

**AN ALTERNATIVE ANALYSIS OF DTV TOWER SITES  
TO SERVE THE DENVER AREA**

**EXECUTIVE SUMMARY**

The undersigned have reviewed the report Denver DTV Site Investigations by John F.X. Browne & Associates, and made comments as well as provided additional information. We have also made a site comparison using a numerical rating system that includes issues and considerations that are of concern to communities located near broadcast antennas as well as those issues of concern to the broadcasters themselves. The numerical comparison in the Browne Report considered only issues of concern to the broadcasters.

When all economic and community related issues are considered, Lookout Mountain rates lower than either Eldorado Mountain or Squaw Mountain as a broadcast antenna site. In fact Lookout Mountain is the lowest rated site of all – and by a large margin.

Eldorado Mountain is slightly superior to Lookout Mountain with respect to coverage, followed closely by Squaw Mountain. Lookout Mountain is the site with the least economic burden to the broadcasters, but this site also has the greatest economic burden to the community surrounding the proposed antenna site.

Browne’s “Site D”, which Browne rated lower than Eldorado Mountain, Lookout Mountain and Squaw Mountain, was considered by Browne to offer “interesting possibilities”. If “Site D” is the Ramstetter site, we concur.

Neither this report nor the Browne Report supports the claim by Lake Cedar Group that Lookout Mountain is the *only* site that can satisfy the requirements for DTV transmission to the greater Denver Metro area.

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# AN ALTERNATIVE ANALYSIS OF DTV TOWER SITES TO SERVE THE DENVER AREA

## 1. INTRODUCTION

In July 1999, the Jefferson County Board of Commissioners denied an application by the Lake Cedar Group (LCG) to rezone residential property on Lookout Mountain to allow the construction of a high power digital television (DTV) broadcast tower. The Board of County Commissioners stated that one of the reasons for denial of the application was LCG's failure to adequately consider alternative sites. LCG subsequently petitioned the FCC to preempt Jefferson County's decision, stating, among other things, that the decision made "impossible" the implementation of DTV broadcasting in the Denver area. In an attempt to support this claim, LCG has submitted to the FCC and Jefferson County a report [1] titled Denver DTV Site Investigations by John F.X. Browne, hereinafter referred to as the "Browne Report."

The conclusion of the Browne Report does not support LCG's claim that the denial of rezoning on Lookout Mountain has made DTV implementation impossible in the Denver area. While it subjectively concludes that Lookout Mountain is the "best" broadcast site for DTV, it does not conclude that Lookout Mountain is the only viable site, nor that DTV cannot be implemented except at Lookout Mountain.

The Browne Report contains a number of unsupported and incorrect claims and speculations that should not pass unnoticed. It also contains a numerical rating chart that makes a comparison of various known and undisclosed sites, using rating criteria of concern only to broadcasters. The report herein modifies and expands the scope of the Browne comparison to include criteria that represent areas of concern not only to the broadcasters, but also to the community that would be affected by the LCG proposal. These comments and additional information are provided in response and rebuttal to the Browne Report.

## 2. REVIEW AND CRITIQUE OF BROWNE MATERIAL

### 2.1 TABLE MOUNTAIN QUIET ZONE (Browne [1], pp 5-7)

Federal rules require protection of a “quiet zone” north of Boulder from interference caused by broadcasters. The rules require that the signal levels from broadcast transmitters be below a certain level at the quiet zone. Transmitters that were operating at the time the rules were established were “grandfathered,” and allowed to continue to exceed the established maximum allowable signal level. Dennis S. Friday, Chief, Radio Frequency Technology Division at NIST, has reviewed the FCC 301 forms associated with the proposed Lookout Mountain DTV transmitters, and determined that some of the proposed transmitters would exceed the allowable signal levels at the quiet zone, some by as much as 14.6 dB (28.8 times too high). He stated that NIST would accommodate these excessive levels, and that NIST should be consulted before the FCC authorizes any future power increases, and that all requests would be dealt with on a case-by-case basis [2].

Since that time, the FCC has authorized FOX DTV channel 32 on Lookout Mountain to increase power from the originally proposed 223 kW to 1000 kW. Presumably NIST was consulted and has approved the increase. This approval would indicate that NIST is willing to consider further accommodations (or at least allow the same signal levels at the quiet zone when transmitted from any alternate site). The Browne Report uses the specific example of Eldorado Mountain to demonstrate the power reduction that would be necessary in order to satisfy the quiet zone requirements. The report does *not*, however, mention the cancellation techniques currently used by broadcasters on both Lookout Mountain and Mt. Morrison to reduce signal levels in the quiet zone. These same cancellation techniques can be used on the DTV antennas on Eldorado Mountain to allow full power transmission to the intended audience. Additional discussion on the quiet zone is included in section 2.6.1.

### 2.2 CO-LOCATION (Browne [1], pp 7-10)

The Browne Report discounts alternate locations based on the assumption that re-locating existing Lookout Mountain FM and analog TV transmitters to alternate sites is necessary and would cause technical problems with regard to the Table Mountain quiet zone and “short spacing” to other FM and TV stations. For reasons of economy, broadcasters may desire to have their

transmitting facilities for analog and DTV in one common location. While this may be desirable economically to the broadcasters, it is not a necessity from an engineering or coverage perspective. It is merely a matter of convenience.

The immediate problem is finding a permanent home for the DTV transmitters, not re-locating existing analog TV and FM transmitters. Problems related to co-location of FM and analog TV transmitters should not be cause for site elimination when selecting a permanent site for DTV transmission.

### 2.3 SHADOWING AND MULTIPATH (Browne [1], pp 13-16)

Receivers currently used for DTV transmission in the United States are susceptible to failure due to the effects of “multipath,” or reflected signals arriving with different delay times. In an urban environment, the reflecting objects may be buildings, trees, poles or even the walls of the room surrounding the antenna. The Browne Report discusses broadcasters’ concerns about possible multipath due to intervening mountainous terrain from any transmission site that is not immediately overlooking the plains. The report also expresses concern for possible multipath from reflections off the mountains if the antenna were to be placed on a tall tower on the eastern plains. What the report does *not* discuss is that Lookout Mountain is surrounded to the south and west by higher terrain in close proximity that also will produce multipath reflections. With respect to multipath, Eldorado Mountain is clearly superior to Lookout Mountain, with far fewer potential reflecting objects in proximity. Reflections from mountainous terrain such as that between Squaw Mountain and Denver will be out of the “main beam” of the antennas, and will certainly be weaker and more diffuse than those reflections off of mountains that are nearby and in the “main beam” of antennas at the Lookout Mountain site.

With regard to shadowing, multipath considerations have also been used in the Browne Report to discard the possibility of On-Channel-Repeaters for DTV. These repeaters have been successfully demonstrated [3], but the Browne Report rejects the demonstration as “not a good enough example for the Denver situation.” This rejection is unsupported.

### 2.4 RFR (Browne [1], pp 17-18)

RFR, or Radio Frequency Radiation, has been a persistent problem on Lookout Mountain. Stations KHIH, KOSI, KKHK, KUVU, KCFR and KALC are currently operating at reduced power in order to get RFR levels down to

100% maximum permissible exposure (MPE). It does not make sense to add more emitters on Lookout Mountain when the RF levels are at 100% MPE. The Browne Report states that the LCG proposal for Lookout Mountain would reduce overall RFR from the current levels. LCG has repeatedly made this claim, but the claim is based on the assumption that many of the existing FM stations on Lookout Mountain would move to the proposed LCG tower. LCG has never presented evidence that any of the FM stations have agreed to move to its proposed tower. Jefferson County has been misled in this fashion before. In 1988 Jefferson County granted permission for a broadcast tower on Mt. Morrison, based in part on claims that the new tower would take as many as six FM stations from Lookout Mountain, thereby reducing the RFR levels. In fact, no stations moved from Lookout Mountain to the new tower on Mt. Morrison, and the single FM station (KIMN) that did move to the new tower is now responsible for RF levels as high as 232% MPE in Red Rocks park, owned by the City and County of Denver. Obviously it is more sensible to place the new DTV transmitters at a site that is not already subject to excessive RFR.

## 2.5 RESIDENTIAL AND BUSINESS INTERFERENCE

Residential and business interference due to high power broadcast signals is not addressed in the Browne Report. The community surrounding Lookout Mountain, high technology businesses and the Colorado School of Mines in Golden, are plagued with interference problems from the existing emitters on Lookout Mountain. This situation can only get worse if more emitters are added. When selecting a broadcast site, one should take into account the likelihood that interference problems may occur. Sites with few residences and/or businesses nearby are preferable to those in populated areas.

## 2.6 SPECIFIC SITE COMPARISONS (Browne [1], pp 19-36)

One of the most important aspects of site consideration is coverage area. The ideal site would have line-of-site to all intended viewers. The mountainous terrain to the west of Denver and other topographical features cause some shadowing from all sites. In order to more readily visualize and understand the coverage from some of the possible alternate sites (Eldorado Mountain, Lookout Mountain and Squaw Mountain), in Appendix C we show computer generated coverage maps.<sup>1</sup> The first three maps are full size views,

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<sup>1</sup> Coverage maps produced by Jay Jacobsmeyer, Pericle Communications Company. These maps are part of the record of the Jefferson County Zoning Case # 98015154RZP1.

and the next two pages allow side-by-side comparisons of the coverages afforded by Lookout Mountain and Eldorado Mountain and Squaw Mountain respectively. The yellow areas of the coverage maps show the highest received signal levels, with purple, red and black being successively weaker.

### 2.6.1 ELDORADO MOUNTAIN (Browne [1], pp 30-31)

The coverage map comparison of Eldorado Mountain and Lookout Mountain shows that Eldorado Mountain has significantly better coverage to the north and east, and essentially the same coverage to the south as Lookout Mountain. In particular, the Eldorado Mountain site has no shadowing in Boulder, whereas the Lookout Mountain site has a shadow (approximately .8 inches above the + on the full size Lookout Mountain map).

The Browne Report states that the Table Mountain quiet zone issues are “greatly magnified” because the site is much nearer to the quiet zone. Upon closer examination, it is clear this is not correct: The distance from Lookout Mountain to the quiet zone is 42.5 km, and the distance from Eldorado Mountain to the quiet zone is 23 km. Signal levels from antennas decrease with the square of the distance from the antenna, so all other things being equal, signals at the quiet zone would be 5.3 dB (3.4 times) higher from the Eldorado Mountain site than from the Lookout Mountain site. There is another factor, however, that mitigates this increase. Due to the higher elevation of Eldorado Mountain and the shorter distance to the quiet zone, the downward angle from an antenna on Eldorado Mountain to the quiet zone is approximately two degrees, whereas the downward angle from the Lookout Mountain site is only one degree. The proposed DTV antennas have a one-degree downward tilt to their pattern, and therefore the Lookout Mountain antennas point directly at the quiet zone. The elevation pattern of a typical DTV antenna (channel 16, for example) is reduced by -2 dB (a factor of .628) at a downward angle of two degrees. Therefore, the net increase in signal level at the quiet zone due to transmission from Eldorado Mountain instead of Lookout Mountain is only 3.3 dB, or a factor of 2.14. This can hardly be considered “greatly magnified,” considering that NIST has already approved excesses by a factor of 14.6 dB (28.8 times too high). Actually, by using either directional antennas or canceling techniques that are already being used on Lookout Mountain and Mt. Morrison (or a combination of both), signal levels at the quiet zone due to transmitters at the Eldorado Mountain site could be made lower than those

presently negotiated as acceptable when transmitted from Lookout Mountain. Browne's suggestion on page 7 that the solution to excess signal level at the quiet zone from Eldorado Mountain is to reduce power from 1000 kW to 11.5 kW with an omnidirectional antenna shows an unwillingness to address solutions to technical problems in a rational manner. A diligent engineer would certainly address techniques to reduce power in the direction of the quiet zone without reducing power in all directions.

## 2.6.2 SQUAW MOUNTAIN (Browne [1], pp 28-30)

The coverage comparison maps reveal that Squaw Mountain, due to its higher elevation, has better coverage than Lookout Mountain to the east and south, but has shadowing at the edge of the foothills. The shadowing is most demonstrable in the Boulder area, and would require repeaters or boosters in order to achieve adequate coverage in this area. Station KYGO FM broadcasts from this site, and the #1 ratings [4] of this station attest to the wide coverage available from this site.

The Browne Report comments that the westward position of this site results in coverage of sparsely populated areas (to the west of the Front Range), and that this is an inefficient use of power / coverage. The omnidirectional antennas Lake Cedar Group proposed to use at the Lookout Mountain site would also "waste" one half of their power on this same sparsely populated area. With regard to the Table Mountain quiet zone there is no issue. The Squaw Mountain Site presents no problem.

The Browne Report uses co-location issues as another reason to reject the Squaw Mountain site, but co-location of FM and NTSC television is not necessary. Should some or all of the NTSC stations wish to co-locate, a short spacing waiver would be required for Channel 4 (KCNC) at Squaw Mountain because the Squaw Mountain site is slightly too close to Grand Junction. Short spacing waiver requests are reviewed by the FCC on a case-by-case basis, and apparently only at the request of the station. KCNC has not made such a request. It should be noted that short-spacing waivers have been granted in order to move station KOSI to Lookout Mountain, as it was too close to Steamboat Springs. The request for waiver stated that the Rocky Mountain chain, "forms an effective north-south barrier...". It should further be noted that the 14,000 foot high continental divide and Squaw mountain itself are

geographic features between the Squaw Mountain site and Grand Junction, which should result in an easy approval of a short spacing waiver.

Another concern the Browne Report expressed about the Squaw Mountain site was that the tower height would be only 250 feet above the site, and that the resulting low placement of the antennas would cause problems with ground level radiation. We note that Channel 59, a 5 megawatt station on Mt. Morrison, operates with a radiation center 26.2 meters (85 feet) above ground level. Channel 50, a 2.5 megawatt station on Lookout Mountain, operates with a radiation center 39 meters (128 feet) above ground level. According to Marsand, Inc., Professional Engineering Consultants for KCEC, the Channel 50 antenna contributes a maximum of 9.57% MPE at the ground. It would appear from these examples that with proper control of azimuth and elevation patterns, five or more DTV stations could transmit from a 250 foot tower at Squaw Mountain without violating ground level radiation standards.

### 2.6.3 “SITE D” (RAMSTETTER SITE?) (Browne [1], pp 33-36)

We are unable to fully evaluate Site D described in the Browne Report, as we do not know its location. We are encouraged, though, to see that the Browne Report concludes, “Site D offers interesting possibilities,” even though by Browne’s own rating system it scored 363 points compared to 384 points and 411 points for Squaw Mountain and Eldorado Mountain respectively.

Site D may be the Ramstetter Site, which has existing towers and is at an elevation of approximately 8000 feet, approximately one mile north of Golden Gate Canyon Road. The site coordinates are:

LAT 039 Deg 47’ 50”

LON 105 Deg 19’ 53”

### 2.6.4 SEDALIA SITE

Site description:

Address 2539 N. Highway 67, Sedalia, CO 80135

(7 miles west of Sedalia on Highway 67)

LAT 039 Deg 23’ 06” N

LON 105 Deg 02’ 51” W

Elevation 7330 feet AMSL (2235 M)

**Business Contact:**

Dave Jackson, Director of Business Operations

At Contact

PO Box 348

2539 N. Hwy. 67

Sedalia, CO 80135

Tel (303) 688-5162

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This site in Douglas County is a former microwave relay site on 52 acres zoned for telecommunications. Current tenants on the existing tower are KSBS Channel 67 low power TV, Pagenet and Arch paging antennas. Access to the tower site is on a gently sloping one-half mile long dirt road off Highway 67. The site is positioned at the edge of the Front Range, but more to the east and south than any of any of the other developed sites considered, and has an unobstructed view of the Denver Metro area. A coverage map for low power Channel 67 TV, transmitting only 33.6 kW ERP from a low position on the tower, is included as Appendix D. One can see that the coverage extends well north of Brighton, even with low power and low antenna height. There are about 10 residences that can be seen when standing on top of the existing tower. At least one of these residences is at an elevation higher than the base of the tower. Even though the number of residences is extremely small compared to the number near the Lookout Mountain site, the presence of these residences tends to detract from the desirability of this site as a high power broadcast site.

## 2.7 METHODOLOGICAL CRITIQUE (Browne [1], pp 1-4, 33)

The Browne Report concludes by stating (p 37), “...in my professional opinion, the Lookout Mountain site is the best site from which the television stations can achieve the service to the public mandated by the Federal Communications Commission and that each of the other sites considered falls short in one or more ways ....”. Mr. Browne’s opinion is ostensibly supported by a Table (unnumbered page) entitled “*Ranking of Issues/Considerations*,” bearing a revision date of 2/23/00 (the Browne Ranking). The Browne Ranking arbitrarily selects 17 site characteristics for comparison (e.g. access, zoning, coverage, development costs), assigns an arbitrary weight or significance (i.e. 2-5) to each characteristic, and finally places Mr. Browne’s “grade,” “score” or “status” of 0 – 9 for each characteristic on each individual site. Although this is certainly not a scientific or engineering analysis, and is highly speculative, subjective and arbitrary, the Browne Ranking merits comment and rebuttal, as it apparently demonstrates LCG’s “rationale” that Lookout Mountain is the “best” site.

### 2.7.1. LACK OF METHODOLOGICAL JUSTIFICATION

There is little description about the methodology used to generate anything about the Browne Ranking, specifically 1) the categories, 2) their assigned values, or 3) their weighting.

### 2.7.2. MISSING CATEGORY DESCRIPTIONS

The Browne Report contains only a meager description of some of the 17 categories and none of a few. For example – Browne’s category #17, Studio/Transmitter Interconnect, is nowhere described. Inexplicably, Eldorado receives a score of only 3, despite the presence of dozens of transceivers there already, including some being used by LCG members.

Similarly, there is no description of factors falling within the Environmental category. The Browne Report states that in identifying alternate undeveloped sites, two of the environmental criteria were that the site(s) be “removed from any substantial residential development,” and that the site(s) is “not within 5 miles of residential areas on higher terrain.” Site D, Squaw Mountain, and Eldorado Mountain all meet these environmental considerations, whereas Lookout Mountain meets neither. Yet mysteriously, Squaw Mountain

scores only a 5 in this category, and Site D only a 3, while Lookout Mountain also scores a 5.

By failing to describe the factors falling within or taken into consideration in each category, the Browne Report and Ranking (and consequently Mr. Browne's conclusions) are effectively meaningless.

### 2.7.3. EXISTING CATEGORY DESCRIPTIONS

Even those categories where Mr. Browne provides description are not helpful in developing a quantitative score for the Browne Ranking. The Table Mountain Quiet Zone (Browne's category # 14) is described in pages 5-7. While it may be true that violating the spirit of the grandfathering provisions is something that LCG could count positively for Lookout Mountain, it is inexplicable that the scores for Lookout Mountain and Squaw Mountain should be 9, while the score for Eldorado Mountain is only 3. It is unclear whether the Browne position is that the Eldorado site is incapable of meeting the requirement, or too expensive (a different category). As discussed in sections 2.1 and 2.6.1 above, resolution of any quiet zone concerns with Eldorado Mountain is clearly achievable.

Land ownership (Browne's category #16) may be an important issue to Lake Cedar Group, as it and its members do own property on Lookout Mountain. Nevertheless, there is no explanation for the basis for assigning a score of only "3" to Squaw Mountain (which is available for purchase) and Eldorado (which was available for sale until recently and remains available for lease), and "0" to five of the undeveloped sites.

With respect to RFR (Browne's category #7), it is undisputed that there have been numerous FCC and County citations for existing overages of federal and county radiation standards on Lookout Mountain. Yet Lookout Mountain is given a "6" which is only one point less than the "7" for Squaw Mountain.

For none of the other categories is there any description of scoring - either quantitative or qualitative. It is therefore impossible for readers of the Browne report to understand the scoring system. The Browne allocation of scores within each category is not based upon any defined rationale.

2.7.4. MISSING CATEGORIES. The 17 Browne categories leave out four

that have been of utmost importance to the local community and the Jefferson County Commissioners and on which considerable testimony has been provided.

a. SAFETY. One of the main reasons the county planning department recommended denial was the safety issue associated with tower fall.

b. PROPERTY VALUES/COMPATIBILITY. The category of depressed real estate values was also the subject of expert testimony at the rezoning hearings. Incompatibility with existing residential use in the neighborhood was cited by the Board of County Commissioners as a reason for denial of the Lookout Mountain rezoning. Browne fails to discuss the compatibility of the proposed tower with existing residential and non-residential land uses in the neighborhood. The operators of several historic structures on Lookout Mountain have already provided considerable negative testimony on compatibility.

c) AESTHETICS. Telecommunication towers and associated support buildings, located at or near ridgelines – within the visual gateway to the Rocky Mountains – are eyesores. Aesthetics are traditionally recognized as an integral part of land use considerations and decision-making. Browne has ignored these zoning issues.

d). INTERFERENCE / RFR. Interference has been and is an ongoing problem on Lookout Mountain. Possibly Mr. Browne would argue that it fits under his category #7 - RFR Issues, but his brief dismissal of this topic on pages 17 and 18 fails to discuss the problems of cars not starting, garage doors and gates inexplicably opening, and other interference problems at sites near the proposed LCG tower. The inconveniences and business disruptions of RFR interference reported by dozens of witnesses deserve attention. For convenience, we include this in the category of RFR.

### **3. REVISIONS TO THE BROWNE RANKING**

This analysis has kept as much of the Browne methodology and terminology as possible. Section 4 discusses, whereas Browne did not explicitly, the three main components of this methodology: the selection of categories, the scoring, and the weighting. Section 5 contains the revised version of the Browne Ranking and brief comments. This Section provides a rationale for eight differences in methodology:

### 3.1. FAA ISSUE

The category of FAA approval (Browne's category # 6) is dropped. A criterion that is a prohibition on tower siting should have very high weighting – or else should be considered as a hurdle to be conquered before any further analysis. Green Mountain is clearly not a viable candidate (a Browne score of 3 and all others are the maximum (9) for the FAA score). No one is proposing this site. Green Mountain receives a high relative total score because the low FAA weighting (which should have excluded it) is only 45 possible points out of his maximum possible score of 648 (about a 7% weighting). Since this “FAA” category is more appropriately a condition for consideration at all, this category has been eliminated.

### 3.2. 100-POINT TOTAL

The numerical scoring system is changed so as to make the choices more understandable. The Browne maximum score is a confusing 648 points; the new system has a simple 100 points. It uses a 10-point scoring system - rather than Browne’s nine point system - to exploit the conveniences of the decimal system and standard scoring methodology. Every assigned point is now exactly one percentage point.

### 3.3. TEN CATEGORIES, EQUAL WEIGHTING.

A number of similar categories are combined (but without deleting any of Browne's other than the FAA issue). The advantage is that discussions of appropriate relative weighting become much simpler – all weightings are identical. Browne’s unnecessary and confusing repetition of weights associated with the categories is now not necessary.

### 3.5. TABLES vs. ROWS

The ten categories are placed in rows rather than columns to increase understandability of the results.

### 3.6. REDUCED NUMBER OF SITES

All candidate sites that are not likely to be proposed have been deleted. Specifically, Green Mountain, Mount Morrison (Mt. Morrison is

generally similar to Lookout Mountain, but is not being proposed by Mr. Browne), and all but one of the “Undeveloped Sites” have been deleted.

### 3.7 SITE “D”

Only one of the undeveloped sites is included in this analysis because the others would entail excessive speculation. A site listed as the “Ramstetter” site that closely matches Browne’s description of Site “D” – the best of the Browne “Undeveloped Sites” has been considered. The Ramstetter site is almost exactly at the elevation and distance from the quiet zone given by Browne for site D, and already contains telecommunication towers

### 3.8 ADDED SEDALIA SITE

An additional developed site near Sedalia in Douglas County is also considered.

## **4. CATEGORIES, SCORING RULES, WEIGHTS AND EXAMPLES.**

The selection, weighting, and scoring of criteria are all-important aspects of the Browne methodology. The Browne category choices are presumably adequate for decisions that would involve only the Broadcasters. However, the Browne categories and weightings are unrealistic from the standpoint of the Jefferson County Commissioners’ criteria for making land use decisions as articulated in State statute and County regulations, and FCC decision makers considering preemption, and subsequent legal challenges to both. Browne has assigned a zero significance (by leaving out an important category) or low weight to most of those issues that members of the Jefferson County Commissioners have stated were instrumental in their votes. The following is a brief rationale for the authors' proposed alternative scoring for the ten newly defined categories, followed by a brief rationale for the individual 10% weightings.

### **1) COVERAGE**

A perfect score could only be earned by a site that is perfect for coverage. The Lookout Mountain site (like all sites) has significant regions (especially mountain valleys) of poor reception – and so should not receive the

perfect score that might be given to satellite delivery. Nevertheless, Lookout Mountain would receive a higher score than Squaw Mountain, which has poor coverage in Boulder. However, Browne does not consider the availability of On-Channel-Repeaters [3] that may give even superior performance, with a minor increase in costs to sites such as Squaw Mountain (see Section 2.3 above).

A weighting of 10% is appropriate given the importance of coverage to all those within the signal range of these stations.

## **2) RFR and INTERFERENCE**

A design that cannot possibly cause excess power levels to harm or inconvenience any private citizen would receive a perfect score (of 10). As more residences and businesses receive high levels, the score must decline, with a "0" going to a site that is both above legal limits and cannot be reduced. Even though it has not been shown that the existing high radiation levels on Lookout Mountain (that are now exactly at the legal limit in several locations) can be reduced below the legal limit through any process under the control of LCG, a score of 2 (rather than 0) is assigned to the Lookout Mountain site.

A 10% weight is based on staff, community, and Board of County Commissioner concerns. There was testimony on, and is considerable evidence of, electronic interference and existing overages – both of which Browne has ignored.

## **3) FCC ISSUES**

A score of “10” would apply for any site with absolutely no FCC issues, while a "0" would apply for any site with a huge difficulty in achieving FCC approval. Acknowledging the historic context of the FCC with Lookout Mountain, a perfect "10" score has been given to the Lookout Mountain site. The authors have given Lookout Mountain this score in spite of the fact that Lookout Mountain has previously exceeded FCC RFR limits, a violation of FCC regulations. This problem should probably result in a lower score for Lookout Mountain in this category.

Knowledge of the waivers already given to move stations *to* Lookout Mountain, and calculation of relatively small difference in impact at the Table Mountain Quiet Zone suggests that these problems are less severe than Browne

has speculated for the other sites. In general, FCC issues would tend to increase with distance moved from the present analog TV sites on Lookout Mountain and Mt. Morrison. Accordingly, the alternate sites have been assigned scores in the 7 – 9 range.

In this category, three categories used by Browne are included (#8 – “FCC Issues”, # 9- “DTV Interference”, and #11 – “FM Co-location”), which had a total weighting of 15 %. If these technical hurdles were truly difficult, one could understand such a high weighting. However, the Browne report is full of equivocal language. For instance on page 8 Mr. Browne, in referring to co-location and TV separations, states: “Depending upon the exact site selected, this **could** (emphasis added) be a limitation.” Similarly, on page 14 in referring to the “Analog Environment,” Browne uses the words “...very problematic...,” and “...it is doubtful...”. These comments demonstrate that these three combined “FCC” categories relate to inconvenience - not to proven extreme difficulties – so that a small reduction in Browne’s weighting (from 15% to 10%) is appropriate.

#### **4) ENVIRONMENT/ COMPATIBILITY**

The extremes of perfect and zero scores are obvious and no site should receive either. However, shorter towers would certainly receive higher scores on the environmental part of this category (as would occur on Eldorado Mountain and Squaw Mountain). Lookout Mountain has been assigned a “4” since there will be a larger avian kill at this site with a guyed tower than at other sites and because of non-compatibility of tower/antenna land uses with neighboring residential and historic landmark land uses. In particular, there is the open issue of federal legislation protecting the several existing non-residential historic sites on Lookout Mountain with hundreds of thousands of visitors annually.

Browne assigns a 7% weight - which is insufficient because there is no mention of the important category of non-residential (historic structures) compatibility. As this alone could be cause for rejection of a new tower, the weighting of 10% seems conservative.

## **5) MAJOR STRUCTURE COSTS**

These comprise three Browne categories: # 2 – Access, # 3 - Power Availability, and #15 - Development Costs. A perfect score would be one that entails zero new expense in these three categories. One might be inclined to give the Lookout site as high a score as given by Browne, except that LCG has produced a very high-cost tower design. At other (higher) mountains, a shorter tower and/or multiple un-guyed towers would suffice. It is less clear what should define a "zero" score - perhaps sites where all could agree that costs are unreasonably high. This study uses approximately the same scoring values used by Browne, as modified by the tower cost correction.

The three Browne categories that have been combined in this first cost category had a weighting of 17%. See category 6 for weighting considerations.

## **6) ANTENNA COSTS AND OWNERSHIP**

These entail three Browne expense areas: #14 - Table Mountain Quiet Zone, #16 Land Ownership Availability, and #17 - Studio Transmitter Interconnect. The scoring scheme is identical to our category #5 cost issues, and there is some obvious overlap. The scoring again reflects the values assigned by Browne, with a notable advantage again given to Lookout in this category. Because this category now includes the issue of tower ownership, the Eldorado Mountain site is downgraded slightly for that reason. However, land ownership is not a major profit driver for any station (as evidenced by the large number of stations that already rent space). Additionally, there may be significant accounting advantages to leasing over ownership.

The Browne combined categories included in the new category #6 had a weighting of 19%. The total weighting Browne used for the cost related items in new categories #5 and #6 was 36%. Considering that costs will be amortized over the lifetime of the facility, estimated to be 50 years or more, a 20% total weighting was assigned to the two combined categories (10% for each).

## **7) PROPERTY VALUES**

A perfect score would be assigned to a site that does not lower any property values. In the table that follows, a zero score is one that has undisputed negative impact of \$100 million (about a 10% decline in the estimated Lookout Mountain neighborhood residential valuation on average).

On Lookout Mountain, there has been testimony of a probable monetary impact already of this 10% magnitude for some, and a much higher number for hundreds (perhaps thousands) of residences should the LCG tower be installed. With a local property tax on the order of 1% of assessed value, the decrease to the county treasury is approximately \$1 million annually. As this may have already occurred, a score of 2 seems conservatively high for the proposed additional LCG tower on Lookout Mountain.

Browne's exclusion of this category in his analysis is perhaps an oversight. Land use decisions are always heavily influenced by this criteria. Its importance is the basis of the assigned weight of 10%.

## **8) AESTHETICS**

A site with a perfect score is obviously one with zero negative impact. It is virtually impossible to assign this score at any site, and this has not been done. At the other extreme, a score of "0" would be "deserved" by a project that is widely visible and that is not in compliance with the important aesthetic considerations articulated in adopted Community and County Plans. Because there is some consolidation (counterbalanced, it seems, by the "supertower - starmount" design), and the building is not visible from every part of the County and there is already considerable tower blight on the mountain, and there will be visual blight wherever a tower is placed, a value of 4 is assigned to the proposed LCG design. Appreciably higher values are assigned to the other sites, which are generally much higher and farther from major roads.

The Browne report includes this category (with a weight of only 4%), under the #4 category of "existing towers," relating only to the number of towers. The 10% weighting is especially justified in order to account for the stated county preference for preserving the "Mountain Backdrop." Considerable testimony was given on the huge size of the proposed transmitter building. The building design was a primary issue before the County Planning Commission.

## **9) SITE CHARACTERISTICS, SAFETY, FALL**

This category is an expansion of Browne category #1 – "Site Characteristics", modified to now also include the Browne-un-acknowledged issue of tower fall. A site with no possibility of the tower falling on any other tower, power line, home, or public road, and having minimum concerns about guy-wire placement, should receive a full credit for the "fall" portion of the

score. A zero score should follow from any tower that might fall outside the property boundaries. Accordingly, a score of 4 is assigned to the proposed 850' LCG tower, thereby giving allowance to aspects of this category not related to tower fall.

A weight of 10% is assigned to this new combined category for several reasons. First, tower fall appears as a primary concern of the JeffCo Planning department, based on existing County planning rules. This concern resulted in a planning department recommendation to deny rezoning. Second, there was considerable concern expressed by nearby citizens, including several upon whom the tower could have fallen. Thirdly, it was mentioned as a reason for denial by at least one commissioner. Lastly, Browne has already assigned a value of 4% for his category #1. Perhaps this should be treated rather like the FAA criteria (as a "gate"), but a more conservative approach has been taken, treating this ninth category only as a 10% decision weight.

## **10) ZONING**

A "10" score should prevail for any site already properly zoned. We concur with Browne that a County Commission denial should earn a "0" score. Scoring between these extremes is less clear, but obviously higher scores should go to sites with existing properly zoned high-power transmitters. Higher scores were assigned at other sites than were given by Browne, but not "10's", since all sites considered may require some county zoning action.

This zoning category was given a 7% weight by Browne. The rezoning denials on the land proposed for the LCG site in 1983, 1985, 1990 and 1999 by the County Commissioners, which have resulted in Browne giving the LCG project a "0", could also be treated as the FAA topic has been treated. That is, one could argue that a quadruple zoning denial should eliminate a site from further consideration. To only give it a weight of 10% is conservative.

## 5. REVISED TABLE

Using the above methodology, the following tabular summary results sets forth our opinions and conclusions:

Category	Lookout	Eldorado	Squaw	Ramst'r	Sedalia
1. Coverage	8	9	6	7	7
2. RFR & Interference	2	10	9	8	7
3. FCC Issues	10	7	8	9	7
4. Environment/Compat.	4	8	8	8	8
5. Tower/Power/Access	9	6	7	5	5
6. Antenna/Ownership	10	5	7	7	8
7. Property Values	2	9	8	7	6
8. Aesthetics	4	8	8	8	8
9. Safety/Site	4	10	10	9	7
10. Zoning	0	7	8	5	7
<hr/>					
Totals (%)	53	79	79	73	70

The numbers speak for themselves. While Browne finds that Lookout Mountain is by far the best site, this analysis, which includes community concerns, finds that it is the worst. The basic underlying reason for Lookout Mountain's low rating in this analysis is that it is the only site that is in or near a heavily populated residential area, and this significantly influences the scoring in many of the rating categories. If community concerns are not taken into

account (as is the case with the Browne Report), then Lookout Mountain may be the obvious “best” site, as it places the least economic burden on the broadcasters in terms of immediate out-of-pocket expense.

Most importantly, the conclusion of this analysis is that there are several viable alternative developed and undeveloped sites available for placement of DTV transmitters to serve the Denver Metro area, all of which can be considered superior to the Lookout Mountain site.

## **7. REFERENCES**

[1] John F.X. Browne & Associates, Denver DTV Site Investigations – Lake Cedar Group, Denver, CO (Dated December, 1999 - but with a final table dated "Rev 2/23/00")

[2] Friday, Dennis S. , Chief, Radio-Frequency Technology Division, NIST, Boulder CO; letter dated October 24, 1998 to Mr. Fred Thomas (2pages, Appendix A)

[3] Husak, Einoff and Salomon, On-Channel Repeaters for Digital Television Implementation and Field Testing, Advanced Television Technology Center, Presented at the NAB99 Broadcast Engineering Conference, Las Vegas, NV, April 20, 1999 (7 pages, Appendix B)

[4] Denver Business Journal “Largest Denver-Area Commercial Radio Stations,” January 8-14, 1999 & January 7-13, 2000 (2 pages, Appendix E)

## **APPENDIX A**

Letter from Dennis Friday to Mr. Fred Thomas [2]

## **APPENDIX B**

Husak et al, "On-Channel Repeaters for Digital Television Implementation and Field Testing [3]

## **APPENDIX C**

MAP 1: Coverage Map for Eldorado Mountain site

MAP2: Coverage Map for Lookout Mountain site

MAP 3: Coverage Map for Squaw Mountain site

MAP 4: Side-by-side comparison of Lookout Mountain and Eldorado Mountain sites.

MAP 5: Side-by-side comparison of Lookout Mountain and Squaw Mountain sites.

## **APPENDIX D**

Coverage map for KSBS Channel 67 low power TV.

## **APPENDIX E**

Denver Business Journal “Largest Denver-Area Commercial Radio Stations,”

January 8-14, 1999 & January 7-13, 2000 [4]

## RESUMES:

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UHF Technology Group: Designed digital spread spectrum communications systems.

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1984-present: Owner, Pacific Millimeter Products.

Design millimeter wave components for use in radio astronomy, test instrumentation, communication systems, anti-collision radar and fusion plasma diagnostics.

#### Patents:

4,286,229

Multiple Frequency Oscillator

4,433,314

Millimeter Wave Multiplexer

4,492,960

Switching Mixer

4,873,501

Transmission Line Notch Filter Element

#### Publications:

"A Broadband 40-60 GHz Balanced Mixer," IEEE Transactions on Microwave Theory and Techniques, Volume 24, No. 1, pp 63 & 64, January, 1976.

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"Suspended Substrate Ka Band Multiplexer," Microwave Journal, June 1981, pp 73-77.

"A Compact, Low-Cost 60 GHz Communicator," IEEE 1982 International Symposium on Microwave Theory and Techniques, digest p231&232.

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My technical specialty is in spacecraft electronics and power systems. I am currently a manager in the electronics department at Lockheed Martin Astronautics (LMA). I have had numerous technical and management positions in my 19 years at LMA, formerly Martin Marietta.

During 1994, I was the acting manager for all electrical design personnel at Martin Marietta Denver. This included all RF, digital, power, attitude control, worst case analysis, instrumentation, and ground support detail designers. I was responsible for design oversight of the numerous programs that these individuals were working on as well as the personnel management and development of these individuals.

I have been program manager providing technical, schedule and cost leadership of numerous Air Force and NASA research and development programs such as, High Power Technology, Miniature Autonomous Power System, Network Technology and Hardware Development. Additionally I have been the Principal Investigator of internal power and attitude control research and development off and on for six years.

President of Mount Vernon Country Club Metropolitan District and President of Mount Vernon Country Club Corporation, 5/98-Present:

As president of these two organizations, I oversee the operations of the community, the country club, the recreational facilities and act as a type of mayor for the metropolitan district. Mount Vernon Country Club serves the largest number of meals of any country club in Colorado.

### Publications:

"A New Two-Switch Forward Resonant Topology" 1986 HFPC

"Design Concepts for a 5kW DC/DC Series Resonant Converter" 1987

IECEC

"Design Techniques for 20k Hz Power Converters" 1987 IECEC  
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