sites and/or facility designs that would avoid or minimize adverse land use and other effects included in this Telecommunications Plan. The analysis shall include in writing the specific factors considered by the service provider for selecting the proposed facility site over alternative sites. In particular, proposed facilities that are not co-located or clustered at existing telecommunications sites shall provide information substantiating the unfeasibility of such sites.

Program LU 1.4.5: Proposals for new or modified telecommunications facilities within the environs of the Marin County Airport (Gnoss Field) shall be reviewed for conformance with the Marin County Airport Land Use Plan.

Policy LU 1.5. Development of telecommunications facilities in areas identified for conservation in the Marin Countywide Plan, which include, but are not limited to Stream and Creekside Conservation Areas, the Bayfront Conservation Zone, Ridge and Upland Greenbelt Areas, and the Coastal Recreational Corridor, should conform to the development policies of the Environmental Quality Element of the Countywide Plan.

Policy LU 1.6. Locating telecommunications facilities on sites where they cause the loss of important natural or cultural (i.e., prehistoric or historic) resources or on sites designated by the County for other kinds of land uses that may be precluded or impeded by development of a telecommunications facility should be discouraged.

Program LU 1.6.1: Proposed sites may be denied where there are alternative sites available which reduce or eliminate potential significant adverse effects on natural or cultural resources, or reduce impediments to the implementation of Countywide Plan and specific plan land use policies.

Program LU 1.6.2: The size of telecommunications sites should be limited to the minimum required to provide the proposed telecommunications services, while allowing for the possibility of future co-location and clustering, particularly for sensitive locations in terms of natural resources or implementation of Countywide and specific plan land use objectives.

Policy LU 1.7. Telecommunications sites in proximity to existing or proposed recreational trails or open space lands should be subject to requirements to ensure that these public uses are not adversely affected.

Program LU 1.7.1: Telecommunications sites in the vicinity of existing or proposed recreational trails or open space areas should be sited and designed to preserve the continuity of public access and ease of public use.

Program LU 1.7.2: Telecommunications sites should be selected and designed to minimize the visual effects for nearby recreational trails and open space areas.

Program LU 1.7.3: Development guidelines for telecommunications sites shall ensure that users of recreational trails and open space areas will not be exposed to radio frequency energy in excess of FCC limits.

Program LU 1.7.4: Existing roads should be used for access to telecommunications sites whenever possible to prevent the disturbance of ridge and open space lands.

Policy LU 1.8. New construction or expansion of telecommunications facilities on Mt. Tamalpais shall be discouraged. However, if new facilities must be constructed and/or existing facilities will remain, then the County should consider consolidation of Mt. Tamalpais facilities onto a single peak.

Program LU 1.8.1: The County shall use its best efforts, including correspondence, lobbying, and contacting legislative representatives, to strongly discourage federal, state and local agencies not subject to County land use controls from expanding the number of telecommunications facilities on Mt. Tamalpais and to encourage the removal or consolidation of existing facilities.

Program LU 1.8.2: The County should discourage the expansion or new construction of telecommunications facilities on Mt. Tamalpais and encourage the consolidation of facilities.

Program LU 1.8.3: The County may allow new or existing commercial wireless systems to be co-located on existing structures on Mt. Tamalpais if such co-located antennas do not significantly increase adverse visual effects from the facility and promotes consolidation.

Objective LU 2: To minimize the number of stand-alone commercial wireless and other minor facility sites.

Policy LU 2.1. New commercial wireless facility sites should be co-located or clustered at an existing or planned telecommunications site unless requiring the proposed facility to be located at another stand-alone location would either prohibit service or have the effect of prohibiting wireless service, or result in adverse land use effects that would otherwise be avoided or minimized to an acceptable level.

Program LU 2.1.1: If the County approves a new commercial wireless facility site, that site shall accommodate co-location or clustering in the future if additional use is reasonably likely and co-location or clustering will not be incompatible with surrounding land uses.

Program LU 2.1.2: The County shall identify County-owned property where co-located or clustered commercial wireless communications facilities could be accommodated without creating significant adverse effects, and shall encourage wireless communications facilities to locate at those sites.

Program LU 2.1.3: The County shall allow innovative design solutions to siting wireless communications facilities where they are not obtrusive, such as on light poles and other structures in the public right of way.

Objective LU 3: To ensure that the siting or expansion of telecommunications facilities does not significantly adversely affect plant or animal species.

Policy LU 3.1. The construction or expansion of a telecommunications facility shall be denied if it creates a significant threat to the health and survival of threatened or endangered species or species of migratory birds.

Policy LU 3.2. Environmental review for the proposed construction or expansion of a telecommunications facility shall evaluate the potential for significant adverse effects on plants or animal species, including, but not limited to telecommunications towers that have the potential to interfere with the migratory flyway or flight paths used by resident bird species, where facilities could affect sensitive resource areas, and where clearing native vegetation is required for facility construction or expansion. Where potential significant effects are identified, the

environmental review shall also identify appropriate mitigations including re-siting, changes in the design of the facility and/or techniques found to be effective and acceptable to discourage birds from approaching the tower area, and monitoring studies of bird strikes.

3. VISUAL AND AESTHETIC COMPATIBILITY

Visual effects are one of the most commonly cited concerns about telecommunications facilities in general. Historically, the County's telecommunications policies were primarily aimed at protecting scenic qualities of ridgelines and upland areas. However, the shear number of commercial wireless facilities that have been proposed in lowland areas since 1990 make visual effects of minor telecommunications facilities as important as major telecommunications facilities.

Sources of Visual Effects - General

The visual effects of a telecommunications facility are a function of its siting and site design, the height and bulk of structures, the nature of lighting, exterior finish colors or materials, landscaping, and the physical context of the site.

Site location is to a large extent determined by the needs of the service provider who has identified line-of-sight and elevation requirements for their telecommunications technology and coverage area. Highly elevated sites with expansive lines-of-sight, such as Mt. Tamalpais and Big Rock Ridge, are typically used for major facilities and will thus attract many service providers. Because such prominent ridgeline locations also have great potential for visual effects, design considerations become more significant. Generally within such a site it would be more desirable to co-locate or cluster buildings, towers and antennas rather than have them scattered over a wide expanse of ridgetop. Whenever possible, facilities should be located below the ridgeline to eliminate or reduce the visibility of the facility.

Certain types of facilities are likely in residential and commercial areas. These may include point-to-point microwave dishes, land mobile antennas, satellite earth stations for cable television, and commercial wireless antennas. The extent of their visual effect depends on the size and nature of the antenna and support structure as well as the visual setting of the area. A stealth design that visually or architecturally integrates antennas into the design or appearance of an existing structure or site has the least visual effect. Similarly, a panel antenna attached to an existing structure or a relatively short pole antenna located adjacent to a large water tank may also be visually unobtrusive. As a general rule, visual effects will increase commensurate with the number and size of the antennas and associated support structures.

The height and type of towers, other antenna support structures, and related buildings are significant determinants of the visual effect of the facilities. Generally, the taller a tower, the greater its visual effect. To minimize its visual effects, tower heights should be limited to the minimum height necessary to permit the telecommunications services proposed for that location. However, tower height is also related to capacity. Permitting a taller tower at a telecommunications site may postpone the need for development of additional towers or sites or

permit co-locating antennas in the future. Also, taller towers permit antennas to be mounted higher which would reduce EMF emissions on the ground.

Guyed towers have less visual effect in medium- to long-distance views than self-supporting towers, because the guyed tower itself is less massive, and the guy wires disappear when viewed from some distance. However, guyed towers provide less capacity as they cannot generally support the same antenna and transmission line load as self-supporting towers. Because of the wires, guyed towers require a larger site, and it is more difficult to screen a guyed tower for views from immediately adjacent properties. All these trade-offs need to be considered in determining what combination of height and tower type provides the best mitigation for a particular site.

The equipment building for a telecommunications facility should be sited where it can be most easily screened and designed to be compatible with the surrounding natural and built environments. In ridgeline areas, the building should be placed below the ridgetop, depressed into the ground where possible or earth bermed. In other locations, the building should be sited to minimize visual effects from adjacent sites. Existing or proposed vegetation should screen buildings.

The color and reflectiveness of buildings, antennas, towers and cables will affect the degree to which these facilities are visually obtrusive. Facilities should be painted to blend in with the landscape against which they will be seen. Facilities that are primarily viewed against a backdrop of soils, trees or grasslands will be less obtrusive when painted colors matching these landscapes. Facilities that rise above the horizon line should be painted in non-reflective blues or grays. The visibility of microwave and satellite dishes can be minimized by using mesh construction whenever possible. Care should be taken that the mountings of antennas are also non-reflective and an appropriate color to blend with their background.

Appropriate provision of landscaping can also reduce the visual effects of telecommunications facilities. In all cases, vegetated areas disturbed during construction shall be replanted. This is to minimize erosion and to remove or reduce the visual effect caused by the disturbed soil area. The restorative plantings should be predominantly native and compatible with the existing vegetation in the area. For sites adjacent to or in developed areas, additional landscaping to provide screening of telecommunications buildings, towers and antennas may be required. The line-of-sight for some antennas may be impeded by plantings, which must be taken into consideration in the development and approval of landscape plans.

The aggregate visual effect of telecommunications facilities can also be reduced by minimizing the number of sites needed through the efficient use of existing and planned facilities. Wherever possible, new telecommunications facilities should be placed at existing facility sites, and multiple devices consolidated in the course of facility renovation, as discussed in Chapter II, Section 6 ("Potential Engineering Efficiencies for Telecommunications"). New sites should be permitted only upon clear demonstration of need after analysis substantiates the impracticality of upgrading or expanding existing sites to accommodate the proposed facility. New sites should also be subject to conditions of approval that allow for future co-location, clustering, and other site efficiencies.

The roads providing access to ridgetop and hillside locations also may detract from the visual qualities of the affected area. To the extent possible, new sites on ridgetops and hillsides should use existing access roads to avoid the visual effects of a new roadway. The proposed access to expanded or new sites should be evaluated to ensure that new roads are permitted only when no existing roads are available and suitable.

Visual Effects of Commercial Wireless Facilities

The visual effects of commercial wireless facility sites can be characterized and addressed much the same as major telecommunications facility sites. For instance, site location provides a visual context for the facility and the height, cross section, and appearance of structures for the facility provide the source of potential visual effects. The visibility and appearance of the facility depend largely on the extent to which it differs and stands out from the visual setting of the surrounding area. The visual contrast between the proposed facility and the surrounding environment can be reduced and made less obtrusive by distance, design, color, vegetation, lighting, height limits, site layout and other variables.

Although most commercial wireless facilities are located in lower elevation areas, they do exist on ridgelines and open space areas. New facilities are likely to be proposed in these locations in the future as service providers expand their networks into less populated communities of Marin County. The visual effects of a new commercial wireless facility on a ridgetop or other elevated site may be greater than a lower elevation site due to the prominence of the facility site location. Because of the relatively small size and cross section of a typical commercial wireless facility, that visual effect may be relatively small when viewed from a substantial distance. Even a small visual effect can, however, be significant where it introduces a new and inconsistent element into view.

A new stand-alone facility is likely to have a more significant visual effect than one co-located at an existing ridgetop telecommunications facility site or on another existing structure. In general, it is consistent with the policies in this Telecommunications Plan to allow such co-location rather than to create new sites when a ridgetop site is needed for a commercial wireless facility, notwithstanding the incrementally greater visual effect of the co-location site.

Commercial wireless facilities are typically located in lower elevation sites adjacent to Highway 101, arterial roadways, and densely populated areas. The visual settings for new facility sites in these locales can include, but is not necessarily limited to industrial, commercial, agricultural, residential, or mixed use (e.g., agricultural/residential, commercial/residential).

In general, industrial sites offer the best visual setting for commercial wireless facilities because the appearance of a monopole, antennas, and other equipment will merge easily with industrial buildings and equipment. Thus, the potential visual effects of a commercial wireless facility within or directly adjacent to an industrial site are typically minimal.

Commercial areas also generally provide a compatible setting for commercial wireless facilities because they can be integrated visually and architecturally with larger buildings, signs, and other

structures commonly found in commercial centers. Careful attention should be given to the specific location and design of the facility structures, antennas, and transmitter equipment to ensure they do not detract from the appearance and architectural qualities of commercial properties.

Agricultural and other rural areas define much of the undeveloped visual character of inland, western, and far northern portions of Marin County. Most of these areas are largely undeveloped and are open to expansive views of grassy flatlands and rolling hillsides. This type of visual setting usually has limited opportunities for screening or visually blending new wireless facilities with existing built and natural features. The indiscriminate siting of commercial wireless facilities within agricultural land can create a contrast to the bucolic scenery that is prevalent. Tree clusters, rock outcroppings, and agricultural buildings can be used to minimize the visibility of wireless facilities. Creative stealth design solutions can also assist in this regard, such as disguising a monopole as a windmill or designing an equipment building as an agricultural accessory structure.

Marin's residential neighborhoods are another valued source of visual context. Although it is difficult to generalize about all such settings, typical neighborhoods are characterized by small scale structures and extensive vegetation. Many kinds of utilities are present, but few if any involve structures more than about forty feet tall. In such a setting, a commercial wireless facility can create adverse visual effects insofar as it is usually taller and has an industrial/mechanical appearance in comparison to residential structures in the area. Therefore, the land use policies contained above in Section 2 of this chapter that discourage a stand-alone facility in or near residential areas also support policies for avoiding or minimizing visual effects.

Co-location - Benefits and Limitations

If antennas for a new commercial wireless facility can be attached to or sited adjacent to an existing structure, generally the magnitude of its visual effect will be less. Co-location is, therefore, a preferred approach to minimizing the visual effects of new commercial wireless facilities in virtually all areas of Marin County, especially in or near residential areas where the potential for such effects can be considerable.

However, there is a limit to how much co-location should occur. As additional users are added to a site, the visual effects become incrementally more significant as the combined size and height of antennas and support structures increases and becomes more noticeable. In addition to increasing the number of antennas, a co-located facility may require an additional 10 to 15 feet of tower height per user to provide vertical separation between antennas that is needed to reduce radiofrequency interference. At some point, the additional users contribute to an adverse visual effect that may be worse than a new stand-alone site. Therefore, the policies of this Telecommunications Plan promote co-location with the understanding that it may not be appropriate in every case where it is technically feasible depending upon the availability of alternative sites and the trade-offs relative to visual effects.

Reducing Visual Effects of New Commercial Wireless Facility Sites

Where a proposed commercial wireless facility is located in a visually sensitive area or will contrast with its surroundings, the County should consider whether co-locating the proposed facility at existing facility sites or structures could accommodate that facility with fewer visual effects. Local agencies can use the telecommunications facility sites inventory in Appendix A of this Telecommunications Plan, information about facility networks and coverage areas throughout Marin County, and alternative sites analysis, if needed, to evaluate proposed facility sites for consistency with the policy objective of minimizing adverse visual effects.

Visual effects can be reduced by locating monopoles, antennas and other equipment behind or next to existing buildings, public utilities, such as water tanks, and other structures to screen or minimize their appearance, particularly if the adjacent structure is as large or larger than the proposed facility. The implementation of siting and design standards should be considered for telecommunications facilities located at water tanks and other public or private utility structures within or adjacent to open space areas to ensure the preservation of scenic resources. In general, telecommunications facilities should be sited and designed to appear as an integral part of the utility structure. It may also be possible to locate a proposed facility site where the existing utility structure screens it from surrounding views. Other more specific siting and design standards may be necessary on a project-by-project basis.

Visual effects also can be reduced by limiting the height of a facility support structure to the minimum necessary to provide the requisite level of service and to allow for co-location, although co-location often will increase tower height. A maximum height limit would cap the potential effect but may limit or impede co-location opportunities. The ultimate height of monopoles and other support structures should, therefore, be evaluated on a case-by-case basis.

The visibility of wireless facilities can be mitigated by placing a facility site within or next to existing landscaping and/or landscaping the area around the facility site. Although the antennas at or near the top of a pole or other support structure must have an unobstructed line-of-sight, the remainder of most towers can be obscured. Evergreen trees and shrubs can more effectively obscure views of a facility than deciduous plant species because foliage is present throughout the year. Landscaping introduced to screen facilities should be predominantly native to reinforce the natural landscape of the surrounding area.

A commercial wireless facility site typically includes a relatively small accessory building. Visual effects of that building can be reduced by limiting its size and height to the minimum needed for the proposed facility and potential co-locators, and by requiring the use of building materials common to the visual context. For instance, concrete or aggregate finishes may be common in an industrial area, whereas lap siding or brick may be common in a residential area. In agricultural and other rural areas, simple architectural styles and natural wood materials that reflect an agrarian setting should be used for equipment buildings, as should agricultural fences (e.g., wood post and wire). If accessory structures on a commercial wireless site are visible, use of compatible materials and architectural style will reduce their obtrusiveness.

If accessory structures are below ground, there can be very little or no post-construction visual effect if the graded area is recontoured to reflect the surrounding natural topography. Undergrounding transmitters and other components of a wireless communications facility that can operate below the ground surface may be warranted in visually sensitive areas, such as residential neighborhoods or open space areas, or in urban areas where competition for land is high.

Different forms of antennas can be used to minimize visual effect. For instance, instead of putting panel or omni-directional antennas on a triangular platform at the top of a tower, flush-mounted panels can be used or fluted supports can attach antennas to the tower, creating a much smaller visual cross section.

Stealth Design

One of the most successful techniques for minimizing or avoiding visual effects is to integrate antennas and other telecommunications equipment into the design of existing buildings and other structures so they are essentially invisible or not readily recognizable to the casual observer. Such "stealth" designs hold the most promise for no or low visual effects. The options available to achieve a stealth design depend on the nature of the antennas used in a particular commercial wireless facility application. Provided below are some examples of how stealth designs can be accomplished.

- In appropriate settings, panel antennas can be installed on short poles on hillsides. The visual effect of the panels can be reduced by painting them to blend in with the hillside and surrounding vegetation or rocks. In some cases the antennas may be concealed behind vegetation or rock outcrops so long as coverage is not obstructed. However, unless access to the site is otherwise restricted, a fence must be built around the installation to prevent unauthorized persons from approaching the antennas. The fence can substantially increase the visual effect of the site unless designed with materials and colors that reflect the context of the site.

- Panels also can be mounted on monopoles, towers, roof tops or building surfaces. They are especially suited for buildings, because their slab-like monolithic shape can often be integrated into the architectural style of a wall, fascia, parapet, etc.

- The simplest integration may be accomplished by painting the panel, feed cable and mounting hardware a suitable color and mounting it directly to the exterior surface. For a better visual integration, the panel and its appurtenances are entirely concealed behind a covering that is visually opaque but radio frequency-transparent, such as the fiberglass covers commonly seen over microwave dishes. The latter method is more expensive, but offers the most effective solution to minimizing the visual effect of the panel antenna.

- Panel antennas can be concealed in a 16-inch fiberglass cylinder which is only slightly longer than the length of a single panel. When mounted on a cluttered roof and painted to match its surroundings, this antenna array assumes the appearance of a ventilation duct. This technique can be employed for two panels back-to-back to achieve a bi-directional pattern, or three panels arranged in an omni-directional pattern.

- The best engineering solution for complex coverage requirements will usually call for a roof-mounted antenna installation. A roof-mounted installation requires less cabling and expense. When viewed from ground level near the building, short antennas mounted low near the center of a roof will often be less visible than building-mounted panels. However, antennas at roof level will be more visible from a distance unless they are somehow concealed or disguised.

- Omni-directional antennas are typically mounted on roof-tops, poles, monopoles and towers. By use of stand-off mounting brackets, omni-directional antennas can be mounted on the sides of towers and monopoles, but not buildings. Omni-directional antennas cannot be mounted close to building surfaces.

- In some areas power utilities may allow antenna arrays to be mounted on the tops or sides of existing high-voltage electrical transmission line support structures. Smaller antennas, such as micro facilities, can be mounted on street telephone and light poles with the consent of local utilities, or other structures so as to be effectively unnoticeable to the casual observer. However, antenna concealment may be difficult or impossible for street pole mounted installations.

- Monopoles can be disguised as free-standing building elements and artificial trees (e.g., pines, oaks, palms, etc.), and special appurtenances on the monopole can conceal or draw attention away from the antenna array. The ability of these structures to minimize the visual effect of an antenna installation is highly dependent on site specifics, and it is difficult to draw general conclusions about their effectiveness.

- Self-supporting signs, like those found in mall parking lots or along freeways, can be used to support and conceal antenna arrays. Usually top-mounted fiberglass or plastic sign boards conceal the antenna array. These boards present substantial wind loads, thus self-supporting signs typically require two or more legs for added strength. Such a sign will be wider than a monopole of equivalent height, and the overall visual effect of the sign may be greater than that of a conventional monopole with unscreened antennas.

- On buildings, antenna arrays can be concealed behind screens that are opaque to view but not to RF signals, such as fiberglass.

- Sometimes a component of a building can be replaced or modified to conceal antennas with little or no change in the visual character of the building. For example, in an historic residential neighborhood, an entire existing church steeple could be replaced with a fiberglass one to conceal a cellular omni antenna.

- Other stealth structures include smokestacks, stadium light standards, flag poles, theater marquees, windmills, rock outcrops and "public art." In a forest setting, an entire fiberglass ranger lookout station could be constructed to conceal a large antenna array.

Stealth siting can be a viable alternative to an outright prohibition on wireless communications facilities in historic or architecturally significant areas where such sites may be unavoidable due to coverage requirements or other concerns.[1]

POLICIES FOR VISUAL AND AESTHETIC COMPATIBILITY

Objective VIS 1: To protect the visual quality of the County by regulating the number, location, and design of telecommunications facilities so that adverse visual effects are eliminated or reduced to the maximum extent possible while allowing for adequate telecommunications services.

Policy VIS 1.1. The cumulative visual effect of telecommunications facilities can be minimized by encouraging the most efficient use of existing sites and facilities and thereby postponing the need to develop new sites.

Program VIS 1.1.1: New sites should be permitted only upon clear demonstration of need, the impracticality of upgrading or expanding an existing site or co-locating on an existing telecommunications structure, and subject to conditions to ensure the new facility minimizes adverse visual effects. The necessity of the proposed facility should be assessed by reviewing the wireless communications site inventory contained in Appendix A, and evaluating a service providers network facilities plan and, if determined necessary, an alternative sites analysis (refer to Program LU 1.4.3 and LU 1.4.4).

Program VIS 1.1.2: Wherever possible, new telecommunications devices should be co-located or clustered at existing facilities and multiple devices consolidated in the course of facility renovation, unless co-location or clustering will result in significant adverse visual effects that could be avoided or minimized by alternative facility locations and/or design.

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[1] On May 29th the FCC ruled that a proposed 480-foot tall, self-supporting FM broadcast tower in Bronx, New York, would adversely affect the nearby historical New York Botanical Garden. Specifically, the Commission concluded that the tower would "...introduce a visual element out of character with the property and its setting under 36 C.F.R. 800.9." Although commercial wireless facilities are smaller, the FCC decision suggests they would be less likely to supersede local action based on similar concerns.

Program VIS 1.1.3: New facilities or modifications to existing facilities should be reviewed for potential consolidation or co-location of existing and proposed antennas, towers or tower sites, sharing of ancillary facilities and/or use of engineering techniques to make the most efficient use of transmitters, towers and antennas. The potential for co-locating a proposed facility should be assessed by reviewing the wireless communications site inventory contained in Appendix A, and evaluating a service providers network facilities plan, and, if determined necessary, an alternative sites analysis (refer to Program LU 1.4.3 and LU 1.4.4).

Program VIS 1.1.4: To minimize visual effect, service providers should be encouraged to share facilities to the greatest extent possible. Joint use should be strongly encouraged within multiple antenna sites, including buildings, access roads, parking areas, utilities, towers and antennas.

Objective VIS 2: To ensure that new telecommunications facilities or modification of existing facilities are sited, designed and built in a manner which minimizes visual effects to surrounding areas.

Policy VIS 2.1. The sites of new telecommunications facilities or substantially modified ones should be selected to minimize potential visual effects.

Program VIS 2.1.1: To the greatest extent feasible, all telecommunications facilities should be sited below visually prominent ridgelines. If determined necessary by the County review authority, an alternative sites analysis should be used to evaluate potential telecommunications sites situated below visually prominent ridgelines (refer to Program LU 1.4.4).

Program VIS 2.1.2: Multiple telecommunications facilities including buildings, towers and antennas should be co-located or clustered rather than scattered along a ridgetop or hillside to the extent feasible given the need to minimize radio frequency interference. In wooded hillside areas, a greater scattering of facilities may be appropriate to minimize the visibility of a larger co-location facility or cluster of multiple facilities (e.g., antenna farm).

Program VIS 2.1.3: A visual analysis of telecommunications facilities that could have a significant adverse visual effect shall be submitted with the application materials to assess the proposed facility at design capacity. The visual analysis shall include a photo-montage or photo-simulation, and/or poles or other similar device erected at the proposed facility site. The visual analysis shall address views of the proposed facility from public vantage points and private property if determined necessary by the County review authority. The visual analysis shall also depict cumulative conditions by including information on existing, approved, and proposed telecommunications facilities that will or may eventually be approved at the proposed site. The visual analysis may be expanded to address alternative locations within the coverage area.

Policy VIS 2.2. Buildings, towers and antennas should be located on each site and designed in a manner which minimizes visual effects.

Program VIS 2.2.1: Telecommunications support facilities such as vaults and equipment rooms, utilities and other support structures should be placed underground, depressed, earth bermed, or sited below ridgelines or other significant public line of sight to the greatest extent feasible particularly in areas of high visibility where other visual screening techniques are inappropriate to the project area or cannot be successfully implemented. Earth berming and other topographic alterations should be compatible with the surrounding natural topography and not block significant public views. All facilities should visually blend with the surrounding natural and built environments.

Program VIS 2.2.2: Due to their high visibility, dish and parabolic antennas should be located at as low an elevation as possible without compromising the function of the device, preferably on the sides of buildings or ground mounted on slopes below the ridgeline wherever possible, rather than elevated on towers.

Program VIS 2.2.3: Utilities extended to service telecommunications sites shall be undergrounded or placed within existing or proposed structures to eliminate their visibility.

Program VIS 2.2.4: Telecommunications facilities, particularly equipment buildings, should be located below the ridgeline or other significant public line of sight wherever possible.

Program VIS 2.2.5: Telecommunications towers should be the minimum height required to permit the services proposed for that location and services that could co-locate at that location in the future without causing significant adverse visual effects. The proposed maximum height of a tower, monopole or other support structure may be confirmed through an independent analysis or peer review of technical information submitted by the service provider.

Program VIS 2.2.6: Microwave dishes within the regulatory purview of the County should be closely regulated, particularly in urban areas, to minimize their visual effects through appropriate siting, design, materials, and colors as recommended herein.

Program VIS 2.2.7: In order to minimize visual effects, guyed towers for major telecommunications facilities should be used instead of self-supported towers to minimize the size of the site, to minimize the need for screening from adjacent properties, or to reduce the potential for bird strikes in migratory pathways or significant flight paths used by local bird populations, except where self-supported towers are required to provide the height and/or capacity necessary for the proposed telecommunications uses.

Program VIS 2.2.8: The placement of towers, equipment buildings, etc. within a particular site should avoid or minimize encroachment into scenic views or otherwise cause adverse visual effects, particularly from any adjacent residential development or public viewpoint.

Program VIS 2.2.9: Antennas and other equipment should be integrated into an existing or proposed non-communications structure or co-located on an existing structure rather than on a new stand-alone structure whenever possible, provided that it does not significantly increase adverse visual effects of the facility.

Program VIS 2.2.10: When a new stand-alone structure is necessary, a monopole should be used for commercial wireless and other minor telecommunication facilities except where another type of support structure (e.g., lattice or guyed tower) must be used to provide necessary structural support or to minimize adverse visual effects. The height of the monopole or tower should be the minimum necessary for the proposed service and for other services that could co-locate on the tower. In appropriate situations, a monopole or tower could be required to resemble a natural feature or less obtrusive built feature that is consistent with the visual character of the surroundings.

Program VIS 2.2.11: Telecommunications facilities located on or adjacent to water tanks and other public utility or public service facilities shall be sited to minimize their visibility to the maximum extent feasible, particularly where existing public utility/service structures are sited within or adjacent to designated open space or other scenic areas. Public utility and other existing structures should be used to screen the telecommunications facility from off-site vantage points. Telecommunications facilities should be clustered and designed to appear as part of the existing public utility/service structure, including but not limited to materials and colors that visually blend with the predominant visual backdrop. Where appropriate, other site-specific development standards should be implemented in connection with Design Review for a proposed telecommunications facility site.

Program VIS 2.2.12: Building-mounted telecommunications facilities shall be sited and designed to appear as an integral part of the structure or otherwise minimize their appearance, such as by being screened from view or being placed above the pedestrian line-of-sight on a secondary facade. Roof-mounted facilities should be clustered in one area and set back from the edge of the roof, unless an alternative facility design will further minimize visual impacts, or hidden behind a parapet or screen to minimize visibility from street-level locations.

Program VIS 2.2.13: The County shall encourage equipment for a wireless communications facility to be enclosed in an existing structure or placed underground.

Program VIS 2.2.14: Accessory structures containing equipment for wireless communications facilities shall reflect the predominant architectural style(s) of the surrounding area and shall visually blend with the natural and built environments. The

materials, colors, and design of fences erected around the perimeter of the wireless site shall also reflect the natural and built environments of the surrounding area.

Program VIS 2.2.15: Wireless communications facilities should be permitted on historically or architecturally significant structures if there are no other available support structures or site locations that will avoid or reduce potential adverse visual effects and if the facilities are integrated with the structure or its setting so it is not visually inconsistent to a casual observer from a prominent vista or significant public corridor.

Policy VIS 2.3. The colors, materials, and lighting of towers, antennas and buildings shall be selected to minimize visibility as follows, unless specific colors or lighting are required by Federal or State agencies.

Program VIS 2.3.1: Materials used for equipment buildings and other telecommunications structures should be compatible with the surrounding natural and built environments. No advertising signage or logos shall be displayed on telecommunications facilities except for small identification plates used for emergency notification.

Program VIS 2.3.2: Telecommunication facilities should be painted to blend with the landscape or visual backdrop against which they will be seen.

Program VIS 2.3.3: Telecommunication facilities which will be primarily viewed against soils, trees or grasslands should be painted colors matching these landscapes.

Program VIS 2.3.4: Telecommunication facilities which rise above the horizon line should be painted in non-reflective blues or grays.

Program VIS 2.3.5: The mountings of antennas should be nonreflective and the appropriate color to blend with their background.

Program VIS 2.3.6: Microwave and satellite dishes within the regulatory purview of the County should be of mesh construction wherever possible.

Program VIS 2.3.7: The use of exterior lighting shall be permitted for safety purposes only and shall be manually operated (i.e., kept off except during nighttime maintenance activities), low wattage, hooded, and directed downward to minimized visual effects.

Program VIS 2.3.8: Tower lighting required by the FAA should, to the greatest extent feasible, be shielded or directed to minimize glare as viewed from off-site locations.

Policy VIS 2.4. Landscaping shall be used to minimize and mitigate visual effects of telecommunications facilities.

Program VIS 2.4.1: Vegetation adjacent to the disturbance area for a telecommunication facility shall be protected from construction effects by fencing. Applicants for telecommunications facilities may be required to submit a tree protection plan with construction permits to demonstrate compliance with this program. Vegetated areas disturbed during construction should be replanted to minimize erosion and to enhance the natural aesthetics of the site.

Program VIS 2.4.2: Landscaping to screen telecommunications buildings, towers and antennas should be required particularly for sites adjacent to or in developed areas. For a wireless communications site adjacent to residential uses, landscaping should be selected and situated to maximize screening of the site from those residences. However, the performance of antennas should not be impeded by plantings. This needs to be taken into consideration in the development, review and approval of landscape plans.

Program VIS 2.4.3: Applications for telecommunications facilities shall include a landscape plan that shows existing vegetation to remain and to be removed entirely or in part (i.e., trimming), and indicates the location, species type, and size of vegetation proposed for planting. Proposed landscaping shall be consistent with the predominant existing vegetation in the area and should consist of native, evergreen, and drought tolerant species unless other species are approved for the purpose of maximizing the amount of screening as soon as possible.

Program VIS 2.4.4: Applicants for telecommunications facilities may be required to enter into a landscape performance and maintenance agreement with the County to ensure the installation and long-term survival of required landscaping. The agreement shall include a financial security and shall be effective for a duration sufficient to ensure survival of the vegetation.

Policy VIS 2.5. The access roads to telecommunications facilities, particularly on ridgelines, should be subject to evaluation to minimize their visibility.

Program VIS 2.5.1: To the extent possible, new telecommunication sites should take access over existing fire roads or other existing roads or drives to avoid the visual effects of a new roadway.

Program VIS 2.5.2: The proposed access to expanded or new sites shall be evaluated to ensure that new roads are permitted only when no existing ones are available and suitable. New roads in agricultural and other rural areas should have the minimum width necessary to satisfy access and safety requirements.

Program VIS 2.5.3: Proposed repair and/or maintenance of the access roadway should be evaluated for potential visual effects and mitigations of these effects.

Program VIS 2.5.4: Whenever feasible, parking areas for telecommunications facilities should be shared by different service providers. Parking areas shall be no larger than required to accommodate reasonably likely post-construction traffic volume and shall be situated, designed and landscaped to minimize their visual effect.

4. ELECTROMAGNETIC FIELDS

This section of the Plan Update discusses the issues of human health effects from electromagnetic fields (EMF) and government regulation of EMF exposure. There is considerable public interest in Marin County and elsewhere regarding EMF exposure from telecommunications facilities and its effect on people. This issue has become increasingly controversial due in large part to the proliferation of commercial wireless facilities and continuing health studies on the matter. Local government control over EMF emitted by telecommunications facilities has also become controversial because federal law clearly prohibits local agencies from regulating commercial wireless facilities based on EMF if the facility complies with FCC standards for permissible exposure to EMF emissions. Accordingly, the County does not have jurisdiction to regulate the placement, design, or operation of telecommunications facilities based solely on EMF emissions if they comply with the federal standards. The County does, however, encourage service providers to avoid siting new telecommunications facilities in areas where EMF exposure may be of particular concern in order to avoid conflicts over this issue.

Electromagnetic Frequency Radiation and Research About its Effects

A radio frequency (RF) signal consists of EMF that radiates from a transmitting antenna at near the speed of light. The EMF interacts with objects in their path. An object may absorb the EMF completely or partially or the EMF may pass through an object unaffected or re-radiate from an object.

All radio frequency transmitters emit non-ionizing EMF which increases with the strength of the signal. High levels of non-ionizing EMF can produce physical effects on humans, but the threshold of all these effects are still being studied and are the subject of ongoing debate in the scientific community and elsewhere. Experts disagree on how much and under what conditions these effects begin to occur and the significance of the effects.

In the past thirty years, researchers have undertaken thousands of studies addressing the potential human health effects of exposure to non-ionizing energy in EMF. Among the health measures that have been studied are cellular and subcellular systems, hematologic and immunologic systems, reproductive systems and genetics, central nervous system, behavior, cataracts, auditory system, endocrine system, metabolism and growth, cardiovascular system, longevity and mortality, carcinogenesis and mutagenesis, shock, burns, and effects on pacemakers.

Most studies of EMF exposure are on non-human subjects. Because most potential effects of EMF exposure vary considerably with the nature of the subject, effects observed with non-human subjects are not necessarily the same for humans. Epidemiological studies of humans exposed to

high levels of EMF are considered inconclusive because of confounding factors, such as exposure to carcinogens in the workplace. Although some studies indicate EMF at frequencies and power levels used for telecommunications can affect the central nervous system, behavior, auditory system, and carcinogenesis, a causal link has yet to be accepted by the majority of the scientific and medical community.

Based on the research, there are three kinds of potential effects of EMF exposure on humans: thermal effects, non-thermal effects and shock/burn effects.

- Thermal Effects

When an electromagnetic field interacts with an object with high water content, such as human tissue, the energy in that field can induce motion in the cells that comprise the object. The effect of this motion is perceived as frictional heat.

The energy absorbed by a person can cause heating that raises a person's basal metabolic rate or core temperature. If a person's core temperature rises a little, as it does when a person exercises or is ill, the body's thermoregulatory system dissipates the heat with no lasting effect. Increasing core temperature beyond that amount can cause lasting harm or death. High levels of RF energy, in excess of 10,000 milliwatts per square centimeter (mw/cm^2), would cause a body to heat in potentially hazardous amounts. EMF levels due to telecommunications facilities are seldom more than a few mw/cm^2. They cannot cause acute thermal effects.

The relative potential health risk of thermal effects is based on four principal factors:

- Power: The higher the power output of a transmitter or group of transmitters at a site, the greater the likelihood of effects due to EMF exposure, because EMF levels on the ground will tend to be higher.

- Frequency: The potential effect of EMF varies with the frequency of the signal. Humans absorb most energy from frequencies in the 30 to 300 megahertz (MHz) range. Frequencies in this range are called "resonant frequencies." A given effect will occur at lower power in the resonant frequencies. Electromagnetic fields (EMF) that are above and below the resonant frequencies either does not penetrate tissue or penetrates such a small distance that it does not cause heating or other lasting effects.

- Distance: The EMF level associated with a transmitting antenna drops off inversely in proportion to the square of the distance from the antenna, (e.g., increasing distance from an antenna by a factor of three units reduces EMF levels by a factor of nine units). Therefore, to the extent EMFs pose increased risk of harm, that risk dissipates rapidly with distance from the source of the emission.

- Duration of exposure: The potential for health effects from thermal causes will be greater with more prolonged exposure. Residents on or immediately abutting the

site of an EMF source would be expected to have the longest exposure and be subject to greater risks. Full-time on-site workers (eight hours of exposure per day) would have the next highest exposure risk, followed by occasional maintenance workers or members of the general public who might visit the site or abutting land several times a month.

- Nonthermal Effects

When an electromagnetic field interacts with an object with electrical potential, such as human tissue, the energy in that field can affect the tissue or system in which it is a part through means other than heating. Increasingly, scientists and medical researchers have studied these non-thermal effects of EMF exposure. Some studies have linked EMF exposure to changes in calcium ion influx across the blood brain barrier, atypical hormone secretions, behavioral changes, and changes in vision and eye tissue. But the existence of such effects does not mean that they are caused by EMF exposure or that they are significant or adverse to human health.

Reasonable and responsible people continue to be concerned about the potential for adverse health effects due to long-term exposure to low levels of EMF. The scientific and medical community continue to research the issue and to dispute its merits. It is a dispute that goes on far beyond the borders and expertise of local land use agencies in Marin County.

In response to the concern about non-thermal effects from EMF exposure, the County regularly advises telecommunications service providers that it is prudent to site new transmitting facilities in areas that will avoid or minimize the long-term human exposure to EMF in residential neighborhoods and locations where persons may be immunologically compromised such as elementary schools, pre-schools, and hospitals. Although not a regulation, this advisory policy of "prudent avoidance" is intended to avoid or minimize community conflicts over EMF and non-thermal effects. This policy is not intended to regulate the location of new facilities or otherwise replace, modify or supplement the FCC-adopted Maximum Permissible Exposure levels for electric and magnetic field strength and equivalent plane-wave power density.

- Shock/Burn Effects

Radio frequency energy also can cause a burn or shock response in people under some conditions. This burn is caused by an induced current. It is most likely to occur at frequencies in the resonant range or lower (i.e., less than 300 MHz) and particularly in frequencies below 30 MHz.

Recent EMF Emission Standards

In 1992, the Institute of Electronic and Electrical Engineers (IEEE) adopted guides and standards for the safe use and measurement of RF energy recommended by the American Natural Standards Institute (ANSI).[2] The standard is referred to as "ANSI/IEEE C95.1-1992." The standard has different provisions for occupational and general public exposure. There are five frequency ranges within which different Maximum Permitted EMF Exposure levels are permitted, corresponding to human sensitivity. Various means can be used to comply with the EMF standard, including:

- Reducing the effective radiated power of a facility;
- Prohibiting public access to areas exposed to EMF exceeding the standard;
- Posting warning signs in areas exposed to excess EMF;
- Installing shielding on building-based antenna towers;
- Installing reflective material on adjacent building windows;
- Changing the power-to-gain ratio;
- Replacing existing antenna with a more efficient model;
- Optimizing spacing of antenna elements for minimal downward energy; and
- Raising the antenna.

These standards reflect years of research and discussion by leading scientists and practitioners throughout the country about thermal and non-thermal effects. By and large, the wireless communications facilities emit EMF levels that are well below the maximum permissible levels allowed by the FCC standards.[3]

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[2] IEEE is the world's largest technical professional society comprised of more than 320,000 engineers throughout the world. It is a non-profit organization that promotes the development and application of electrotechnology and applied sciences for the benefit of humanity, the advancement of the profession and the well being of its members. ANSI is a non-profit, privately funded membership organization that coordinates development of voluntary natural standards in the United States. Its membership includes more than 1,200 companies, 250 professional, technical, trade, labor and consumer organizations and about 30 government agencies. The County adopted the 1982 ANSI standard for EMF exposure in 1990 as part of the Telecommunications Facilities Policy Plan.

[3] The earth radiates an estimated 0.3 to 0.0003 $\mu W/cm^2$ at frequencies of 30 to 300 GHz. The mean level of RF energy from broadcast radiofrequency sources is estimated to be .001 $\mu W/cm^2$. The US Environmental Protection Agency described population-weighted average exposure levels from RF sources in urban areas calculated from measurements in 15 large cities. The estimated residential median exposure for people in these areas was 0.005 $\mu W/cm^2$ at FM radio and television broadcast frequencies and 0.019 $\mu W/cm^2$ at AM broadcast frequencies (30 Hz - 806 MHz). The report concluded there is negligible background exposure above 806 MHz. On Mt. Barnabe, a new cellular facility in combination with other sources of RF energy on the site was estimated to cause EMF levels on the ground of less than 1% of the amount permitted by IEEE/ANSI C95.1-1992 (i.e., 569 $\mu W/cm^2$ for 869 MHz).

Federal and County Regulation of EMF Emissions

Federal Standard. Section 704 of the Telecom Act expressly preempts local government jurisdiction over EMF emissions from commercial wireless facilities. That section provides:

> No State or local government or instrumentality thereof may regulate the placement, construction and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions.

The FCC has adopted an EMF exposure standard based largely on ANSI/IEEE C95.1-1992 and a similar standard promulgated by the National Council on Radiation Protection and Measurement (NCRP) in 1986.[4] (See Appendix F.) The FCC is considering rules about how to calculate and measure EMF and what local governments can request an applicant to do to show it does or will comply with the FCC standard (refer to footnote 13 at page II-40). In the meantime, the FCC decides on a case-by-case basis whether local requirements impede siting commercial wireless facilities and whether local EMF regulations are inconsistent with the Telecom Act or FCC rules implementing it.

County Standard: The County presently cannot do more with regard to regulation of EMF emissions than the FCC rule allows. Given the low levels of EMF emissions typical of commercial wireless facilities, the County will not regulate EMF emissions from such facilities that do or will comply with the FCC rule.[5] However, the County has adopted the FCC standard as its own and requires an applicant to demonstrate that a proposed communications facility, in combination with other sources of emissions, will not exceed that standard. The County may also require verification of calculated EMF levels by field testing after the facility is constructed.

The County also supports public and private research efforts by allowing for the adoption of a different exposure standard if the FCC revokes or changes its rule, or if Congress relaxes federal preemption of the issue.

County Review Process: Transmitters operating at power levels of 1,000 watts or more, particularly in the resonant frequencies between 30 MHz and 300 MHz, pose a greater risk due to EMF emissions than lower-powered facilities, and should be subject to discretionary permit review process (e.g., Use Permit and/or Design Review) to determine their acceptability and conditions of operation. Applications for modifications at existing telecommunications sites or the development of new sites should include information on proposed power levels and frequencies in order to determine if discretionary review should be required.

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4 NCRP is a non-profit organization chartered by the United States Congress to provide government, the public, and industry with recommendations and guidance concerning human exposure to ionizing and non-ionizing radiation.

5 The FCC categorically exempts from NEPA transmitters located 10 meters or more off the ground (other than on a rooftop), or if the total power of all channels is not more than 1,000 watts ERP (cellular, certain SMRs and narrowband PCS) or 2,000 watts ERP (broadband PCS). A facility must comply with the FCC limits whether or not categorically exempt from NEPA.

Where a discretionary permit is required, the permit application materials should include projected EMF exposure levels caused by the proposed facility in combination with other significant sources of EMF in the vicinity. If a new source combined with existing EMF sources would cause field strengths or power densities exceeding the allowable standard at ground level at the nearest point to which the general public has access, the source would violate the FCC standard, and the permit application should be denied, consistent with that standard, or approved subject to conditions under which compliance with the standard is assured.

Radio frequency energy is affected by objects and topography that contribute some uncertainty in the calculation of EMF levels for a new transmission source. As a safety check, where predicted levels of EMF are greater than one-third of the allowable standard at the point(s) where the public has the closest access to the antennas, EMF levels should be measured in the field at such point(s) after the new source is constructed but before the permit allows it to operate. If the measurements show EMF levels exceed the standard, the permit should be suspended or altered to ensure compliance.

Methods of Calculating and Measuring EMF: Calculations of EMF should be done in accordance with methods that have been field tested to assure that the methods result in accurate predictions. Currently, the best methods are published by the Office of Science and Technology (OST) based on work by the U. S. Environmental Protection Agency. The accuracy of these methods has been verified by measurements in the field. The OST manual is being updated to reflect changes warranted by technology, the Telecom Act and FCC rules. The County should follow closely the rulemaking process at the FCC, and be prepared to amend implementing regulations and informational guides accordingly.

Unless the FCC provides otherwise, the methods in the OST manual should be used to predict EMF levels until the County finds alternative methods that are at least as accurate. These methods can predict the electric and magnetic field strengths and equivalent plane-wave power density on the ground at a given distance from a given antenna transmitting at a given power.

The OST has graphed these relationships for specific antennas to make it easy to implement EMF standards. The graphs do not deal with a site where more than one source of EMFs is transmitting at the same time. In that case, the separate contribution of each source in the frequency range in question can be computed separately and the results added to create a conservative composite.

Sometimes, the calculations need to be checked in the field, or measurements are necessary to establish existing EMF levels. Field measurements of EMFs take skill, experience, time and the proper tools. Two kinds of tools are commonly used to measure EMF levels:

> A broadband meter - is used to measure the total field from all sources in all directions, and can measure ambient EMF levels down to as little as a few microwatts per centimeter. Although a broadband meter does not distinguish between frequencies, it can show whether ambient EMF levels in the area of a proposed or problematic facility warrant more detailed and expensive measurements using a narrow band meter or spectrum analyzer.

A narrow band meter - can measure the amount of energy contributed in each frequency where two or more telecommunications facilities have transmitters near each other.

Other tools may be needed to measure accurately radio frequency energy levels caused by microwave facilities, including a spectrum analyzer, calibrated horn antennas, and waveguides.

Care must be taken to avoid inducing errors due to the misuse of equipment or the failure to adapt to surrounding conditions. Many kinds of errors can be caused, particularly if measurements are made near metal objects that can re-radiate energy, creating the appearance EMF levels are higher than they are in fact.

In a complex radio frequency environment, measurements can be verified by using more than one tool. Different kinds of probes, attenuators, and antennas may be needed to enable each tool to work in a given environment. Also, to avoid errors about the energy emitted by a given source in a multiple-source environment, other transmitters in the area may have to be turned off.

Because of the technical nature of EMF calculations and measurements, the County should require applicants to provide for independent, peer review of calculations and measurements when warranted.

POLICIES FOR ELECTROMAGNETIC FIELD (EMF) EMISSIONS

Objective EMF 1: To avoid or minimize community conflicts over the potential adverse health effects from new commercial wireless and other telecommunications facilities by the prudent avoidance of locating such facilities in close proximity to areas where persons will be exposed to pro-longed electromagnetic frequency (EMF) emissions.

Policy EMF 1.1. The County should regularly advise service providers that it is prudent to avoid siting new transmitting facilities where prolonged EMF exposure will be experienced in residential neighborhoods and other locations where persons may be immunologically compromised such as elementary schools, pre-schools, senior facilities, and hospitals. This advisory policy of "prudent avoidance" is intended to avoid or minimize the degree of community conflict that can arise when telecommunications facilitates are located in residential and other areas where prolonged exposure to EMF occurs. This advisory policy may also facilitate the approval of new commercial wireless and other telecommunications facilities by reducing or avoiding the potential for a protracted decision-making process that can occur as a result of the controversy over EMFs and non-thermal effects. This policy is advisory only and is not intended to regulate the location of new facilities, deny a proposed facility, require site modifications or otherwise replace, modify or supplement the Maximum Permissible Exposure levels for electric and magnetic field strength and equivalent plane-wave power density in the EMF emission guidelines adopted by the FCC.[6]

6 47 CFR 1.1310.0. See Appendix D for a copy.

Objective EMF 2: To ensure that new sites or modification of existing telecommunications facilities are sited, designed, and built in a manner which minimizes potential health risks from electromagnetic field (EMF) radiation.

Policy EMF 2.1. The County shall ensure a proposed new or modified telecommunications facility will not cause electromagnetic field (EMF) strengths or equivalent plane-wave power densities in excess of the Maximum Permitted Exposure levels for electric and magnetic field strength and equivalent plane-wave power density in the EMF emission guidelines adopted by the FCC. [6]

Program EMF 2.1.1: The County should apply the Federal Communications Commission's EMF emission guidelines[6] as the County standard for evaluating potential adverse health risks from EMFs unless and until the FCC and other appropriate Federal or State agency provides otherwise and the County adopts a different standard.

Program EMF 2.1.2: Applications for modifications that could increase EMF levels at existing telecommunications sites or the development of new sites shall include a site specific report on existing and predicted electric and magnetic field strengths or equivalent plane-wave power density levels for the relevant frequency range(s) at the closest point(s) of public access. The report shall demonstrate whether the proposed facility, in combination with other existing sources of EMF in the affected area, will not cause EMFs to exceed the Maximum Permitted Exposure level.

Program EMF 2.1.3: EMF reports shall be prepared by a qualified radio frequency engineer based upon superior methods of calculation of EMF levels as they may be improved in the future.

Program EMF 2.1.4: A Use Permit, Design Review, or other discretionary permit application for a new source of EMF should be denied where calculations show that the new source combined with existing sources would expose members of the general public to EMF in excess of the Maximum Permitted Exposure level. In the event the FCC adopts a more restrictive Maximum Permitted Exposure Level, or the County adopts a more restrictive EMF exposure standard if allowed by future changes in Federal law, the service provider shall be required to demonstrate compliance with the more restrictive standard unless such a requirement is preempted by State or Federal law. If the service providers cannot demonstrate compliance with the more restrictive standard, the discretionary permit should be revoked unless revocation is preempted by State or Federal law.

Program EMF 2.1.5: Where the actual or predicted level of EMF are more than one-third of a Maximum Permitted Exposure level (in the relevant frequency range) where the public has nearest access to the EMF-emitting equipment, or when changes in a facility not otherwise regulated by the County could increase EMF levels significantly, the County should require the independent preparation or peer review of the following information: a) measurements of the predicted and/or actual EMF levels at the closest

point to which the public has access to a facility before taking discretionary action on the permit request; b) measurements of the actual EMF levels at the closest point to which the public has access to a facility after the facility is constructed but before it becomes operational on a permanent basis; and c) periodic EMF monitoring reports after the approved facility is constructed and operational to verify ongoing compliance with applicable EMF standards.

Program EMF 2.1.6: Safety standards shall be required, where appropriate, to protect persons working in areas that are not accessible to the general public who might be exposed to EMF levels in excess of the Maximum Permitted Exposure Level adopted herein. Such standards may include restricted access to telecommunications facilities, temporarily ceasing operating of the facility for work required within specified distances of antennas, and posting safety signage in compliance with FCC requirements. Safety standards shall be recommended in EMF reports required by Policy EMF 2.1.2 above.

Program EMF 2.1.7: Signage notifying persons about the presence of EMF-emitting telecommunications facilities should be required in open space areas accessible to the public where such facilities may be inconspicuously sited and/or designed and unnoticeable to the casual observer. Signage shall be subject to review and approval by the County in consultation with the Marin County Open Space District staff where appropriate.

5. PUBLIC SAFETY

There are three principle safety-related issues for wireless communications facilities: structural safety, access, and maintenance.

Structural Safety

An antenna, its attaching members and its supporting structure can pose hazards to public safety like any other structure and its parts. It can fail due to design errors, faulty materials, poor workmanship or fabrication, accidents, vandalism, lack of maintenance or natural hazards. Such failures, however, are rare.

The potential for failure can be reduced by subjecting building permits for telecommunications facilities to the latest building and industry codes. The latest update to the RS-222-C standards by the Telecommunications Industry Association and Electronics Industry Association is TIA/EIA-222-F "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures."

Access

It is in the service providers interests to ensure a wireless communications facility is secure by design. Most stand-alone sites are fenced or surrounded by bollards. Fences prevent casual pedestrian access to a tower and equipment, but can have an industrial visual quality (e.g., chain link).

Bollards present a less industrial appearance, such as where a wireless communications facility is integrated with other public utilities or art. They protect against vehicles but not against casual pedestrian access. When such access exists, additional attention to safety is warranted in the design review process. Rooftop sites also may be fenced depending on the accessibility and sensitivity of the installation. Building-mounted sites typically are not readily accessible.

A tower may attract unauthorized climbers. There are a variety of ways to secure a tower against unauthorized access, such as anti-climbing devices and elevated ladders. These measures should be required as a precaution where public access is possible.

Equipment for a typical wireless communications facilities is combined into a small building or one or more vaults. These fully enclosed structures generally protect against casual or imprudent contact with the equipment or exposure to electrical hazards. Underground utilities for a wireless communications facility pose no particular hazard if installed consistent with codes.

Maintenance

It is in the service providers' interest to maintain a tower, given its relatively high initial cost. On rare occasions, connectors have failed due to lack of maintenance. The County should encourage necessary maintenance of the structural safety of wireless communications facilities, as it does for all structures. But administration and enforcement of regulations requiring approval and execution of a maintenance program or the like for each facility is not warranted by the magnitude of the risk of such failure. Service providers' interest will suffice for structural safety.

POLICIES FOR PUBLIC SAFETY

Objective PS 1: To ensure that new facilities or modifications of existing telecommunications facilities provide adequate structural integrity as well as protection from fire hazards and vandalism.

Policy PS 1.1. Telecommunications facilities should be designed and built in compliance with applicable building code and TIA/EIA-222-F "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures" and its amendments and revisions.

> Program PS 1.1.1: Service providers should be required to submit a report from a professional engineer describing the tower structure, including the number and type of antennas it is designed to accommodate and the basis for calculation of capacity, and

demonstrating that it complies with applicable structural standards. This information should be submitted with applications for building permit.

Policy PS 1.2. Each site shall be designed and constructed to prevent unauthorized access and vandalism.

Program PS1.2.1. The design of telecommunications sites should include specific features to prevent unauthorized access and vandalism. Such features may include, but not be limited to fencing, anti-climbing devices, elevated tower ladders, and security monitoring by electronic means or personnel.

Policy PS 1.3. Towers should be regularly checked and maintained by service providers to keep them in a sound and safe condition until the towers are dismantled and removed from the site.

Policy PS 1.4. The towers should be designed so that in the event of failure they will fall within the fenced portion of the site and/or away from adjacent development to the extent feasible.

Program PS 1.4.1: Structures should be set back from nearby towers and from adjacent parcels or public property or street to the extent feasible.

Policy PS 1.5. Towers should be adequately spaced so that the failure of one tower will not cause adjacent towers to fall, provided that clustering of more than one tower is appropriate pursuant to policies of this Telecommunications Plan.

Policy PS 1.6. Fire and safety hazard reduction around the facility should be accomplished in accordance with applicable laws, regulations, orders, and ordinances.

Program PS 1.6.1: Buildings should be equipped with a fire suppression system to prevent the spread of fire in the hillsides.

Program PS 1.6.2: Telecommunications sites should be landscaped with drought, wind and fire resistant plants. Applications for new and/or expanded facilities shall provide landscaping plans that detail planting and indicate how landscaping will be watered until it is established. Refer also to landscape plan requirements in Policy VIS 2.4.

Program PS 1.6.3: Service providers and owners of property on which telecommunications facilities are located should be required to dismantle and remove antennas, towers and accessory structures which have been inoperative or abandoned for one year unless the service provider requests an extension of time to propose or allow future reuse of the inoperative site for a future telecommunications facility. Service providers may be required to post a bond or other suitable security as a condition of a County permit in order to guarantee removal of abandoned structures.

Program PS 1.6.4: Applications should be conditioned to prohibit smoking and require proper disposal of smoking materials at telecommunications facilities in fire hazardous or wildland areas.

Program PS 1.6.5: Applicants for facilities in fire hazard or wildland areas shall be required to submit a lands management plan detailing proposals for removing and controlling brush at a telecommunications site.

Policy PS 1.7. Earthquake standards for telecommunications facilities shall ensure that communications will be maintained in the event of an earthquake.

6. OPERATION OF TELECOMMUNICATIONS FACILITIES

Telecommunications facilities may cause noise, traffic and parking effects and radio frequency interference, and they require maintenance for more than public safety reasons.

Noise: Noise may result from the testing or use of backup generators or from air conditioners. Power cells can be used in place of generators in some applications. Wind blowing through a guyed tower or through the framework of a lattice tower also may cause noise.

Traffic: Post-construction traffic typically consists of a maintenance vehicle once every week or two. If care is taken to avoid land use and visual incompatibility, vehicular traffic associated with maintenance and operation of a facility has negligible impacts.

The County can regulate noise emissions and can require adequate access to and parking at telecommunications facilities using clear and objective standards. Access and parking improvements for such a low volume of vehicle trips should not increase the visual and natural resource effects from development and use of the site. Noise producing equipment, such as generators or air conditioners, should be sited and/or insulated to minimize noise effects for adjacent properties and comply with noise guidelines in the Countywide Plan Noise Element.

RF Interference: Telecommunications facilities can cause radio frequency interference, particularly high-powered broadcast services. Typically lower-power facilities, such as for commercial wireless services, have less potential for such effects. Interference can be reduced or eliminated by installing appropriate filters on transmitting and/or receiving equipment, by combining transmitters with multiplexing and common antennas, by separating receiving and transmitting devices, or by using natural topographic features to shield one facility from the transmission of another nearby facility.

The FCC has exclusive jurisdiction over RF interference. FCC rules require broadcast licensees (i.e., service providers) to satisfy at no cost to the consumer most types of interference complaints received by the licensee within a year after the license is issued. Thereafter, a licensee must provide information and help complainants remedy interference with consumer devices. Mobile receivers and non-radio frequency devices such as tape recorders and hi-fi amplifiers are not protected by the FCC rule. Often interference can be corrected by shielding or filtering the consumer device or by altering the energy patterns of transmitting equipment.

While the County is precluded from regulating radio frequency interference, it is not restricted from helping to facilitate remedies to reduce interference. To the extent radio frequency interference impedes co-location of commercial wireless facilities, it is in the County's interests to help remedy those problems to reduce the number of facility sites in the County.

Maintenance: Because of the importance of landscaping to mitigating visual effects, a telecommunications facility operator should be required to maintain and irrigate required landscape materials as needed to ensure their survival and to replace them if they do not survive.

Some wireless facilities present unique maintenance needs. For instance, plastic bark and leaves on some tree-look-a-like towers have degraded in sunlight and fallen off creating a potentially hazardous roadside mess and negating the mitigating value of the faux materials. When a service provider proposes an innovative approach to siting a wireless communication facility, local agencies should determine whether it creates specific maintenance needs to prevent public safety hazards or to assure that visual mitigation or other policy objectives are successfully implemented over the life of the facility.

POLICIES FOR TELECOMMUNICATIONS FACILITY OPERATION

Objective OI 1: To ensure that the potential effects from the operation of a telecommunications facility for adjacent uses or other telecommunications facilities are minimized.

Policy OI 1.1. Development approval for expansion or establishment of new sites should include mitigation for traffic and noise effects.

Program OI 1.1.1: Adequate employee parking should be provided within the telecommunications site.

Program OI 1.1.2: The siting and design of telecommunications facilities shall be consistent with the objectives, policies, and programs of the Countywide Plan Noise Element. In particular, noise producing equipment should be sited and/or insulated to minimize noise effects on adjacent properties consistent with the guidelines in the Countywide Noise Plan Element.

Program OI 1.1.3: Guyed towers or lattice towers should not be located in close proximity to residential areas if the noise generated by wind blowing through the tower will exceed the guidelines in the Countywide Plan Noise Element.

Program OI 1.1.4: The County may require a noise assessment, if determined necessary, to verify whether the location, design, or operation of telecommunications facilities will comply with the Countywide Plan Noise Element.

Program OI 1.1.5: In residential areas, traffic to and from telecommunications sites should be limited to the minimum number of vehicle trips required for routine

maintenance, testing, and emergency repairs. The number of vehicle trips associated with routine maintenance and testing may be prescribed a condition of project approval.

Policy OI 1.2. The County should encourage efforts, such as the non-interference agreement being promoted among the Big Rock Ridge operators, to reduce radio frequency interference and encourage site operators to cooperate in such agreements where sites are located near one another.

V. IMPLEMENTATION

V. IMPLEMENTATION

1. IMPLEMENTATION OF THIS POLICY PLAN

The basic actions required to implement the policies and programs of this Telecommunications Plan are to:

- Adopt this Telecommunications Plan.
- Amend Title 22 (Zoning) to revise permit requirements and criteria that provide procedural incentives for preferred facility locations (e.g., co-location) and innovative design.
- Maintain a data base of telecommunications sites and disseminate that data for use in identifying potential co-location and clustered sites for new telecommunications facilities throughout Marin County.

2. REVIEW PROCESS FOR TELECOMMUNICATIONS FACILITIES

Network Facilities Plan Review

The County has a strong interest in becoming fully informed about the various technical and planning aspects of telecommunications systems, particularly wireless communications services, and the long-term effects of developing new telecommunications facilities in Marin County. It is beneficial in this regard for service providers to submit as much information as possible about the type of service they are proposing to operate and a comprehensive plan of their facilities network. This information should be reviewed by the County prior to taking action on permit applications for site-specific facilities so that decisionmakers, interested agencies, and the public have a clear and complete understanding of the service providers' "big-picture" plan and how individual facility sites relate to their network as a whole. Subsequent decisions on site-specific facilities should be based on their conformance with this Telecommunications Plan and other applicable policies and standards.

Discretionary Review

To promote consistent decisions for telecommunications proposals, efficient use of available resources, and common approaches to addressing and resolving land use issues and concerns, telecommunications facilities should, to the extent possible, be regulated using the same procedures and approval standards throughout the jurisdictions of Marin County.

The particular procedure that applies, and the amount of discretion in the applicable approval standards, should be proportionate to the likelihood and significance of the potential adverse impacts of the facility. The greater the likelihood and more significant the potential impacts, the greater the amount of review and discretion in the approval standards.

The three levels of discretionary review applied by the County to telecommunications facilities are Master Plan, Use Permit with concurrent Design Review, or Design Review only. In addition, telecommunications proposals that are minor and incidental may be exempt from discretionary review. The County must also conduct environmental review for telecommunications proposals within the unincorporated areas of Marin in accordance with the California Environmental Quality Act (CEQA). The County's specific procedures for conducting environmental review are established in the Marin County Environmental Impact Review (EIR) Guidelines.

The basic levels of discretionary review that should be applied by the County for telecommunications proposals are described below. The following procedures pertain only to the unincorporated County jurisdiction and may not reflect the administrative process or zoning nomenclature used by cities or towns.

A. Master Plan/Use Permit and Design Review

Unless otherwise indicated below, all telecommunications proposals should be subject to: 1) Master Plan; or 2) Use Permit with concurrent Design Review. A Master Plan should be required for development of new major facilities or substantial modifications to existing major facilities. What constitutes substantial modification to an existing facility is determined on a case-by-case basis taking into consideration the setting of the facility site, the size and scale of the proposed modifications, the land use issues surrounding the proposal, and other site specific factors that may be relevant. Master Plans must be acted on at noticed public hearings by both the Planning Commission and Board of Supervisors.

Use Permit with concurrent Design Review should be required for development of new minor facilities (e.g. commercial wireless facilities) or substantial modifications to existing minor facilities. Applications for Use Permit with concurrent Design Review can be acted on at public hearings by either the Planning Commission or Deputy Zoning Administrator, and are subject to appeal to the appropriate decisionmaking body.

The review processes summarized above provide for detailed evaluation of a telecommunications proposal, including environmental review pursuant to CEQA, and consideration of issues and concerns from the public and interested agencies through public notice and hearings.

The County also has the authority under these processes to impose conditions of approval to ensure compliance with County policy and standards, or to deny a proposed facility if it is inappropriately sited or if its adverse effects cannot be reduced to an acceptable level. Master Plans and Use Permits allow the County to regulate the ongoing operational aspects of telecommunications facilities, if warranted, and can be used to require periodic permit review and/or renewal to evaluate future changes in policies, physical circumstances in the project area, or telecommunications technology.

B. Design Review

Design Review (without concurrent Use Permit) should be required for commercial wireless and other minor facility proposals that promote the location and design standards of this Telecommunications Plan and are otherwise generally considered to be appropriate in terms of scale and character. In these situations, Design Review is appropriate to determine compliance with policies and development standards, and to provide a procedural mechanism for imposing conditions of approval that implement such policies and standards. Design Review proposals may be acted on administratively by the Community Development Director without a public hearing, although the Director may refer Design Review proposals to the Planning Commission if important policy questions or substantial public controversy arise during review of the proposal. Decisions on Design Review proposals are also subject to appeal. The types of facilities that are typically subject to Design Review include:

- New facilities in a commercial or industrial zone;
- New co-located facilities; and
- New minor facilities with antennas that are architecturally integrated with an existing or proposed public facility, commercial, industrial, or agricultural building (e.g., stealth design).

C. Exempt Projects

Some telecommunications projects have little or no potential for impacts and should, therefore, be exempt from additional review and requirements. The types of facilities that are typically exempt include minor modifications to existing approved telecommunications facilities, including, but not limited to replacement of antennas or other equipment with different or upgraded technologies where no new significant land use or environmental issues are present.

As discussed in Chapter 2, Marin County's land use control over a particular project may be preempted in whole or in part by Federal or State agencies. However, the County and cities and towns in Marin may be able to pursue the objectives of this Telecommunications Plan through informal means, such as commenting on applications before the CPUC or FCC. In order to comment on applications where preemption may occur, local agencies must actively seek information on pending applications, review applications for projects to be located in Marin County, and submit written comments where appropriate.

Procedural Incentives

The County and other local agencies also can promote good wireless facility design by recognizing it when it occurs. The County's review process implements this objective by conducting Design Review only (i.e., not requiring Master Plan or Use Permit), for wireless communications proposals that are co-located, located at preferred sites (i.e., industrial or commercial properties), or have effective stealth designs. Limiting the discretionary review

process in this manner will mean lower permit application fees, and more importantly to service providers, an expedited review process because public hearings are normally not required for Design Review proposals.

POLICIES FOR THE REVIEW PROCESS

Objective RP 1: To establish an effective planning and permitting review process for telecommunications facilities which accords a greater level of review to projects with potentially greater impacts.

Policy RP 1.1. Prior to making a decision on a site-specific telecommunications proposal that is part of a larger network or system, the service provider shall submit to the County information that sufficiently describes the nature of the proposed telecommunications service and technology and a long-range network facilities plan showing the existing, proposed, and planned future facility sites and separate coverage areas for such sites as can be reasonably predicted (refer to Program LU 1.4.3). This information should be considered by the appropriate decisionmaking body prior to acting on a permit request for a site-specific facility that is part of the overall network or system.

Policy RP 1.2. Telecommunications facilities should be regulated using uniform procedures and development standards throughout the unincorporated area of Marin County regardless of the zoning districts where the facilities are located, provided that proposals for telecommunications facilities may be subject to different review processes and/or standards depending upon project-specific factors pertaining to the proposed facility site, facility design and location, intensity of use, and degree of compatibility with surrounding land uses

Policy RP 1.3. The level of discretionary review for a proposed telecommunications proposal should correspond to the degree of potential impact and the significance of land use issues arising from the proposal. Incentives for telecommunications proposals that implement the location and design policies of this Telecommunications Plan should be provided by limiting the administrative processing time and permit fees for such proposals. The level of discretionary review shall be determined by the Community Development Director or other appropriate County decisionmaking authority.

> Program RP 1.3.1: Unless otherwise specified by Program RP 1.3.2 or RP 1.3.3 below, proposed telecommunications facilities shall be subject to Master Plan or Use Permit with concurrent Design Review requirements in order to provide sufficient discretionary review and a mechanism of imposing conditions of approval and necessary mitigation measures.

Program RP 1.3.2: Design Review only (i.e., Master Plan or Use Permit waived) should be required for proposed telecommunications projects that implement the following policy objectives:

a. Co-location;

b. Locating new minor telecommunications facilities at preferred commercial or industrial sites; and

c. Implementing stealth design for a new minor telecommunications facility.

Design Review should be required for these types of proposals to determine compliance with discretionary development standards such as siting, landscaping, colors, etc., and to solicit community input on the proposal prior to the County's decision on the permit application. The determination regarding whether a particular telecommunications proposal qualifies for Master Plan or Use Permit waiver (i.e., only Design Review required) should be made by the Community Development Director after initial review of a complete development application. This determination should also be based on the extent to which the service provider has consulted with the affected community prior to submittal of the Design Review application as recommended by Policy RP 4.3.

Program RP 1.3.3: Telecommunications facility proposals that have little or no potential for impacts should be exempt from discretionary review, including but not necessarily limited to replacement of existing approved antennas, transmitters, or other equipment with new or upgraded technology that is substantially consistent with the scale and design of the existing approved facility and does not result in new adverse effects or significant land use issues. The determination regarding whether a particular telecommunications proposal is exempt from discretionary review should be made through a Design Review exemption request by the service provider.

Program RP 1.3.4: The County should amend Title 22, the Zoning Ordinance, to establish review processes for telecommunications projects, including wireless communications facilities, consistent with Policy RP 1.3 and Programs RP 1.3.1-1.3.3 above.

Policy RP 1.4. Applications for telecommunications facilities shall be required to include information sufficient to address the policies and programs of this Telecommunications Plan in addition to permit application submittal requirements and environmental review pursuant to CEQA. For commercial wireless facilities, service providers should be required to provide the information listed in the Community Development Agency "Guide to The Marin County Telecommunications Facilities Policy Plan" (refer to Appendix E), including, but not limited to network system plans, facility coverage area maps, EMF reports, and visual analysis, and other information as determined by the County to properly evaluate such proposals for conformance with County policy and CEQA.

Program RP 1.4.1: The County may require peer review or the independent preparation of any technical information submitted with permit applications for telecommunications facilities, such as the feasibility of alternative facility sites and/or facility designs, or to verify the predicted and actual EMF emissions from an approved facility for compliance with the EMF emissions standard adopted in this Telecommunications Plan.

Objective RP 2: To promote interjurisdictional review of telecommunications proposals by establishing uniform policies and procedures and coordinating permit review of facility siting.

Policy RP 2.1. Incorporated cities and towns in Marin County should consider adopting rules and regulations similar to those in this Telecommunications Plan with respect to regulating telecommunications within their jurisdictions.

Policy RP 2.2. The County, cities, and towns should consider land use and environmental issues on an interjurisdictional level.

Program RP 2.2.1: The County, cities, and towns should transmit development applications for proposed telecommunications facilities to jurisdictions that are located adjacent to or within the coverage area of the proposed facility to evaluate facility site and design opportunities that further conformance with the policies and standards of the affected jurisdictions. In this regard, jurisdictions within Marin County should review network system plans and coverage area maps during the initial stages of permit processing.

Objective RP 3: To maintain a periodic review procedure for evaluating the compliance of telecommunications facilities with this Telecommunications Plan and with conditions of project approval and new telecommunications technology that may further the objectives and policies of this Telecommunications Plan.

Policy RP 3.1. All discretionary permit approvals granted by the County for telecommunications facilities shall be reviewed at least every 10 years, or more frequently, as specified by the conditions of a project approval. When reviewing requests for permit renewal, the County should work with service providers to evaluate the feasibility and practicality of replacing existing facilities (or components thereof) with new technology that would minimize visual or other land use effects addressed in this Telecommunications Plan.

Policy RP 3.2. Telecommunications facilities that are abandoned or inoperative for a minimum two year period shall be removed from the site by the service provider and property owner. As a condition of permit approval, the County shall require a performance agreement with financial security to ensure the removal of an abandoned or inoperative facility.

Policy RP 3.3. The County shall establish and maintain a data base of existing and potential co-location sites for telecommunications facilities and provide information about them to service providers and other interested parties (refer to Appendix A).

Objective RP 4: To utilize opportunities for advisory or environmental review comments on telecommunications facilities to pursue implementation of this Telecommunications Plan's objectives where the County's land use control is preempted and to use other non-regulatory approaches to promote such objectives.

Policy RP 4.1. The County should request Federal and State agencies, particularly the FCC and CPUC, to notify the County of proposed telecommunications facilities, especially those which may be exempted from local land use control.

Policy RP 4.2. The County should use opportunities for commenting on environmental review documents to recommend compliance with the policies of this Telecommunications Plan as mitigations for various environmental impacts.

Policy RP 4.3. Prior to filing development applications with the County, service providers are encouraged to meet with community organizations (i.e., homeowners associates, local design review boards, etc.) and affected residents within the area of their proposed telecommunications facilities to present the proposal, solicit input, and consider possible site or design modifications to address community concerns.

APPENDIX A

INVENTORIES OF TELECOMMUNICATIONS FACILITIES IN MARIN COUNTY

MAP 1: MAJOR TELECOMMUNICATIONS FACILITY SITES IN MARIN COUNTY

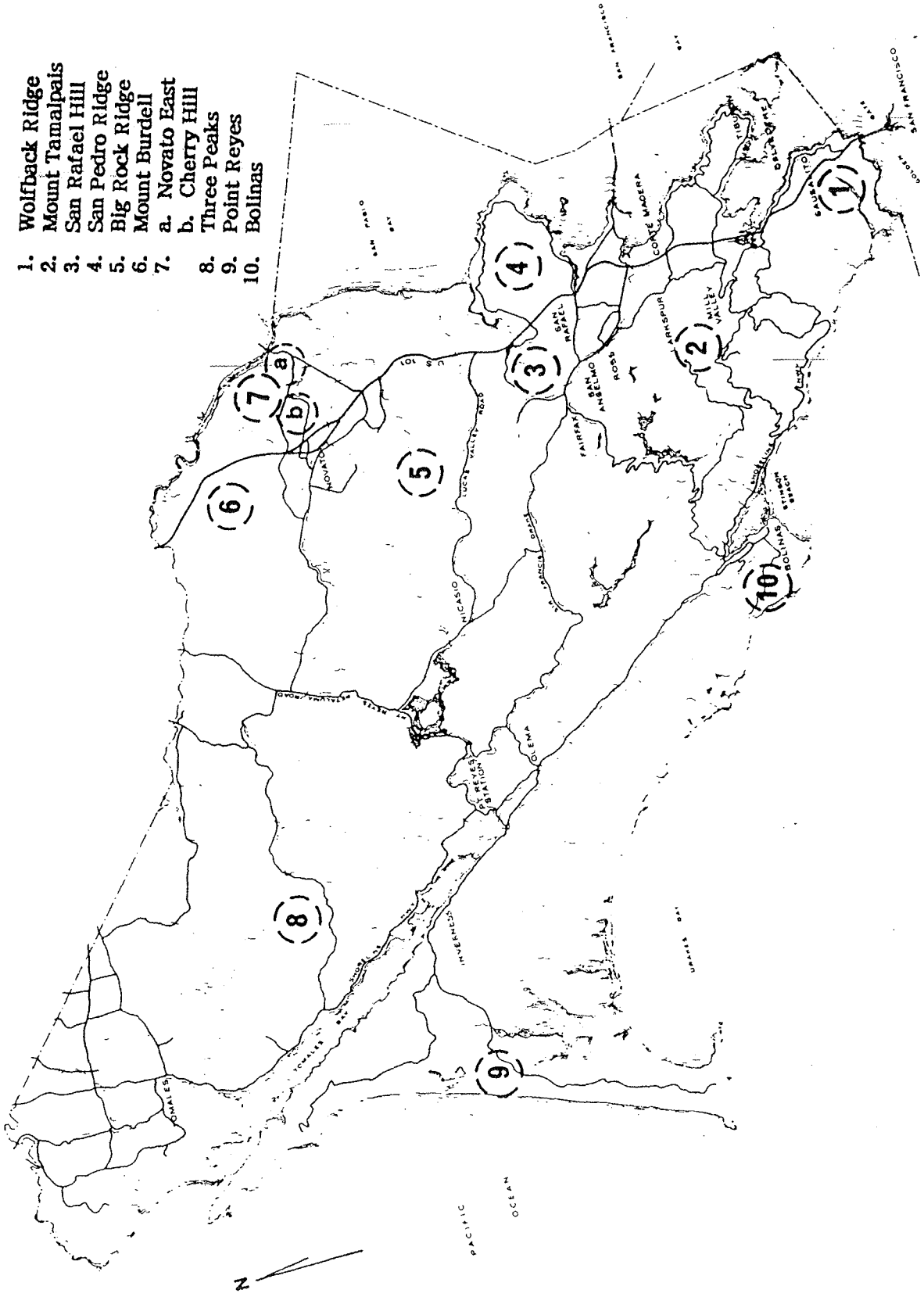


TABLE 2: MAJOR TELECOMMUNICATIONS FACILITY SITES IN MARIN COUNTY (1990)

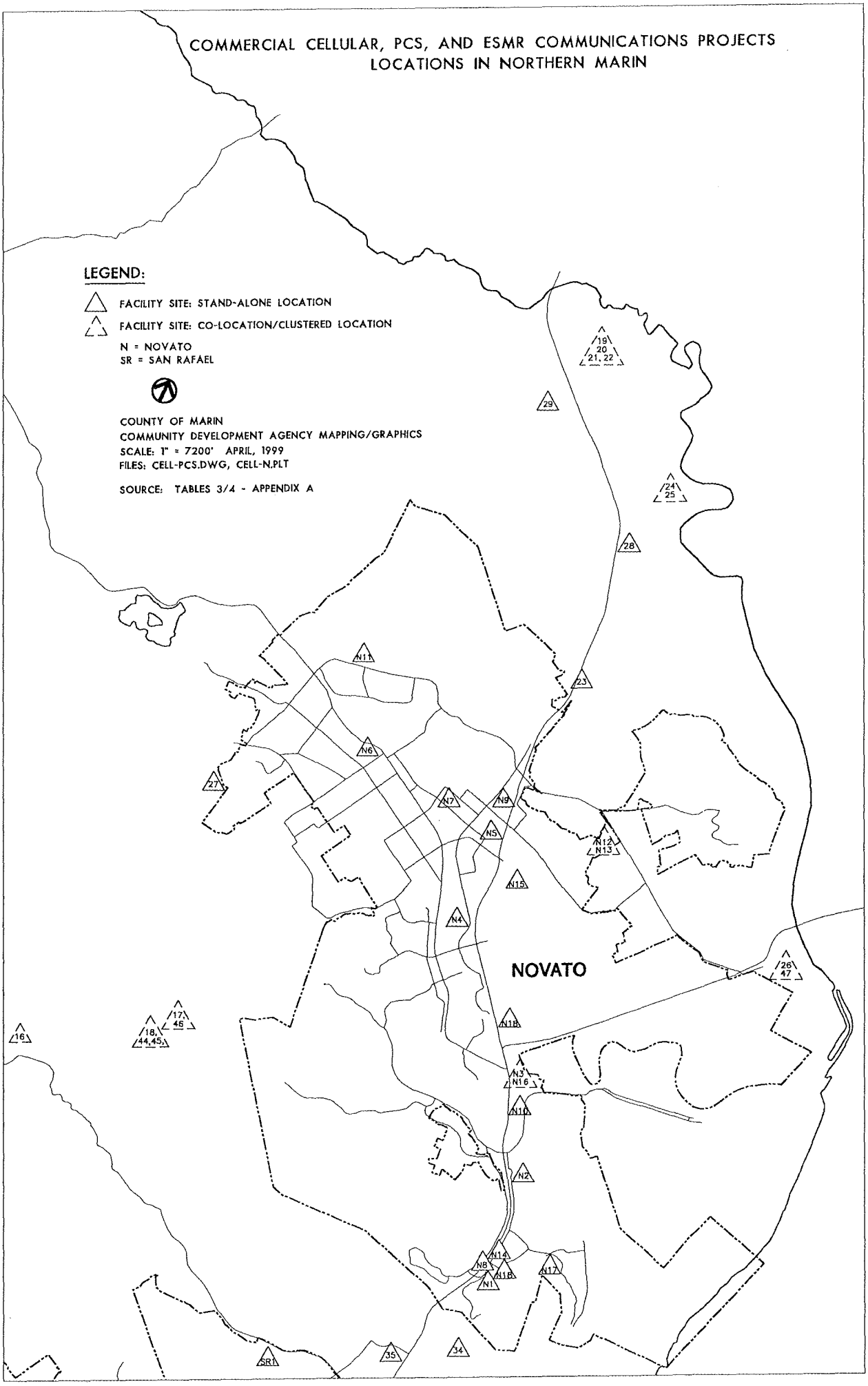
SITE #	SITE NAME & ELEVATION*	OPERATORS	PRINCIPAL USES	LONG & LAT	APN	OWNER
1	Wolfback Ridge elev. 1120	Sundial Broadcasting	FM Broadcast	37 50 57 122 29 56	200-120-02	Sundial Broadcasting
2	Mount Tamalpais elev. 2520 (mid peak)	Telecommunications Properties, FAA, and Air Force	Land mobile, cellular, paging	37 55 44 122 35 11		MMWD Federal Park Service
3	San Rafael Hill elev. 630	United Radiophone System, City of San Rafael	Land mobile, cellular, paging	37 58 52 122 31 11	011-084-42 011-084-41	Angelo Turrini City of San Rafael
4	San Pedro Ridge elev. 1050	C&C Equipment Co., Pacific Bell	Land mobile, cellular, paging	37 59 25 122 29 58	015-250-21 015-250-49	Gayle Corbin Pacific Tel & Tel
5	Big Rock Ridge elev. 1887 (west peak)	Motorola C&C Inc., W. site C&C Equipment Co., and Viacom Cablevision, E. site	Land mobile, cellular, paging	38 03 20 122 35 53	164-310-07 164-300-04 164-310-13	G. Lucas R. Hill G. Lucas
6	Mount Burdell elev. 1500	AT&T Communications	Satellite earth station	38 08 42 122 35 35	125-180-17	AT&T
7a	Novato East sea level	CBS	AM Broadcast	38 08 23 122 31 43	125-190-20	Rancho Del Pantano, Inc.
7b	Cherry Hill elev. 446	Chambers Cable	Satellite earth station	38 06 47 122 32 56	143-110-01	Schwartz, et al
8	Three Peaks elev. 390	AT&T Communications	Satellite earth station	38 08 52 122 47 38	106-241-04	AT&T
9	Pt. Reyes sea level	AT&T Communications, MCI/RCA Global Communications	Satellite earth station, receive site for marine radio	38 05 45 122 56 45	109-090-07 109-090-14 109-090-16	AT&T RCA Global National Park Service
10	Bolinas sea level	MCI International/RCA, Global Communications	Maritime mobile receiving station	37 54 30 122 43 40	188-170-60 180-170-06	National Park Service

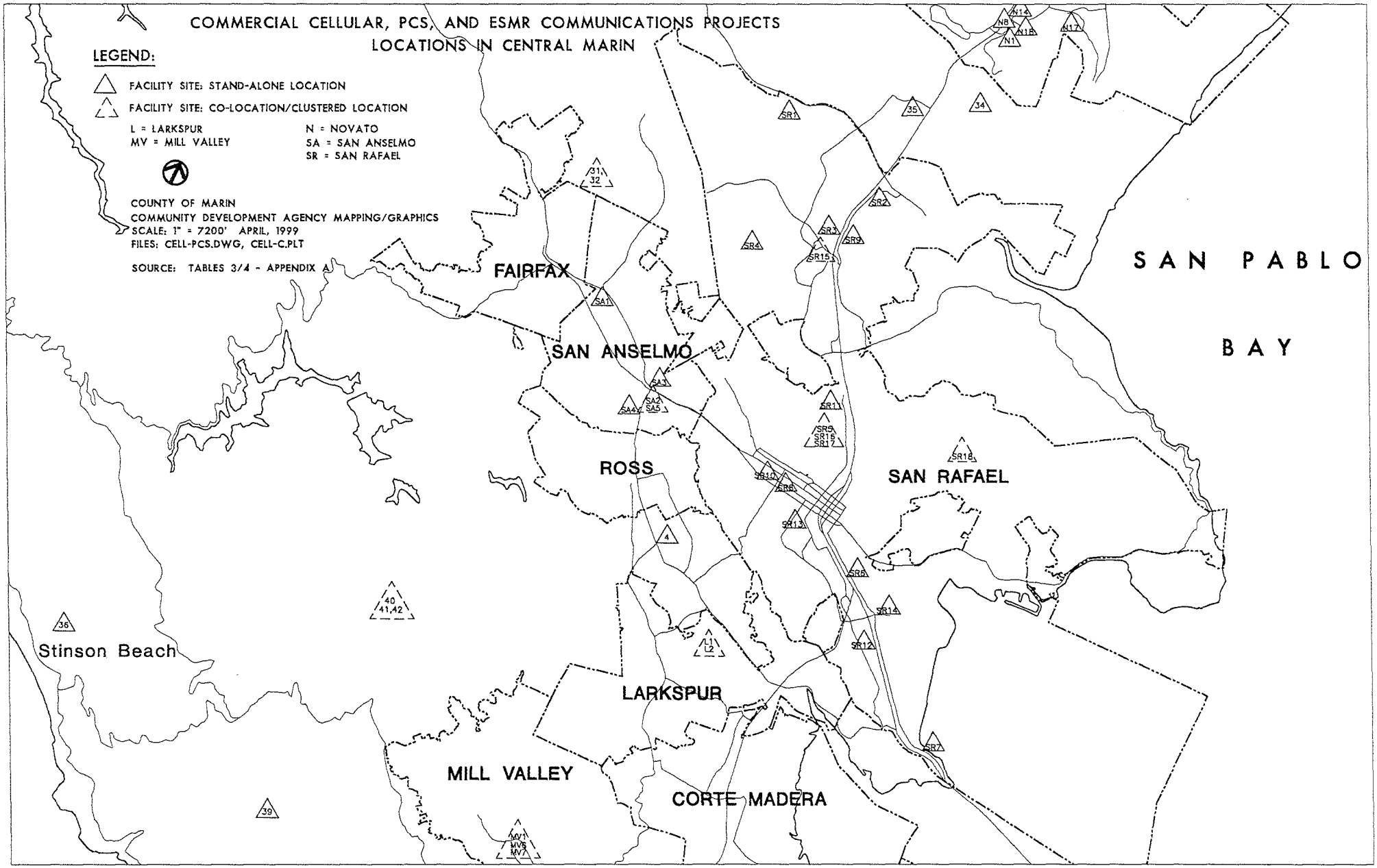
* Elevation figures are above mean sea level.

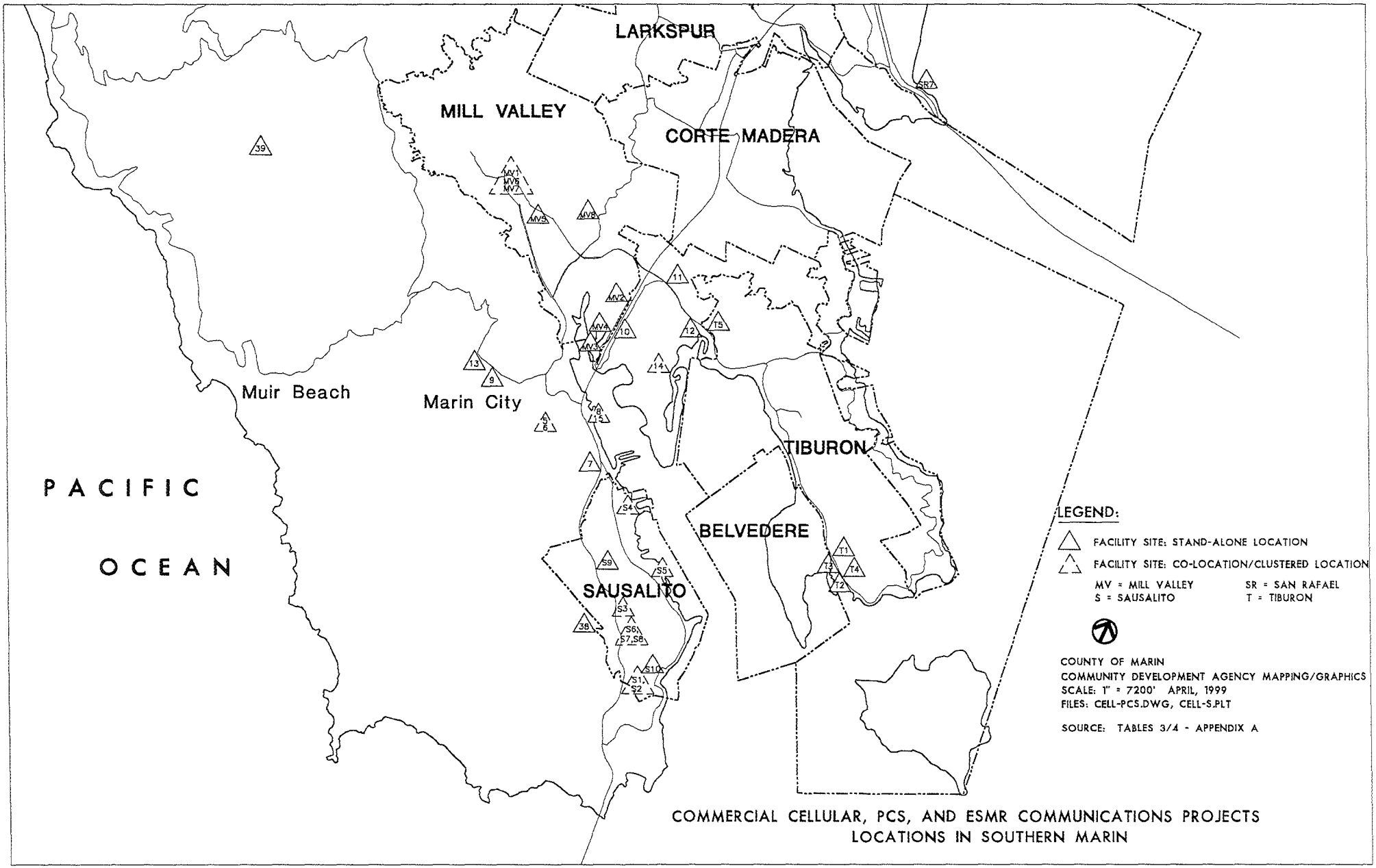
MAP 2: SELECTED MINOR TELECOMMUNICATIONS FACILITY SITES IN MARIN COUNTY

Refer to following maps.

COMMERCIAL CELLULAR, PCS, AND ESMR COMMUNICATIONS PROJECTS LOCATIONS IN NORTHERN MARIN

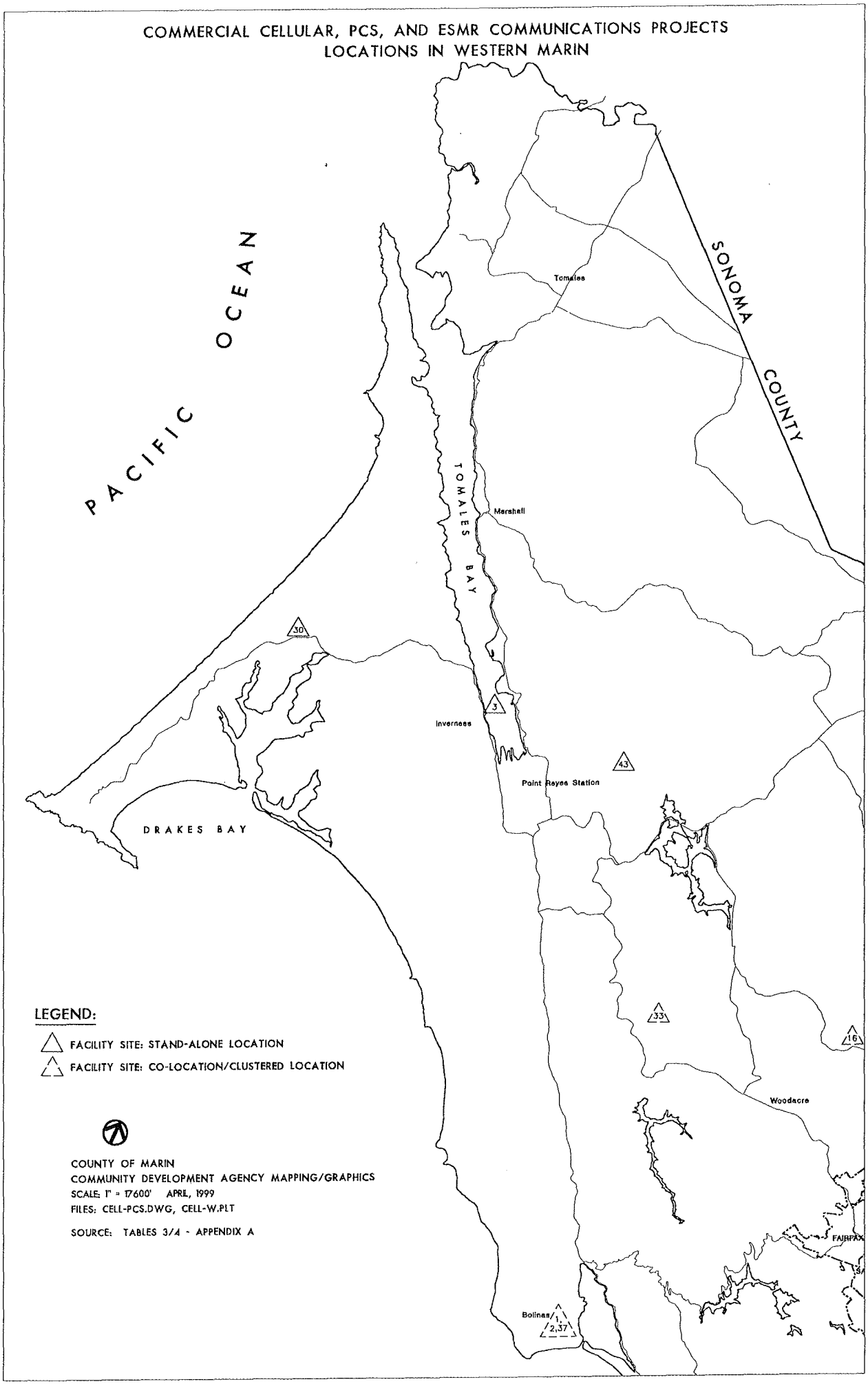



COMMERCIAL CELLULAR, PCS, AND ESMR COMMUNICATIONS PROJECTS
LOCATIONS IN CENTRAL MARIN
LEGEND:
FACILITY SITE: STAND-ALONE LOCATION
FACILITY SITE: CO-LOCATION/CLUSTERED LOCATION
L = LARKSPUR
MV = MILL VALLEY
N = NOVATO
SA = SAN ANSELMO
SR = SAN RAFAEL
COUNTY OF MARIN
COMMUNITY DEVELOPMENT AGENCY MAPPING/GRAPHICS
SCALE: 1" = 7200' APRIL, 1999
FILES: CELL-PCS.DWG, CELL-C.PLT
SOURCE: TABLES 3/4 - APPENDIX A
FAIRFAX
SAN ANSELMO
ROSS
SAN RAFAEL
LARKSPUR
MILL VALLEY
CORTE MADERA
Stinson Beach
SAN PABLO
BAY



COMMERCIAL CELLULAR, PCS, AND ESMR COMMUNICATIONS PROJECTS
LOCATIONS IN SOUTHERN MARIN

COMMERCIAL CELLULAR, PCS, AND ESMR COMMUNICATIONS PROJECTS
LOCATIONS IN WESTERN MARIN



LEGEND:

△ FACILITY SITE: STAND-ALONE LOCATION

△△ FACILITY SITE: CO-LOCATION/CLUSTERED LOCATION

COUNTY OF MARIN
COMMUNITY DEVELOPMENT AGENCY MAPPING/GRAPHICS
SCALE: 1" = 17600' APRIL, 1999
FILES: CELL-PCS.DWG, CELL-W.PLT

SOURCE: TABLES 3/4 - APPENDIX A

TABLE 3: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN UNINCORPORATED MARIN COUNTY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
1. Sprint Spectrum PCS A Block	CP97-91 DM97-92 UP97-93	193-020-55 Bolinas 100 Mesa Road Bolinas Fire/PD Station	MP/CLU	3/57.5'	Installed
2. Cellular One Cellular A Block	CP97-479 DM97-441 UP97-445	193-020-55 Bolinas 100 Mesa Road Bolinas Fire/PD Station	MP/CLU	12/57.5'	Installed
3. Three Guys Cell Comm. Cellular B Block	UP97-72 DR97-71	112-310-26 Inverness 12786 Sir Francis Drake Blvd. Chevron Station	MP	2/44'	Installed
4. Pacific Bell PCS B Block	UP96-400 DX96-399	071-143-58 Kentfield 1004 Sir Francis Drake Blvd. Kentfield Fire/PD Station	RM	6/32.5'	Installed
5. Sprint PCS A Block	UP97-133 DR97-132	052-140-27 Marin City MMWD Tank	MP/CLU	6/24.5'	Installed
6. Pacific Bell PCS B Block	UP97-781 DR97-782	052-140-27 Marin City MMWD Tank	MP/CLU	3/25'	Installed
7. Cellular One Cellular A Block	DM97-808 UP97-809	052-490-04 Marin City Marin City	MP	2/32'	Installed
8. Pac Bell PCS B Block	UP96-406 DX96-405	052-247-01 Mill Valley 242 Redwood Hwy. Heliport, North of Sausalito	ATF/CLU	2/33'	Withdrawn

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 3: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN UNINCORPORATED MARIN COUNTY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
9. Pacific Bell PCS B Block	UP96-013 DX96-028	050-252-26 Mill Valley 303 Poplar St. Poplar Plaza	ATF	6/38'	Installed
10. Sprint PCS A Block	UP97-137 DR97-136	043-151-03,09 Mill Valley 680 Redwood Hwy Tam Motel	ATF	6/31.5'	Installed
11. Sprint PCS A Block	UP97-125 DR97-124	034-141-08 Mill Valley 7 North Knoll Rd. Eagle Rock Professional Bldg.	ATF	4/40'	Installed
12. Sprint PCS A Block	UP97-127 DR97-126	055-051-20,21,22 Mill Valley 240 Tiburon Westminster Church	ATF	6/41'	Withdrawn
13. Sprint Spectrum PCS A Block	DR97-592 UP97-593	050-241-10 Mill Valley 414 Ash Street Mt. Tam Methodist Church	ATF	6/36'	Withdrawn
14. Sprint PCS A Block	UP97-531 DR97-529	043-261-21 Mill Valley 308 Reed Blvd. Alto-Richardson Fire District.	LT/COL	4/60'	Installed
15. Sprint	UP97-135 DR97-134	052-247-01 Mill Valley 242 Redwood Highway Heliport, North of Sausalito	ATF/CLU	4/41.5'	Withdrawn
16. GTE Mobilnet Cellular B Block	UP95-020 DR95-032	164-310-02 Nicasio Lucasfilm Skywalker Ranch	MP/COL	3 ea./ (2) - 16' / (1) - 19'	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 3: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN UNINCORPORATED MARIN COUNTY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
17. Cellular One Cellular A Block	UP93-050	164-300-04 Novato Big Rock Ridge C&C site	GM/ATFCOL	5/60'	Installed
18. Motorola		164-310-07 Novato Big Rock Ridge Motorola site	LT/ATF/COL	Multiple/ 80'	Installed
19. GTE Mobilnet FCC db Cellular B Block	UP91-026 DR91-092	125-130-04 Novato Redwood Hwy. Corda Ranch	ATF(1)/MP(5)/CLU	6/15'	Installed
20. Cellular One (FCC db) Cellular A Block	DR96-278	125-130-04 Novato 10300 Redwood Highway Corda Ranch, Redwood Hwy	MP/CLU	6/22'	Installed
21. Nextel 800 MHz SMR/ESMR	UP96-352 DX96-487	125-130-04 Novato 10300 Redwood Highway Corda Ranch, Redwood Hwy	TM/CLU	3/40'	Installed
22. PacBell PCS B Block		125-130-04 Novato 10300 Redwood Highway Corda Ranch, Redwood Hwy	MP/CLU	6/15'	Installed
23. Sprint PCS A Block	UP97-121 DR97-120	125-190-57 Novato 8121 Binford Road Cervantes, Redwood Hwy	ATF/MP	2 ea./ (1) - 38' /(1) - 26.5',	Installed
24. Pac Bell PCS B Block	UP96-404 DR96-403	125-160-13 Novato 8950 Redwood Highway Redwood Landfill	MP/COL	6/35'	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 3: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN UNINCORPORATED MARIN COUNTY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
25. Nextel 800 MHz SMR/ESMR	UP97-470 DR97-469	125-160-13 Novato 8950 Redwood Highway Redwood Landfill	MP/COL	3/60'	Withdrawn
26. Sprint PCS A Block	UP97-123 DR97-122	157-091-45 Novato 100 Phillip Terrace Rosenberg, Black Point	MP/COL	4/32.5'"	Installed
27. Sprint Spectrum PCS A Block	UP97-356	146-360-24 Novato 135 Wild Horse Valley Rd. Wild Horse Valley	MP	6/48'	Withdrawn
28. Sprint PCS A Block	UP97-313 DR97-312	125-160-12 Novato 8900 Redwood Highway Silviera Ranch	MP	2/35'	Installed
29. Sprint Spectrum PCS A Block	DR97-319 UP97-320	125-130-24 Novato 8900 Redwood Highway Silviera Ranch	MP	4/35'	Installed
30. MCI/ARINC (3 Sis)	UP94-024	109-090-14 Pt. Reyes National Seashore	GT	1/92'	Installed
31. Sprint PCS A Block	UP97-65 DR97-62	174-190-07 San Anselmo 41 Wilder Blvd. Cappe	MP/CLU	6/38.5'	Withdrawn
32. Cellular One Cellular A Block	DR97-180 UP97-181	174-190-07 San Anselmo 41 Wilder Blvd. Cappe	ATF/CLU	12/15'	Withdrawn

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 3: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN UNINCORPORATED MARIN COUNTY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
33. Cellular One et al. (FCC lic. db) Cellular A Block	UP93-034 DR93-076	168-240-01 San Geronimo Mt. Barnabe Forest Knoll	ATF/COL	4/39'	Installed
34. Nextel 800 MHz SMR/ESMR	UP95-008 DR95-009	155-010-44 San Rafael Redwood Highway Pacheco East	MP	4/45'	Installed
35. Sprint PCS A Block	UP97-335 DR97-334	164-471-63,65,69 San Rafael 190 Marinwood Ave. Marinwood Plaza	MP	6/37.5'	Installed
36. Sprint Spectrum PCS A Block	CP97-83 DM97-84 UP97-85	195-260-31 Stinson Beach SBCWD Tank	MP	4/18'	Installed
37. GTE Mobilnet (FCC lic. db) Cellular B Block		193-020-55 Bolinas 100 Mesa Drive Dowtown Bolinas	LT/CLU	*/*	Installed
38. Smart SMR of Cal. (FCC lic. db) 800 MHz SMR/ESMR		200-120-06 Sausalito Wolfback Ridge North of Mt Beacon	*	*/*	Installed
39. Smart SMR of Cal. (FCC lic. db) 800 MHz SMR/ESMR		199-070-18 GGNRA, West of Mill Valley 4.4 mi WNW SR 1 & Hwy 101	*	*/200'	Installed
40. Bay Area Cellular (FCC lic. db) Cellular A Block		197-120-31 2001 E. Ridge Crest Blvd. Diablo Comm., Mt. Tamalpais	MP/COL	*/80'	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 3: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN UNINCORPORATED MARIN COUNTY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
41. Smart SMR of Calif. (FCC lic. db) 800 MHz SMR/ESMR		197-120-31 2001 E. Ridge Crest Blvd. Diablo Comm., Mt Tamalpais	MP/COL	*/ 60'	Installed
42. FCI 900, Inc. (FCC lic. db) 900 MHz SMR/ESMR		197-120-31 2001 E. Ridge Crest Blvd. Diablo Comm., Mt Tamalpais	MP/COL	*/ 50'	Installed
43. Bay Area Cellular (FCC lic./struc. db) Cellular A Block		119-030-03 East Northeast of Pt Reyes Stn 1.7 mi. N. of Black Mtn	MP	*/ 220'	Installed
44. Smart SMR of Cal. (FCC lic. db) 800 MHz SMR/ESMR		4.5 miles southwest of Novato Big Rock Ridge Motorola site	LT/ATF/COL	*/ 85'	Installed
45. Power Spectrum (FCC lic. db) 900 MHz SMR/ESMR		4.5 miles southwest of Novato Big Rock Ridge Motorola site	LT/ATF/COL	*/ 80'	Installed
46. FCI 900, Inc. (FCC lic. db) 900 MHz SMR/ESMR		4.5 miles southwest of Novato Big Rock Ridge C&C site	GM/ATF/COL	*/ 100'	Installed
47. Nextel	UP98-18 DR98-51	157-091-45 & 46 Novato 100 Philip Terrace Rosenberg, Black Point	MP/COL	2/ 25.5'	Approved 2/23/98

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

LARKSPUR

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
1. GTE Mobilnet (FCC lic. db) Cellular B Block		022-161-07 Greenbrae 510 Via Casitas	*	*/*	Installed
2. Smart SMR of Cal. (FCC lic. db) 800 MHz SMR/ESMR		022-161-07 Greenbrae 510 Via Casitas	*	*/*	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

MILL VALLEY

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
1. GTE Mobilnet		028-013-18 Mill Valley 25 Throckmorton	ATF/CLU	5/35'	Installed
2. Pac-Bell		030-211-49 Mill Valley 817 Redwood Hwy.	ATF	2/35'	Installed
3. Cell One		030-260-26 Mill Valley 591 Redwood Hwy.	ATF	1/45'	Installed
4. GTE Mobilnet		030-260-33 Mill Valley 655 Redwood Hwy.	ATF	2/5'	Installed
5. Pacific Bell		028-233-36 Mill Valley 300 E. Blithedale	ATF	2/5'	Installed
6. Pacific Bell		028-013-18 Mill Valley 25 Throckmorton	ATF/CLU	4/35'	Installed
7. Page Net		028-013-18 Mill Valley 25 Throckmorton	ATF/CLU	2/45'	Installed
8. Sprint		033-101-25 Mill Valley Alto Tank (MMWD)	GM	1/8'	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

NOVATO

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY TYPE/ SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/DATE
1. Sprint Spectrum (Hamilton Bldg.)	DR97-001 UP 97-012	155-020-47 Novato 5390 Nave Drive	ATF	2/41'6"	Installed
2. Sprint Spectrum (Nave Bowl)	DR 97-011 UP 96-031	157-400-24 Novato 5778 Nave Drive	ATF	4/39'6"	Installed
3. Sprint Spectrum (PG & E Substation)	DR 97-009 UP 97-010	157-171-17, Novato 157-400-18 895 Bel Marin Keys Blvd.	ATF/CLU	6/55'	Installed
4. Sprint Spectrum (Holley Transmission)	DR 96-047 UP 97-011	152-051-08 Novato 170 Ford Way	ATF	6/39'6"	Installed
5. Sprint Spectrum (Grant/Madrone)	DR 97-012 UP 96-027	153-053-13 Novato	MP	6/28'	Installed
6. Sprint (Square Shop. Ctr.)	DR 96-028	132-183-14 Novato 2055 Novato Blvd.	ATF	4/35'6"	Installed
7. Pacific Bell Mobile Services	DR 95-024	141-252-29 Novato 1500 Grant Ave.	ATF	2/40'	Installed
8. Pacific Bell Mobile Services	DR 95-025	155-020-45 Novato	ATF	2/40'	Installed
9. Pacific Bell Mobile Services	DR 97-031 UP 96-033	143-073-01 Novato 801 Golden Gate Way	MP	6/40'	Approved 7/2/97
10. Pacific Bell Mobile Services	DR	157-332-18 Novato 83 Hamilton Drive	ATF	5/40'	Installed
11. GTE Mobilnet (San Marin Plaza)	DR 94-033	124-202-28 Novato 155 San Marin Dr.	ATF	8/27'6"	Installed
12. GTE Mobilnet	UP 84-071	143-110-01 Novato 615 Atherton Ave.	DP/CLU	7/54'	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
13. Cellular One	DR 89-051 UP 89-018 UP 94-040	143-110-01 Novato 615 Atherton Ave.	DP/CLU	3/75'	Installed
14. Cellular One	UP 93-031	155-020-42 Novato 5420 Nave Drive	MP	3/40'	Approved 8/12/93
15. Nextel	DR 97-014 UP 96-039	153-180-21 Novato 586 Davidson Ave.	DP	6/24'	Approved 7/22/94
16. Cellular One	DR 97-065 UP 97-041	157-171-17 Novato 150 Hamilton Drive	ATF/CLU	9/105"	Approved 1/21/98
17. GTE Mobilnet (FCC lic/struc.db) Cellular B Block		157-180-35 Southeast of Ignacio Hamilton Air Force Base	MP	UI/137'	*
18. Bay Area Cellular (FCC struc. db) Cellular A Block		155-020-50 Southeast of Ignacio 5480-A Nave Drive,	MP	*/45'	*

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

SAN RAFAEL

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
1. Sprint Spectrum (Lucas Valley Water Tank)	ED 96-96	165-010-03 San Rafael Old Lucas Valley Rd.	MP	1/*	Installed
2. Sprint Spectrum	ED 96-94	155-131-26 San Rafael 55 Mitchell Blvd.	MP	1/*	Installed
3. Sprint Spectrum	ED 96-104	178-240-21 San Rafael 1010 Northgate Dr.	ATF	4/*	Installed
4. Sprint Spectrum	ED 96-97	175-060-44 San Rafael 1 Wellbrook Heights	ATF	5/*	Installed
5. Sprint Spectrum	ED 96-105	011-084-92 San Rafael Robert Dollar Dr.	LT/COL	4/*	Installed
6. Sprint Spectrum	ED 96-98	014-203-07 San Rafael 647 Francisco Blvd.	ATF/RM	4/*	Installed
7. Sprint Spectrum	ED 96-144	009-161-52 San Rafael 2175 Francisco Blvd.	ATF	4/*	Installed
8. GTE Mobilnet	ED 95-78	011-255-21 San Rafael 1299 Fourth St.	ATF	5/*	Installed
9. Pacific Bell Mobile Services	ED 96-21	155-072-03 San Rafael 7 Professional Ctr. Pkwy.	ATF	4/*	Installed
10. Pacific Bell Mobile Services	ED 96-13	011-245-38 San Rafael 220 Shaver St.	ATF	4/*	Installed
11. Pacific Bell Mobile Services	ED 95-94	011-041-29 San Rafael 1825 Lincoln Ave.	ATF	4/*	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY/SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/ DATE
12. Pacific Bell Mobile Services	ED 96-135	018-142-71 San Rafael 1011 Andersen Dr.	ATF	4/*	Installed
13. Pacific Bell Mobile Services	ED 96-134	San Rafael 773 Lincoln Ave.	MP	1/*	Approved 1/23/97
14. Page Net	ED 97-41	008-082-46 San Rafael 3301 Kerner Blvd.	ATF	4/*	Installed
15. Page Net	ED 97-42	178-240-20 San Rafael 1050 Nortgate Dr.	RM/COL	4/*	Installed
16. Smart SMR of CA (FCC lic. db) 800 MHz SMR/ESMR		San Rafael Hill San Rafael Robert Dollar Scenic Drive,	COL	*/85'	Installed
17. GTE Mobilnet (FCC lic. db) Cellular B Block		011-051-27 San Rafael San Rafael Hill North of downtown,	COL	*/ *	
18. Bay Area Cellular (FCC lic./struc. db) Cellular A Block		015-250-49 San Rafael 2000 Bayhills San Pedro Ridge 1.5 mi. NE of San Rafael,	LT/CLU FCC structure #113842	*/118'	

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

SAN ANSELMO

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY TYPE/ SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/DATE
1. Pacific Bell Mobile Services	*	005-153-03 San Anselmo 1509 Sir Francis Drake	PCS ATF	3/30'	Installed
2. Pacific Bell Mobile Services	*	006-251-04 San Anselmo 324 Sir Francis Drake	PCS ATF/CLU	3/35'	Installed
3. Cellular One	*	006-092-08 San Anselmo 640 Sir Francis Drake	 ATF	6-9/25'	Installed
4. GTE Mobilnet	*	007-282-20 San Anselmo 305 San Anselmo Ave.	 ATF	4/35'	Installed
5. Sprint Spectrum	*	006-251-04 San Anselmo 324 Sir Francis Drake	PCS ATF/CLU:	3/35'	Installed

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

TIBURON

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY TYPE/ SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/DATE
1. Sprint PCS	19705	058-171-83 Tiburon 1505 Tiburon Blvd.	ATF	6/41'	Installed
2. Page Net	19706	059-102-20 Tiburon 78 Main St.	RM	3/45'	Installed
3. Pacific Bell	19606	059-101-03 Tiburon 1620-1632 Tiburon Blvd.	RM	3/30'	Installed
4. GTE Mobilnet	19403	058-171-11 Tiburon 1679 Tiburon Blvd.	GM	3/6'	Installed
5. Sprint	19710	034-212-18 Tiburon 1 Blackfield Drive	ATF	3/27'-8"	Approved 10/8/97

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 4: SELECTED MINOR TELECOMMUNICATIONS FACILITIES IN INCORPORATED CITIES

SAUSALITO

SERVICE PROVIDER	APPLICATION NO.	LOCATION (APN/AREA)	FACILITY TYPE/ SITE TYPE	NUMBER OF ANTENNAS/ MAX. HEIGHT	STATUS/DATE
1. Nextel		Hecht Ave./ Waldo Tunnel Sausalito	ATF (temp. structure) CLU	4/15'	Installed
2. Pac-Bell/Sprint		Hecht Ave./ Waldo Tunnel Sausalito	MP/COL	6/32'	Installed
3. Pac Bell		064-252-09 Crecienta Lane Sausalito	2MP/GM CLU	4/20'	Installed
4. Page Net		063-140-24 475 Gate 5 Road Sausalito	RM/ATF CLU	2/10'	Installed
5. Cellular One		064-082-02 1750 Bridgeway Sausalito	ATF/CLU	9/2'	Installed
6. Cellular One		065-181-44 300 Spencer Sausalito	RM/GM COL/CLU	6/2.5'	Installed
7. Pacific Bell		065-181-44 300 Spencer Sausalito	ATF/GM COL/CLU	3/5'	Installed
8. GTE		300 Spencer Sausalito	CLU	3/*	Installed
9. Sprint Spectrum	UP/DR 97-02	Rodeo Ave. exit Sausalito	ATF	3/30'	Approved
10. Cellular One	DR 97-68	065-238-08 300 Main Street Sausalito	ATF	2/30'	Approved

Facility Type: MP = Monopole; ATF = Attached Facility (structure mounted); GT = Guyed Tower; LT = Latticed Tower; GM = Ground Mounted; TM = Tree Mounted; DP = Dipole;
Facility Site Type: COL = Co-location; CLU = Clustered.
* Information not available or currently unknown

TABLE 5: SELECTED MINOR TELECOMMUNICATIONS SITES BY SERVICE, OPERATOR & ELEVATION

SERVICE	LICENSEE	ELEVATION		
		LOW (< 500' AMSL)	HIGHER (500-1000'AMSL)	RIDGETOP (> 1000' AMSL)
SMR/ESMR, Trunked 806-821 & 851-866 MHz, FCC Pt 90, 2-WAY VOICE & DATA	Nextel Communi-cations, Inc., aka Smart SMR of California (formerly owned by Motorola)	• Pacheco East, San Rafael • 510 Via Casitas, Greenbrae • Redwood Landfill, Novato • Corda Ranch, Novato	• GGNRA, west of Mill Valley • San Rafael Hill, San Rafael	• Wolfback Ridge, Sausalito • Big Rock Ridge, Motorola site, Novato • Mt Tamalpais
CELLULAR (CRS), 824-849 & 869-894 MHz, FCC Pt 22, 2-WAY VOICE & DATA: A Block	Cellular One (aka Bay Area Cellular Telephone Company)	• BFPD Stn, Bolinas • Marin City • 5480-A Nave Drive, Ignacio • Corda Ranch, Novato	• North of Black Mtn, Pt Reyes Stn • 615 Atherton Ave, Novato	• Wolfback Ridge, Sausalito • San Pedro Ridge, San Rafael • Mt Barnabe, San Geronimo • Big Rock Ridge, C & C site, Novato • Mt Tamalpais
CELLULAR A Block	Three Sisters Cell Company	• Point Reyes, Nat'l Seashore (unconfirmed)		
CELLULAR (CRS), 824-849 & 869-894 MHz, FCC Pt 22, 2-WAY VOICE & DATA: B Block	GTE Mobilenet	• 100 Mesa Drive, Bolinas • 510 Via Casitas, Greenbrae • Hamilton AFB, Ignacio • 155 San Marin Drive, Novato • Corda Ranch, Novato	• San Rafael Hill, San Rafael • Robinwood Drive, Novato	• Lucasfilm, Skywalker Ranch, Nicasio • Wolfback Ridge, Sausalito • Big Rock Ridge, C & C site • Mt Tamalpais
CELLULAR B Block	Three Guys Cell Commmunication	• Chevron Station, Inverness		
SMR/ESMR, Trunked 896-901 & 935-940 MHz, FCC Pt 24, 2-WAY VOICE & DATA	Power Spectrum, Inc.			• Big Rock Ridge, Motorola site
SMR/ESMR	FCI 900, Inc.			• Big Rock Ridge, C & C site • Mt Tamalpais

TABLE 5: SELECTED MINOR TELECOMMUNICATIONS SITES BY SERVICE, OPERATOR & ELEVATION

SERVICE	LICENSEE	ELEVATION		
		LOW (< 500' AMSL)	HIGHER (500-1000'AMSL)	RIDGETOP (> 1000' AMSL)
PCS, Narrow-band, 901-902, 930-931, 940-941 MHz, FCC Pt 24, PAGING & RADIOLOCA-TION	• Paging Network of Virginia • KDM Messaging Company • Nationwide Wireless Network • Airtouch Paging • BellSouth • Pagemart II • Conxus Prop.	Locations unknown		
PCS, Broadband, 1850-1990 MHz, FCC Pt 24, 2-WAY VOICE & DATA, A MTA Block	Sprint Spectrum L.P. (also listed as Sprint PCS)	• BFPD, Bolinas • SBCWD tank, Stinson Beach • MMWD tank, Marin City • Tam Motel, Mill Valley • Eagle Rock Bldg, Mill Valley • Westminster Church, Mill Val. • Mt Tam Metho-dist, Mill Valley • Alto-Richardson Fire, Mill Valley • Marinwood Plaza, San Rafael • Cervantes, Novato • Rosenberg, Black Pt, Novato • Silviera Ranch, Novato		

TABLE 5: SELECTED MINOR TELECOMMUNICATIONS SITES BY SERVICE, OPERATOR & ELEVATION

SERVICE	LICENSEE	ELEVATION		
		LOW (< 500' AMSL)	HIGHER (500-1000'AMSL)	RIDGETOP (> 1000' AMSL)
PCS, Broadband, B MTA Block	Pacific Bell Mobile Services (also listed as Pacific Telesis Mobile Services, Pacific Bell and PacBell; recently merged with SBC Communications)	• MMWD tank, Marin City • Poplar Plaza, Mill Valley • KFPD station, Kentfield • Redwood Land-fill, Novato • Corda Ranch, Novato		
PCS Broadband	GWI PCS, Inc.	Locations unk		
PCS Broadband	AT&T Wireless	Locations unk		
PCS Broadband	Western PCS	Locations unk		
PCS Broadband	NextWave Power Partners, Inc.	Locations unk		

APPENDIX B

INDEX AND PHOTOGRAPHS OF SELECTED TELECOMMUNICATIONS FACILITIES

INDEX TO PHOTOGRAPHS

NO.	SITE LOCATION	MAJOR TELECOMMUNICATIONS FACILITY/FEATURE PICTURED
1	Big Rock Ridge	Guyed-Mast Tower: C & C Equipment Company
2	Mount Burdell	Self Supporting Tower: AT&T
3	Gnoss Field (East)	AM Radio Towers: CBS Radio
4	Mt. Tamalpais (Middle Peak)	Telcommunications Properties Site
5	San Rafael Hill	United Radiophone Site
6	San Pedro Ridge	C & C Equipment Company Site
7	San Pedro Ridge	AT& T Site
8	Big Rock Ridge (West Site)	Motorola Site
9	Cherry Hill	Chambers Cable Site
10	Three Peaks	AT&T Communications Site

Photo 1

Big Rock Ridge
C&C Equipment Company

Photo 2

Mount Burdell
AT&T

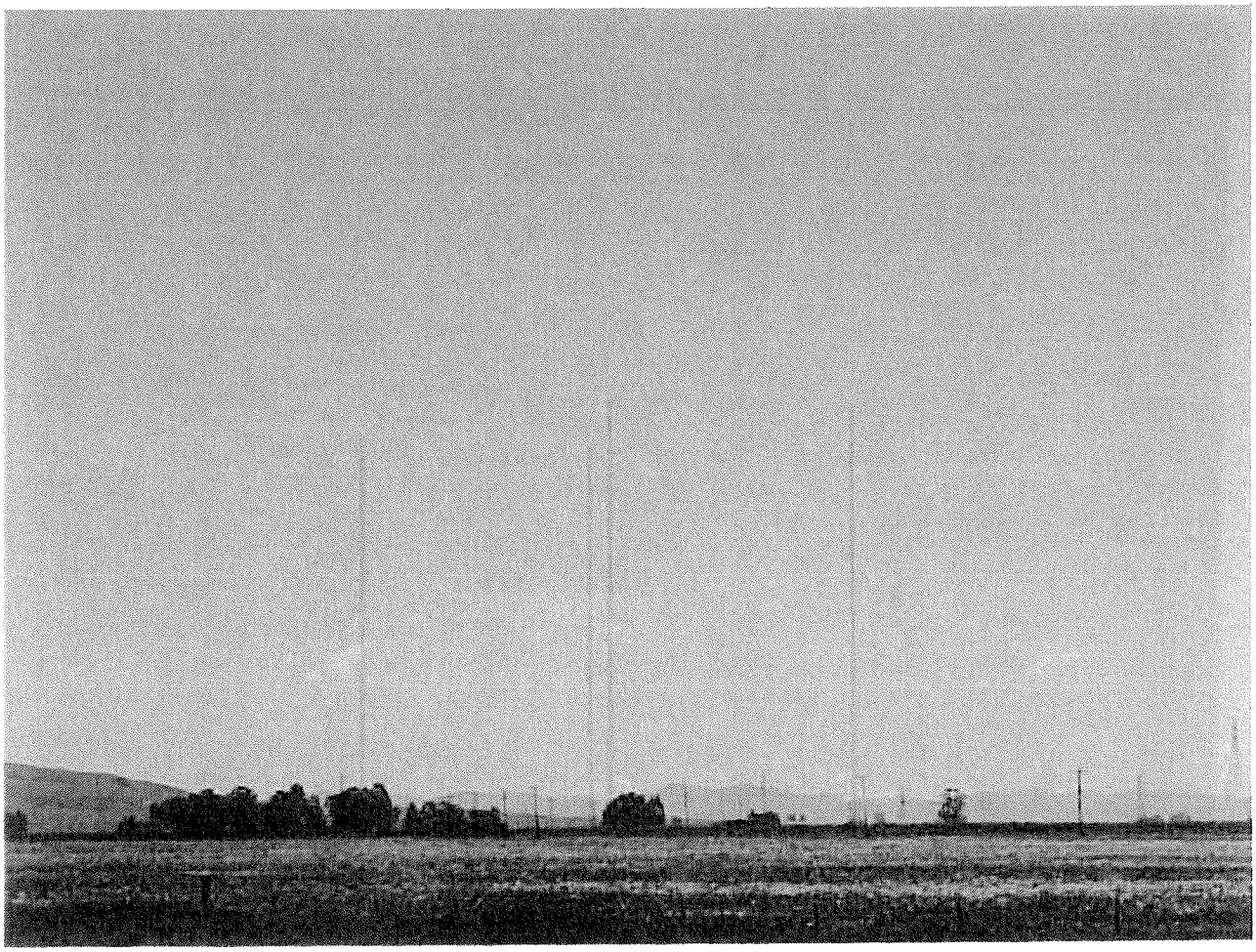


Photo 3

Gnoss Field (East)
AM Radio Towers: CBS Radio

Photo 4

Mt. Tamalpais (Middle Peak)
Telecommunications Properties Site

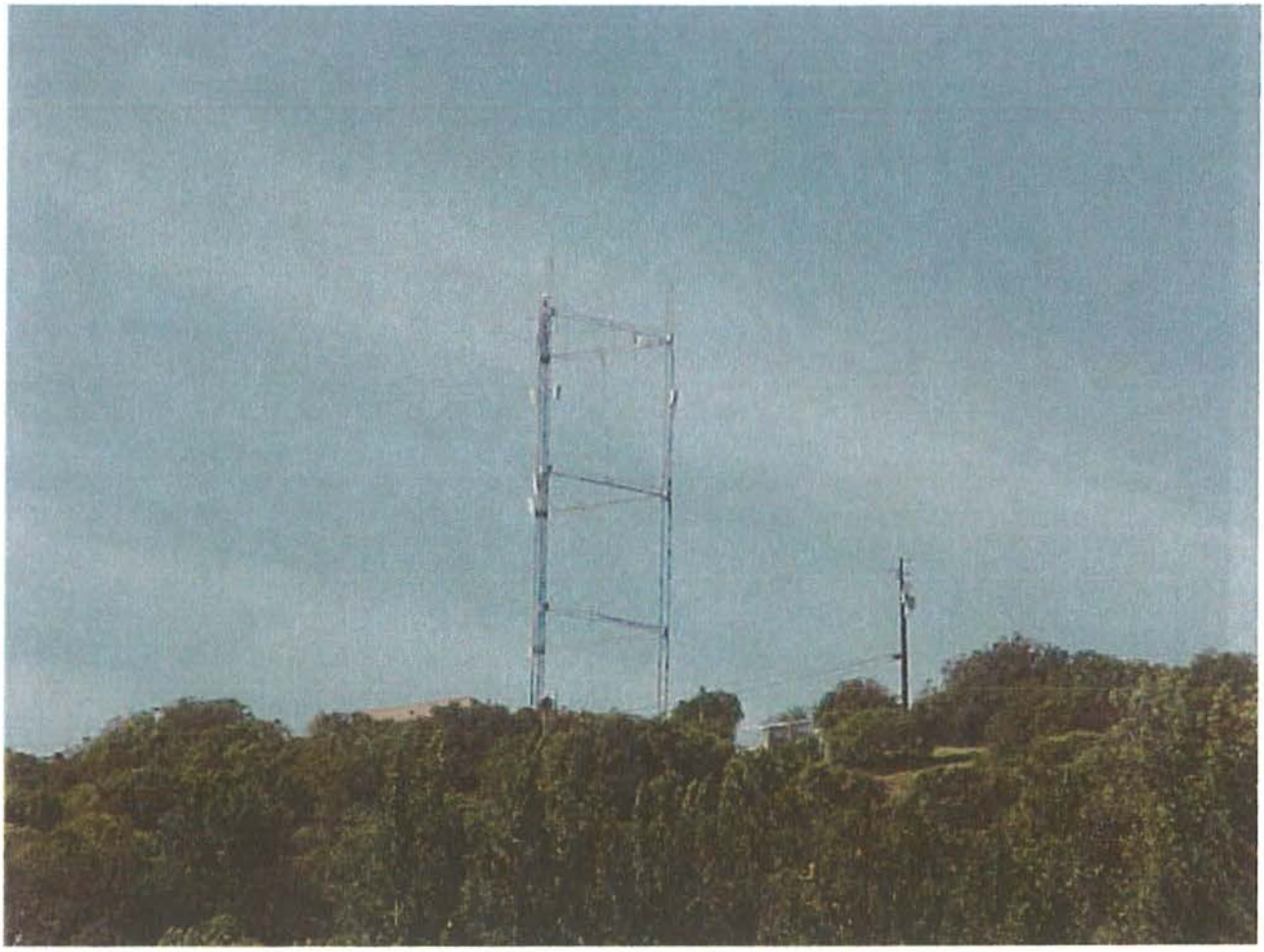


Photo 5

San Rafael Hill
United Radiophone Site

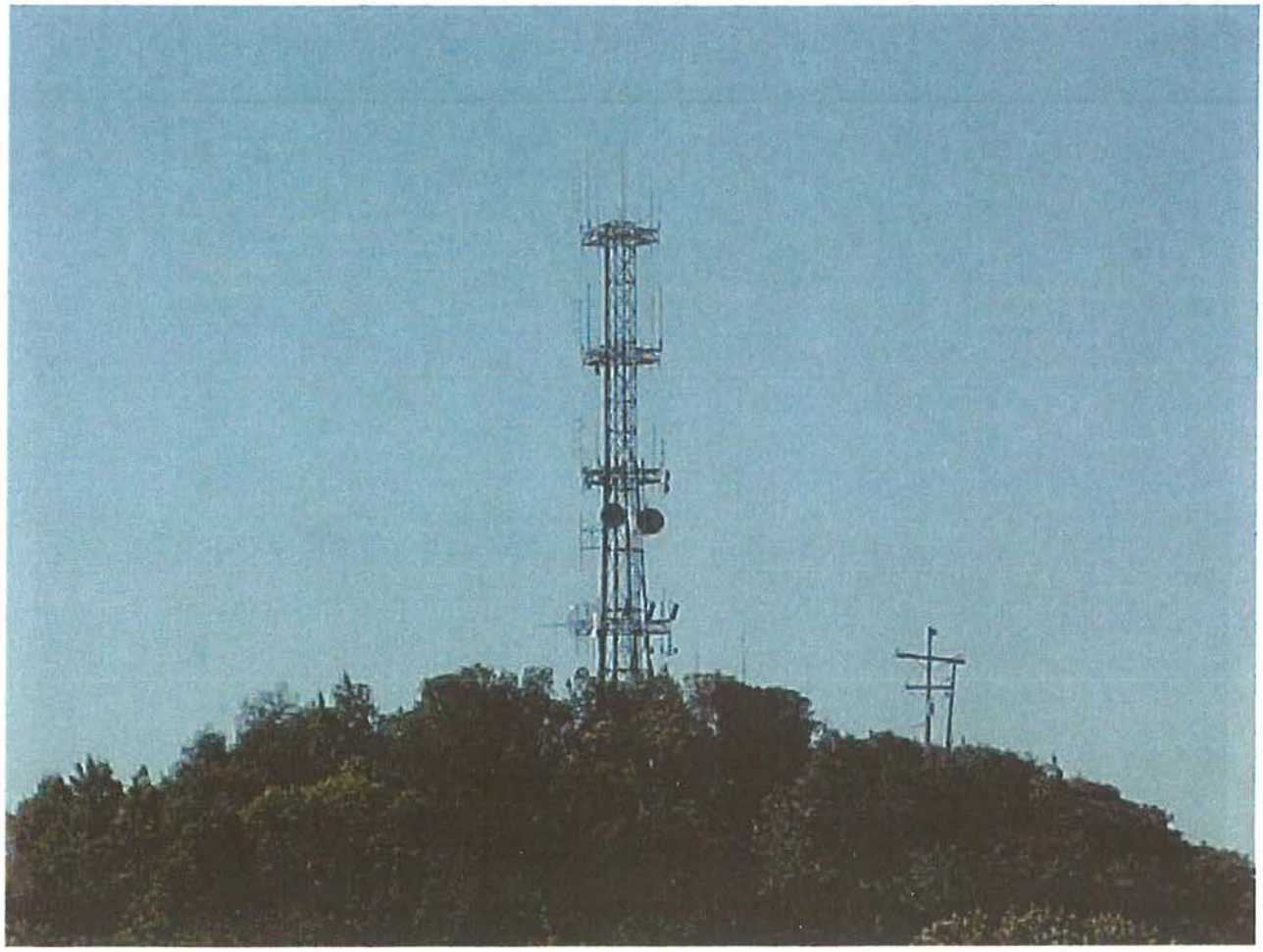


Photo 6

San Pedro Ridge
C&C Equipment Site

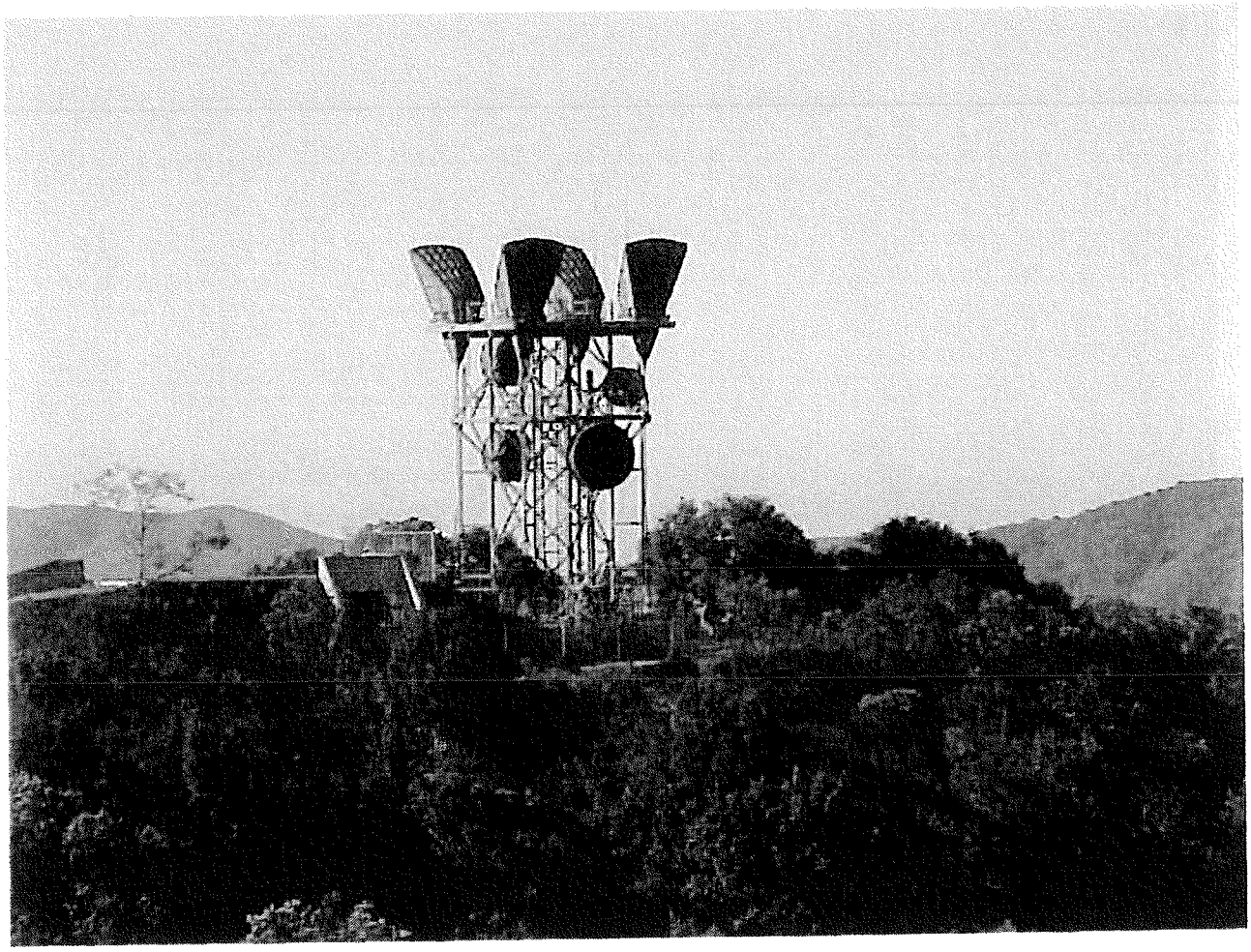


Photo 7

San Pedro Ridge
AT&T Site

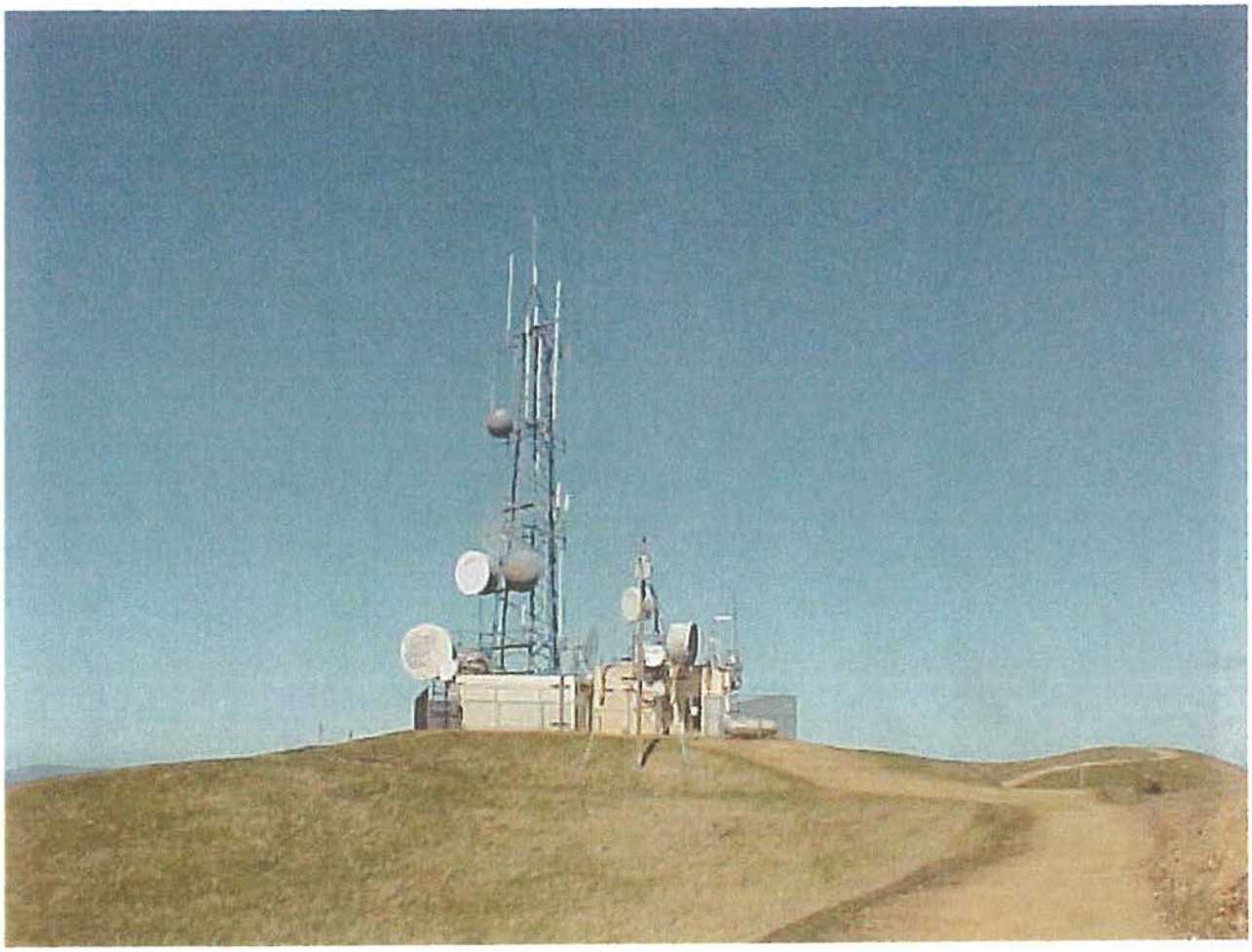


Photo 8

Big Rock Ridge (West Site)
Motorola Site

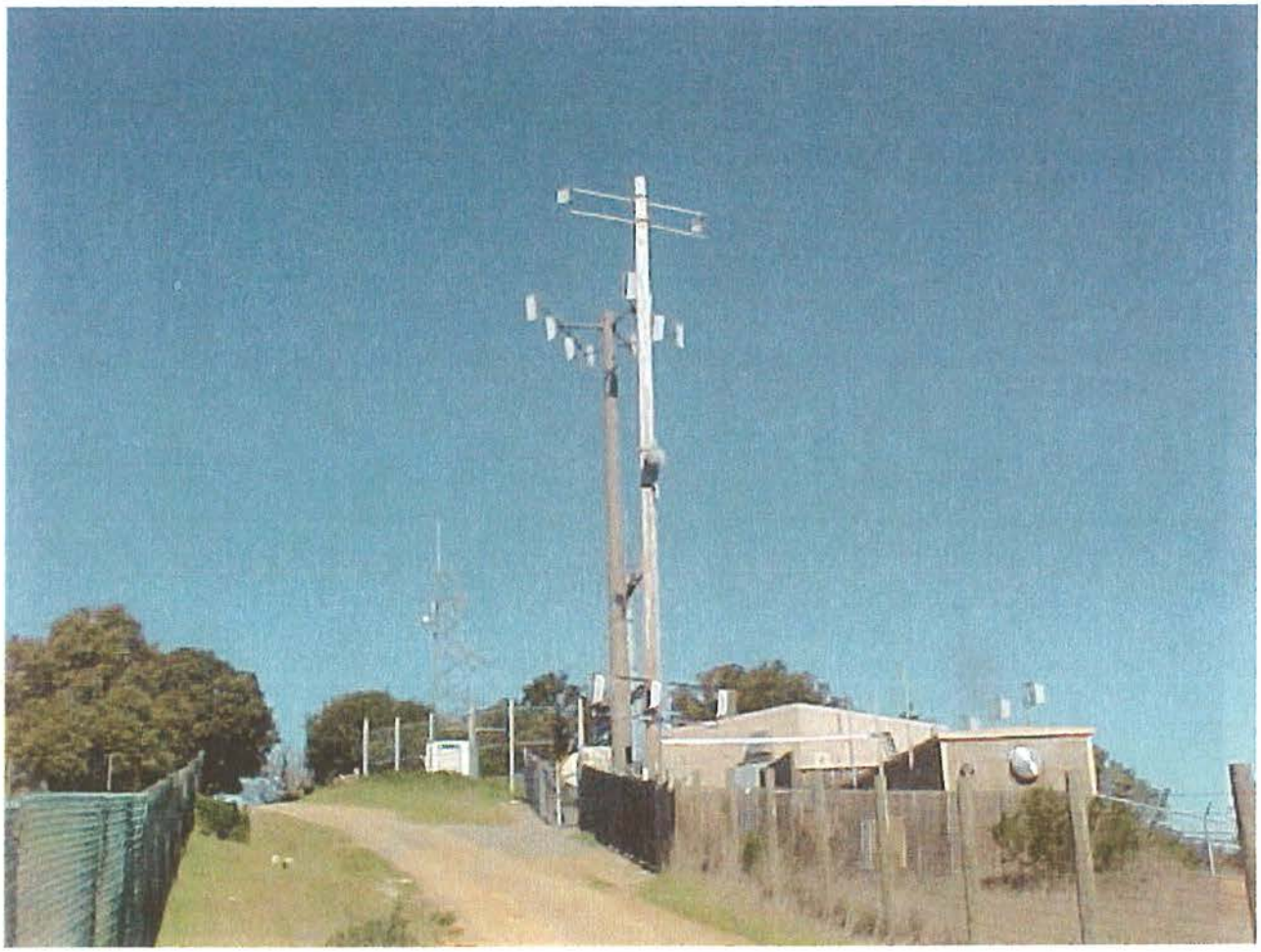


Photo 9

Cherry Hill
Chambers Cable Site

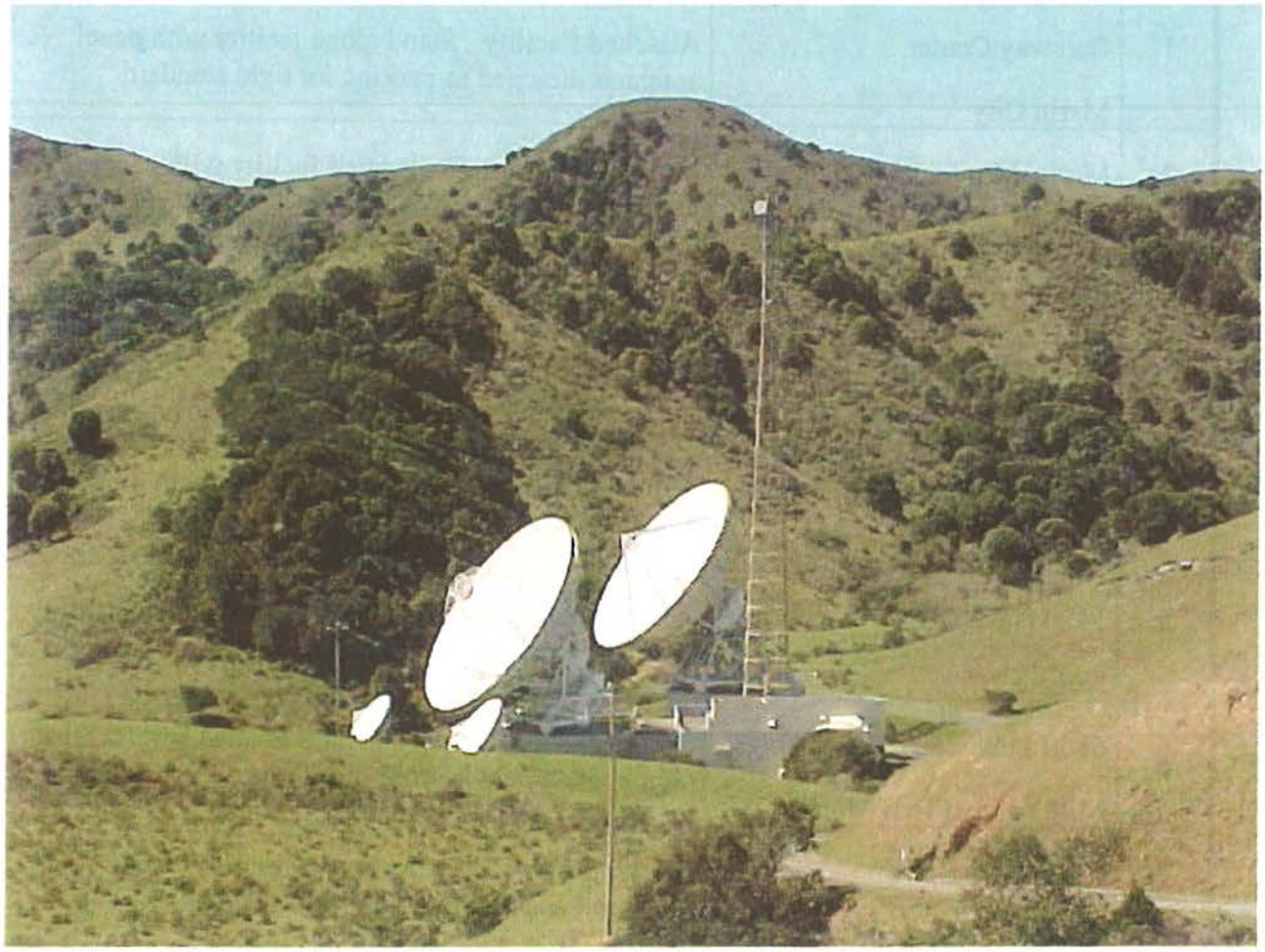


Photo 10

Three Peaks
AT&T Communications Site

INDEX TO PHOTOGRAPHS

NO.	SITE LOCATION	COMMERCIAL WIRELESS FACILITY/FEATURE PICTURED
1	Gateway Center Marin City	Attached Facility: Stand alone facility with panel antennas attached to parking lot light standard
2	Marin Municipal Water Tank Marin City	Monopole tower: Co-located facility with panel antennas
3	7 North Knoll Road Mill Valley (Eagle Rock Professional Building)	Attached Facility: Stand alone facility with roof-top mounted panel antennas
4	Pacheco Ridge East Marinwood	Monopole tower: Stand alone facility with dipole antennas
5	5420 Nave Drive Novato	Telephone pole (monopole) with panel antenna array
6	680 Redwood Highway Mill Valley (Tam Motel)	Stealth Design: Panel antennas located behind false chimney element at front of building
7	5300 Nave Drive Novato (Nave Bowl)	Stealth design: Roof-mounted dipole antennas disguised as architectural roof ornament
8	300 Main Street Sausalito	Stealth design: Microfacility attached to light pole

Photo 1

Gateway Center – Marin City

Facility Type: Panel Antennas Attached to Light Standard

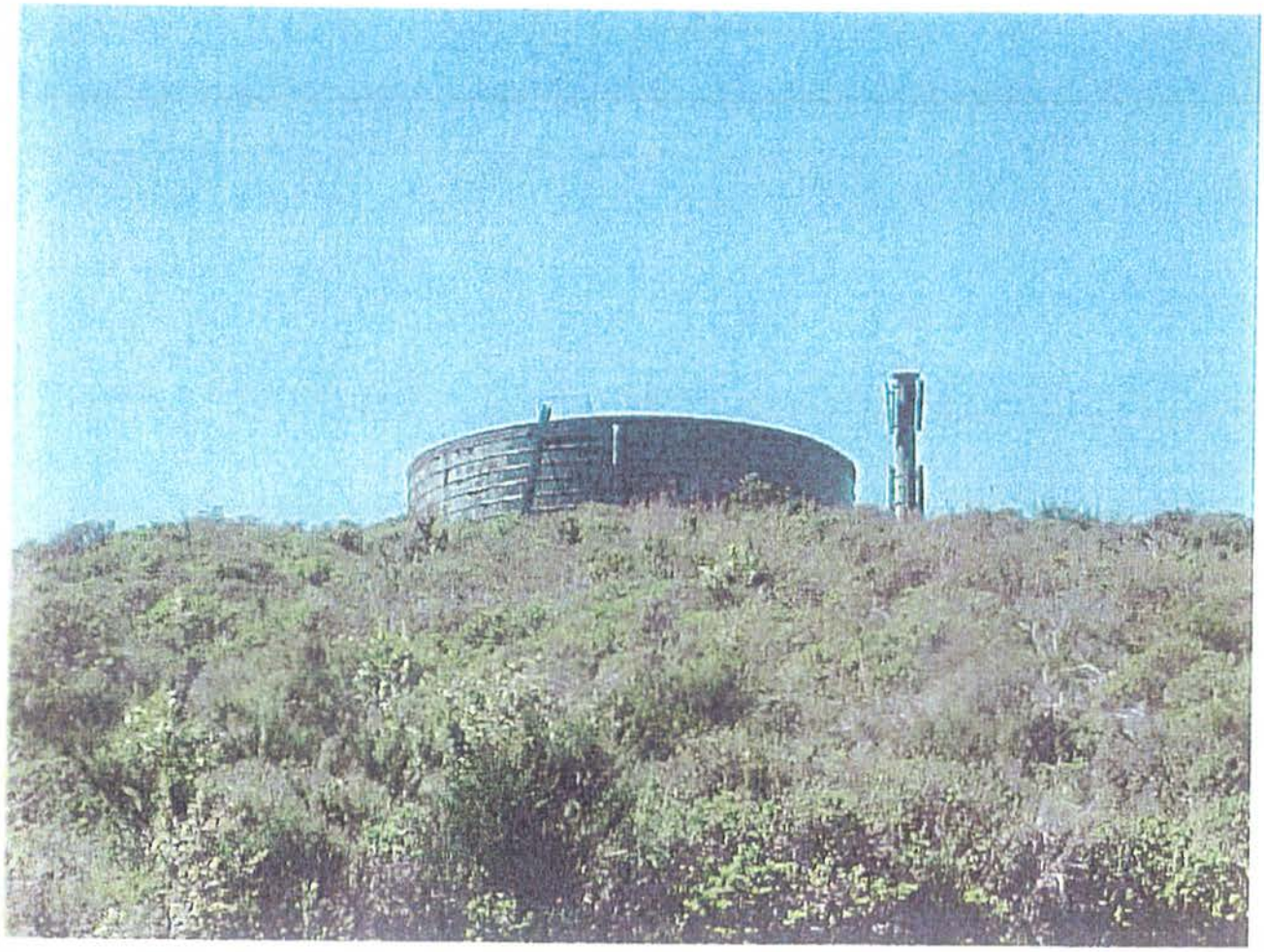


Photo 2

Marin Municipal Water Tank – Marin City

Facility Type: Monopole Located Adjacent to Water Tank

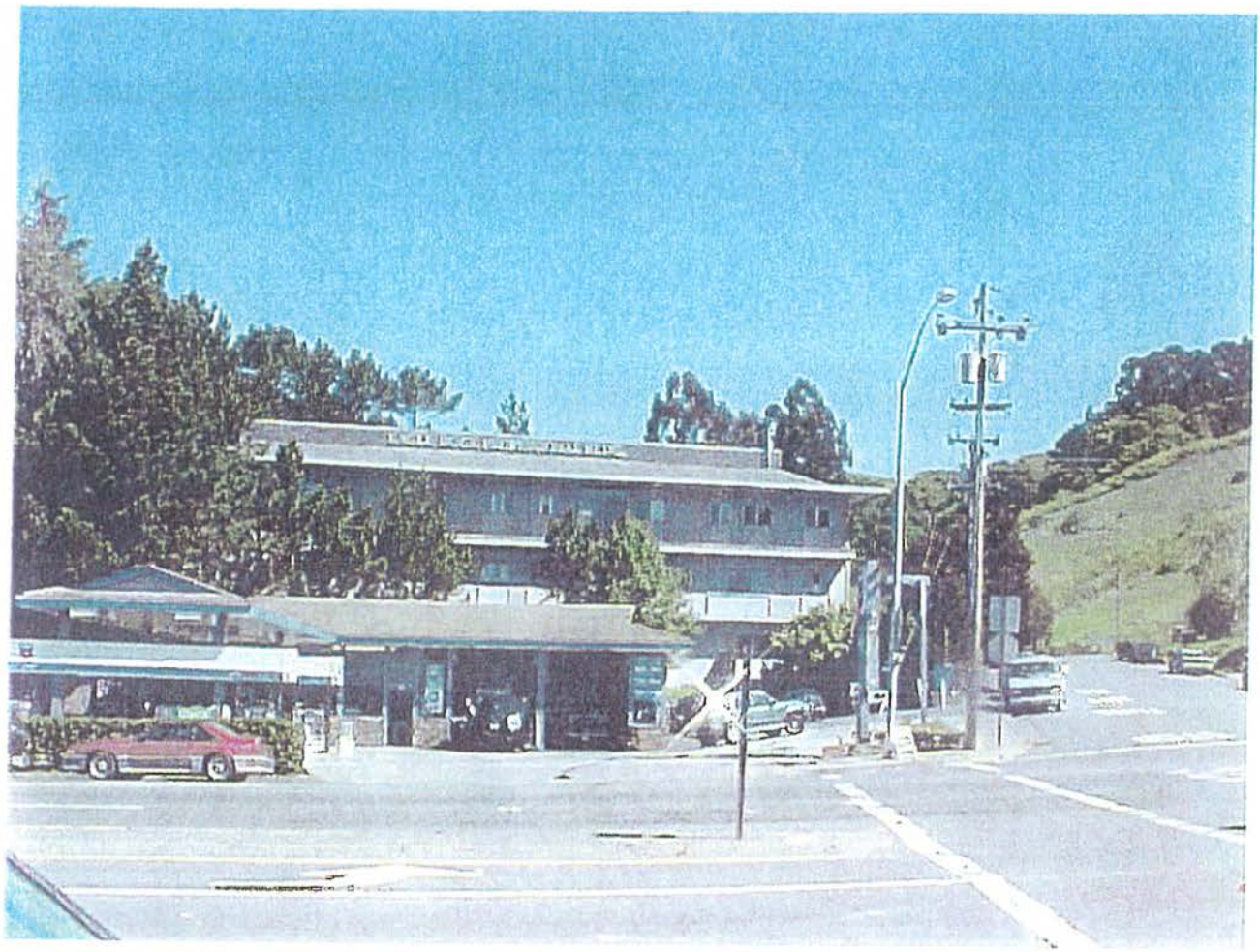


Photo 3

7 North Knoll Road, Mill Valley

Facility Type: Panel Antennas Mounted at Far Right Edged of Parapet Roof

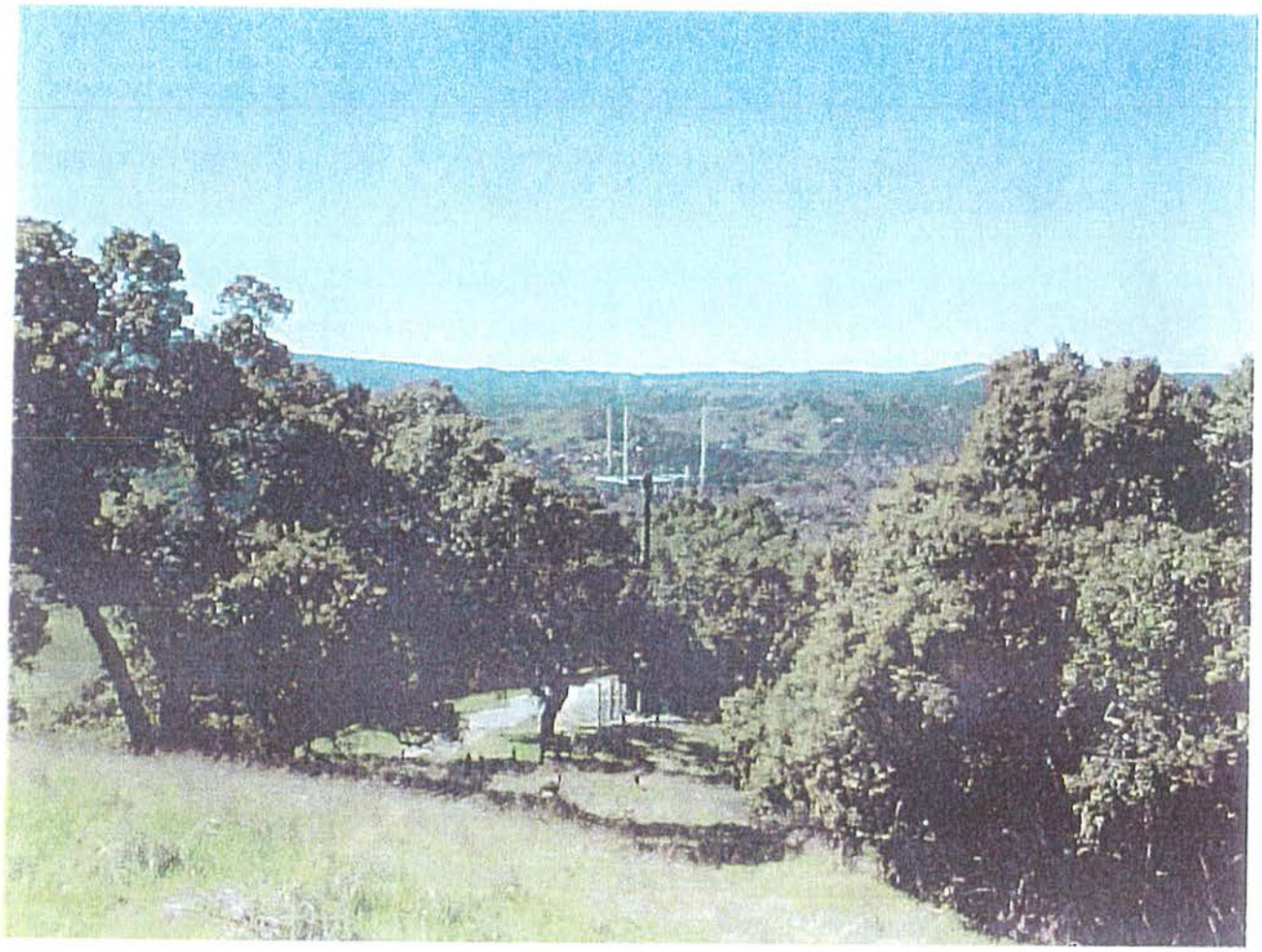


Photo 4

Pacheco Ridge East - Marinwood

Facility Type: Dipole Antennas

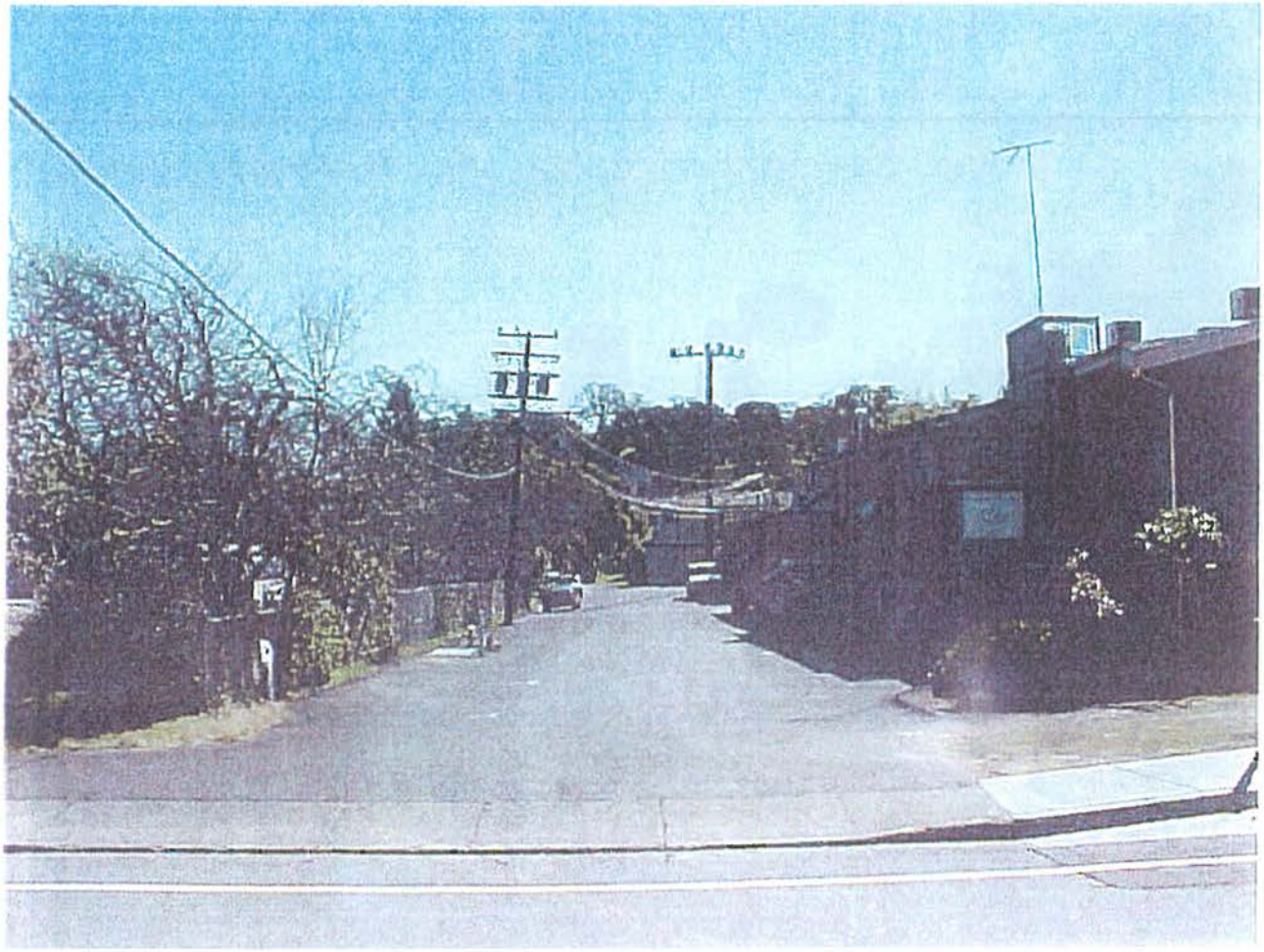


Photo 5

5420 Nave Drive - Novato

Facility Type: Panel Antennas Mounted on Utility Pole

Photo 6

680 Redwood Highway – Mill Valley

Facility Type: Panel Antennas Mounted Inside of False Chimney

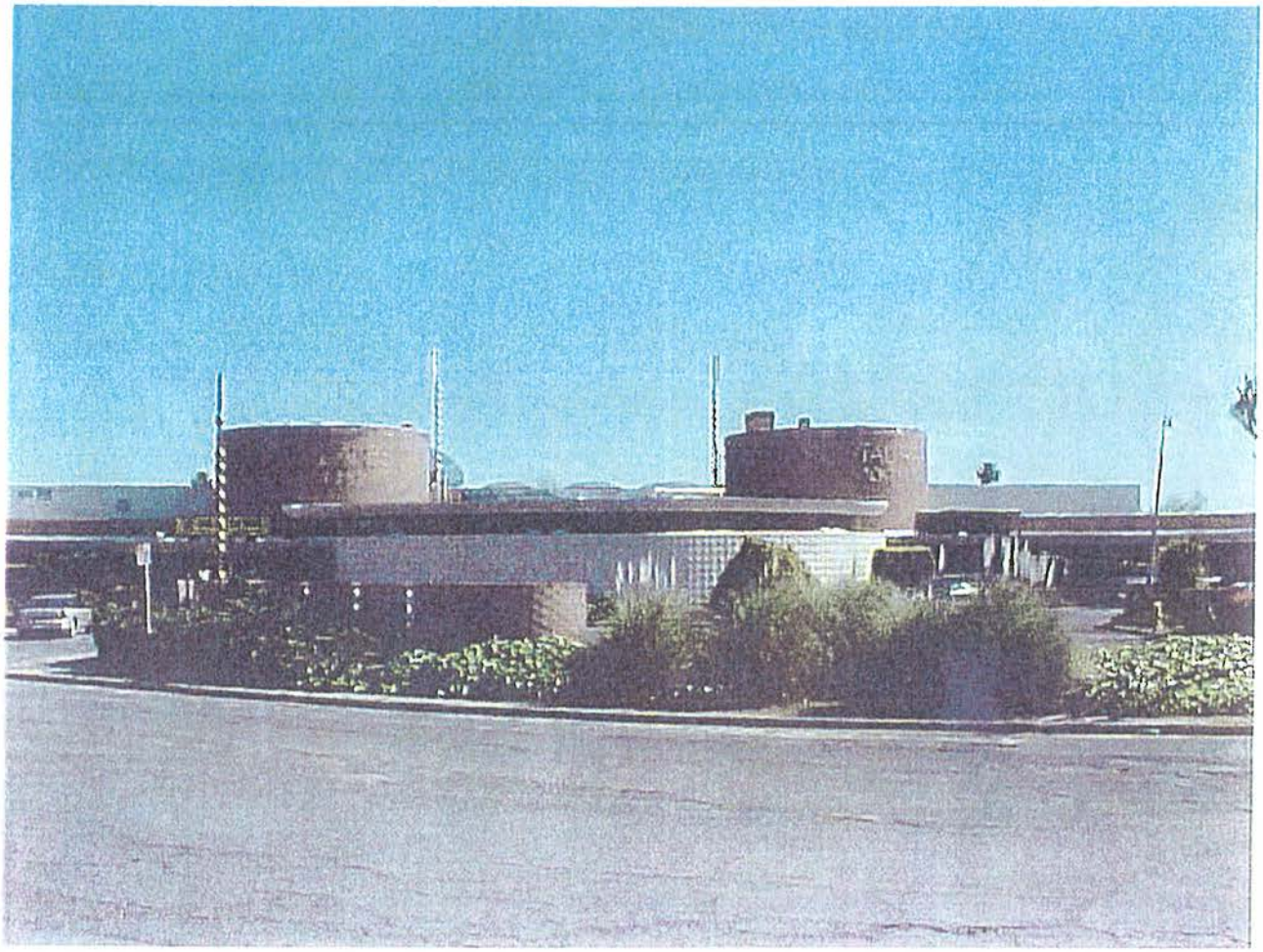


Photo 7

5300 Nave Drive - Novato

Facility Type: Panel Antennas Mounted on Roof Ornaments

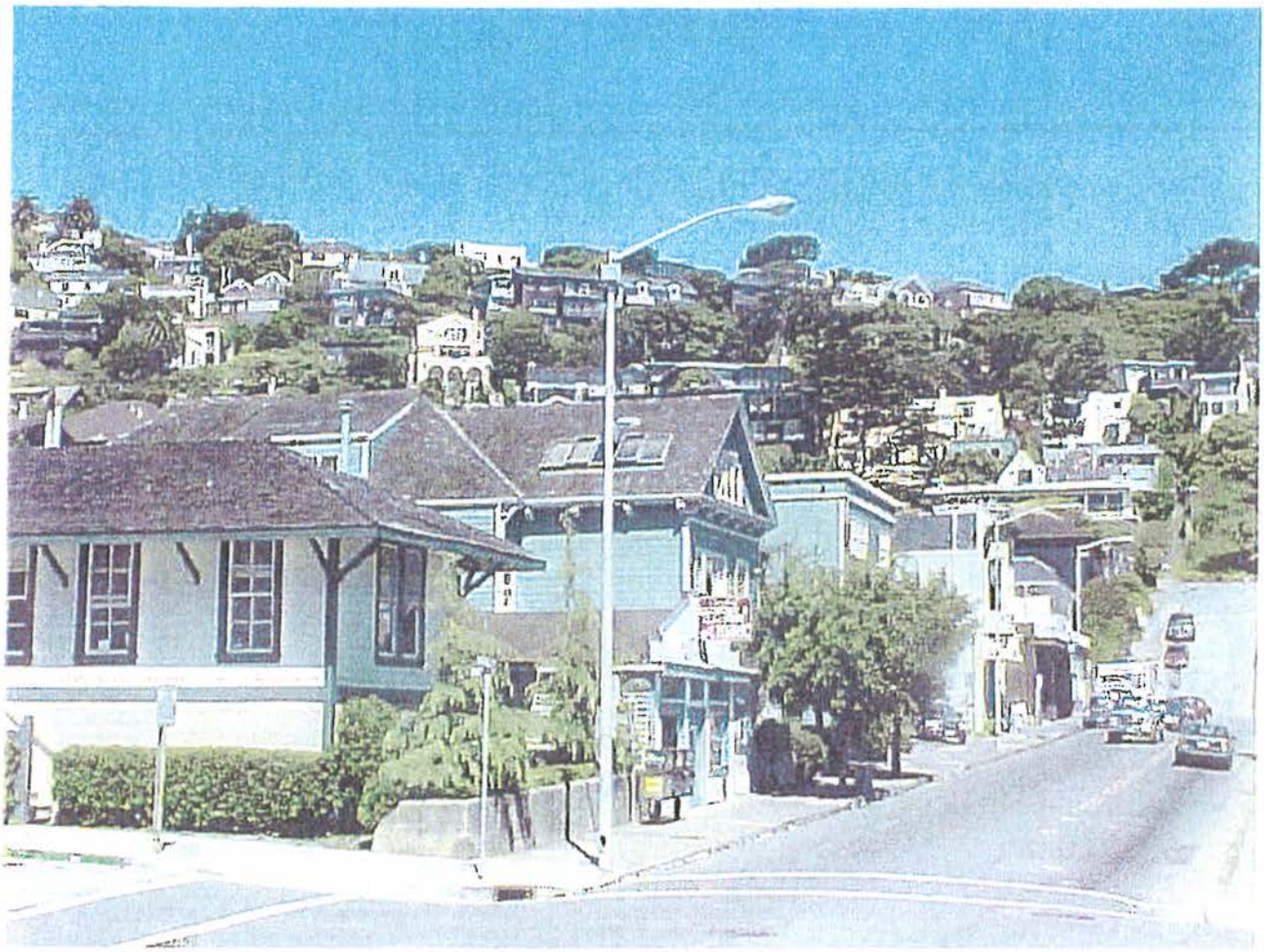


Photo 8

300 Main Street – Sausalito

Facility Type: Micro-facility Mounted at Top of Vertical Section of Light Standard

APPENDIX C

FCC DATABASE

APPENDIX C:

FCC ANTENNA STRUCTURE DATABASE

This appendix contains information about the antenna structure database maintained by the Federal Communications Commission (FCC). This database provides limited information about antenna structures within the US, including Marin County. The following information and database description was provided by the FCC.

Part 17 of the FCC Rules specifically define the term "antenna structures" as "[t]he radiating or receive system, its supporting structures and any appurtenances mounted thereon." The FCC has adopted an antenna structure registration process under which each antenna structure that requires Federal Aviation Administration (FAA) notification -- including new and existing structures -- must be registered with the FCC by its owner.

An antenna structure could be a free standing structure, built specifically to support or act as an antenna, or it could be a structure mounted on some other man-made object (such as a building or bridge). In the latter case, note that the structure must be registered with the FCC, not the building or bridge. Objects such as buildings, observation towers, bridges, windmills, and water towers that do not have an antenna mounted on them are not antenna structures and should not be registered. Keep in mind that the FCC only has jurisdiction over antenna structures, and thus, other objects that do not support antennas are not required to be registered with the FCC -- regardless of their location or height.

Most antenna structures that are higher than 60.96 meters (200 feet) above ground level or that may interfere with the flight path of a nearby airport must be studied by the FAA and registered with the FCC.

A proposed antenna structure must be registered with the FCC and be assigned a Registration Number prior to construction.

Regardless of whether an antenna structure must be registered with the Commission, there may be state and/or local regulations (separate from the requirements of the FCC and FAA) which must be satisfied prior to construction.

The owner must modify the registration information submitted to the FCC for the following:

- A change in painting and/or lighting specifications as recommended by the FAA.

- A change in coordinates or height for the structure. (This means that the originally submitted data was in error or that the structure has been relocated. If a structure's coordinates change by more than one second or height increases by more than one foot, a new FAA determination will be required.)

- A change in ownership information (name, mailing address, telephone number).

- Dismantling of the antenna structure.

The FCC's Wireless Telecommunications Bureau (WTB) provides detailed information on antenna support registration filing procedures and database access on its internet homepage on the World Wide Web at http://www.fcc.gov/wtb/antstruc.html.

ANTENNA STRUCTURES IN MARIN COUNTY

The FCC antenna structure database was accessed in July, 1997. A search was performed which extended 22.5 miles from the town of Tocaloma. The results of that search were used to complete the inventory of the minor telecommunications facilities in Tables 3 through 5 of Appendix A. The database provided the correct geographic location of several of the inventoried commercial wirless facility sites and detailed elevation data for towers at those sites. Also several entries were added to the inventory based on new information found in the database.

The database can serve as a useful tool for County planners who wish to corroborate existing CMRS site information from other sources or to discover the location of new sites. However, the following shortcomings of the antenna structure database must be considered:

1. Many antenna structures in the County will not appear in the database because they are exempt from FAA notification. Exempt structures are those which are low in elevation and far from airports, or those which are shielded by terrain or existing man-made structures. For example, none of the Mt. Tamalpais towers are recorded.

2. Many of the structures that are listed in the database do not support antennas. Older structures may have been removed or abandoned. Other listings may indicate structures that were planned for but never built. Still other entries may be duplicates. For example, there are seven listings for the Big Rock ridge sites.

3. The database does not reveal which FCC-licensed services are using the structure, or how many and what kind of antennas of antennas it supports. Often the applicant's name is the only clue as to the structure's use.

4. Like any large database, it contains erroneous information. Certain errors may propagate. The most insidious are inaccurate geographic coordinates. If the early applicants at a major facility provides bad coordinates, later applications for new structures will tend to reflect the errors. Also, applicants at new sites will simply use the coordinates and elevation of existing nearby sites rather than determining the correct information. On Big Rock, the Motorola and C&C sites are 400 feet apart, yet applicants routinely use one set of coordinates to describe either site.

5. The "CITY" location information is often wrong. This makes it difficult to determine which sites are actually within the County. At least one entry indicates "PETALUMA" for a site near Novato, and the KCBS AM towers are listed in "SAN FRANCISCO." When in doubt, the actual location should be determined by coordinates.

The following pages show all of the database entries for Marin County.
Bolinas Point; site of RCA Global Communications tower:

LATITUDE ->375447 LONGITUDE ->1224328
STREET -> RCA ANTENNA FARM
CITY -> BOLINAS STATE -> CA
STRUCTURE TYPE -> TOWER FCC TOWER # -> 031172
SUPPORT FT -> .0 SUPPORT METERS -> .0
TOWER FT -> .0 TOWER METERS -> .0
ANTENNA FT -> .0 ANTENNA METERS -> .0
BEACON FT -> 0 BEACON METERS -> .0
FCC AGL FT -> 300.0 FCC AGL METERS -> 91.0
FCC AMSL FT -> 475.0 FCC AMSL METERS -> 144.0
APPLICANT NAME -> ACTION DATE -> 00000 TYPE -> OLD

Point Reyes Station; Cellular A Block site:

LATITUDE ->380620 LONGITUDE ->1224619
STREET -> N BLK MTN APPLICANT NAME -> BAY AREA CELLULAR
CITY -> PT. REYES STATION STATE -> CA
STRUCTURE TYPE -> TOWER FCC TOWER # -> 084982
SUPPORT FT -> .0 SUPPORT METERS -> .0
TOWER FT -> .0 TOWER METERS -> .0
ANTENNA FT -> .0 ANTENNA METERS -> .0
BEACON FT -> 0 BEACON METERS -> .0
FCC AGL FT -> 220.0 FCC AGL METERS -> 67.0
FCC AMSL FT -> 870.0 FCC AMSL METERS -> 265.0
ACTION DATE -> 880718 TYPE -> ADD
REMARKS: A BAND CELLULAR

Three Peaks; near Marshall, includes AT&T satellite earth stations:

LATITUDE ->380852 LONGITUDE ->1224736
STREET -> 5.5 MILES NNE OF APPLICANT NAME -> AT&T
CITY -> POINT REYES STATE -> CA
STRUCTURE TYPE -> TOWER FCC TOWER # -> 094877
SUPPORT FT -> .0 SUPPORT METERS -> .0
TOWER FT -> 259.0 TOWER METERS -> 78.0
ANTENNA FT -> .0 ANTENNA METERS -> .0
BEACON FT -> 0 BEACON METERS -> .0
FCC AGL FT -> 259.0 FCC AGL METERS -> 78.0
FCC AMSL FT -> 617.0 FCC AMSL METERS -> 188.0
ACTION DATE -> 930324 TYPE -> MOD
REMARKS: FAA LTR OF 5/9/89 RE COMPLIANCE WITH ORDINANCE OF MARIN

Mt Beacon, Wolfback Ridge; KDFC-FM, 800MHz SMR (Cellular A&B Block):

LATITUDE ->375058
STREET ->
CITY -> SAUSALITO
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> .0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 303.0
FCC AMSL FT ->1378.0FCC
ACTION DATE -> 610404

LONGITUDE ->1222956
APPLICANT NAME ->
STATE -> CA
FCC TOWER # -> 031049
SUPPORT METERS -> .0
TOWER METERS -> .0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 92.0
AMSL METERS -> 420.0
TYPE -> OLD

San Pedro Ridge; site of Pacific Bell microwave facility:

LATITUDE ->375919
STREET -> 1.5 MI NE OF CITY
CITY -> SAN RAFAEL
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> 64.0
ANTENNA FT -> 17.0
BEACON FT -> 0
FCC AGL FT -> 81.0
FCC AMSL FT ->1107.0
ACTION DATE -> 921013

LONGITUDE ->1223006
APPLICANT NAME -> PACIFIC BELL
STATE -> CA
FCC TOWER # -> 031358
SUPPORT METERS -> .0
TOWER METERS -> 19.0
ANTENNA METERS -> 17.0
BEACON METERS -> .0
FCC AGL METERS -> 24.0
FCC AMSL METERS -> 337.0
TYPE -> MOD

San Pedro Ridge; C&C site:

LATITUDE ->375924
STREET -> 2.6 KM E OF CIVC CTR
CITY -> SAN RAFAEL
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> 38.0
ANTENNA FT -> 12.0
BEACON FT -> 0
FCC AGL FT -> 50.0
FCC AMSL FT ->1108.0
ACTION DATE -> 910325

LONGITUDE ->1222957
APPLICANT NAME -> MARIN BROADCASTING
STATE -> CA
FCC TOWER # -> 112629
SUPPORT METERS -> .0
TOWER METERS -> 11.0
ANTENNA METERS -> 12.0
BEACON METERS -> .0
FCC AGL METERS -> 15.0
FCC AMSL METERS -> 337.0
TYPE -> ADD

San Pedro Ridge; Cellular A Block site and KKHI-FM:

LATITUDE ->375925
LONGITUDE ->1222958
STREET -> SAN PEDRO MTN
APPLICANT NAME -> MARIN BROADCASTING
CITY -> SAN RAFAEL
STATE -> CA
STRUCTURE TYPE -> TOWER
FCC TOWER # -> 113842
SUPPORT FT -> .0
SUPPORT METERS -> .0
TOWER FT -> 118.0
TOWER METERS -> 36.0
ANTENNA FT -> .0
ANTENNA METERS -> .0
BEACON FT -> 0
BEACON METERS -> .0
FCC AGL FT -> 118.0
FCC AGL METERS -> 36.0
FCC AMSL FT ->1175.0
FCC AMSL METERS -> 358.0
ACTION DATE -> 920911
TYPE -> MOD

San Pedro Ridge:

LATITUDE ->375949
LONGITUDE ->1223041
STREET -> SAN PEDRO HILL
APPLICANT NAME -> CERTIFIED LOCK & SAFE
CITY -> SANTA VENITIA
STATE -> CA
STRUCTURE TYPE -> TOWER
FCC TOWER # -> 122906
SUPPORT FT -> .0
SUPPORT METERS -> .0
TOWER FT -> 60.0
TOWER METERS -> 18.0
ANTENNA FT -> .0
ANTENNA METERS -> .0
BEACON FT -> 0
BEACON METERS -> .0
FCC AGL FT -> 60.0
FCC AGL METERS -> 18.0
FCC AMSL FT ->1010.0
FCC AMSL METERS -> 307.0
ACTION DATE -> 931119
TYPE -> ADD
REMARKS: SPONSOR STATED PROPOSAL IS NOT ON FAA LEASED PROPERTY.

San Rafael:

LATITUDE ->380101
LONGITUDE ->1223136
STREET ->
APPLICANT NAME ->
CITY -> SAN RAFAEL
STATE -> CA
STRUCTURE TYPE -> TOWER
FCC TOWER # -> 031430
SUPPORT FT -> .0
SUPPORT METERS -> .0
TOWER FT -> .0
TOWER METERS -> .0
ANTENNA FT -> .0
ANTENNA METERS -> .0
BEACON FT -> 0
BEACON METERS -> .0
FCC AGL FT -> 211.0
FCC AGL METERS -> 64.0
FCC AMSL FT -> 216.0
FCC AMSL METERS -> 65.0
ACTION DATE -> 581230
TYPE -> OLD

San Rafael; north of downtown:

LATITUDE ->380111	LONGITUDE ->1223225
STREET -> 1600 LOSGAMOS DR	APPLICANT NAME -> BAY AREA TELEPORT
CITY -> SAN RAFAEL	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 093751
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 81.0	TOWER METERS -> 24.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 81.0	FCC AGL METERS -> 24.0
FCC AMSL FT -> 111.0	FCC AMSL METERS -> 33.0
ACTION DATE -> 890222	TYPE -> ADD

San Rafael; north of downtown:

LATITUDE ->380134	LONGITUDE ->1223102
STREET -> 4570 REDWOOD HWY	APPLICANT NAME ->
CITY -> SAN RAFAEL	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 031450
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> .0	TOWER METERS -> .0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 210.0	FCC AGL METERS -> 64.0
FCC AMSL FT -> 210.0	FCC AMSL METERS -> 64.0
ACTION DATE -> 720509	TYPE -> OLD

San Rafael; north of downtown:

LATITUDE ->380138	LONGITUDE ->1223113
STREET ->SE OF SILVERA BRCH	APPLICANT NAME ->
CITY -> SAN RAFAEL	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 031453
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> .0	TOWER METERS -> .0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 213.0	FCC AGL METERS -> 64.0
FCC AMSL FT -> 219.0	FCC AMSL METERS -> 66.0
ACTION DATE -> 821229	TYPE -> OLD

Fairfax:

LATITUDE ->380215
STREET -> 5 MI NW OF CITY
CITY -> SAN RAFAEL
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> .0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 55.0
FCC AMSL FT ->1135.0
ACTION DATE -> 660720

LONGITUDE ->1223400
APPLICANT NAME ->
STATE -> CA
FCC TOWER # -> 031490
SUPPORT METERS -> .0
TOWER METERS -> .0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 16.0
FCC AMSL METERS -> 346.0
TYPE -> OLD

Fairfax:

LATITUDE ->380224
STREET -> 1.5 M NW
CITY -> FAIRFAX
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> 68.0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 68.0
FCC AMSL FT ->1158.0
ACTION DATE -> 880423

LONGITUDE ->1223418
APPLICANT NAME -> HORIZON CABLE TV, INC.
STATE -> CA
FCC TOWER # -> 081978
SUPPORT METERS -> .0
TOWER METERS -> 20.0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 20.0
FCC AMSL METERS -> 353.0
TYPE -> ADD

Ignacio; southeast of downtown:

LATITUDE ->380300
STREET ->BOLING & SELFRIDGE
CITY -> NOVATO
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> .0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 60.0
FCC AMSL FT -> 270.0
ACTION DATE -> 880405

LONGITUDE ->1223120
APPLICANT NAME -> HORIZON CABLE TV, INC.
STATE -> CA
FCC TOWER # -> 081663
SUPPORT METERS -> .0
TOWER METERS -> .0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 18.0
FCC AMSL METERS -> 82.0
TYPE -> ADD

Ignacio; Cellular A Block site:

LATITUDE ->380307	LONGITUDE ->1223143
STREET -> 5480-A NAVE DR	APPLICANT NAME -> BAY AREA CELLULAR
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 124606
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 45.0	TOWER METERS -> 13.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 45.0	FCC AGL METERS -> 13.0
FCC AMSL FT -> 125.0	FCC AMSL METERS -> 38.0
ACTION DATE -> 940510	TYPE -> ADD

Ignacio; Hamilton Air Force Base, Cellular B Block site:

LATITUDE ->380318	LONGITUDE ->1223108
STREET ->	APPLICANT NAME -> GTE MOBILNET
CITY -> HAMILTON	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 123739
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 137.0	TOWER METERS -> 41.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 137.0	FCC AGL METERS -> 41.0
FCC AMSL FT -> 247.0	FCC AMSL METERS -> 75.0
ACTION DATE -> 940217	TYPE -> ADD

Ignacio; southeast of downtown:

LATITUDE ->380322	LONGITUDE ->1223132
STREET -> 99 SMITH RANCH RD	APPLICANT NAME -> CAL STATE AUTO ASSN
CITY -> SAN RAFAEL	STATE -> CA
STRUCTURE TYPE -> BTWR	FCC TOWER # -> 117998
SUPPORT FT -> 35.0	SUPPORT METERS -> 10.0
TOWER FT -> 15.0	TOWER METERS -> 4.0
ANTENNA FT -> 10.0	ANTENNA METERS -> 10.0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 60.0	FCC AGL METERS -> 18.0
FCC AMSL FT -> 90.0	FCC AMSL METERS -> 27.0
ACTION DATE -> 920803	TYPE -> ADD

REMARKS: 8/3/92 -- EXISTING LICENSE KAS450.

Big Rock Ridge; C&C site tenant? Note longitude error is 10 minutes !

LATITUDE ->380333	LONGITUDE ->1222610
STREET -> BIG ROCK 4.5 MI W	APPLICANT NAME -> PINOLE VALLEY TRUCKING
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 095123
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 65.0	TOWER METERS -> 19.0
ANTENNA FT -> 20.0	ANTENNA METERS -> 20.0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 85.0	FCC AGL METERS -> 25.0
FCC AMSL FT ->1953.0	FCC AMSL METERS -> 595.0
ACTION DATE -> 890320	TYPE -> ADD

Big Rock Ridge; C&C site, Cellular A (& B?) Block, 900 Mhz SMR:

LATITUDE ->380333	LONGITUDE ->1223610
STREET -> 4 1/2 MI E.	APPLICANT NAME -> CAL STATE AUTO ASSN.
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 113578
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 85.0	TOWER METERS -> 25.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 85.0	FCC AGL METERS -> 25.0
FCC AMSL FT ->1972.0	FCC AMSL METERS -> 601.0
ACTION DATE -> 910625	TYPE -> ADD

Big Rock Ridge; correct NAD 27 coordinates & elev. of C&C site:

LATITUDE ->380333	LONGITUDE ->1223611
STREET -> BIG ROCK, 4 MI SW	APPLICANT NAME -> CALIFORNIA, STATE OF
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 113827
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 100.0	TOWER METERS -> 30.0
ANTENNA FT -> 18.0	ANTENNA METERS -> 18.0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 118.0	FCC AGL METERS -> 36.0
FCC AMSL FT ->2007.0	FCC AMSL METERS -> 611.0
ACTION DATE -> 930413	TYPE -> MOD

REMARKS: FILED BY C & C EQUIPMENT CO. 3/11/93 -- INCREASED AGL/AMSL

Big Rock Ridge; Motorola site? This pole may not exist:

LATITUDE ->380334	LONGITUDE ->1223617
STREET -> 1/2 MI SW OF	APPLICANT NAME -> ALL CITY PAGING INC
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> POLE	FCC TOWER # -> 114562
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 80.0	TOWER METERS -> 24.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 80.0	FCC AGL METERS -> 24.0
FCC AMSL FT ->1967.0	FCC AMSL METERS -> 599.0
ACTION DATE -> 920731	TYPE -> MOD

Big Rock Ridge; correct NAD 27 coordinates of Motorola site:

LATITUDE ->380335	LONGITUDE ->1223617
STREET -> BIG ROCK RIDGE	APPLICANT NAME -> PAGING NETWORK OF SF INC
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 114325
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 104.0	TOWER METERS -> 31.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 104.0	FCC AGL METERS -> 31.0
FCC AMSL FT ->1988.0	FCC AMSL METERS -> 605.0
ACTION DATE -> 920319	TYPE -> MOD

Big Rock Ridge; Motorola site ? 800 & 900 MHz SMRs are here:

LATITUDE ->380338	LONGITUDE ->1223617
STREET -> BIG ROCK RIDGE	APPLICANT NAME -> MOTOROLA INC
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 121644
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 80.0	TOWER METERS -> 24.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 80.0	FCC AGL METERS -> 24.0
FCC AMSL FT ->1967.0	FCC AMSL METERS -> 599.0
ACTION DATE -> 930727	TYPE -> ADD

Big Rock; Motorola site ? erroneous coordinates & elevations:

LATITUDE ->380340	LONGITUDE ->1223616
STREET -> BIG ROCK RIDGE	APPLICANT NAME -> LAIDLAW ENV SERVICES
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 113057
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 60.0	TOWER METERS -> 18.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 60.0	FCC AGL METERS -> 18.0
FCC AMSL FT ->1940.0	FCC AMSL METERS -> 591.0
ACTION DATE -> 910506	TYPE -> ADD

Ignacio; south of downtown:

LATITUDE ->380342	LONGITUDE ->1223239
STREET -> 1225 ESCONDIDA	APPLICANT NAME ->
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 031568
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> .0	TOWER METERS -> .0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 44.0	FCC AGL METERS -> 13.0
FCC AMSL FT -> 164.0	FCC AMSL METERS -> 50.0
ACTION DATE -> 780421	TYPE -> OLD

Ignacio; north of downtown:

LATITUDE ->380434	LONGITUDE ->1223216
STREET -> 37 HAMILTON DR.	APPLICANT NAME ->
CITY -> IGNACIO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 031598
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> .0	TOWER METERS -> .0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 90.0	FCC AGL METERS -> 27.0
FCC AMSL FT -> 130.0	FCC AMSL METERS -> 39.0
ACTION DATE -> 771101	TYPE -> OLD

Novato; State of California site:

LATITUDE ->380515
LONGITUDE ->1223202
STREET -> 1 MI E HWY 37
APPLICANT NAME -> CALIFORNIA, STATE OF
CITY -> NOVATO
STATE -> CA
STRUCTURE TYPE -> POLE
FCC TOWER # -> 120183
SUPPORT FT -> 25.0
SUPPORT METERS -> 7.0
TOWER FT -> .0
TOWER METERS -> .0
ANTENNA FT -> 24.0
ANTENNA METERS -> 24.0
BEACON FT -> 0
BEACON METERS -> .0
FCC AGL FT -> 49.0
FCC AGL METERS -> 14.0
FCC AMSL FT -> 57.0
FCC AMSL METERS -> 17.0
ACTION DATE -> 960523
TYPE -> MOD
REMARKS: INCREASE TO EXISTING TOWER # 120183, FAA 92-AWP-1205-OE.

Novato; this tower may not have been built:

LATITUDE ->380542
LONGITUDE ->1224019
STREET -> 3.8 MI SW OF CITY
APPLICANT NAME -> N. BAY BROADCASTING
CITY -> NOVATO
STATE -> CA
STRUCTURE TYPE -> TOWER
FCC TOWER # -> 065602
SUPPORT FT -> .0
SUPPORT METERS -> .0
TOWER FT -> .0
TOWER METERS -> .0
ANTENNA FT -> .0
ANTENNA METERS -> .0
BEACON FT -> 0
BEACON METERS -> .0
FCC AGL FT -> 298.0
FCC AGL METERS -> 90.0
FCC AMSL FT ->1658.0
FCC AMSL METERS -> 505.0
ACTION DATE -> 850930
TYPE -> MOD

Novato; City of Novato site:

LATITUDE ->380615
LONGITUDE ->1223400
STREET -> N END HAYDEN DR
APPLICANT NAME -> NOVATO, CITY OF
CITY -> NAVATO
STATE -> CA
STRUCTURE TYPE -> POLE
FCC TOWER # -> 117203
SUPPORT FT -> 20.0
SUPPORT METERS -> 6.0
TOWER FT -> .0
TOWER METERS -> .0
ANTENNA FT -> 20.0
ANTENNA METERS -> 20.0
BEACON FT -> 0
BEACON METERS -> .0
FCC AGL FT -> 40.0
FCC AGL METERS -> 12.0
FCC AMSL FT -> 195.0
FCC AMSL METERS -> 59.0
ACTION DATE -> 920602
TYPE -> MOD
REMARKS: SITE IS SHIELDED

Novato; Cellular A Block site:

LATITUDE ->380646	LONGITUDE ->1223257
STREET -> 615 ATHERTON AVE	APPLICANT NAME -> BAY AREA CELLULAR
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 115965
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 80.0	TOWER METERS -> 24.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 80.0	FCC AGL METERS -> 24.0
FCC AMSL FT -> 535.0	FCC AMSL METERS -> 163.0
ACTION DATE -> 920219	TYPE -> ADD

Novato; Cellular B Block site:

LATITUDE ->380647	LONGITUDE ->1223256
STREET -> ROBINHOOD DRIVE	APPLICANT NAME ->
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 031679
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> .0	TOWER METERS -> .0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 54.0	FCC AGL METERS -> 16.0
FCC AMSL FT -> 504.0	FCC AMSL METERS -> 153.0
ACTION DATE -> 840208	TYPE -> OLD

Novato; KCBS AM array east of Gnoss Field:

LATITUDE ->380823	LONGITUDE ->1223145
STREET ->	APPLICANT NAME -> KCBS
CITY -> SAN FRANCISCO	STATE -> CA
STRUCTURE TYPE -> 4 TWR ARRAY	FCC TOWER # -> 117392
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 505.0	TOWER METERS -> 153.0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 505.0	FCC AGL METERS -> 153.0
FCC AMSL FT -> 511.0	FCC AMSL METERS -> 155.0
ACTION DATE -> 920608	TYPE -> MOD

REMARKS: ALL TOWERS OF EQUAL HEIGHT.

Burdell Mountain:

LATITUDE ->380842
STREET -> 2.5 MILRD NO.OF
CITY -> NOVATO
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> .0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 91.0
FCC AMSL FT ->1591.0
ACTION DATE -> 890130
LONGITUDE ->1223535
APPLICANT NAME -> AT&T
STATE -> CA
FCC TOWER # -> 091883
SUPPORT METERS -> .0
TOWER METERS -> .0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 27.0
FCC AMSL METERS -> 484.0
TYPE -> ADD

Burdell Mountain:

LATITUDE ->380846
STREET ->BURDELL MT 6.3 M N
CITY -> NOVATO
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> 100.0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 100.0
FCC AMSL FT ->1658.0
ACTION DATE -> 880218
LONGITUDE ->1223525
APPLICANT NAME -> MOBILECOMM OF SF
STATE -> CA
FCC TOWER # -> 080646
SUPPORT METERS -> .0
TOWER METERS -> 30.0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 30.0
FCC AMSL METERS -> 505.0
TYPE -> ADD

Burdell Mountain; possible site of new UHF TV station KWOK, chl 68:

LATITUDE ->380853
STREET -> BURDELL MOUNTAIN
CITY -> NOVATO
STRUCTURE TYPE -> TOWER
SUPPORT FT -> .0
TOWER FT -> 300.0
ANTENNA FT -> .0
BEACON FT -> 0
FCC AGL FT -> 300.0
FCC AMSL FT ->1780.0
ACTION DATE -> 910417
LONGITUDE ->1223533
APPLICANT NAME -> NORTH BAY TV
STATE -> CA
FCC TOWER # -> 112882
SUPPORT METERS -> .0
TOWER METERS -> 91.0
ANTENNA METERS -> .0
BEACON METERS -> .0
FCC AGL METERS -> 91.0
FCC AMSL METERS -> 542.0
TYPE -> ADD

Burdell Mountain; State of California tower:

LATITUDE ->380900	LONGITUDE ->1223531
STREET ->BURDELL MTN 3 MI N	APPLICANT NAME -> CALIFORNIA, STATE OF
CITY -> NOVATO	STATE -> CA
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 121943
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> 200.0	TOWER METERS -> 61.0
ANTENNA FT -> 15.0	ANTENNA METERS -> 15.0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 215.0	FCC AGL METERS -> 65.0
FCC AMSL FT ->1773.0	FCC AMSL METERS -> 540.0
ACTION DATE -> 930825	TYPE -> ADD

REMARKS: FINAL 9-9-93 PROVIDED NO PETITIONS ARE FILED; EXPIRES 3-9-94.

Novato; Corda Ranch Cellular A Block provider:

LATITUDE ->381057	LONGITUDE ->1223537
STREET ->	APPLICANT NAME -> CELLULAR ONE
CITY -> PETALUMA	STATE -> CA [East side Redwood Hwy]
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 115458
SUPPORT FT -> 16.0	SUPPORT METERS -> .0
TOWER FT -> 2.0	TOWER METERS -> 4.0
ANTENNA FT -> .0	ANTENNA METERS -> 2.0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 18.0	FCC AGL METERS -> 5.0
FCC AMSL FT -> 293.0	FCC AMSL METERS -> 89.0
ACTION DATE -> 920109	TYPE -> ADD

Novato; Corda Ranch Cellular B Block provider:

LATITUDE ->381103	LONGITUDE ->1223553
STREET -> 103000 REDWD HWY	APPLICANT NAME -> GTE MOBILNET
CITY -> NOVATO	STATE -> CA [East side Redwood Hwy]
STRUCTURE TYPE -> TOWER	FCC TOWER # -> 119657
SUPPORT FT -> .0	SUPPORT METERS -> .0
TOWER FT -> .0	TOWER METERS -> .0
ANTENNA FT -> .0	ANTENNA METERS -> .0
BEACON FT -> 0	BEACON METERS -> .0
FCC AGL FT -> 22.0	FCC AGL METERS -> 6.0
FCC AMSL FT -> 182.0	FCC AMSL METERS -> 55.0
ACTION DATE -> 930119	TYPE -> MOD

APPENDIX D

FCC LIMITS ON MAXIMUM PERMISSIBLE EXPOSURE TO EMF

Sec. 1.1310 Radiofrequency radiation exposure limits.

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, ``Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."

Note to Introductory Paragraph: These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in ``Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of ``IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

Table 1--Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magenetic Field Strength (A/m)	Power Density (mW/cm\2\)	Averaging Time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0.	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f\2\)	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f\2\)	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Citation: Code of Federal Regulations, Title 47, Chapter 1, Part 1

APPENDIX E

GUIDE TO ISSUES, POLICIES, AND CRITERIA

APPENDIX E:

COUNTY OF MARIN
COMMUNITY DEVELOPMENT AGENCY - PLANNING DIVISION

GUIDE TO THE MARIN COUNTY TELECOMMUNICATIONS FACILITIES POLICY PLAN

Telecommunications facilities are typically permitted subject to Design Review and Use Permit approvals. The administrative process for securing such approvals can be complex and time consuming. To facilitate preparation and review of telecommunications applications, the Community Development Agency has prepared this guide to provide industry representatives, community members, and County decision makers with an understanding of the issues, policies, and criteria which will be evaluated during review of telecommunications facilities.

ISSUES

The County has a long tradition of protecting the important natural and built environments which define Marin. To this end, the County has adopted a comprehensive Countywide Plan and specific community plans which provide for housing and economic development for County residents while also protecting ridgelines, open space and sensitive environmental areas, the unique aesthetic qualities of the Marin communities, and the health and safety of its citizens. In 1990, the County adopted the Marin County Telecommunications Facilities Policy Plan (Telecommunications Plan) to identify potential impacts arising from the growth of major telecommunications facilities and to establish appropriate policies, standards, and guidelines that implement the overall goals and objectives of the Countywide Plan. The 1990 Telecommunications Plan was prepared prior to the advent of commercial wireless communications and thus focuses primarily on the anticipated expansion of major telecommunication facilities located in ridgeline areas.

The recent proliferation of commercial wireless facilities and other telecommunications technologies facilities has prompted the County to update the Telecommunications Plan. The update of the Telecommunications Plan sets forth policies and programs that respond to the land use issues and community concerns relating to the commercial wireless networks currently being developed in Marin County.

The basic administrative and land use elements addressed by the Telecommunications Plan include:

- Requirements for materials accompanying permit applications
- Location preferences for telecommunications facilities
- Co-location and clustering of telecommunications facilities
- Electromagnetic frequency radiation

- Lighting, Noise, and traffic
- Roads and accessways
- Vegetation
- Public safety
- Visual Compatibility and facility site design
- Removal of abandoned telecommunications facilities

PRUDENT AVOIDANCE

The County has experienced a growing community awareness about the perceived health effects from human exposure to electromagnetic frequency radiation (EMF) emitted by the operation of wireless communications facilities. The Telecommunications Plan addresses the potential health effects from EMF radiation by requiring new or expanded wireless communications facilities to meet standards for permissible exposure to EMF as adopted by the Federal Communications Commission (FCC). These requirements are consistent with the Federal Communications Facilities Act of 1996 which stipulates that permitting agencies cannot deny or require relocation of a proposed wireless communications facility on the basis of health effects if the facility meets EMF exposure standards adopted by the FCC.

Notwithstanding the County's adoption of federal standards that minimize exposure to EMF, there is continued interest and debate in Marin County about the potential health effects of such exposure. In response to this concern, the County regularly advises service providers that it is prudent to avoid locating new wireless communication facilities in areas that will result in prolonged human exposure to EMF. This advisory policy of "prudent avoidance" is intended to avoid or minimize, where possible, community conflicts over EMF exposure from new or modified telecommunications facilities. The policy is not intended to regulate the location of new wireless communications facilities or otherwise replace or supplement the standards for permissible human exposure to EMF as adopted by the FCC and the County.

APPLICATION INFORMATION

To facilitate application preparation and review, each telecommunications provider shall complete the attached checklists and submit them with their applications. These checklists require applicants to clearly indicate whether they have submitted information which responds to each of the land use elements described above, and where that information may be found.

GENERAL STANDARDS - APPLICATION REQUIREMENTS

Development application shall be accompanied by the following:

Page No./
Document No.

_____ 1. A written description of the technology proposed.

_____ 2. A written description of the type of consumer services to be provided.

3. A list of applicant's facilities sites, including location, type, number of antennae, and base transceiver stations for:

_____ Existing Sites

_____ Approved sites not yet constructed

_____ Proposed sites (applications filed and pending) in all County jurisdictions

_____ Anticipated planned sites for new, upgraded and abandoned facilities (applications not yet filed)

4. A map (or maps) depicting:

_____ The geographic location and boundaries of all coverage areas (search rings) planned by applicant in all of the County's jurisdictions. (10 copies)

_____ The location of applicant's facilities sites within each coverage area (map symbols and numbers correspond to Item 3). (10 copies)

_____ 5. A map depicting the coverage area of proposed facility, including all information required by Item 3. (USGS topographic base maps are suggested.) (10 copies)

_____ 6. As determined by the Director of Community Development, payment, in full, for all costs associated with the peer review of any technical information submitted by applicant, or

_____ 7. As determined by the Director of Community Development, payment, in full, for all costs associated with the independent preparation of such information prepared by the County, or consultants to the County.

8. Graphic and technical information including the following for all submittals:

_____ Site plan, architectural plan, landscape plan and other information as required by Design Review Supplemental Checklist (10 copies)

_____ Radio frequency radiation reports

_____ Visual analysis

_____ Alternative sites analysis, including co-location and shared-location

_____ Additional information which may be required based upon preliminary review of the initial submittal:

_____ Traffic analysis

_____ Noise analysis

_____ Biological assessment

_____ Independent peer review of information submitted by the applicant

The graphic and technical information listed above shall be prepared by qualified professionals acceptable to the Director of Community Development.

_____ 9. Copies of land use easements or restrictions (including open space and scenic) that encumber the proposed facility site.

_____ 10. Ten (10) copies of any photographs, maps, photosimulations, graphs and charts included as part of the application.

11. In addition to the information listed above, the County will require the applicant to enter into a performance agreement(s) as a condition of permit approval for the following:

_____ a. Removal of the approved facility should it be abandoned

_____ b. Maintenance of required landscaping

_____ c. Periodic independent monitoring of EMF emissions from the approved facility by County, paid for by provider _____.

LOCATION OF WIRELESS COMMUNICATION FACILITIES

Checklist

All wireless telecommunications facilities shall satisfy, or answer, the conditions or questions listed below. If answering "Yes" refer to appropriate submittal information (e.g., project plans, technical report, etc.). If answering "No" provide explanation as to why the information is not submitted or relevant.

		Yes	Page No./ Document No.	No	Explanation
1.	Will the proposed facility be sited in a location where it unreasonably interferes with the operation of the Marin County Airport?				
2.	Can the proposed facility be located on:				
	A publicly used structure?				
	A co-location site?				
	A shared location?				
	An industrial site?				
	A commercial site?				
3.	Does the proposed location avoid:				
	Residential areas?				
	Demonstrate prudent avoidance of sensitive receptor sites?				
	Schools and other sensitive receptors relative to EMF issue? (e.g., daycare, hospitals, elderly care, etc.)				
4.	Can the proposed facility be attached or sited adjacent to existing structures?				
5.	Is the proposed facility a monopole?				

		Yes	Page No./ Document No.	No	Explanation
6.	Is the proposed monopole facility to be located in:				
	A residential area?				
	An agricultural area?				
	A commercial area?				
	Next to public lands? (e.g., GGNRA, MCOSD, etc.)				
	Other areas?				
7.	Have all feasible alternatives to a separate monopole facility been considered?				

CO-LOCATION AND SHARED-LOCATION STANDARDS

In order to be considered for approval as a co-location or shared-location site, the application for a proposed wireless communication facility must include, or answer, the following:

		Yes	Page No./ Document No.	No	Explanation
1.	A graphic and written analysis that identifies all technically feasible sites within the coverage area that would accommodate the proposed service.				
	This analysis shall include information regarding technically feasible alternative sites and/or facility designs that would avoid or minimize adverse effects related to:				
	Land use compatibility				
	Visual resources				
	Public safety				
	Other factors address by CEQA				

CO-LOCATION AND SHARED-LOCATION STANDARDS (continuation)

		Yes	Page No./ Document No.	No	Explanation
2.	A written analysis of the specific factors resulting in selection of the preferred site over the alternatives, including the reasons for not selecting co-location or shared-location sites.				
3.	Are there other existing or planned facilities in the coverage area of the proposed project? (Either owned/operated by applicant or other providers/carriers)				
4.	Are the facilities leases exclusive? Describe.				
5.	Does the design of the co-location or shared-location site promote shared use by different carriers?				
6.	Does the design of the co-location or shared-location facilities consolidate future planned facilities?				
7.	Does the application include a request for multiple antenna support structures?				
8.	Does the application include facilities with unutilized space for co-location of other antennas and equipment?				
	For competing carriers?				

RADIO FREQUENCY RADIATION

		Yes	Page No./ Document No.	No	Explanation
1.	Does the proposed facility, operating alone or in conjunction with other telecommunication facilities, exceed the standards established by the Federal Communications Commission for permissible human exposure to radio frequency radiation (RFR)?				
2.	Does the application include an "RFR" report?				
3.	Does the "RFR" report measure the predicted and actual levels of "RFR" radiation emitted by the proposed facility?				

LIGHTING

		Yes	Page No./ Document No.	No	Explanation
1.	Does the application include a detailed lighting plan?				
2.	Is the proposed lighting manually operated, low wattage, hooded and directed downward?				
3.	Is the tower lighting shielded or otherwise directed to minimize light and glare impacts of nearby properties and residents?				
4.	Are warning signs lighted by low-wattage fixtures, directed downward and hooded?				

ROAD AND ACCESSWAYS

The application must include a description of the facility's access roads and parking areas and must answer the following:

		Yes	Page No./ Document No.	No	Explanation
1.	Are existing roads and parking areas used to access and service the proposed facilities?				
	If not, why not? _____ _____				
2.	Will any new roads or parking areas be capable of being shared with subsequent telecommunication facilities and/or other permitted uses?				
3.	If any new access roads are to be constructed in agricultural or open space areas, will such road meet the minimum width and surface standards necessary to conform to fire safety and emergency access requirements?				
4.	What is the size of the proposed parking area? _____				
	Is the size of the parking area limited to minimum necessary to accommodate maintenance vehicles?				

VEGETATION

		Yes	Page No./ Document No.	No	Explanation
1.	Does the application include a landscape plan?				
2.	Does the landscape plan indicate all existing vegetation?				
3.	Does the landscape plan indicate vegetation to be removed or trimmed?				
4,	Does the landscape plan identify proposed plantings by type, size and location?				
5.	Will the proposed landscape screen the proposed facility?				
6.	Will the proposed landscaping contribute to the stabilization of the soils on sloping sites?				
7.	Are the proposed landscape materials native, drought tolerant species compatible with the natural setting of the facility site?				
8.	Is there a plan to protect the existing trees and screening vegetation from damage during construction and operation?				
9.	Is there a revegetation plan?				
10.	Is there an erosion control plan?				
11.	Does the application include a landscape performance and maintenance agreement between the applicant and the County?				

NOISE AND TRAFFIC

		Yes	Page No./ Document No.	No	Explanation
1.	Does the application identify the location and type of noise generating equipment (generators, air conditioning units, etc.)?				
2.	Does the application include an operation plan that complies with the noise exposure standards of the Marin Countywide Plan (maximum allowable exterior noise level of 60 dB at the property line, maximum interior noise level of 45 dB)?				
3.	Does the application specify the maximum number of vehicle trips required for maintenance and testing?				

VISUAL COMPATIBILITY AND FACILITY SITE DESIGN

		Yes	Page No./ Document No.	No	Explanation
1.	Does the application include a visual analysis of the proposed facility at full buildout?				
	Does the application describe anticipated future expansion of the proposed facility?				
2.	Does the visual analysis include:				
	A photo montage of the proposed facility?				
	A computer based simulation of the proposed facility?				
	Story poles (or similar techniques) erected on the proposed site?				
3.	Can the proposed facilities be sited or designed to appear as an integral part of the support structure?				

VISUAL COMPATIBILITY AND FACILITY SITE DESIGN (continued)

		Yes	Page No./ Document No.	No	Explanation
4.	If wall-mounted, can the proposed facilities be integrated with the architectural style and character of the supporting structure?				
5.	Can the proposed facilities be completely screened from view?				
6.	Are the proposed facilities to be located on the front, or most prominent, facade of a structure?				
7.	Are the proposed facilities to be located above the pedestrian line of sight?				
8.	If roof mounted, can the proposed facilities be seen from the street?				
9.	If constructed, would a parapet conceal a roof mounted facility?				
10.	Can support facilities (base stations, equipment cabinets, back-up generators) for building mounted facilities be installed within the existing building envelope?				
	Underground?				
11.	Are the proposed support facilities compatible with the architectural style and construction materials of the surrounding development and/or land use setting?				
12.	If necessary, can the proposed support equipment be painted, screened/fenced, landscaped, or otherwise treated to minimize its visual impact?				
13.	If the proposed facility is to be sited in open space or undeveloped hillside areas that are highly visible, can the facility be designed to resemble natural landscape elements such as rock outcroppings or trees?				
14.	Can the proposed facility be designed as a piece of public area?				

VISUAL COMPATIBILITY AND FACILITY SITE DESIGN (continued)

		Yes	Page No./ Document No.	No	Explanation
15.	Is the proposed facility to be located on, or near, a historic or architecturally significant structure?				
	If so, can the proposed facility be visually integrated with the architecture of the existing structure?				
16.	Do the proposed facilities interfere with prominent vistas or significant public view corridors?				
17.	Do the proposed facilities interfere with views from surrounding residences?				
18.	Do the proposed facilities display any advertising signage or identifying logos?				
19.	Are the proposed facilities to be located adjacent to existing rooftop equipment to avoid visual clutter?				
20.	Does the application demonstrate that the proposed facility has been designed to attain the minimum height from a technical point of view?				
21.	Will the proposed facilities be painted to blend with the structures, vegetation, sky, or landscape against which they will be viewed?				

INDEMNIFICATION

		Yes	Page No./ Document No.	No	Explanation
1.	Has the applicant agreed to defend, indemnify, hold harmless the County from any claims, actions, or proceedings?				

APPENDIX F

HUMAN EXPOSURE CONDITIONS FROM ELECTROMAGNETIC FREQUENCY

APPENDIX F: HUMAN EXPOSURE CONDITIONS FROM ELECTROMAGNETIC FIELDS

Electromagnetic fields (EMFs) have an electric and a magnetic component. Electric field strength is expressed in units of volts per meter (V/m). Magnetic field strengths are expressed in units of Gauss (G), and is commonly reported in thousandths of a Gauss (milligauss, or mG). Both electric and magnetic fields can be stated in terms of power density, which is the conventional measure of human exposure conditions near broadcast and wireless communications facilities. Power density can be reported in thousands of a watt (milliwatts) per square centimeter (mW/sq.cm).

The frequencies of EMFs is measured in units of hertz (Hz) which is cycles per second. Power lines have frequencies of 60 Hz in the U.S. Radio frequencies (RF) are much higher, ranging from thousands of hertz (kilohertz, or kHz) to millions and billions of hertz (megahertz and gigahertz, MHz and GHz). Broadcast and wireless communications services (e.g., cellular and PCS) on frequencies expressed in MHz. Microwave facilities are in the GHz range.

The RF power radiated from broadcast FM and television facilities range from a few thousand to five million watts (for UHF TV). For cellular and PCS facilities, the power radiated from each transmitting antenna is usually several hundred watts, which is much less than the power radiated by most broadcast facilities. Cellular and PCS facilities radiate much more power than portable telephones, but human exposure conditions are much greater from the portable telephone than a wireless communications facility because the portable telephone is held within a couple of inches of the ear, while the closest public approach to a wireless communications facility is typically tens to hundreds of feet.

The power density, and thus the exposure level, near a wireless communications facility generally decreases with an increase in distance from the transmitting antenna. However, the decrease in power density is not monotonic due to the pattern characteristics of transmission antennas, the height of the antennas above ground level, and other environmental factors unique to each facility. In fact, the highest power densities are not directly beneath the antennas. Instead, the maximum exposure levels usually occur at distances between 50 to 800 feet from the base of the antenna support structure in the direction of maximum radiation.

The following table presents a summary comparison of EMF levels emitted by a typical stand-alone wireless communications facility and other common sources of EMF.

TABLE 7: COMPARISON OF EMF LEVELS

Source of EMF	Power Density	Notes
CMRS Cellular or PCS Facility	0.0001 to 0.001 mW/sq.cm max at approximately 50 to 800 feet from the facility.	The range of exposure levels for this type of equipment is between one-thousand and ten-thousand times less than the limits established by the FCC for public exposure to radio frequency (RF) EMF in the cellular and PCS operating frequency range.
Portable Cordless, Cellular, or PCS Phone	1.0 to 10.0 mW/sq.cm near the user's head. Note: The FCC requires cellular and PCS portable phones to meet public MPE limits when the portable's antenna is approximately 8" from the user.	Exposure to this type of equipment results in much higher levels than cellular or PCS facilities, even though such phones usually transmit with less than 1 watt. At two inches from the phone, power density levels can be in the 1.0 to 10.0 mW/sq.cm. Higher power portable devices, such as the hand-held radios used by public safety workers can generate even higher exposure levels.
Microwave Ovens	1.0 mW/sq.cm	Leakage from microwave ovens which operate at RF frequencies, can cause exposure levels of approximately 1.0 mW/sq.cm within a couple of inches of the oven door. Older or damaged ovens can cause far higher exposure levels.

Source of EMF	Power Density	Notes
Television Sets or Computer Video Displays	greater than 1000 mW/Sq. cm	Extremely Low Frequency (ELF) fields from this type of equipment can be greater than 1000 mW/Sq.cm at a distance of one foot from the screen. However, the propagation of ELF fields and their reputed biological effects are different from the EMFs generated by commercial wireless facilities. Thus, a direct comparison of exposure levels may not be meaningful.
Overhead Powerlines, in-house wiring, electric blankets, and electric motors in certain appliances	60 Hz EMFs	Humans can be exposed to 60 Hz EMF from these sources which are ten to hundreds of times higher than the EMFs generated by a nearby wireless facility. However, 60 Hz fields differ in frequency from wireless EMFs by a factor of approximately 15 million, and thus a direct comparison of biological effects based on exposure levels alone is problematic.

APPENDIX G

REFERENCES AND RESOURCES

APPENDIX G: REFERENCES AND RESOURCES

Organizational Resources

Federal Communications Commission (FCC)
1919 M Street, NW
Washington, DC 20554
(202) 418-0200
http://www.fcc.gov

National Telecommunications and Information Agency (NTIA) Department of Commerce
14th Street and Constitution Avenue, NW
Washington, DC 20230
(202) 377-5802
http://www.ntia.doc.gov

Alliance for Public Technology (APT)
901 15th Street, NW
Suite 230
Washington, DC 20005-2301
(202) 408-1403
apt@apt.org

International City/County Management Association (ICMA)
777 North Capitol Street, NE
Washington, DC 20002
(800) 745-8780

National Association of Telecommunications Officers and Advisors (NATOA)
1200 19th Street, NW, Suite 300
Washington, DC 20036
(202) 429-5101
natoa@sba.com

National League of Cities
1301 Pennsylvania Avenue, NW
Washington, DC 20004

Internet locations of Interest

FCC information on the Telecommunications Act of 1996 *http://www.fcc.gov/telecom.html*

FCC information on state and local government issues *http://www.fcc.gov/state&local*

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FCC Wireless Telecommunications Bureau, "Fact Sheet #2," Washington, DC, September 17, 1996.

"Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation - Final Rule," Vol. 61, No. 153, Federal Register 41006, August 7, 1996.

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APPENDIX H

GLOSSARY

APPENDIX H: GLOSSARY

Amateur Radio Service (ARS): An International and FCC-regulated voluntary, non-commercial radio communications service implemented for the purpose of self-training, intercommunication, emergency communication and technical investigations carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

American National Standards Institute (ANSI): The U.S. standards organization that establishes procedures for the development and coordination of voluntary American National Standards.

ANSI: Abbreviation for American National Standards Institute.

Antenna: Any structure or device used to radiate or collect electromagnetic fields or waves. Specifically, a device that converts radio frequency electrical energy into radiated electromagnetic energy and vice versa; in a transmitting station, the device from which radio waves are emitted.

Dipole antenna: A 2-conductor antenna, usually straight, one-half wavelength long, and center-fed so as to have equal current in both halves. When mounted vertically it has a radiation pattern which is omnidirectional in the horizontal plane.

Directional antenna: An antenna which has a radiation pattern which is not omnidirectional.

Isotropic antenna: A hypothetical, point-source antenna having equal gain in all directions, and used as a reference antenna for determining the gain of other antennas, especially those that operate at microwave frequencies.

Micro facility antenna: A small, visually unobtrusive directional or omnidirectional antenna installed at a micro communications facility. Micro facility antennas are unobtrusive enough to be effectively unnoticed by a casual observer when installed on light standards, utility poles, flag poles, traffic signals or building interiors and exteriors. See "Stealth design."

Omnidirectional antenna: An antenna that has a radiation pattern that is nondirectional in azimuth (i.e., uniform in the horizontal plane). Note that the vertical radiation pattern may be of any shape.

Panel antenna: A directional antenna that is shaped like a square or rectangular panel and that transmits and/or receives radio frequency signals in a horizontal beamwidth of typically not more than 120 degrees.

Parabolic antenna: A specialized directional antenna consisting of a parabolic reflector and a radiating or receiving element at or near its focus to transmit or receive signals in the UHF or microwave portion of the radio frequency spectrum. In general, the antenna has a circular shape , ranging in diameter from approximately one foot to forty feet or more. Some specialized parabolic antennas are shaped like a horn. Because of their shape and function, they are often also called "dish" antennas, microwave dishes, and satellite dishes.

Yagi antenna: A linear end-fire directional antenna consisting of three or more parallel dipole elements: one driven, one reflector, and one or more directors to improve its function. A Yagi antenna offers very high directivity and gain. The formal name for a "Yagi antenna" is "Yagi-Uda array."

Whip antenna: A vertical wire or rod-shaped omnidirectional antenna. Whip antennas are often quite flexible, hence the name "whip." See "Antenna - omnidirectional "

Antenna support structure: A structure consisting of a pole, tower, building or other device that supports antennas, and any surmounting appurtenances (attachments such as beacons or lightning rods).

Guyed tower: A tower which is supported by the use of cables (guy wires) which are anchored to the ground. Most guyed tower are of steel lattice construction with a uniform cross-section dimension along the entire length.

Lattice tower: A tower characterized by an open framework of lateral cross members. A lattice tower can be either guyed or self-supporting.

Monopole: A single upright pole engineered to be self-supporting and does not require guy wires.

Self-supporting: Any antenna support structure which does not require guy wires, buildings, or other devices for support. Most self-supporting towers are steel lattice, but others are made from wood or concrete.

Applicant: A person(s) or entity who has filed a zoning, building, or other permit application with the County of Marin. Also person(s) or entity who has filed an application for an FCC license.

Attached wireless communications facility: A wireless communications facility in which the antenna(s) is affixed, fastened or joined to a structure used for a purpose other than wireless communications.

Base station: See "Station - Base station".

Broadband : The property of any communications facility, equipment, channel or system in which the range of frequencies used for transmission (i.e., bandwidth) is greater than 0.1% of the midband frequency. Also, "broadband" is often used to distinguish a system from its "narrowband" counterpart, where both terms are subjectively defined relative to the implied context. For example, Personal Communications Services systems operate in both broadband and narrowband frequency ranges. See "Narrowband."

Broadcasting: General term for transmission of audio, visual and other types of information intended for direct reception by the general public.

Broadcast Services: FCC-authorized Broadcasting Services that include primarily commercial and non-commercial educational (NCE) radio and television , such as AM radio, FM radio, high and low power television, digital television (DTV), and the Broadcasting-Satellite Service. Broadcast Services are regulated by the Mass Media Bureau of the FCC.

Broadcasting-Satellite Service: An FCC-regulated broadcasting service in which signals transmitted or retransmitted by space stations (i.e., satellites) are intended for direct reception by the general public. In the broadcasting-satellite service, the term "direct reception" shall encompass both individual reception and community reception. See "Direct Broadcast Satellite (DBS) services."

Build-out transmitters: In the Cellular Radiotelephone Service, transmitters added to the first cellular system authorized on a channel block in a cellular market during the five year build-out period in order to expand the coverage of the system within the market.

California Environmental Quality Act (CEQA): A statute enacted by the California Legislature in 1970 that requires public agency decisionmakers to assess and consider the environmental effects of their decisions on projects.

California Public Utility Commission (CPUC): A State commission that regulates the construction and operation of public utilities, including telecommunications systems.

Cell: In a cellular-based mobile radio system, a cell is a portion of a larger geographical service area which is served by one base station, or a subsystem (e.g., sectorized antenna) of that base station. See "Microcell."

Cell site: A wireless communications facility site in a Cellular Radiotelephone Service system, personal communications services system, or Specialized or Enhanced Specialized Mobile Radio Services system, or any other radio system that provides geographic coverage in a cellular fashion.

Cellular Radiotelephone Service (CRS): The oldest of the Commercial Mobile Radio Services. Cellular systems operate in the frequency range between 824 to 849 MHz, and between 869 to 894 MHz.

Channel: A path for conveying electromagnetic signals, usually distinguished from other parallel paths. For example, a channel used in a wireless communications system can be a segment of a frequency band.

Clustering: Siting two or more separate telecommunications towers, other antenna support structures, and equipment buildings on the same site in close proximity to each other; the consolidation of wireless facilities to increase joint location efficiency.

Combiner: Any radio frequency equipment which permits an antenna and possibly its associated transmission line to be shared by more than one transmitter, receiver or transceiver. The use of the term "combiner" in this report is very general: it includes equipment for receiving antennas (multicoupler) and for transmission and reception by a single antenna (duplexer).

Combining: The sharing of antennas and transmission lines by more than one wireless communications service provider through the use of combiners. Note that, generally, only those service providers that operate within the same frequency band, and attempt to serve the same geographic area, such as FM radio broadcasters, are able to use combiners.

Commercial Mobile Radio Services (CMRS): A wireless communications service that is provided for profit (i.e., with the intent of receiving compensation or monetary gain), is an interconnected service, and is available to the public, or to such classes of eligible users as to be effectively available to a substantial portion of the public. CMRS includes the Cellular Radiotelephone Service (CRS), Specialized Mobile Radio Service (SMR), Enhanced Specialized

Mobile Radio Services (ESMR), Personal Communications Services (PCS), paging services (excluding not-for-profit paging systems that serve only the licensee's own internal communications needs) and certain other mobile radio services that offer interconnected service for profit.

Communications: Information transfer, among users or processes, according to agreed conventions. Also, the branch of technology or engineering concerned with the representation, transfer, interpretation, and processing of information and data among persons, places and machines. See "Telecommunications."

Common carrier: A wired or wireless telecommunications service provider which furnishes interstate communications service or interstate access service for hire--whether by wire, radio or cable. The Common Carrier Bureau and the Wireless Telecommunications Bureau of the FCC regulate common carriers within the United States. See "Commercial Mobile Radio Services."

Co-locate: To use a single support structure for the placement of antennas for more than one wireless communications system or service provider.

Communications system: See "Wireless communications system"

Coverage area: The geographical area within which a wireless communications facility or system can provide acceptable service. See "Service area."

CPUC: Abbreviation for California [State ?] Public Utilities Commission.

Data: The representation of information, facts, concepts or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or automatic means, Also, any representations such as characters or analog quantities to which meaning is or might be assigned.

DBS: Abbreviation for Direct Broadcast Satellite.

Dead spots: Small areas within a service area where the field strength is lower than the minimum level for reliable service. See "Fill-in transmitters."

Digital Television (DTV): Television that is transmitted using digital technology. DTV transmissions can include HDTV, standard definition television, and one-way data.

Dipole: See "Antenna- Dipole".

Directionality: A quality of an antenna, loosely defined as the ability to concentrate and "directionalize" the intensity of an emitted or received radio frequency signal. See "Directivity," and "Radiation pattern."

Directivity: A quality of an antenna which is the ratio of its radiation intensity in the direction of its maximum value to the radiation intensity of a reference antenna. See "Gain."

Direct Broadcast Satellite (DBS) services: General term for the distribution or broadcasting of programming or services by satellite directly to the subscriber's premises without the use of ground receiving or distribution equipment, except at the subscriber's premises or in the uplink process to the satellite. See "Broadcasting-Satellite Service."

Direct-to-consumer or direct-to-home satellite services: See "Direct Broadcast Satellite (DBS) services."

Downlink: A wireless communications link from a satellite, spacecraft, aircraft or any other airborne station to a ground-based fixed station or mobile station. Also, a link from a satellite to an aircraft or other lower-altitude airborne station. See "Link."

Duplexers: A special type of combiner that allows a transceiver to use a single antenna for transmitting and receiving. See "Combiner."

E: The symbol for Electric field.

Earth station: See "Station - Earth station."

Effective Isotropic Radiated Power: See "Equivalent Isotropically Radiated Power."

Effective Radiated Power (ERP): The power supplied to an antenna multiplied by the net gain of the antenna in a given direction. If a direction is not specified, the direction of maximum net gain is assumed. The type of reference antenna should be specified; if no reference type is specified then it is often assumed that a half-wave dipole is the reference antenna. See "Antenna - Dipole antenna," and "Gain."

EIRP: Abbreviation for Equivalent Isotropically Radiated Power or Effective Isotropic Radiated Power.

Electric field (E): The effect produced by the existence of an electric charge, such as an electron, ion, or proton, in the volume of space or medium that surrounds the charge. Also, the electric force that acts on a unit electric charge independently of that charge. Note that this term is often used interchangeably with "electric field strength."

Electric field strength: The magnitude of the electric field at a point in space, expressed as the RMS value of the field in volts per meter (V/m). *Note:* the term has sometimes been called the electric field *intensity*, but such use is deprecated, since intensity connotes power in other areas of electromagnetic study, such as optics.

Electromagnetic Field (EMF): The influence or effect created by a combination of electric and magnetic energy that makes up a wave which propagates at or near the speed of light. EMFs are generated by transmitters, antennas or other sources of electromagnetic energy. Within the context of this report, EMFs refer primarily to RF phenomena. Note that EMFs and electromagnetic waves, often mistakenly called "RF signals," can be thought of as manifestations of the same phenomena. In fact, the term "wave" is no more than a label used for a category of time-varying fields for which a propagation velocity may be defined. See "Electromagnetic waves."

Electromagnetic Radiation (EMR): Radiation made up of electromagnetic waves. The term EMR includes gamma radiation, X-rays and other forms of ionizing radiation, as well as non-ionizing optical and radio waves. For non-ionizing RF radiation, which is the subject of this report, the preferred term is EMF. See "Electromagnetic Field," "Electromagnetic spectrum," and "Radiation."

Electromagnetic spectrum: The spectrum of electromagnetic radiation (EMR), defined here in terms of wavelength: gamma radiation, shorter than 0.006 nm; X-rays, 0.006 to 5 nm; ultraviolet light, 5 to 400 nm; visible light, 400 to 700 nm; infrared light, 700 nm to 0.1 mm; radio, greater than 0.1 mm. See "Radio spectrum."

Electromagnetic waves: Waves characterized by temporal and spatial variations of electric and magnetic fields. Electromagnetic waves are known as radio waves, infrared waves, light waves, etc. depending on the wavelength. See "Radio waves," and "Wavelength."

EMF: Abbreviation for Electromagnetic Field.

Emission: Electromagnetic energy propagated from a source by radiation or conduction. The emission may be either desired or undesired. Emissions radiated from an RF source give rise to EMFs. See "Electromagnetic Fields," and "Radiation."

EMR: Abbreviation for Electromagnetic Radiation.

Energy density: The instantaneous power density integrated over its duration. Also, the electromagnetic energy per unit of volume or surface area.

Environmental Protection Agency (EPA): The federal agency responsible for promulgating and enforcing rules and regulations pertaining to the public health, welfare, and environmental quality.

EPA: Abbreviation for Environmental Protection Agency.

Equivalent Isotropically Radiated Power (EIRP): The power supplied to an antenna multiplied by the gain of the antenna, relative to a theoretical isotropic antenna, in a given direction. If a direction is not specified, the direction of maximum gain is assumed. Maximum EIRP is often specified for microwave antennas. See "Antenna - Isotropic antenna," and "Gain."

ERP: Abbreviation for Effective Radiated Power.

FAA: Abbreviation for the Federal Aviation Administration.

Facility: Generally a fixed, mobile or transportable structure including the aggregate of equipment, such as transmitters, receivers, antennas, supporting structures, transmission lines, power supplies, cables, switches, etc. used for providing wireless communications services. Also, a real property entity consisting of one or more of the following: a building, a support structure, a utility system, pavement, and underlying land.

Far-field region: The region at a distance sufficiently removed from an antenna or other RF source where the electromagnetic fields radiated by that source are approximately plane-wave in nature. The radiation pattern of an antenna is usually measured or calculated in the far-field region.

FCC: Abbreviation for the Federal Communications Commission.

Federal Aviation Administration (FAA): The federal agency responsible for promulgating and enforcing rules and regulations pertaining to the use of airspace by aircraft and the operation of airports and other aircraft landing and departure areas, including development of land uses within airport environs.

Federal Communications Commission (FCC): The federal agency responsible for regulating the development and operation of civilian telecommunications systems, including but not limited to the implementation of the Federal Telecommunications Act of 1996. The FCC is composed of five (5) members who are appointed by the President subject to confirmation by the Senate. Normally, one Commissioner is appointed or reappointed each year, for a term of five (5) years. The rules and regulations of the Commission are contained in Chapter I of Title 47 of the Code of Federal Regulations (47 CFR).

Field strength: See "Electric field strength."

Fill-in transmitters: Transmitters added to a wireless communications system or station that do not expand the existing service area, but are established for the purpose of improving reception in dead spots. See "Dead spots."

Fixed Service: A radio service operating between specified fixed points.

Fixed station: See "Station - Fixed station".

Free space: Literally, in the vacuum of space and clear of the Earth or other bodies. Antenna characteristics are often predicted or calculated based on the assumption that the antenna is in free space.

Frequency (f): Of a periodic oscillation or wave, the number of identical cycles per one second; expressed in units of hertz (Hz). See "Hertz."

Frequency sharing: The sharing of a common radio frequency or frequency band, or common group of frequencies by more than one wireless service provider or user in the same geographical area on a non-interference basis.

Gain: A quality of an antenna, often referred to as "net power gain," which is closely related to directivity. Gain is the ratio of radiated power in a given direction to that of a reference antenna *for equal power input.* When a direction is not stated, the gain is usually taken to be in the direction of maximum radiation. Gain differs from directivity in that it takes into consideration the actual efficiency of an antenna as well as the shape of its radiation pattern. See "Directivity," and "Radiation pattern."

Guyed tower: See "Antenna support structure - Guyed tower."

H: Symbol for Magnetic field.

Hand-held or handheld transceiver: A portable mobile station capable of being hand-carried by an individual and normally operated while being held in the hands of the user (e.g., two-way "walkie-talkies" and portable cellular phones).

Hertz (Hz): A unit for expressing frequency: 1 Hz = 1 cycle per second. 1 kilohertz (kHz) = 1000 Hz; 1 megahertz (MHz) = 1000 kHz or 1,000,000 Hz; 1 gigahertz (GHz) = 1000 MHz, or 1 billion Hz. See "Frequency (f)."

High-Definition Television (HDTV): Television that has approximately twice the horizontal and twice the vertical transmitted resolution specified by the existing NTSC standard.

Horn: An directional antenna formed by an open-ended wave guide, of increasing cross-sectional area, which radiates directly in a desired direction or couples to a reflector which forms a desired radiation pattern. A very wide range of radiation patterns may be formed by controlling the horn dimension and shape, placement of the reflector, and reflector shape and dimension. Horns may have longitudinal cross-section shapes that are elliptical, conical, hyperbolic or parabolic curves. Horn antennas are usually used to transmit and receive signals in the microwave portion of the radio frequency spectrum.

Intensity: The square of the electric field strength of an electromagnetic wave. Under certain circumstances, the intensity of an electric field is proportional to the power per unit area in the direction of propagation of the electromagnetic wave (i.e., the irradiance). *Note:* intensity is NOT synonymous with field strength. See "Electric field strength," and "irradiance."

Interconnected service: A radio service that is interconnected with a public switched network, or interconnected with a public switched network through an interconnected service provider, that gives subscribers the capability to communicate to or receive communication from all other users on the public switched network. See "Public switched network."

Intermittent: Transmitter operation that is non-continuous, that is stopping and starting at intervals.

Interference: In general, energy from any source that impedes the reception of desired signals. Permissible or acceptable interference is observed or predicted interference which complies with quantitative interference and sharing criteria contained in International and FCC Regulations. Harmful interference endangers the functioning of a radionavigation service or of other safety services, or seriously degrades, obstructs, or repeatedly interrupts a radio service operating in accordance with International and FCC Regulations. Note that with the US, the FCC has

exclusive jurisdiction over civilian interference matters. Interference from radio frequency sources is sometimes abbreviated as "RFI" for Radio Frequency Interference."

Irradiance: Radiant power incident per unit area upon a surface, usually expressed in watts per square meter, but may also be expressed in joules per square meter. The deprecated synonym for irradiance is "power density."

Land mobile service: A mobile service between base stations and land mobile stations, or between land mobile stations. See "Commercial Mobile Radio Services," and "Private Land Mobile Radio Service."

Land mobile station: A mobile station in the land mobile service capable of surface movement. See "Station - Mobile station."

Lattice tower: See "Antenna support structure - Lattice tower."

Link: A general term used to indicate the existence of communications between two points or between two stations. A radio path between two points is often called a radio link, or a microwave link if microwave radio frequencies are used. In all cases, the type of link should be identified, such as downlink, uplink, point-to-point link, or data link.

Major wireless communications facility: See "Wireless communications facility - Major wireless communications facility".

Magnetic field (H): The effect produced by the existence of a moving electrically-charged particle, in the volume of space or medium that surrounds the moving charge. Note that this term is often used interchangeably with "magnetic field strength."

Magnetic field strength: The magnitude of the magnetic field at a point in space, expressed as the RMS value of the field in ampere per meter (A/m) or in oersteds.

Microcell: In a cellular-based mobile radio system, a microcell is a small portion of a larger geographical service **area** which may be indoors or otherwise isolated from other system facilities. A microcell may be served by either a full-sized or micro communications facility. See "Cell."

Micro communications facility: A wireless communications facility that utilizes a micro facility antenna and possibly other stealth design features so as to be effectively unnoticeable to a casual observer. A micro communications facility has limited power, and can be located indoors or outdoors to serve a microcell area. See "Antenna - Micro facility antenna."

Micro facility antenna: See "Antenna - Micro facility antenna."

Microwave: Loosely defined as an electromagnetic wave having a wavelength of 300 to 1 mm (i.e., frequencies from 1 to 300 GHz); highly directional when used for radio frequency transmission; uses relatively low transmitter power levels compared to other forms of transmission. Microwaves exhibit many of the properties associated with visible light, e.g., they are easily concentrated into a beam.

Minor wireless communications facility: See "Wireless communications facility - Minor wireless communications facility".

Mobile Service: A radio communication service carried on between mobile stations or receivers and land stations, and by mobile stations communicating among themselves, and includes: (a) both one-way and two-way radio communication services; (b) a mobile service which provides a regularly interacting group of base, mobile, portable, and associated control and relay stations (whether licensed on an individual, cooperative, or multiple basis) for private one-way or two-way land mobile radio communications by eligible users over designated areas of operation.

Mobile station: See "Station - Mobile station".

Mobile Telephone Switching Office (MSTO): The interface between the radio system and the public switched telephone network (PSTN). The MTSO performs all signaling functions that are necessary to establish calls to and from mobile stations.

Monopole: See "Antenna support structure - Monopole."

Multicouplers: For receivers, a type of combiner that permits a receiving antenna to be shared by two or more receivers. Generally, a device for connecting several receivers or transmitters to one antenna in such a way that the equipment is properly matched to the antenna. See "Combiner."

Multiplexing: The combining of two or more independent signals or information channels onto a single transmission path or medium. Two basic forms of multiplexing are time-division multiplexing (TDM), and frequency-division multiplexing (FDM).

Narrowband: The property of any communications facility, equipment, channel or system in which the range of frequencies used for transmission (i.e., bandwidth) is less than 0.1% of the midband frequency. Also, "narrowband" is often used to distinguish a system from its

"broadband" counterpart, where both terms are subjectively defined relative to the implied context. For example, Personal Communications Services systems operate in both narrowband and broadband frequency ranges. See "Broadband."

National Environmental Protection Act (NEPA): A federal law that establishes national policies aimed at protecting the environment, providing a interdisciplinary framework for federal agencies to prevent environmental damage, and procedures to ensure that federal agency decisionmakers take environmental factors into account. Under NEPA, telecommunications projects that involve discretionary approval and/or funding from a federal agency are subject to environmental assessments and/or other procedural requirements undertaken by federal agencies.

Network: Generally, an interconnection of three or more communicating entities, for example a system comprised of interconnected wireless communications facilities that provide a wireless service within a common coverage area. See "Wireless communications system."

NIER: Abbreviation for Non-ionizing Electromagnetic Radiation.

Non-broadcast services: FCC-authorized radio services that are not in the Broadcast Services, include the ARS, CRS, ESMR, PCS, fixed-point microwave and satellite services (except the Broadcasting-Satellite Service), and private land mobile radio services (PLMRS). See "Broadcast Service."

Non-ionizing Electromagnetic Radiation (NIER): Electromagnetic waves of low frequency, long wavelength, and low photon energy unable to cause ionization (i.e., to remove an electron from an atom). See "Radio spectrum."

Nonthermal effect: An effect of exposure to non-ionizing electromagnetic radiation that is not attributable to heating caused by the absorption of electromagnetic energy in animals or the human body. Also called an "athermal" or "field-specific" effect.

OSHA: Abbreviation for Occupational Safety and Health Administration, a Federal agency.

Omnidirectional antenna: See "Antenna - omnidirectional antenna".

Panel Antenna: See "Antenna - panel antenna".

Parabolic antenna: See "Antenna - parabolic antenna".

PCS: Abbreviation for the Personal Communications Services.

Personal Communications Services (PCS): one of the Commercial Mobile Radio Services regulated by the Wireless Telecommunications Bureau (WTB) of the FCC under 47 CFR Part 24; also identified as one of the Personal Wireless Services regulated by the Telecommunications Act of 1996. The PCS provide a wide array of mobile and ancillary fixed communications services to individuals and businesses including unlicensed wireless services and common carrier wireless exchange access services as defined in 47 USC 332(c)(7)(C)(i).

Plane wave: A wave in which the wave fronts are planar, the electric and magnetic field vectors have constant values in the plane of the wave front, and the field vectors and the direction of propagation are all mutually perpendicular. Plane wave conditions tend to exist in free space and in the far-field region of antennas.

Plane-wave power density: The power density of an electromagnetic wave that predominates in the far-field region of an antenna, and has a wavefront that is essentially in a plane. See "Power density," and "Far-field region."

PLMRS: Abbreviation for the Private Land Mobile Radio Service.

Point-to-Point: Refers to a link, transmission path, or communications between two stations or facilities. See "Link."

Power: The rate of transfer or absorption of energy per unit time in a system. The output power of an RF transmitter is measured in watts (W). See "Watt."

Power density: The magnitude of the electromagnetic energy flux density at a point in space, in power per unit area (watts per square meter). Also, it is the power incident on a surface per unit surface area (i.e., irradiance). For plane waves, power density is the quantity measured by a survey meter when the sensing element is sensitive to the square to the magnitude of the electric and magnetic fields. See "Plane-wave power density," and "Irradiance."

Private Land Mobile Radio Service (PLMRS): A mobile service that is neither a commercial mobile radio service nor the functional equivalent of a service that meets the definition of commercial mobile radio service. Private Land Mobile Radio Services include not-for-profit land mobile radio and paging services that serve the licensee's internal communications needs and mobile radio service offered to restricted classes of eligible users (e.g., the Public Safety Radio Services).

Propagation: In general terms, a transfer of energy without a transfer of matter.

PSTN: Abbreviation for the Public Switched Telephone Network.

Public Switched Telephone Network (PSTN): Commonly refereed to as the "public telephone network." Specifically, any common carrier switched network, whether by wire or radio, including local exchange carriers, interexchange carriers, and mobile service providers, that use the North American Numbering Plan in connection with the provision of switched services.

PUC: Abbreviation for the Public Utilities Commission.

Radiation: Generally, a type of emission; specifically the energy flux produced in the form of waves by a source, or the energy itself.

Radiation pattern: An attribute of an antenna which is the variation in its radiation qualities, usually far-field power gain, as a function of an angular direction from the center of the antenna with respect to a given horizontal or vertical axis. A radiation pattern is a three dimensional concept, but it can be represented graphically in two-dimensions in either the horizontal (azimuth) or vertical (elevation) planes with respect to the surface of the earth. See "Gain."

Radio: A generic term referring to telecommunication by means of modulation and radiation of electromagnetic waves in the radio portion of the electromagnetic spectrum. Also, a general term applied to the use of the radio spectrum. RF transmitters, receivers and transceivers are often called "radios." See "Radio spectrum," and "Telecommunications."

Radio device: Any equipment that facilitates wireless telecommunications through the reception, transmission, or both, of RF electromagnetic waves. Common radio devices are antennas, receivers, transmitters and transceivers.

Radio frequency (RF): A frequency in the radio spectrum. See "Radio Spectrum."

Radio services: A broadcast or communications service involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes. FCC-regulated radio services include the Amateur, Broadcast, and Wireless Communications Services.

Radio spectrum: The radio frequency (RF) portion of the electromagnetic spectrum. The frequency ranges for radio are: Ultra Low Frequency (ULF), lower than 3 Hz; Extremely Low Frequency (ELF), 3 Hz to 3 kHz; Very Low Frequency (VLF), 3 to 30 kHz; Low Frequency (LF), 30 to 300 kHz; Medium Frequency (MF), 300 kHz to 3 MHz; High Frequency (HF), 3 to 30 MHz; Very High Frequency (VHF), 30 to 300 MHz; Ultra High Frequency (UHF), 300 MHz to 3 GHz; Super High Frequency (SHF), 3 to 30 GHz; Extremely High Frequency (EHF), 30 to 300 GHz; Submillimeter, 300 GHz to 3 THz (3000 GHz). See "Electromagnetic spectrum," "Frequency," and "Non-ionizing Electromagnetic Radiation (NIER)."

Radio waves: An electromagnetic wave of radio frequency. See "Electromagnetic waves."

Receive-only RF facility: An RF facility that only receives and does not transmit signals.

RF: Abbreviation for Radio frequency.

RFI: Abbreviation for Radio Frequency Interference. See "Interference."

Satellite dish: See parabolic antenna.

Satellite downlink: See "Downlink."

Satellite uplink: See "Uplink."

Satellite earth station: See "Stations - Earth station."

Service area: The geographic area considered by the FCC to be reliably served by a wireless communications station, system or transmitter.

Service contour: The locus of points surrounding a station or transmitter where the predicted median field strength of the signal from that station or transmitter is the minimum field strength that is considered sufficient to provide reliable service to mobile stations or other intended receivers.

Service provider: In the context of this report it is an entity that provides an FCC-regulated radio communications service, and/or operates a wireless communications facility. See "Radio services," and "Wireless communications facility (WCF)."

Shadow: Area within a service area where the field strength is lower than the minimum level for reliable service due to manmade or natural obstructions between a transmitter and a receiver. See "Dead spots."

Sources of EMF: Typically a transmitting antenna operating between 100 kHz and 30. GHz. Other sources of EMF include man-made equipment, such as computers, television receivers, power lines and automobiles; and natural sources such as lightning, auroras and planetary bodies, including the Sun.

Signal strength: See "Field strength."

Specialized Mobile Radio Service (SMR) and Enhanced Specialized Mobile Radio Service (ESMR): Two of the Wireless Communications Services regulated by the Wireless Telecommunications Bureau (WTB) of the FCC. SMR/ESMR services operate at either 800 MHz or 900 MHz. In general, these are wide geographic area Commercial Mobile Radio Services (CMRS) that offer real-time, two-way switched voice service that is interconnected with the public switched network, either on a stand-alone basis or packaged with other telecommunications services. However, some local SMR licensees offer mainly dispatch and paging services to specialized customers in a non-cellular system configuration which is not interconnected to the public switched network. These local SMR services are generally considered a Private Land Mobile Radio Service (PLMRS) rather than a CMRS. See "Wireless Communications Services.

Specific Absorption Rate (SAR): The rate at which energy is absorbed in the tissue, due to exposure to electromagnetic waves, in watts per kilogram (W/kg). SAR values have been related to threshold levels for potential biological hazards.

Spectrum: The arrangement of a broad range of frequencies or wavelengths in ascending or descending order. See "Electromagnetic spectrum," and "Radio spectrum."

Station: One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location, facility or vehicle for implementing a radio or wireless communication service.

Base station: The common name for all the radio equipment located at one specified site, and that is used for serving one or more mobile stations. Also, a stationary transmitter that provides radio telecommunications service to mobile and/or fixed receivers, including those associated with mobile stations. A base station in a land

mobile service is sometimes called a "land station."

Earth station: A station located either on the Earth's surface or within the major portion of Earth's atmosphere and intended for communication with one or more space stations; or with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space. An Earth station may be a base station in the fixed-satellite service, or, in some cases, in the land mobile-satellite service, located at a specified fixed point or within a specified area on land to provide a feeder link for the land mobile-satellite service.

Fixed station: Stations that are permanently installed at a wireless communications facility. Also, any station in the Fixed Services.

Mobile station: A hand-held portable or vehicle mounted station in a mobile service intended to be used while in motion or during halts at unspecified points. A mobile station in a land mobile service is sometimes called a "land mobile" station. Note that airborne and marine mobile stations are included in this definition.

Stealth design: A wireless communications facility that is designed or located in such a way that the equipment installed at the facility is not readily recognizable as communications equipment to an average person. See "Antenna - Micro facility antenna."

Telecommunications: Any transmission, emission, or reception of signals, signs, writing, images, sounds, or intelligence of any nature, by wire, radio, cable, satellite, fiber optics, laser, visual or other electronic, electric, electromagnetic, or acoustically coupled means, or any combination thereof. This report is primarily concerned with wireless telecommunications, specifically wireless communications services, systems and facilities.

Telecommunications Act of 1996: A comprehensive telecommunications law that establishes a federal policy of encouraging competition among telecommunications service providers. The Act also provides a regulatory framework for the exercise of jurisdiction by state and local agencies over the construction, modification, and placement of wireless communications facilities.

Telephone network: See "Public Switched Telephone Network."

Thermal effect: In a biological system, an effect that is related to the heating of the tissue through the absorption of electromagnetic energy.

Time-Multiplexing: Shared use of a channel or transmitter by several users by means of time sharing whereby only one user is allowed to use the channel or transmitter at any given time. Time multiplexing can facilitate frequency sharing. Also see "Frequency sharing."

Transceiver: A radio device that performs, within a single chassis or common housing, both transmitting and receiving functions.

Transmission line: The structure that forms all or part of a path between radio devices for directing the transmission of electromagnetic energy. Examples of transmission lines include wires, coaxial cables, and waveguides.

Transmitter: A radio device which intentionally generates RF energy for the purposes of wireless telecommunications.

Trunking: A method of operation in which a number of closely-spaced radio frequency channel pairs are assigned to mobile and base stations in a wireless communications facility or system. Trunking allows for the efficient sharing of radio devices at a wireless communications facility, including transmitters, combiners, transmission lines, and antenna(s), by a large number of mobile users.

UHF: Abbreviation for Ultra High Frequency. See "Radio spectrum."

Unlicensed wireless services: The offering of telecommunications services using duly authorized devices which do not require individual licenses; direct-to-home satellite services are excluded from this definition. Note that unlicensed wireless service, and unlicensed radio operators, devices and facilities are still regulated by the FCC. See 47 U.S.C. Section 332(c)(7)(C)(iii)

Uplink: A wireless communications link from a ground-based fixed station or mobile station to a satellite, spacecraft, aircraft or any other airborne station. Also, a link from an aircraft or other airborne station to higher-altitude satellite. See "Link."

VHF: Abbreviation for Very High Frequency. See "Radio spectrum."

Volt: A unit of electromotive force which will cause a current of one ampere to flow through a conductor whose resistance is one ohm.

Watt: A unit of power. In an electrical circuit, a watt is equal to a current of one ampere under one volt of force. See "Power."

Wavelength: The distance, in meters (m), between points of corresponding phase of two consecutive cycles of a periodic wave. . Wavelength = (wave propagation velocity) / frequency. For electromagnetic waves in the Earth's atmosphere, the propagation velocity is close to the speed of light in a vacuum: 3×10^8 meters per second. See "Frequency," and "Electromagnetic waves."

WCF: Abbreviation for wireless communications facility.

Whip antenna: See "Antenna - Whip antenna".

Wireless communications facility (WCF): A land use that sends and/or receives radio frequency signals, including antennas, microwave dishes or horns, structures or towers to support receiving and/or transmitting devices, accessory development and structures, and the land on which they all are situated.

Major wireless communications facility: Large wireless communications towers, typically ranging in height from 70-200 feet, used by multiple service providers. Major wireless communications facilities are usually located on prominent ridgetop areas.

Minor wireless communications facility: Small wireless communications facilities (typically less than 70 feet in height) usually consisting of a monopole or attached wireless communications facility.

Wireless Communications Services: Radio services regulated by the Wireless Telecommunications Bureau (WTB) of the FCC. The primary mobile radio services regulated by the WTB are the Commercial Mobile Radio Services and the Private Land Mobile Radio Service.

Wireless communications system: A collection of individual wireless communications facilities and stations, usually capable of interconnection and interoperation to form an integrated whole system. The components of wireless communications systems generally serve a common purpose, are technically compatible, use common procedures, respond to controls, and operate in unison. See "Network."

Wireless Telecommunications Bureau (WTB): A bureau of the FCC. The Wireless Telecommunications Bureau develops, recommends and administers the programs and policies for the regulation of the terms and conditions under which communications entities offer domestic wireless communications services and of ancillary operations related to the provision of such services (satellite communications excluded). These functions include all wireless communications service providers' and licensees' activities.

Yagi antenna: See "Antenna - Yagi antenna".