



2017

Communications System Evaluation and Recommendation



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# Table of Contents

<b>Introduction</b> .....	2
<b>Executive Summary</b> .....	3
<b>Background Information</b> .....	5
FCC Call Signs.....	6
<b>Coverage</b> .....	7
Overview.....	7
Fire Department Tone Out Coverage .....	8
<b>Dispatch</b> .....	10
Introduction.....	11
Console.....	11
<b>Radio System</b> .....	12
<b>Partnership Opportunities</b> .....	14
Silke Fleetnet Digital Radio Network.....	16
State of Oregon’s ODOT/OSP 700MHz/VHF System.....	18
City of Salem’s Planned 800MHz P25 System.....	21
<b>Advantages Disadvantages</b> .....	24
<b>METCOM Stand Alone System Options</b> .....	25
<b>Recommendations</b> .....	27
<b>Attachments “A” FCC Licenses</b> .....	30
<b>Attachments “B” Propagation Studies</b> .....	38
<b>Attachments “C” Completed User Surveys</b> .....	78

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## *INTRODUCTION*

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The purpose of this assessment is to:

- Provide an evaluation of the current equipment and overall functionality of METCOM 9-1-1 public safety radio/paging communications system
- To identify/explore potential partnerships opportunities with other agencies in the Marion County Area.

The recommendations proposed by Cascade Mobile are based upon advances in technology for radio communications, best practices for public safety LMR systems and the input from the National Public Safety Telecommunications Council report.

The scope of work for this report is not to provide technical solutions to the existing LMR/ paging system but rather to identify issues and to provide a recommendation for moving to a new LMR system based upon the needs of the users and METCOM 9-1-1 operations.

Cascade Mobile utilized user surveys, interviews, radio propagation mapping programs and interviews with the following potential LMR partners:

- Harris Communications (State Radio Project) – Jennine Weber
  - 700Mhz / VHF Trunked P25 Phase I / Phase II
- WCCCA/C800- Ron Polluconi
  - Motorola 800MHz Trunked
- City of Salem – Darren Rice
  - Motorola 800MHz Trunked P25 Phase 2
- Silke Communications – Starsky Brolin, John Lebold
  - Fleetnet UHF Radio Network
  - Passport VHF Trunking Network
- Independent Manufactures
  - JVC Kenwood – Mark Jordan

Cascade Mobile offers the following Executive Summary.

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### *Executive Summary*

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Our interviews with the following user groups and dispatch staff identified numerous shortcomings with the current radio system, among them coverage issues in many areas and tone out issues, particularly for fire agencies in South County. User groups and METCOM also identified budget as a crucial consideration for any future radio system expenditures.

#### Group 1 Meeting

- Turner Fire Department
- Jefferson Fire Department
- Aumsville Fire Department

#### Group 2 Meeting

- Stayton Fire Department
- Sublimity Fire Department
- Santiam Ambulance

#### Group 3 Meeting

- Gates Fire Department
- Detroit Fire Department
- Mill City Fire Department
- Lyons Fire Department

#### Group 4 Meeting

- Aurora Fire Department
- Monitor Fire Department
- Hubbard Fire Department
- Silverton Fire Department
- St. Paul Fire Department
- Woodburn Fire Department
- Woodburn Ambulance

#### Group 5 Meeting

- Woodburn PD
- Hubbard PD

#### Group 6 Meeting

- Stayton PD

- Aumsville PD
- Turner PD

#### Group 7 Meeting

- Silverton PD
- Mt. Angel PD

We researched many different communications system options, including partnership opportunities and stand-alone systems. There are no low-cost options to fix the issues that users have identified. Improvements can be made to the existing system by acquiring additional frequencies and reengineering the existing system into a multicast repeated system, but that will not provide the functionality that users said they wanted.

Conversion to an analog VHF simulcast system would provide functionality similar to what users are requesting, but at a cost approaching that of a standalone system.

While a stand-alone option is very attractive from a governance standpoint, a P25 system would be prohibitively expensive and an NXDN system, while more manageable from a cost perspective, will leave METCOM on a communications island and make interoperability with non-METCOM agencies difficult.

We feel that partnering with an existing 700/800 MHz P25 trunking system, such as the ODOT/OSP 700 MHz system, would be the best overall value for METCOM and its user agencies over the long run. Agencies on all sides of METCOM have moved, or are moving, to 700/800 MHz P25 trunking. P25 trunking would provide the functionality that users told us they wanted, give agencies easy interoperability with surrounding departments, and facilitate possible consolidation of METCOM with another dispatch center at some later date.

Additionally, due to the current consoles being obsolete and the fact that support and replacement parts are difficult to acquire we would strongly urge METCOM 9-1-1 to replace these at their soonest convenience. Making note, that an overall communications plan should be considered when selecting a new console vendor.

We strongly recommend that METCOM and its agencies use this report as a stepping stone to develop a communications system plan. The communications plan should lay out near term, mid-term and long term goals for the communications systems. We strongly discourage making any changes to the radio system without an underlying plan to set priorities and insure that money is spent in a manner which furthers the goal of the plan.

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## *Background Information*

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METCOM 9-1-1 is a Public Safety Answering Point (PSAP) center that was formed by the consolidation of the North Marion County Communications Center (NORCOM) and the Santiam Canyon Communications Center (SCCC) on July 1, 2013.

This consolidation brought together 26 public safety agencies that provide services over 1,000 square miles and respond to over 5,000 calls for service on an average month.

METCOM 9-1-1 operates a High Band VHF frequency LMR / paging system that currently serves 31 public safety entities within Marion County (Total Jurisdictional agencies are 36).

- 17 Fire Districts
- 7 City Law Enforcement Agencies
- 1 USFS Law Enforcement Agency
- 2 Private EMS Agencies
- 1 Public Works Department
- 1 US Forest Service
- 2 Bureau of Land Management

The current system utilizes base station transmitters accompanied with numerous remote receivers deployed throughout Marion County.

To help give a better visualization of the system architecture we have broken out the following tables for easy reference. Below is the first table which shows all the known transmitters within the system and what channel they are transmitting.

<b>Base Station Transmitters</b>			
<b>Location</b>	<b>Channel Name</b>		
Abbey	North 7		
Coffin Mountain	Forrest CH.		
Crosby Road	North 1	North 6	North PD
Detroit FD	South 1		
House Mountain	North 1	South 1	South 4
Marion Hill	South Police		
Mclaren Institutional	North 1		
Pine Street	South 1		
Regis Water Tower	South Police		
Silverton Water Tower	MAPD/SPD		
Sublimity Water Tank	South 3		
Whipper	South 1	South 2	

**FCC ASSOCIATED CALL SIGNS FOR THE ABOVE**

<b>Associated Call Signs</b>		
<b>Channel Name</b>	<b>Call Sign</b>	<b>Licensee</b>
MAPD/SPD	WPWV990	City of Mt. Angel
North 1	KOK934	Woodburn Fire District
North 6	WPYV453	Silverton Fire District
North 7	WPYV453	Silverton Fire District
NORTH PD	KOH484	City of Woodburn
South 1	WNMN401	Stayton Fire District
South 1	WQEN530	Idanha Detroit Fire
South 2	KFZ909	Sublimity Fire
South 3	KFZ909	Sublimity Fire
South 4	WQL974	METCOM 911

The table below shows the known satellite receiver locations and which channels the receivers are voting. Since the FCC does not require receivers to be licensed there will be no FCC call signs associated with these.

<b>Satellite Receivers</b>	
<b>RX Location</b>	<b>RX Channel</b>
Abbey	North 7
Aurora FD	North 6
Crosby Road	North 6
Mt. Angel	MAPD/SPD
Regis Water Tower	South Police
Silverton Water Tower	North 7
St. Paul FD	North 6
Turner Water Tower	South Police
Whipper	South Police
Woodburn FD	North 6

Utilizing the information above we were able to perform radio propagation studies that helped us correlate information and understand better the areas of concern stated by the users and operators of the current system.

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## Coverage

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### Overview

The current METCOM 9-1-1 LMR system coverage, specifically portable radios and pagers, is not very good within the service areas of most agencies. This was something that was noted in a majority of the user surveys that we received from the agencies as well as vocalized in every user interview we conducted.

Cascade Mobile utilized RF propagation software (Designed by Radio Compass and maintained by RadioSoft) to generate models of propagation to estimate coverage. Utilizing the information provided by METCOM 9-1-1 regarding FCC Call Signs and making assumptions that the system is built in compliance with the FCC Licenses allowed us to generate the models (an audit of compliance with FCC licenses and emission was not part of the SOW but highly recommended).

The user statements and examples given regarding the lack of portable radio coverage match with many of the gaps in coverage we see when we generate such RF models. The reasons for these “gaps” in coverage are numerous. Some parts of the county suffer from severe topography challenges while in other areas it is evident that the systems lack of reliable performance is due to lack of overall system engineering.

We can see this in several key components of the system and understand that when METCOM 9-1-1 was formed there did not appear to be a dedicated effort to establish both a short and long term communications systems plan. Once the consolidation was complete this element may have been overlooked and since such time METCOM has been reactionary to these issues vs. being able to proactively execute a communications plan that had been previously engineered and vetted for the desired coverage needed by its users.

During several of our interviews we discovered that some Fire Department agencies, due to poor portable coverage, have deployed Pyramid Vehicular Repeaters (SVR200) to fill in the gaps. In other meetings it was vocalized by Law Enforcement agencies that they are looking to deploy a VRS (Vehicle Repeater System) as well. In interviews with those agencies that did deploy a VRS they advised that the extended portable range that was offered by this product has greatly improved the safety of their staff and provided better service to their communities. This is a very viable approach to the coverage issue especially in areas that have topography and structure challenges since putting transmitters on all the hilltops and in-building amplifiers needed to cover certain areas is not a feasible solution at this time due to cost.

The reason for the successful use of repeaters is due to the mobile radio coverage



offered from the existing system. Most all agencies advised that the mobile radio coverage is good, though there are areas where many users would like to see improvement.

### **Fire Department Tone out Coverage**

This topic has been the most discussed and one that we have received the most amount of documented issues during the system review process. Every Fire agency we met with noted that they don't feel confident that the current VHF tap out system is adequate and regularly misses tone outs, gets partial tone outs, gets tone outs with no audio or receives unwanted tones not associated with any agency or apparatus.

Upon inspection of the architecture and review of the data there are several factors that are contributing to these issues. The primary reason has to do with the current VHF paging system architecture and overall design.

The current paging system utilizes separate paging transmitters all on the same frequency, however the system is not Simulcast. The base station transmitters are positioned throughout the county at separate locations in hopes of covering the districts better. Taking the approach of adding more transmitter sites when not in a simulcast environment promotes human error, especially in areas where transmitters are geographically overlapping to try and cover a certain area. This is very evident in South County when trying to tone out agencies on South 1.

South 1 has three transmit locations that show overlap in the propagation studies and in field testing. Those three sites are Whipper, Pine Street and House Mountain. In an industry where every second matters agencies are in a precarious position with the current architecture. The dispatcher now has to decide which transmitter to tone out first in hopes of reaching the desired agencies to respond. This situation becomes even more precarious when trying to perform mutual aid calls for larger events or in the case of South1, which due to system design, has multiple transmitter locations.

Due to the severity of this issue we wanted to witness the process the dispatcher has to execute when dispatching under the current design.

When a 911 call is received at METCOM 9-1-1 that is going to utilize Fire agency resources the dispatcher must perform the following tasks:

1. Receive 911 call and create the incident in the CAD system
2. Wait for CAD to give a "suggested" list of assets to tone out
  - a. This is based on the information the dispatcher enters into CAD regarding the call and has been predefined by the users.

3. The dispatcher has to unselect the assets proposed by CAD that are not associated with transmitter site #1.
4. Select channel on console to perform the tone out.
5. Execute tone out #1.
6. After the tone has been sent the dispatcher has to give audio regarding the call.
  - a. If the station assets needed for the call require a second tone out from another transmitter location or this is a mutual aid call, which many do and are, then the dispatcher has to continue the process.
7. Pull the call back up in CAD re-select (or if mutual aid select new assets) the same assets toned out from transmitter site #1
8. Select transmitter site #2
9. Perform the second / mutual aid tone out
10. After tone has been sent the dispatcher has to give audio regarding the call.
11. If the station or assets needed for the call require a third tone out from another transmitter location then the process has to repeat itself once again.

There are obvious flaws in the process above due to system design and it promotes human error. Not to mention the entire time all of the above is going on (depending on staffing and time of day) the dispatcher could also be trying to talk to the person generating the 911 call and handle incoming radio traffic from responding units toned out from any one of the previously generated tones. This problem is worsened by the fact that, when the dispatcher is transmitting one of the tones or giving the audio associated with the call, the current architecture does not allow them to "hear" audio coming in from another transmitter site. So if the dispatcher is toning out on South 1 from Pine Street and switches to Whipper for the second tone out and field units from the first tone out try to advise dispatch they are in route or have additional information, the dispatcher will not hear that transmission.

The above process also presents issues when training a new dispatcher or anyone not familiar with specific geographic areas of the county. Due to the system design this can delay a dispatcher from being effective as they may not know which transmitter to use for the different agencies or apparatus. METCOM has tried to mitigate some of this by "labeling" the channels on the console (Pictured below) with which agencies should be dispatched from which sites. However, as we have noted above, that is not 100% and many times the process of a single tone out does not generate the proper response from field units. Therefore a second tone out or transmission must occur to notify the proper staff so that they may respond to the call. This issue is especially apparent when you consider that many of the fire districts in the county are staffed with volunteers. Volunteers may be at their place of work, residence or moving throughout the area or district. So utilizing the concept of a single tone out assigned per agency is not as effective in many instances as the volunteers are not within range of the particular transmitter that is assigned to that



## **Introduction**

We met with METCOM administrative and dispatch personnel to understand how they use their radio consoles and the radio system and the challenges they face. As you would expect, the frustrations that dispatch expressed were similar to those described by units in the field. The field and dispatch are on opposite ends of the same pipe, so a problem at one end is generally a problem at the other end.

The combination of an obsolete radio console with a complex array of radio sites and channels presents many operational and training challenges for the dispatch center. Dispatch, particularly of multi-agency calls, requires numerous manual operations and decisions about which site to use for a given agency and channel. Manual operations and complex decision making in an interrupt driven environment like dispatch inevitably results in errors. Due to the current consoles being obsolete and the fact that support and replacement parts are difficult to acquire we would strongly urge METCOM 9-1-1 to replace these at their soonest convenience. Making note, that an overall communications plan should be considered when selecting a new console vendor.

## **Console**

The Moducom radio console used by METCOM dispatch is obsolete. The generation of ULTRACOM that is deployed at METCOM was built by Moducom between 1996 and 1998. As a result, ongoing support and parts are an issue. The console also lacks features that would minimize some of the radio system issues identified below, specifically automating multi-agency tone outs.

During fire dispatch the CAD system suggests resources to the dispatcher for dispatch to the call. Where a single radio channel and site are involved the dispatcher can just select the correct channel and trigger the tones. The CAD system will manage which tones are sent out.

When the suggested units involve multiple sites the dispatcher must manually deselect resources which are not on the first site, tone out units on the first site, ask CAD for the recommended units again, deselect all of the units that are not on the second site, tone out the site two units, etc. The manual nature of the process is time consuming and prone to error, particularly when the dispatcher is simultaneously handling radio traffic generated by the first tone out.

We observed that the dispatchers prefer a screen layout they call the "Big Screen". The screen has a very high channel count and is visually very dense. It was not obvious to an untrained observer which channels were selected, unselected and active.

While the dispatchers are highly trained, and rely on muscle memory as much as sight, less dense screens with better visual indicators would reduce the potential for errors and provide a better use of monitor real estate.

Some of the dispatchers utilize the use of floor switches to key the radio to talk out. One dispatcher noted that their current foot switches, which have two pedals separated by a

metal fin, can cause a failure to transmit if the dispatcher's foot lands on the fin and doesn't depress the pedal. If a second function is not required in the foot switch (mute for example), we would recommend that future purchases be single pedal switches.

Another item of concern from several user groups both in Law Enforcement and Fire categories was the increase in background noise and the ability to hear multiple other conversations while speaking to dispatch. Several agencies advised that the background noise has picked up over the past year. Initial inspection of the dispatch floor while we were present validated these statements. There is little to no acoustic control items placed on walls or in the area to mitigate this concern. There are companies that specialize in acoustic dampening of ambient noise and it would be our recommendation to have a company come in at an appropriate time and give a proposal.

Several dispatchers commented that during slow times (graveyard shift) it would be useful to consolidate law enforcement onto a single countywide channel to enable them to better monitor and respond to traffic, but wanted to be able to split law enforcement traffic into multiple channels for busy times.

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## *Radio System*

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Many of the operational issues identified by Dispatch and the users are a direct result of the radio system. The number one issue identified by dispatchers was selecting the correct radio site for a given transmission. Dispatchers cited as examples Aumsville PD and South Fire where the same channel is transmitted off of multiple sites. Even senior dispatchers noted that it was often difficult to judge what the best site was for a given transmission. We have outlined the details of this issue in previous sections of this report.

Another concern voiced by dispatchers is coverage, particularly for the Eastern part of the County and for Woodburn PD/Hubbard PD.

The East county coverage issues are largely driven by topography and to fix these issues will require engineering of additional sites and potential deployment of VRS. Such sites as the Abbey appear to be transmit sites that could improve coverage but would need to be further vetted to ensure the assumptions made are accurate. This site specifically is underutilized and if properly built out could provide an increase to system performance.

The concerns brought up by dispatch regarding coverage for Woodburn PD and Hubbard PD are similar to what we are seeing throughout the county. Lack of system engineering and proper RF planning have contributed to these issues.

During much of the beginning portions of the consulting project we were being forwarded reports generated by either WPD, HPD or dispatch regarding communications incidents involving little or no audio from dispatch or from field units. At such time Cascade Networks deployed an Eventide Audio Logger at dispatch so that we could monitor both what was

being received at the repeater, what was being transmitted over the air and what was being forwarded to the console. During the time that was monitored, we researched numerous reports and in each situation were able to find logical reasons for the issues. Most of the events/incidents we researched had to do with the following issues:

- Weak and or poor signal quality in certain areas of town
- Weak and or poor signal quality with in building coverage
- Improper use of noise cancelling microphones

The other issues we discovered had to do with the repeater that was deployed at the dispatch facility for the use of Woodburn/Hubbard PD. The Kenwood NXR710 repeater had a software flaw that was only discovered after many simulated incidents while on the bench at our facility and at the Kenwood repair facility in Long Beach California. Kenwood confirmed our findings and wrote new firmware to fix this issue. The issue in question specifically dealt with audio received from field units and transmitted audio from the console. If these two events happened in rapid succession, the controller in the repeater would lock up. Once the repeater would see this error it would "Reset" and restart. This entire process would take roughly 30-45 seconds for the system to "Reset" and therefore communications for that amount of time would be impacted.

In addition to the issues above, Kenwood technicians noticed that, when reviewing the programming in the repeater prior to sending it back (once the new firmware was installed), it had been improperly adjusted. Kenwood technicians noticed that a setting that has to do with audio modulation had been set outside the manufacturer specifications in what they think was an attempt to adjust this setting in the NXDN mode. Incorrect modulation in the digital mode causes receivers in the field to see data sent by the repeater incorrectly, resulting in an increase the BER (Bit Error Rate) seen by the receiver. High bit error rates in the receiver result in garbled audio or no audio at all. Incorrect modulation adjustment would reduce coverage and would lend itself to causing subscriber issues in the field.

Kenwood aligned the repeater back to the recommended settings and delivered the repeater back to METCOM, where it was re-installed by a member of our staff. Since such time there has been reports of radio issues but those have been more related to in building coverage and operating outside the coverage area of the repeater. To date we have not seen the "Reset" issue reoccur and believe this to be a resolved issue.

These concerns were also present for the Stayton and Turner area. Upon inspection of these areas and visits with their staff we are able to confirm that coverage in these areas are spotty due to some topography issues. This is also another area of the county that would benefit greatly from an engineered RF solution.

The last item concerning Woodburn and Hubbard PD is that during the research phase of this report our staff members met and had conversations with several members from the Oregon State Interoperability Executive Council (Technical Committee Members of - SIEC). During conversations with members of this committee it was vocalized a number of times how frustrated the SIEC was with the fact an NXDN system was deployed in the area without discussion or concern regarding interoperability with other agencies. SIEC understands that budgetary concerns are legitimate but also mentioned that there are numerous grants available to assist agencies to acquire products that would comply with the states goal of P25 interoperability. The mission statement for the Oregon SIEC is to develop

recommendations for policy and guidelines, identify technology and standards, and coordinate intergovernmental resources to facilitate statewide wireless communications interoperability.

We mention the above as it would be something to consider when moving forward with the selection of a new system. The SIEC can be of assistance with grant identification and support of such funds if it was determined the project being funded would further the goals and mission statement of the SIEC. However if the requested grant was to fund a project that further diversified communications in the state and went against the SIEC's goals, that may prove to be a challenging course of obtaining support for such funds.

It would be our recommendation to involve the SIEC as part of the discussion process going forward, specifically to better understand how SIEC support can help METCOM 9-1-1 and its user group.

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### *Partnership Opportunities*

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Going forward there are several partnership opportunities that METCOM can consider to upgrade radio communications. Partnering with other radio systems would allow METCOM to leverage investments that other agencies have made to gain access to radio technology that might otherwise be beyond the immediate budget for METCOM and its user group.

We have investigated three partnership opportunities which could benefit METCOM: Silke Communications FleetNet UHF radio system, the State of Oregon's ODOT/OSP 700MHz/VHF system and the City of Salem's planned 800MHz P25 system.

Silke's FleetNet Digital Radio Network is a privately owned UHF trunked radio system based on Kenwood's NexEdge NXDN radio technology. According to Silke, the network covers from the Canadian border down into California. Silke is actively looking for sites to improve their coverage along SR22, providing the opportunity for a private/public partnership. We also understand that Marion County Sheriff's Office has briefly discussed what a partnership for them would look like. At this time we have no further information regarding that possible scenario as discussions were vague and there has not been a serious move in that direction by the MCSO.

Both the ODOT/OSP and Salem systems would require investment by METCOM in order to increase capacity at existing sites and add sites to cover areas not currently covered by those systems. Both options would give METCOM dispatched agencies access to state-of-the-art P25 trunking systems and would meet the needs of the

SIEC.

P25, shorthand for APCO Project 25, is a widely accepted standard for digital public safety radio communications. Digital radios convert the user's voice into data and then send the voice data, along with other data, like radio ID, over the air to receivers where the data is converted back to voice. Digital radio makes it easy to add additional features like emergency functions, GPS location and the like because everything is transmitted as data.

P25 Phase 1 radio systems have one voice path for each radio frequency channel. Phase 2 systems have two voice paths per radio frequency channel, thereby doubling the system capacity without adding radio frequency channels. Federal grant funding for communications equipment strongly encourages the purchase of P25 capable radios and would most likely gain support from the State of Oregon's SIEC.



## Silke FleetNet Digital Radio Network

Silke's FleetNet Digital Radio Network is based on Kenwood's NexEdge NXDN trunking. NXDN trunking offers features similar to those offered by P25 trunking systems.

Silke's published coverage is as follows:



Silke does not provide a more granular coverage map, but discussions with Silke personnel suggest that coverage for the Western portion of METCOM's service area is good, but that coverage ends at about the Big Cliff Dam as you head East on SR22. METCOM would need to drive test the system to confirm that the coverage was adequate prior to moving forward with a potential deployment.

In addition to the above, METCOM would have to work with Silke to add sites to cover the Eastern portion of Marion County. METCOM may be able to leverage the existing site agreements and microwave assets to negotiate a better deal with Silke. Silke's typical monthly fee is \$16.95 per month, per radio, although they would likely reduce the monthly recurring cost for a large fleet such as METCOM 9-1-1 and its users.

Another consideration to potentially joining this system is that METCOM's current radio console is not capable of directly interfacing to Silke's system. Access to the system would be through control station radios at the dispatch center. A control station radio would be required for each talk group and a transmit combiner and a receive multi-coupler to allow the control stations to operate without interfering with each other. Some newer internet protocol (IP) consoles can directly connect to the trunking system backbone and provide full functionality. If METCOM opted to go this route we would strongly recommend that consoles be replaced as part of the project.

Advantages of moving to Silke's backbone is that the system is already up and running and would not require any further investment by METCOM for infrastructure that is already in place. The added costs would be realized from doing a detailed drive test analysis of the current system to determine portable and in building radio "talk in" coverage. In addition to the aforementioned costs the agencies would have to purchase compatible UHF radios in order to access the network. Doing so would make the interoperability with other agencies a bit more complex, not impossible and fairly easy to accomplish but would add equipment and add points of failure to the system.

There are several disadvantages with potentially partnering with FleetNet system--the backbone would be controlled by another entity and both METCOM and its users would have to have a support agreement in place that identifies response time in case of an outage. Additionally there are monthly fees to use the backbone that would have to be addressed by the users and METCOM.

This also presents an issue for the fire units as they would need both UHF and VHF mobiles with vehicular repeaters for wildland fire communications. A parallel system for fire paging would also have to be deployed and maintained, since there are no NXDN trunking capable pagers on the market. This will prove to be costly as the existing paging system is in drastic need of immediate attention to which there is no "quick fix" or low cost solution to remedy the current issues.

Furthermore, agencies who currently program their own subscriber equipment would no longer be able to do so. Programming trunked radios requires a trunking system key that Silke is unlikely to share. In addition we do not recommend agencies programming their own equipment. The agencies we spoke with who perform this task admitted they did not have anyone on staff who was properly trained and or certified to be performing such actions. This approach is extremely

dangerous and we would not support such actions going forward unless the agencies agreed to appoint a member of their staff who would receive yearly training and certification from such manufactures to perform these actions. Last is that these actions could potentially put the agency in a liable situation should something happen where lack of communications resulted in a litigious situation. Having staff inadequately trained performing these tasks is not advisable.

#### **State of Oregon's ODOT/OSP 700MHz/VHF System**

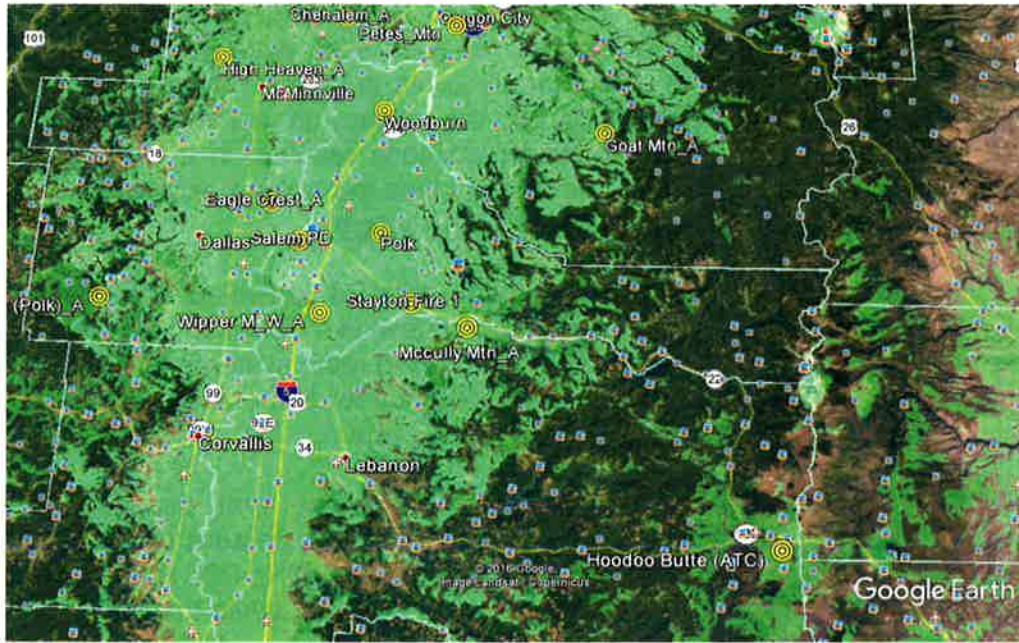
The Oregon Department of Transportation's State Radio Project is replacing aging public safety communications systems statewide. Focused on repairs and modernization, the project is upgrading the existing radio systems for ODOT and the Oregon State Police to create an integrated statewide network and to allow for shared efficiencies with other users of the radio system.

The ODOT/OSP system utilizes a Harris backbone that provides extensive coverage to much of Marion County, the frequency architecture of the system is a hybrid system utilizing both VHF conventional and 700 MHz P25 Phase 2 Trunking. . The VHF system has been operating for several years, while the 700 MHz side of the system has a go live date of Q1 of 2017.

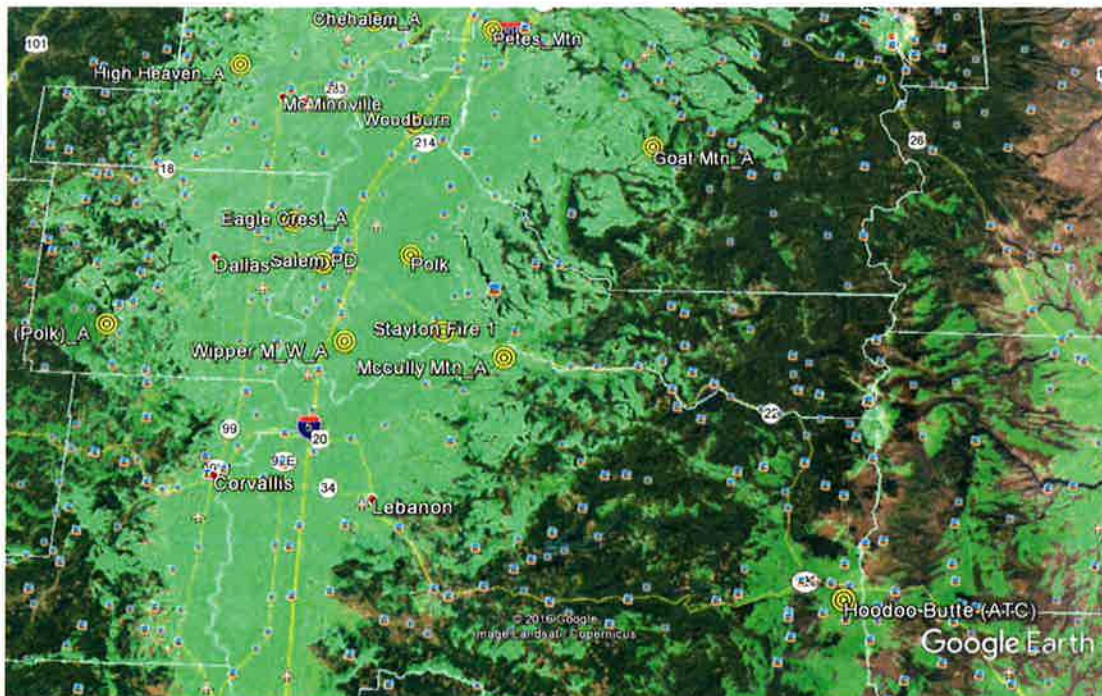
The State of Oregon Radio system currently is configured in a "Horseshoe" shape as it runs up I-5 from just South of Eugene to Portland, East along I-84 to US-97, then South on US-97 to just South of Bend.

Equipment for the ODOT/OSP system has been deployed and testing is currently under way with one ODOT district.

The current predicted portable coverage for the state 700 MHz system is as follows:



The predicted mobile coverage for the 700 MHz system is:



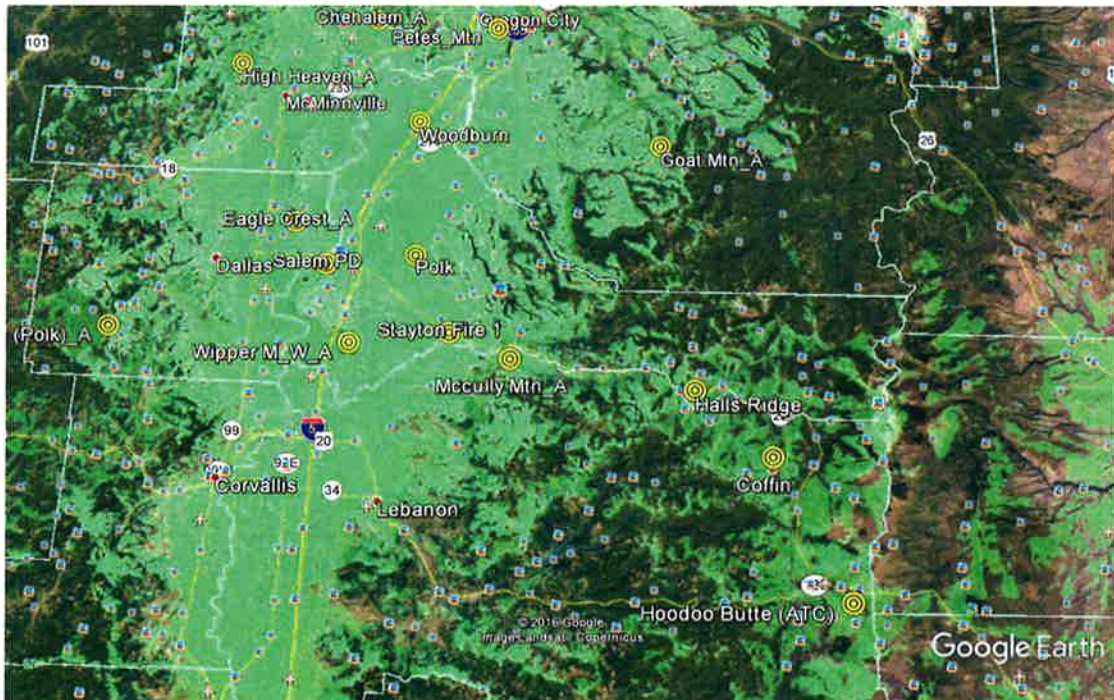
Additional sites at Coffin Butte and Hall's Ridge would fill in coverage for East County.

In addition adding these two sites would also provide better coverage for the HWY 22 corridor when mutual aid is done with Deschutes County. The state is also closing

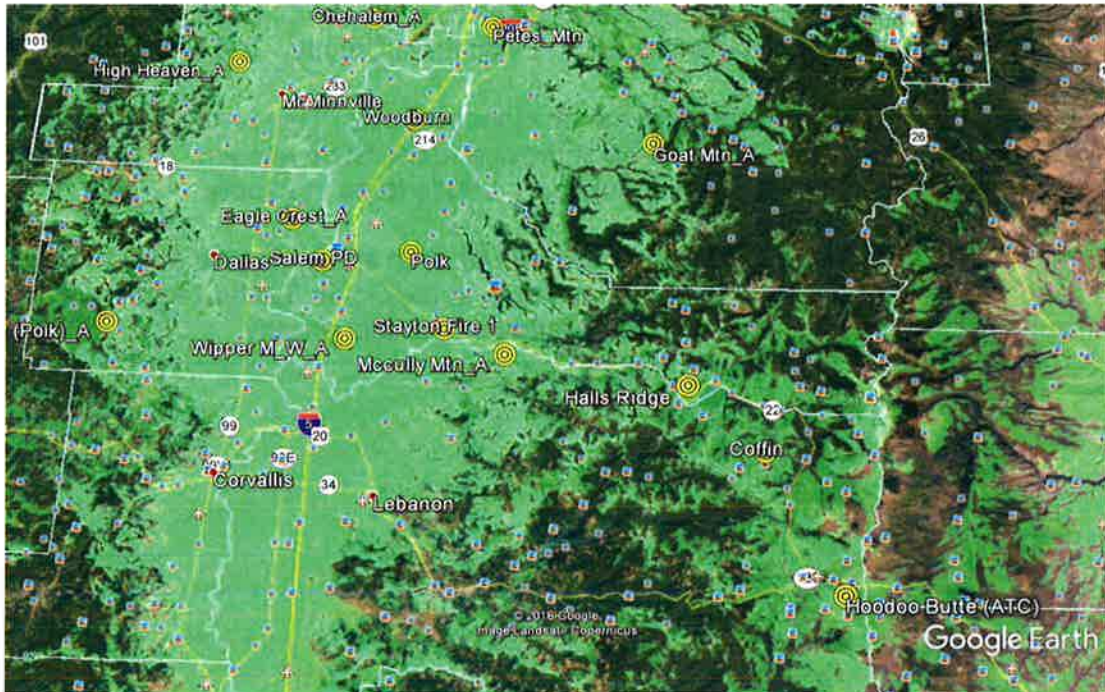
In on final deployment plans for a site on Hoodoo Butte. This is going to provide coverage to Deschutes County, who is moving to the State system. This site will benefit METCOM and its users should they decide to go this route.

You will notice from the below proposed propagation study that the additional sites mentioned above will provide better coverage in the South Eastern portion of Marion County, which we have identified is an issue due to topography.

The map below references proposed portable radio coverage with the additional sites deployed.



And as follows for mobiles:



Channels on the State's VHF system can be interconnected to the trunked system to extend the coverage area of the trunked system.

The State plans to interconnect with the P25 systems in Lane and Linn Counties, as well as the Portland Metro Area and Salem using a P25 feature called the Inter RF Subsystem Interface (ISSI). ISSI gives users of the State system the ability to roam out of their home area but still talk back to their home system.

The State also plans a Console Sub-System Interface (CSSI) for their system, which would allow METCOM to use a variety of dispatch consoles to interface to the State's backbone. METCOM's current consoles will not interface directly to the State system, but could connect using control stations, although with a significant loss of functionality. If METCOM 9-1-1 and its user group was to move forward with this partnership, a replacement of the consoles would be strongly recommended.

### **City of Salem's planned 800MHz P25 System**

The City of Salem has recently awarded an RFP for a new communications system. From the possible solutions, the City of Salem has selected Motorola Solutions to build out an 800MHz P25 Phase 2 Trunking system to cover the City and surrounding areas.

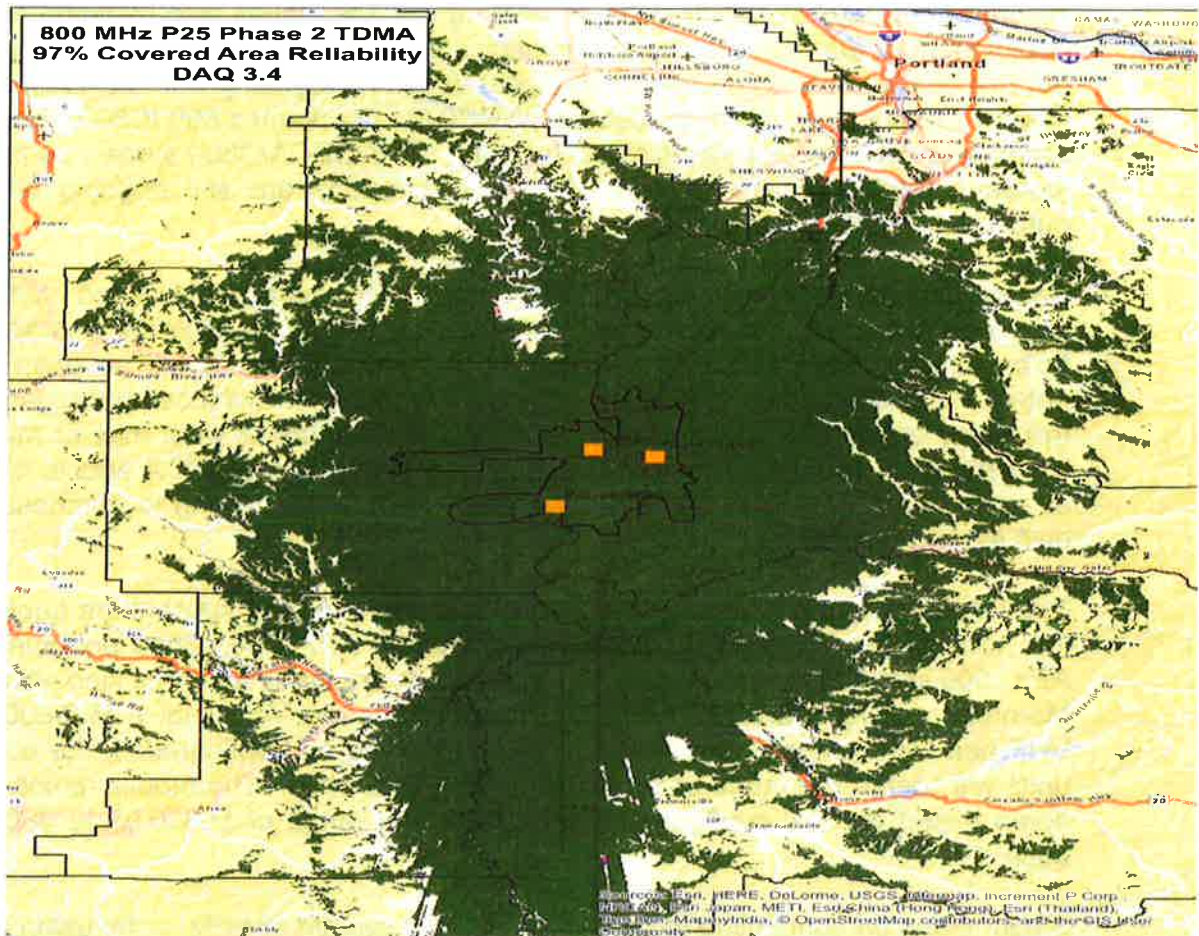
Salem is currently in the process of working out site issues and planning to start deployment of the four site system sometime in Q3 of 2017. In addition to building out this new system, there has been discussions of integrating with the Washington County Consolidated Communications (WCCCA) / Clackamas 800 (C800) system in order to reduce the deployment cost by using the WCCCA/C800 system controllers (cores in Motorola terminology). Those discussions are still ongoing and the outcome has not yet been finalized.

Recent developments with the WCCCA system also must be discussed. WCCCA has currently suspended movement with Motorola on the new system and appears to be heading towards an RFI (Request for Information) that will be open to all potential solutions providers. There are many reasons for this move but regardless, this delay presents a scenario of a possibly altered future of what may or may not happen. This situation needs to be monitored because if WCCCA was to change directions with providers, it would leave the City of Salem having to purchase their own system controllers.

The City of Salem has already purchased and deployed the subscribers quoted for the new system. The City selected the Motorola APX8000 series portables and APX7500 series for the mobiles. These portables are the first of their kind within the Motorola product offering. The new portable radios are "All Band" P25 7/800MHZ, VHF and UHF range 1 and range 2 and, depending on configuration, the portable units will cost in the range of \$6800.00 to \$8600.00 each. The mobile radios, once again based on final configuration will cost in the range of \$6300.00 to \$8000.00 each.

Salem plans on connecting to the WCCCA/C800 system directly, or by using a P25 feature called the Inter RF Subsystem Interface (ISSI). They also plan to connect to the ODOT/OSP system using this same architecture. The ISSI connections allow a user on the Salem system to "roam" onto the WCCCA/C800 or ODOT/OSP system and still talk as if they are on their home system. Though discussions between Salem and the State have not been finalized regarding this matter, the plan is for the new Salem system to be interfaced with the State system for the benefit of users going outside the RF footprint of the new system.

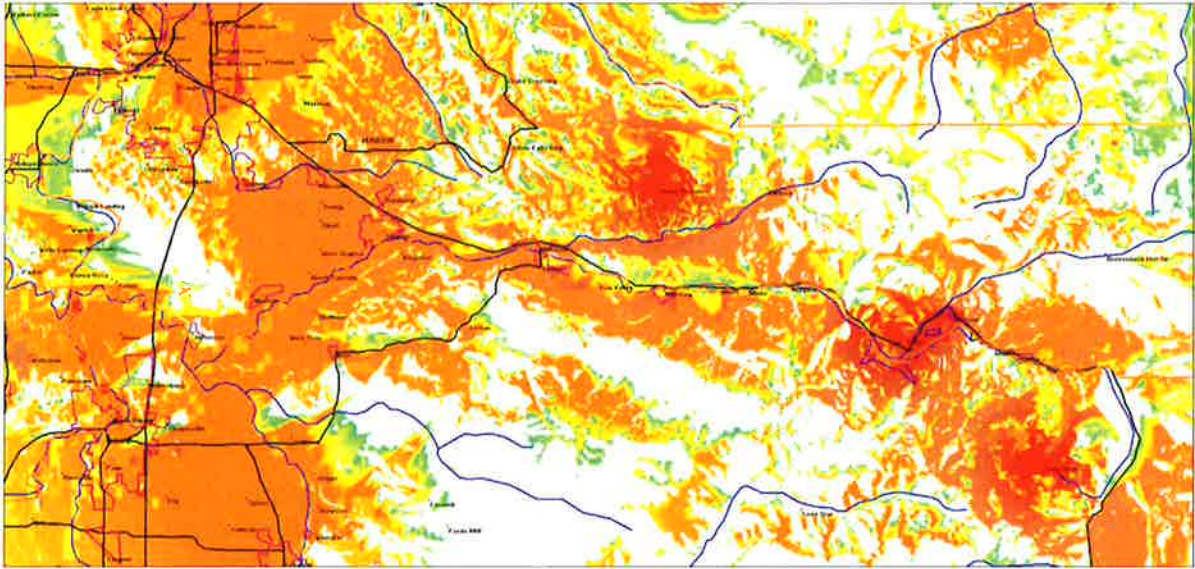
Projected coverage for a three site system originally proposed for Salem is shown below (provided by Ron Polluconi of WCCCA). This map projects the ability of portables to talk in to the system and reflects the DAQ (Delivered Audio Quality – See description and process in the appendices). Portable radio talk in or "talk back" is generally the weak link of any radio system. After running similar propagation studies, we are concerned that the three sites identified below would provide the stated portable talk in coverage. Further engineering reports and testing would have to be done to verify the below results



Salem is discussing adding a fourth site in Keizer, which will make coverage in the Northwest portion of the county more robust. While the above coverage would work well for many of the agencies in the western part of METCOM's service area, additional sites would have to be added to cover the South Eastern portion.

Adding 800 MHz to existing sites available to METCOM at House Mountain, Hall Ridge and Coffin Butte would provide some coverage to the East, but do not appear to be adequate. The following propagation study shows mobile radio coverage from those three sites. (Red, orange and yellow areas would provide reliable coverage.)





Portable radio coverage would be less and therefore would either require the use or deployment of vehicular repeaters or the deployment of additional sites in order to gain the needed coverage for public safety agencies operating in this area.

Salem currently charges outside agencies \$28.00 per month, per radio, to use their existing analog 800MHz radio system. The monthly fee is under review for the new system and could possibly change. If the decision was made to partner with the City of Salem, this may become a negotiating point depending on proposed site buildout by METCOM and how that may benefit the City of Salem. In addition, if Salem has to purchase their own system controllers this may also affect partnership costs.

The other issue with a potential partnership with the City of Salem is that METCOM's current radio console could not interface directly with Salem's system. However, METCOM could use control stations as described above. A few internet protocol (IP) consoles can directly connect to the Motorola backbone and provide functionality through the P25 Console Subsystem Interface (CSSI), but Salem's current contract does not include a CSSI interface and would have to be negotiated with the City of Salem.

If METCOM desired they could utilize Salem's contract with Motorola to purchase Motorola MCC7500 radio consoles for approximately \$42,000 per position (We understand that METCOM has explored and received replacement quotes from other console manufactures. Depending on the system selected console acquisition will need to be a part of that consideration), plus the cost of interfaces to connect METCOM's analog radios if required. A direct connection to Salem's core would give METCOM direct access to Salem's radio system and allow Salem to have access to METCOM's radios, thereby greatly enhancing the ability of METCOM and Willamette Valley Consolidate Communications (WVCC) to back each other up.

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## *Advantages and Disadvantages*

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Partnering with either ODOT/OSP or Salem would have advantages and disadvantages. Advantages would include:

- The ability to easily create countywide, regional and local talk groups for simplified communications between agencies.
  - For example, law agencies could easily operate on talk group's structure like the current law enforcement channels during busy times, but could consolidate onto one or two wide area talk groups during graveyard to improve backup and minimize dispatcher workload.
- Ability to roam away from METCOM's home area
  - Unit IDs
  - Emergency functions
  - Easy interoperability with ODOT, OSP, Salem and Clackamas County.

Disadvantages would be the following:

- Backbone would be controlled by another entity
- The subscriber units are more costly
- There may be monthly fees to use the backbone
- Fire units would need both 700/800MHz and VHF mobiles with vehicular repeaters for wildland fire communications.

Additionally if METCOM and its user group were to partner with one of the 7/800MHz agencies there would be the need to address a paging solution for the fire districts. Upon discussing this with Harris regarding the state ODOT / OSP system they are recommending the deployment of Unication pagers.

Unication was founded in 1992 and become one of the leading innovators in supplying critical messaging solutions in the P25 category.

As part of our review process I spoke with John Roe of Unication who is their head engineer. John advised that Unication has two different solutions that would work for METCOM and its users if they opted to proceed with a partnership with one of the 7/800MHz agencies.

Unication offers a G4 single band P25 voice pager that supports up to 256 different call groups. In addition the G5 dual band P25 pager will support both VHF and 7/800MHz operation and also supports up to 256 different talk groups. Those

agencies in the South Eastern portion of the state would be able to benefit from both ODOT/OSP frequency architecture to receive tone out notification.

If METCOM and its users opted to move in this direction it would be our recommendation to get demo units that Harris and METCOM users could trial throughout the county to establish real world results prior to proceeding with this potential solution.

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### *METCOM Stand Alone System Options*

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In addition to the above mentioned potential partnerships, METCOM and its users also requested that we explore them deploying their own standalone communications system.

Since we have had discussions with two of the major three 7/800MHz manufactures and have outlined above what they have to offer in and around Marion County, we looked at what a potential partnership with either E.F. Johnson, JVC Kenwood or ICOM would look like.

We gathered the following information utilizing the same criteria for each, so that we may get an equal comparison based off of the same build criteria. This criteria is for rough order magnitude estimating only and does not guarantee results until more detailed engineering can be performed.

- 8 site system
- 14 Talk Groups
- Fire Tap out capability

Our staff reached out to Mark Jordan from JVC Kenwood who is the Western Regional Sales Manager for all Enterprise Systems.

Mark and our staff had numerous conversations about the wants and desires of METCOM and its user group. In addition, we spoke about the current challenges facing them today. We further discussed the layout of systems around METCOM 9-1-1 and how a Kenwood engineered system would function for the users and how it would interface with other systems to provide regional interoperability.

There are many assets that METCOM currently has that could be re-deployed in a standalone system such as much of the existing microwave and some of the RF components. Being able to reuse the items will help keep the overall cost down, however, that cost is negated by the fact that METCOM and its users would need to completely re-design the current system. Engineering and frequency allocation will

be a large cost because providing the type of benefits the users vocalized they wanted would either require a Simulcast architecture or a trunked solution.

If the trunking solution was the chosen architecture then our first challenge will be to acquire FB8 and MO8 FCC frequency designators. This is not impossible for this area especially in 6.25 kHz. However frequency coordination and site analysis is going to be costly. I had discussions with the FCC specialist we use for projects like this where frequency acquisition could be difficult. We ran a preliminary study of the existing sites and sites we feel would have to be built out to provide reliable system coverage. The costing estimated for this portion of the project could reach as high as 150K depending on a number of factors. This cost does not factor the needed microwave licenses and would only cover the LMR side of things.

The advantage of this type of a deployment whether it be NXDN or VHF Simulcast is that METCOM would be in control of their own system as opposed to being under the governance of another system owner. A disadvantage to this approach is that if the system was going to be NXDN based it would not get the support of the SIEC. By not having this committees support it may make getting grant support extremely difficult. The SIEC has been very vocal about this and is watching this project closely.

The last area to explore would be interoperability with other outside agencies. Many users said they had little to no need to speak with ODOT or OSP. However they did advise that communications with MCSO and Salem units at times definitely proves to be valuable. With MCSO having discussions with the State currently and Salem already deploying an 800MHz system, it presents a deeper conversation regarding field interoperability and how this would be handled on a long term basis for mutual aid. Though integration is able to be accomplished it adds costs in equipment that is either burdened by the end user or adds a layer of cost at the site. Both options increase costs and add layers of complexity and points of failure.

After careful review of a potential deployment of a JVC/Kenwood system, though many of the objectives could be overcome these are not concerns that need to be addressed with other potential systems. Further when looking at the cost to build and maintain an independent system with interoperable capabilities, those costs came close to if not exceed the cost of only needing to build out two sites for integration to the state system.

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## *Recommendations*

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First and foremost, we recommend that METCOM and its user agencies use this report as a starting point to develop a communications plan. The communications plan should lay out near term, medium term and long term goals for the

communications system. We strongly recommend against making any changes to the radio system without an underlying plan to set priorities and insure that money is spent in a manner which furthers the goal of the plan established by METCOM and its users.

We heard over and over in our meetings with users that budgets are tight. That thought has been in the forefront of our thinking as we've research different options, but we've also kept in mind that, up to a point, the functionality and usability of a communications system is directly related to the cost. We've also been mindful of the fact that what looks like a cost savings in the short term can turn out to be an expensive solution in the long run.

Given the feedback we received in our agency interviews and looking at the immediate and long term cost of the various options, we recommend as a long term goal that METCOM and user agencies partner with one of the 700/800 MHz P25 radio systems. The ODOT/OSP system offers slightly better coverage in the METCOM service area than the Salem system. The ODOT/OSP system has also approved radios from several vendors, including Harris and Kenwood, which provide agencies with more options and creates competitive pressure to minimize unit cost. The State's hybrid VHF/700 architecture might also make it easier to bring on agencies in the Eastern part of the County.

A transition to the ODOT/OSP system could be implemented in stages, starting with new consoles in dispatch to provide a CSSI interface to the State system, then the transition of agencies to the ODOT/OSP system as funding allows. Transition planning would require careful attention to interoperability and mutual aid needs.

Salem's 800 MHz system is also a viable option, but the lack of multiple vendors for subscriber units and the recurring monthly access fee make it less attractive. In addition we have to consider the recent RFI request that will be coming from WCCCA in Q1 of 2017 for their system. If WCCCA was to move to a different provider other than Motorola that would leave the City of Salem in a precarious position. The only factor we see that might outweigh the above is movement to consolidate METCOM with WVCC, where being on Salem's system would be preferable for this to happen.

The obvious disadvantage of partnering with a 700/800 MHz system is the cost, but the fact that agencies on all sides of the METCOM service area are moving in that direction should weigh heavily in your decision making process, both because it presents an opportunity to leverage the investments made by larger agencies and provides seamless interoperability.

We do not see building out your own 700 MHz P25 trunking system as a viable option. While this is attractive from a governance standpoint, the cost of deploying the system and maintaining it over the long term would be a significant financial burden on the users. We are also concerned about the availability of 700 MHz

channels given the channels licensed by the State of Oregon, Tri-Met, Portland, Linn County and Benton County.

Building out a VHF NXDN trunking system is attractive from a cost perspective, but has several pitfalls. The first is that obtaining the large number of VHF FB8 and MO8 channels required will be difficult. Most FCC channels are licensed on a shared basis, with no guarantee that other agencies are not using the same frequency, although efforts are made to minimize overlap and the resulting interference. FB8 and MO8 licenses are a special class of license which guarantees exclusive use. FB8 and MO8 channels are required for trunking systems.

Retaining a frequency consultant to preclear frequencies before they go to the FCC coordinator for licensing is an expensive, but necessary step in order to avoid interference issues that could result in expensive system redesigns during system deployment.

A second issue with an NXDN trunking system is that it will make interoperability with surrounding agencies more difficult, although not impossible. Options are to patch channels on the console at METCOM, use vehicle base interoperability solutions or use analog VHF TAC channels.

Another challenge is that NXDN does not offer a paging solution other than a radio. A parallel paging solution would need to be engineered and deployed, as such would add additional costs in both equipment and maintenance of another system.

The use of NXDN is also strongly opposed by the Oregon State Interoperability Executive Council (SIEC), which will make getting approval on communications grants difficult or impossible. The NXDN system could also complicate future dispatch consolidation negotiations if the other agency insists on the use of a P25 backbone as a condition of a possible merger, thereby stranding the investment METCOM's agencies have made in NXDN.

Short term and medium term improvements can be made to METCOM's existing radio infrastructure. One radio console vendor has proposed customizations to their product to mitigate the multi-agency tone out issues described above. That solution, or one with similar customization, which supports a P25 CSSI interface would improve the function of the current radio system while replacing the current obsolete consoles.

Another option to consider would be to convert the existing South Fire 1 base stations, which share a common simplex frequency, to a multicast analog repeater configuration using the same sites. Each site would have its own transmit frequency, but all sites would share a common input frequency.

This would allow dispatch to tone out from all sites simultaneously and users on South Fire to hear repeated communications from throughout the South Fire coverage area. Multicast would require users to be aware of their location and manually select the best site to monitor, but would provide a wide area solution at minimal cost.

Coverage issues can be addressed with focused engineering efforts to compare actual with predicted coverage and evaluate site equipment to insure that there are no site issues. We also strongly recommend that agencies have their subscriber equipment evaluated on an annual basis to insure that it is in working order. Many coverage issues are actually the result of subscriber equipment with bad antennas, worn out batteries or that have drifted off frequency as their crystals age. For example, we noted that during numerous meetings with METCOM users that several of the apparatus we had seen had improperly installed mobile antennas. This can have a significant effect on overall radio performance, damage the radio and therefore give the user a less than desirable experience.

In closing we want to thank Gina Audritsh, Brad Johnson and the METCOM 9-1-1 user group for their cooperation and participation in providing the information needed for this report.

## **ATTACHMENTS "A"**

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: SUBLIMITY FIRE DISTRICT

ATTN: ACTING CHIEF  
SUBLIMITY FIRE DISTRICT  
115 NW PARKER ST  
PO BOX 911  
SUBLIMITY, OR 97385

Call Sign KFZ909	File Number 0006896773
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0013186440

Grant Date 08-18-2015	Effective Date 08-18-2015	Expiration Date 08-03-2025	Print Date 08-19-2015
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1** Address: 115 NW PARKER ST FIRE HALL  
City: SUBLIMITY County: MARION State: OR  
Lat (NAD83): 44-49-06.4 N Long (NAD83): 122-47-44.3 W ASR No.: Ground Elev: 152.0
- Loc. 2** Area of operation  
Countywide: MARION, OR
- Loc. 3** Area of operation  
Operating within a 40.0 km radius around fixed location 1

**Antennas**

Loc No.	Ant No.	Frequencies (MHz)	Sta. Ck.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp (meters)	Ant. AAT (meters)	Construct Deadline Date
1	1	000153.70000000	FB	1	40	11K2F3E	110.000	300.000	12.0	-38.0	
1	1	000154.01000000 Frequency 000154.01000000 Special Condition Authorization on a secondary basis.	FB	1	40	11K2F3E	110.000	300.000	12.0	-38.0	
1	1	000154.16000000	FB	1	40	11K2F3E	110.000	300.000	12.0	-38.0	

**Conditions:**  
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.



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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: WOODBURN, CITY OF

WOODBURN, CITY OF  
1060 MT HOOD AVENUE  
WOODBURN, OR 97071

Call Sign KOH484	File Number 0006736622
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number 49PW/AP35024167	

FCC Registration Number (FRN): 0004521464

Grant Date 04-07-2015	Effective Date 04-07-2015	Expiration Date 05-30-2025	Print Date 04-08-2015
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1 Area of operation  
Other:VIC:WOODBURN OR
- Loc. 2 Address: 270 MONTGOMERY ST  
City: WOODBURN County: MARION State: OR  
Lat (NAD83): 45-08-44.4 N Long (NAD83): 122-51-29.3 W ASR No.: Ground Elev: 46.0
- Loc. 3 Address: 1060 MT HOOD AVE  
City: WOODBURN County: MARION State: OR  
Lat (NAD83): 45-09-03.3 N Long (NAD83): 122-50-36.7 W ASR No.: Ground Elev: 58.0
- Loc. 4 Area of operation  
Operating within a 40.0 km radius around fixed location 3

**Antennas**

Loc	Ant No.	Frequencies (MHz)	Sta. Chs.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp (meters)	Ant. AAT (meters)	Construct Deadline Date
1	1	000155.1300000	MO	95		11K0F3E 11K2F3E 4K00F7W 8K00F7W	90.000	90.000			

**Conditions:**

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FCC 601-ULSHS1  
August 2007

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: WOODBURN FIRE DISTRICT

ATTN: PAUL IVERSON  
WOODBURN FIRE DISTRICT  
1776 NEWBERG HWY  
WOODBURN, OR 97071

Call Sign KOK934	File Number 0005815708
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0001553460

Grant Date 06-12-2013	Effective Date 06-12-2013	Expiration Date 09-02-2023	Print Date 06-12-2013
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1** Address: 1776 NEWBERG HWY  
City: WOODBURN County: MARION State: OR  
Lat (NAD83): 45-08-52.4 N Long (NAD83): 122-52-03.3 W ASR No.: N/A Ground Elev: 55.0
- Loc. 2** Area of operation  
Operating within a 40.0 km radius around 45-08-52.4 N, 122-52-03.3 W,  
MARION county, OR
- Loc. 3** Area of operation  
Operating within a 56.0 km radius around fixed location 1

**Antennas**

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cts.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp meters	Ant. AAT meters	Construct Deadline Date
1	1	000153.77000000	FB	1		11K0F3E 20K0F3E	110.000	275.000	30.0	38.0	08-13-2001
Frequency 000153.77000000 Special Condition Authorization on a secondary basis.											
1	1	000154.16000000	FB	1		11K0F3E 20K0F3E	110.000	275.000	30.0	38.0	08-13-2001

**Conditions:**

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: STAYTON RURAL FIRE DISTRICT

ATTN: CHIEF  
STAYTON RURAL FIRE DISTRICT  
1988 W. IDA ST.  
STAYTON, OR 97383

Call Sign WNNM401	File Number 0006929253
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0001553544

Grant Date 08-28-2015	Effective Date 08-28-2015	Expiration Date 10-31-2025	Print Date 08-28-2015
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1 Address: 2365 E Pine Street  
City: STAYTON County: MARION State: OR  
Lat (NAD83): 44-48-14.4 N Long (NAD83): 122-46-14.0 W ASR No.: Ground Elev: 171.3
- Loc. 2 Address: 13591 SHADETREE LN  
City: TURNER County: MARION State: OR  
Lat (NAD83): 44-45-26.4 N Long (NAD83): 122-57-33.0 W ASR No.: Ground Elev: 212.4
- Loc. 3 Address: 40593 MC CULLY MOUNTAIN RD  
City: LYONS County: LINN State: OR  
Lat (NAD83): 44-45-46.4 N Long (NAD83): 122-37-48.3 W ASR No.: Ground Elev: 490.4
- Loc. 4 Area of operation  
Operating within a 32.0 km radius around fixed location 1
- Loc. 5 Area of operation  
Operating within a 40.0 km radius around fixed location 2
- Loc. 6 Area of operation  
Operating within a 40.0 km radius around fixed location 3

**Conditions:**  
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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August 2007

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: STAYTON, CITY OF

STAYTON, CITY OF  
362 N THIRD ST  
STAYTON, OR 97383

Call Sign WNMX428	File Number
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0001554161

Grant Date 09-05-2013	Effective Date 09-05-2013	Expiration Date 11-01-2023	Print Date
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1 Address: 362 N THIRD ST  
City: STAYTON County: MARION State: OR  
Lat (NAD83): 44-48-46.4 N Long (NAD83): 122-48-06.3 W ASR No.: Ground Elev: 152.0
- Loc. 2 Address: 476 E. REGIS ST.  
City: STAYTON County: MARION State: OR  
Lat (NAD83): 44-48-27.8 N Long (NAD83): 122-47-22.8 W ASR No.: Ground Elev: 160.0
- Loc. 3 Address: 13591 SHADETREE LN  
City: TURNER County: MARION State: OR  
Lat (NAD83): 44-45-26.4 N Long (NAD83): 122-57-33.0 W ASR No.: Ground Elev: 212.8
- Loc. 4 Area of operation  
Operating within a 48.0 km radius around fixed location 1
- Loc. 5 Area of operation  
Operating within a 40.0 km radius around fixed location 2
- Loc. 6 Area of operation  
Operating within a 40.0 km radius around fixed location 3

**Conditions:**  
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: MOUNT ANGEL, CITY OF

ATTN: POLICE CHIEF  
MOUNT ANGEL, CITY OF  
5 N GARFIELD ST  
PO BOX 960  
MOUNT ANGEL, OR 97362

Call Sign WPWV990	File Number
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0001554799

Grant Date 11-27-2012	Effective Date 07-15-2013	Expiration Date 01-28-2023	Print Date
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1** Address: NR 4800 EASTVIEW LN NE  
City: SILVERTON County: MARION State: OR  
Lat (NAD83): 44-59-38.8 N Long (NAD83): 122-45-57.3 W ASR No.: Ground Elev: 178.0
- Loc. 2** Area of operation  
Operating within a 32.0 km radius around fixed location 1
- Loc. 4** Address: 5 N GARFIELD ST  
City: MT ANGEL County: MARION State: OR  
Lat (NAD83): 45-04-03.8 N Long (NAD83): 122-47-53.2 W ASR No.: Ground Elev: 54.0
- Loc. 5** Address: 306 S WATER ST  
City: SILVERTON County: MARION State: OR  
Lat (NAD83): 45-00-14.4 N Long (NAD83): 122-46-55.9 W ASR No.: Ground Elev: 81.0

**Antennas**

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cls.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp (meters)	Ant. AAT (meters)	Construct Deadline Date
1	1	000154.8150000	FB2	1		11K2F3E	100.000	200.000	41.1	47.6	01-28-2004
2	1	000154.8150000	MO	80		11K2P3E	50.000	100.000			01-28-2004

**Conditions:**

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

FCC 601-ULSHS1  
August 2007

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: SILVERTON FIRE DISTRICT

ATTN: GORDY JENSEN  
SILVERTON FIRE DISTRICT  
819 RAILWAY NE  
SILVERTON, OR 97381-1539

<b>Call Sign</b> WPYV453	<b>File Number</b> 0005891816
<b>Radio Service</b> PW - Public Safety Pool, Conventional	
<b>Regulatory Status</b> PMRS	
<b>Frequency Coordination Number</b>	

FCC Registration Number (FRN): 0007538192

<b>Grant Date</b> 08-14-2013	<b>Effective Date</b> 08-14-2013	<b>Expiration Date</b> 11-06-2023	<b>Print Date</b> 08-14-2013
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1 Address: 819 RAILWAY NE  
City: SILVERTON County: MARION State: OR  
Lat (NAD83): 45-00-18.2 N Long (NAD83): 122-47-46.6 W ASR No.: Ground Elev: 73.0
- Loc. 2 Area of operation  
Operating within a 40.0 km radius around fixed location 1
- Loc. 3 Address: 1 ABBEY DRIVE  
City: MOUNT ANGEL County: MARION State: OR  
Lat (NAD83): 45-03-32.1 N Long (NAD83): 122-46-39.7 W ASR No.: Ground Elev: 144.0
- Loc. 4 Address: 9339 CROSBY ROAD NE  
City: WOODBURN County: MARION State: OR  
Lat (NAD83): 45-10-02.3 N Long (NAD83): 122-52-10.6 W ASR No.: Ground Elev: 57.0
- Loc. 5 Area of operation  
Operating within a 40.0 km radius around fixed location 3
- Loc. 6 Area of operation  
Operating within a 40.0 km radius around fixed location 4

**Conditions:**

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: IDANHA DETROIT RURAL FIRE PROTECTION  
DIST

ATTN: MARSHALL RASH  
IDANHA DETROIT RURAL FIRE PROTECTION DIST  
160 DETROIT AVB N  
PO BOX B  
DETROIT, OR 97342

Call Sign WOEN530	File Number 0007197296
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0014215313

Grant Date 12-21-2015	Effective Date 12-21-2015	Expiration Date 03-11-2026	Print Date 03-23-2016
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

- Loc. 1 Address: 106 DETROIT AVE N  
City: DETROIT County: MARION State: OR  
Lat (NAD83): 44-44-15.3 N Long (NAD83): 122-09-08.3 W ASR No.: Ground Elev: 488.5
- Loc. 2 Area of operation  
Operating within a 40.0 km radius around fixed location 1

**Antennas**

Loc No.	Ant No.	Frequencies (MHz)	Sta. Ch.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp (meters)	Ant. AAT (meters)	Construct Deadline Date
1	1	000154.4150000	FB	1	20	11K0F3E	110.000	275.000	9.0	-467.8	03-11-2007
2	1	000154.4150000	MO	19		11K0F3E	110.000	110.000			03-11-2007

**Conditions:**  
Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

FCC 601-ULSHS1  
August 2007

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**Federal Communications Commission  
Public Safety and Homeland Security Bureau**

**RADIO STATION AUTHORIZATION**

LICENSEE: METCOM 911

ATTN: BRAD J. JOHNSON  
METCOM 911  
1060 MT HOOD AVE  
WOODBURN, OR 97071

Call Sign WQL974	File Number
Radio Service PW - Public Safety Pool, Conventional	
Regulatory Status PMRS	
Frequency Coordination Number	

FCC Registration Number (FRN): 0023632292

Grant Date 08-13-2014	Effective Date 08-13-2014	Expiration Date 08-13-2024	Print Date
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**STATION TECHNICAL SPECIFICATIONS**

**Fixed Location Address or Mobile Area of Operation**

Loc. 1 Address: HOUSE MOUNTAIN  
City: WOODBURN County: MARION State: OR  
Lat (NAD83): 44-50-29.4 N Long (NAD83): 122-28-59.0 W ASR No.: Ground Elev: 1180.3

Loc. 2 Area of operation  
Operating within a 70.0 km radius around fixed location 1

**Antennas**

Loc No.	Ant No.	Frequencies (MHz)	Sta. Cts.	No. Units	No. Pagers	Emission Designator	Output Power (watts)	ERP (watts)	Ant. Ht./Tp meters	Ant. AAT meters	Construct Deadline Date
1	1	000154.4150000	FB	1		4K00F1W 8K30F7W	50.000	90.000	18.2	567.3	08-13-2015
1	1	000154.2950000	FB	1		4K00F1W 8K30F7W	50.000	90.000	18.2	567.3	08-13-2015
1	1	000155.2950000	FB	1		4K00F1W 8K30F7W	50.000	90.000	18.2	567.3	08-13-2015
1	1	000154.1600000	FB	1		4K00F1W 8K30F7W	50.000	90.000	18.2	567.3	08-13-2015

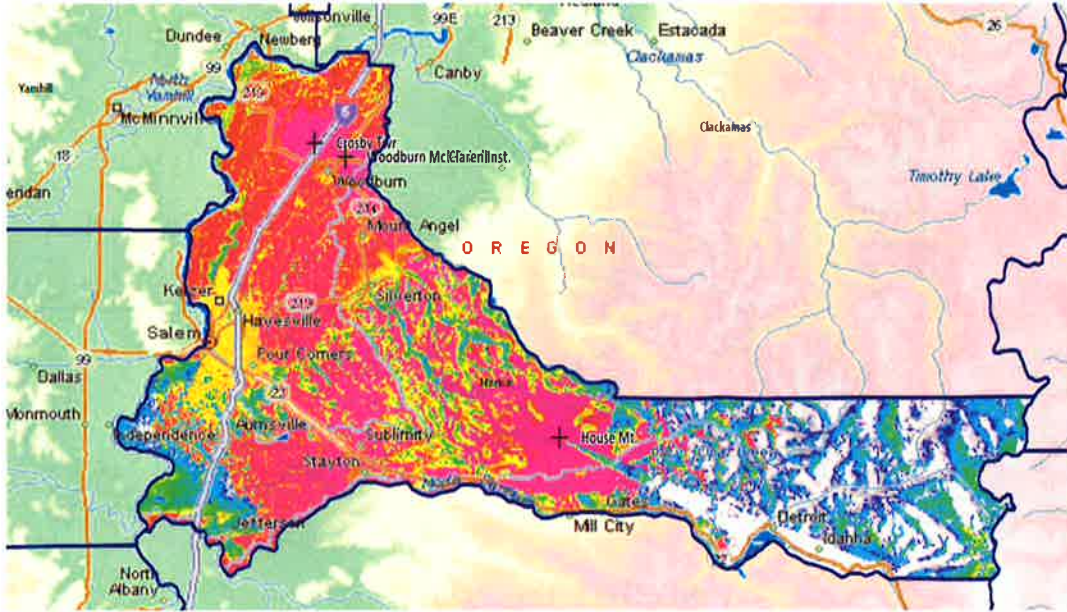
**Conditions:**

Pursuant to §309(h) of the Communications Act of 1934, as amended, 47 U.S.C. §309(h), this license is subject to the following conditions: This license shall not vest in the licensee any right to operate the station nor any right in the use of the frequencies designated in the license beyond the term thereof nor in any other manner than authorized herein. Neither the license nor the right granted thereunder shall be assigned or otherwise transferred in violation of the Communications Act of 1934, as amended. See 47 U.S.C. § 310(d). This license is subject in terms to the right of use or control conferred by §706 of the Communications Act of 1934, as amended. See 47 U.S.C. §606.

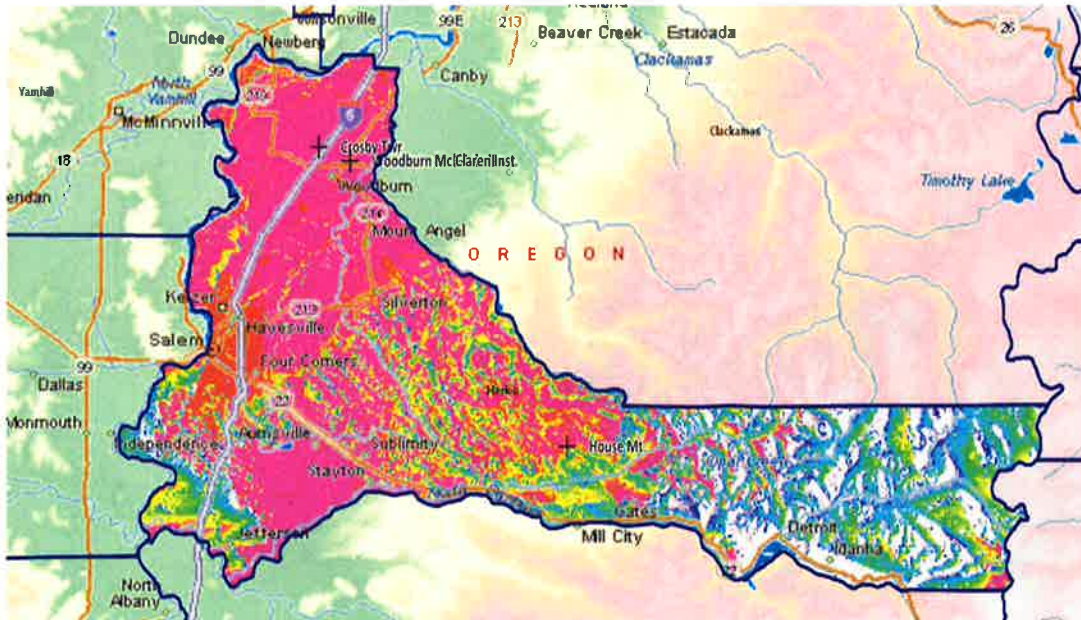


## Attachment "B" Propagation Studies

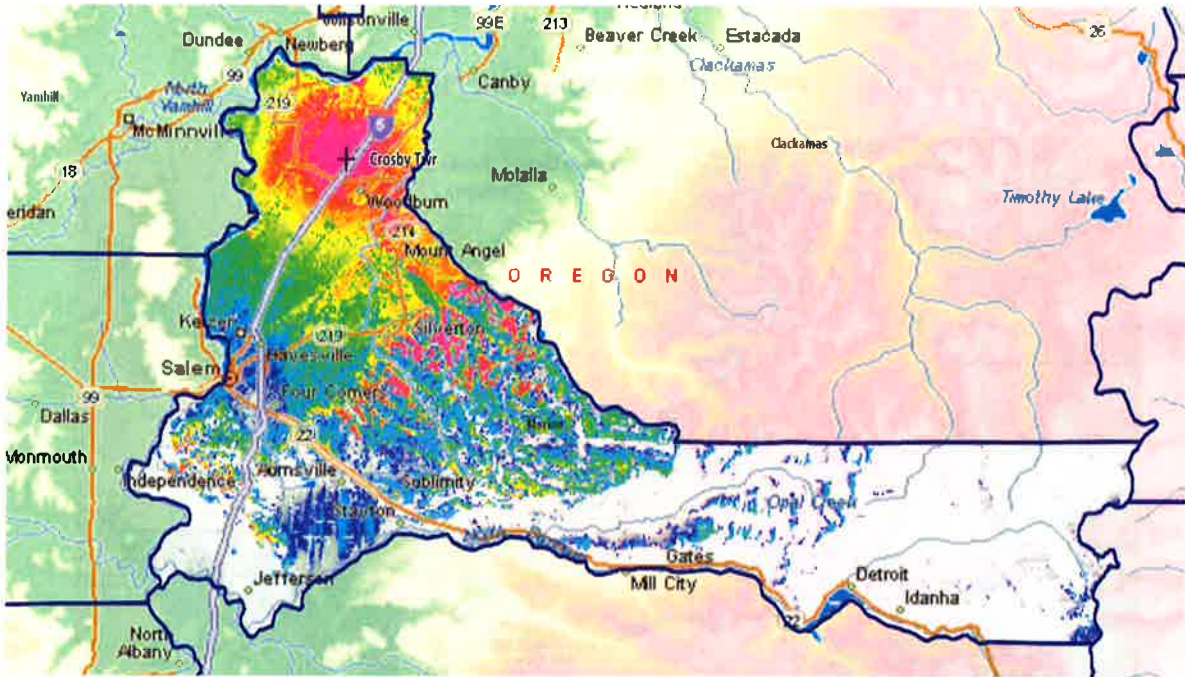
### NORTH 1 Portable Talk "In"



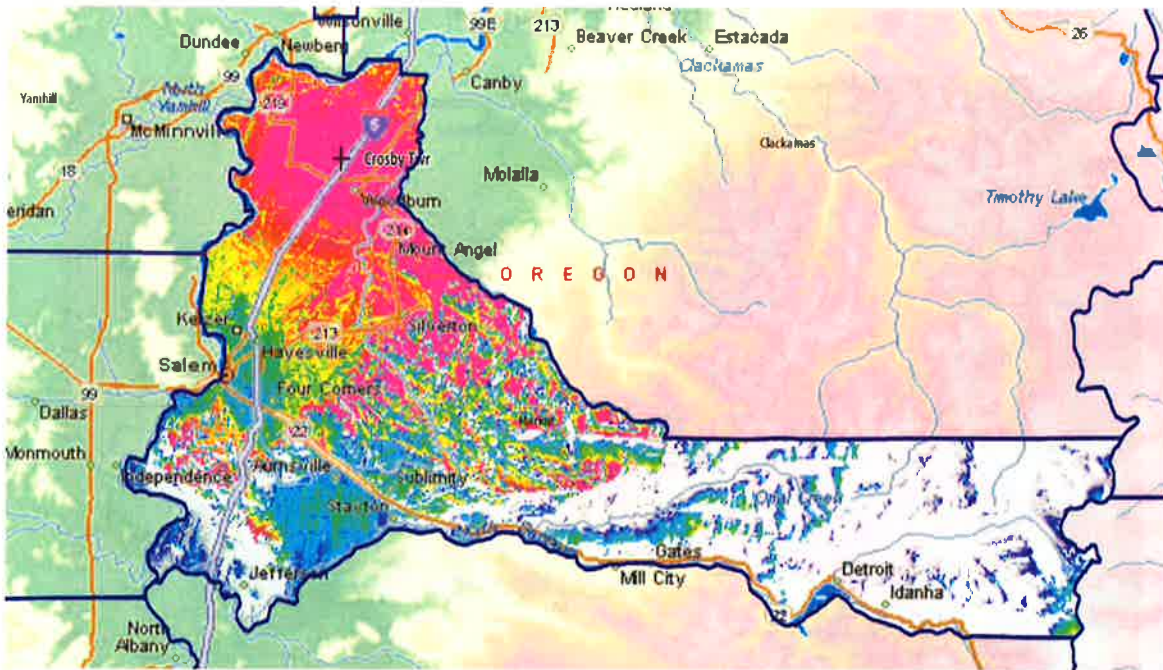
### NORTH 1 Talk "Out"



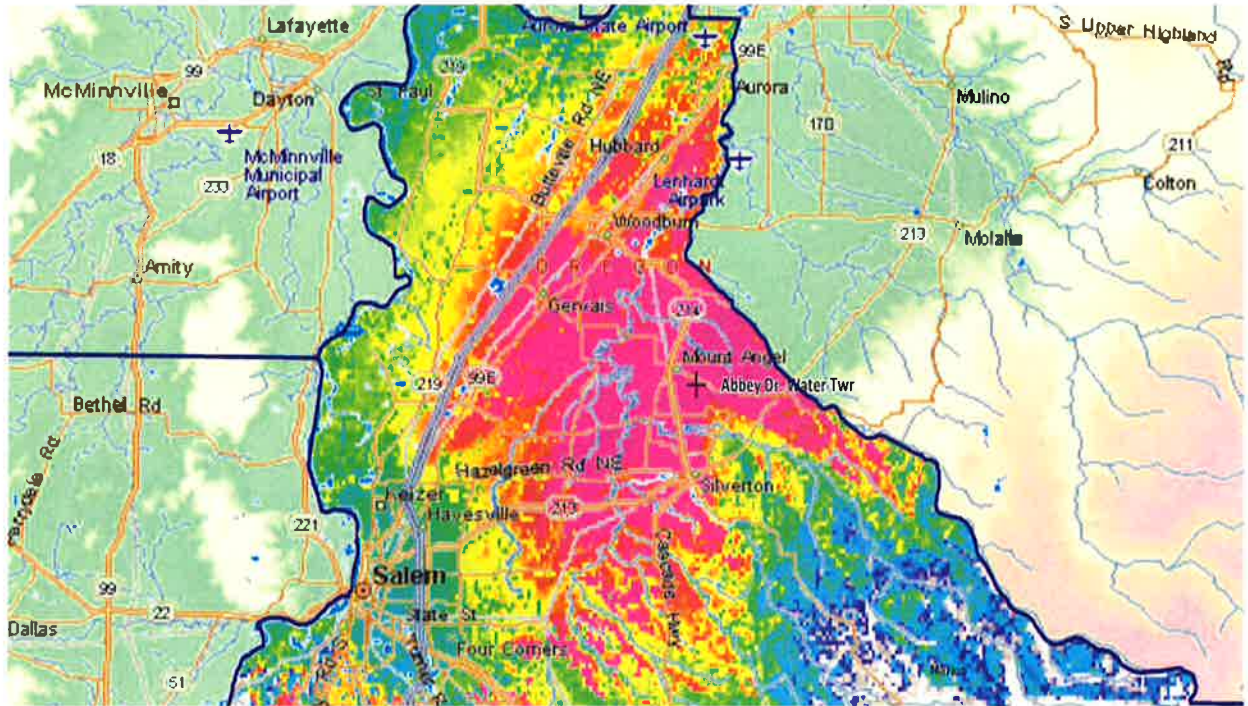
### NORTH 6 Portable Talk “In”



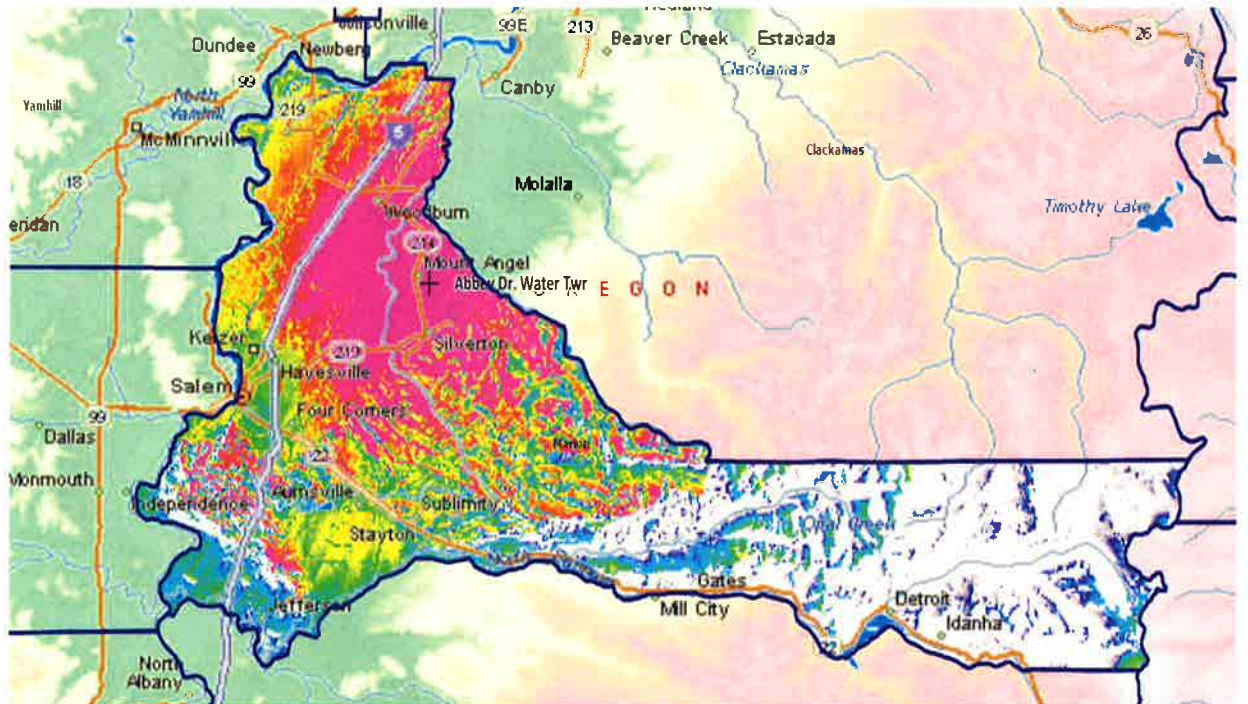
### NORTH 6 Talk “Out”



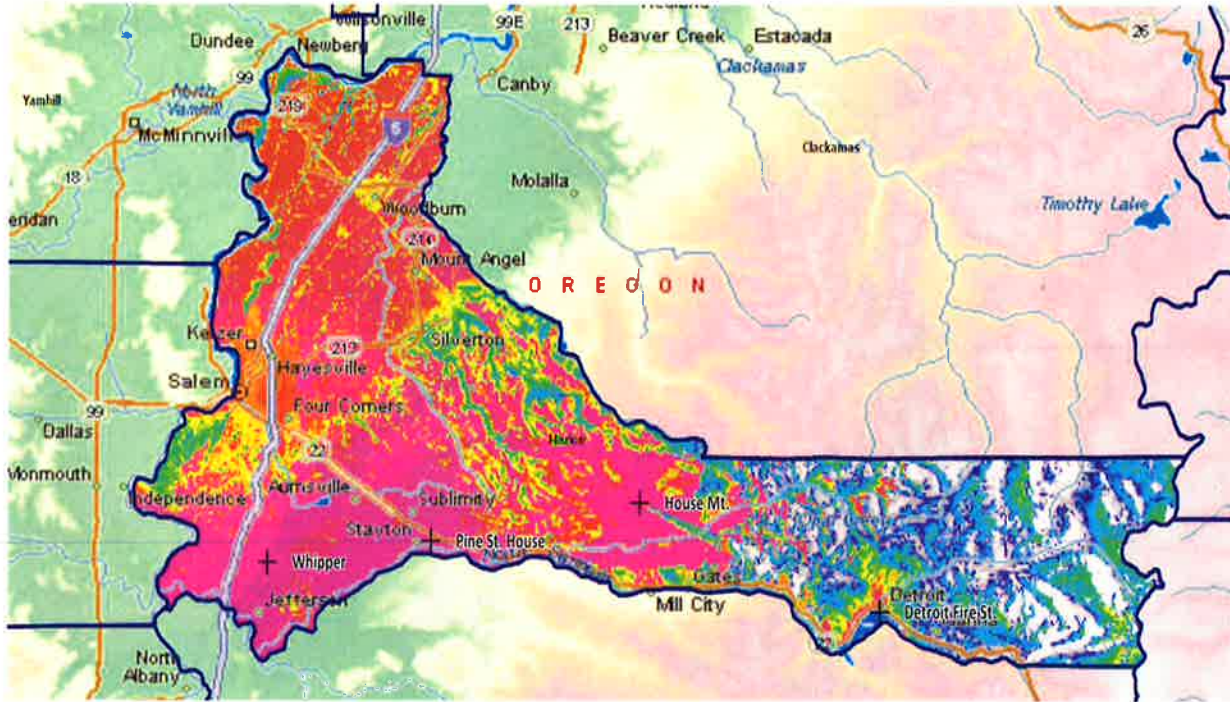
### NORTH 7 Portable Talk “In”



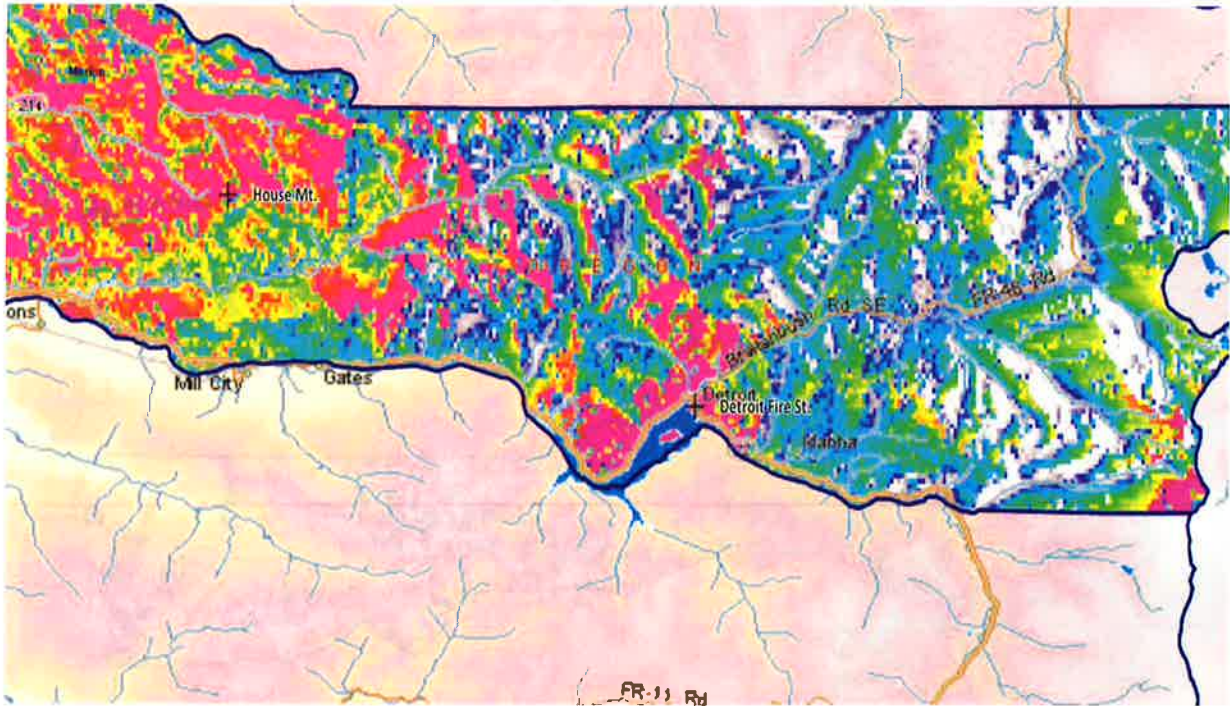
**NORTH 7 Talk "Out"**



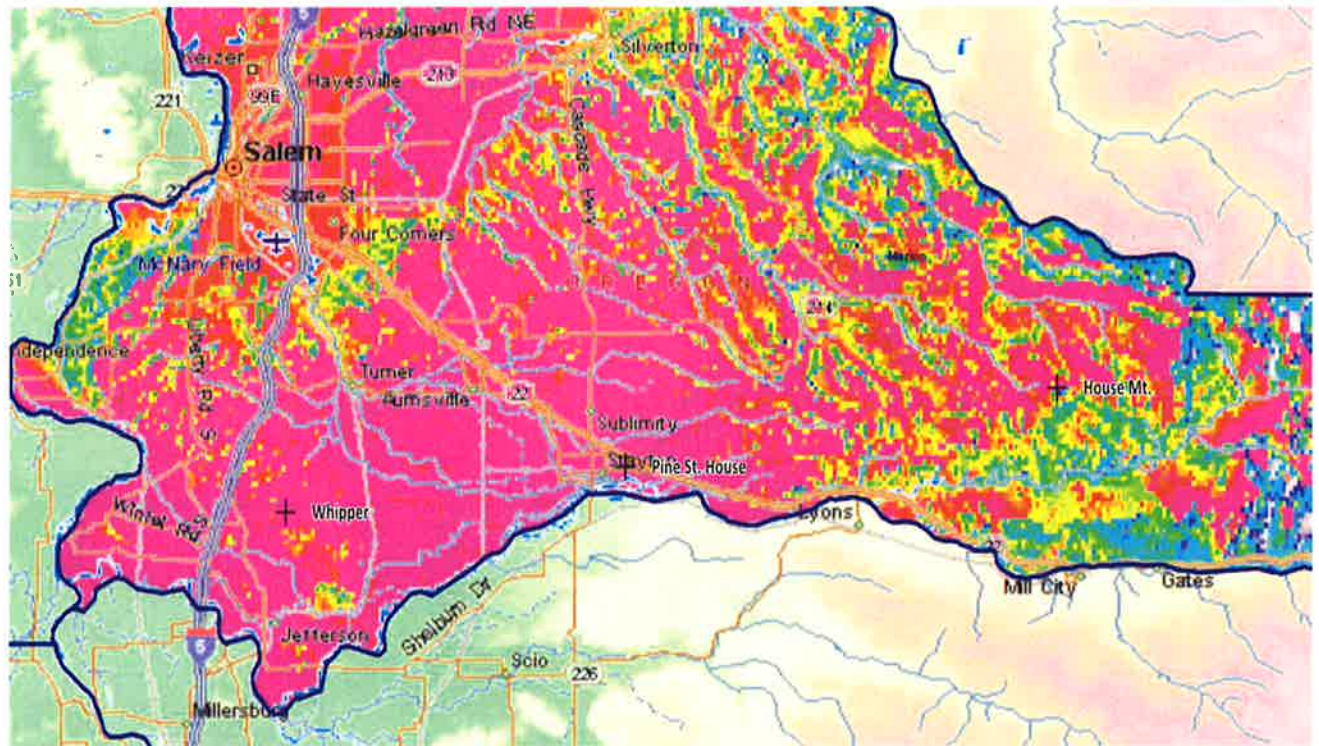
**SOUTH 1 Portable Talk "In"**



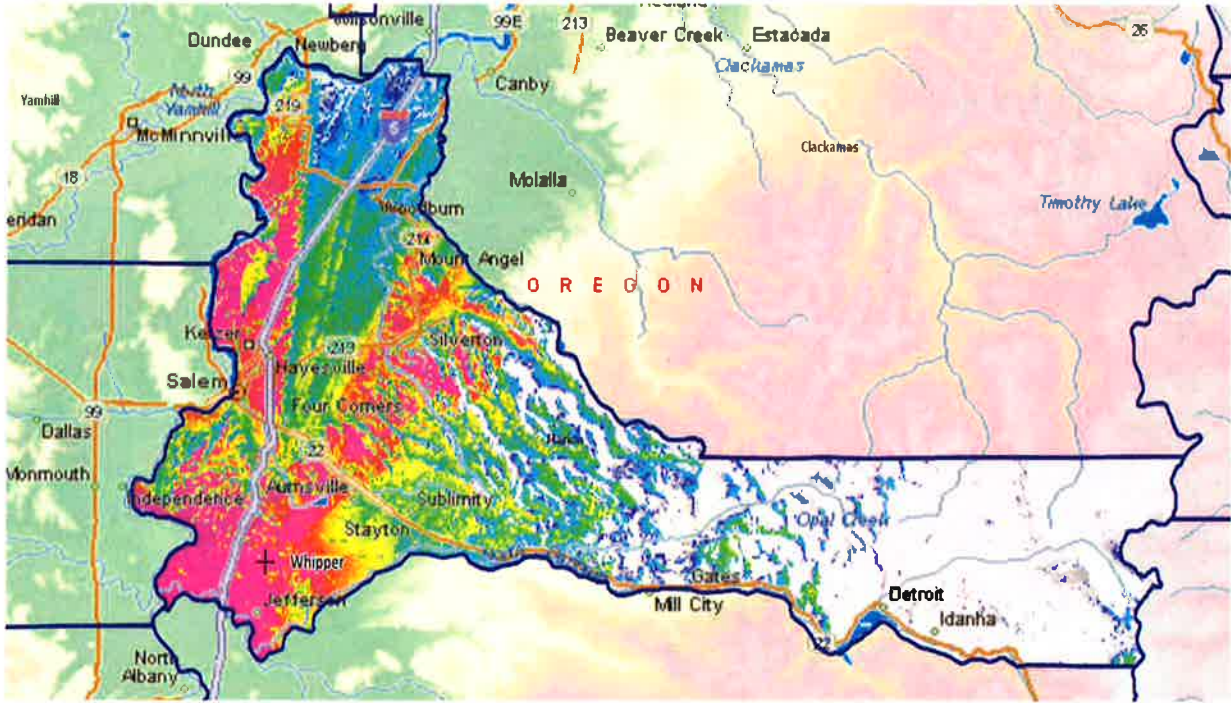
**SOUTH 1 Talk “Out” (South East County)**



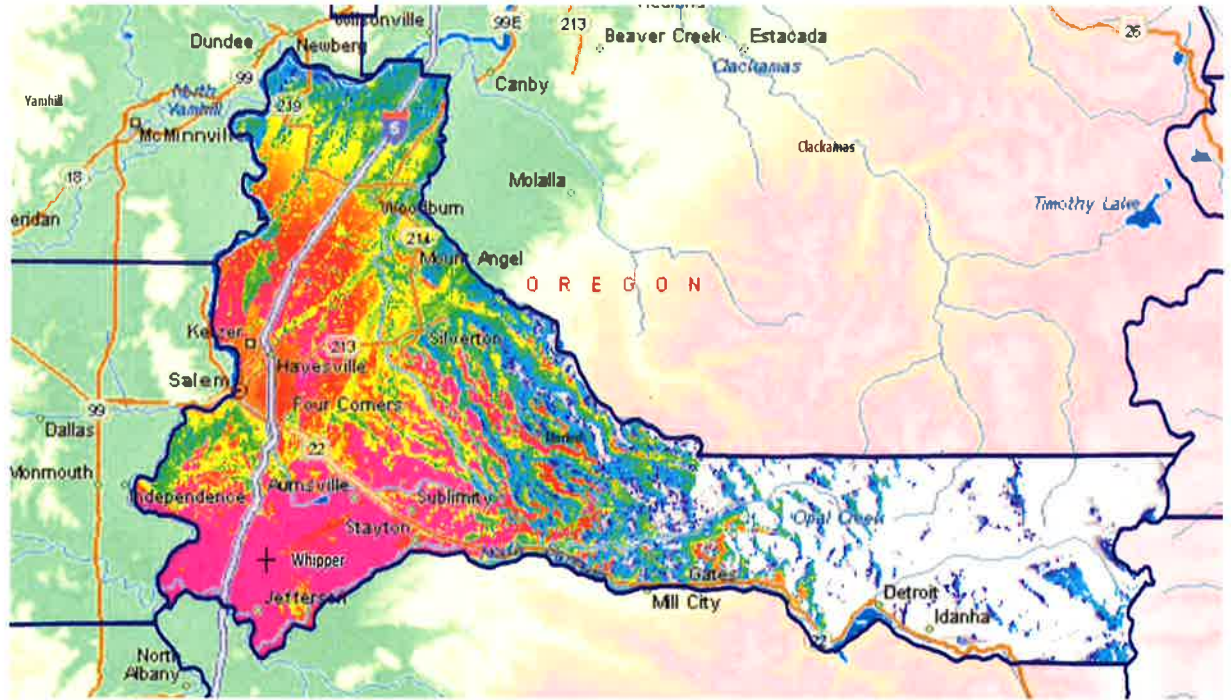
**SOUTH 1 Talk “Out” (South West County)**



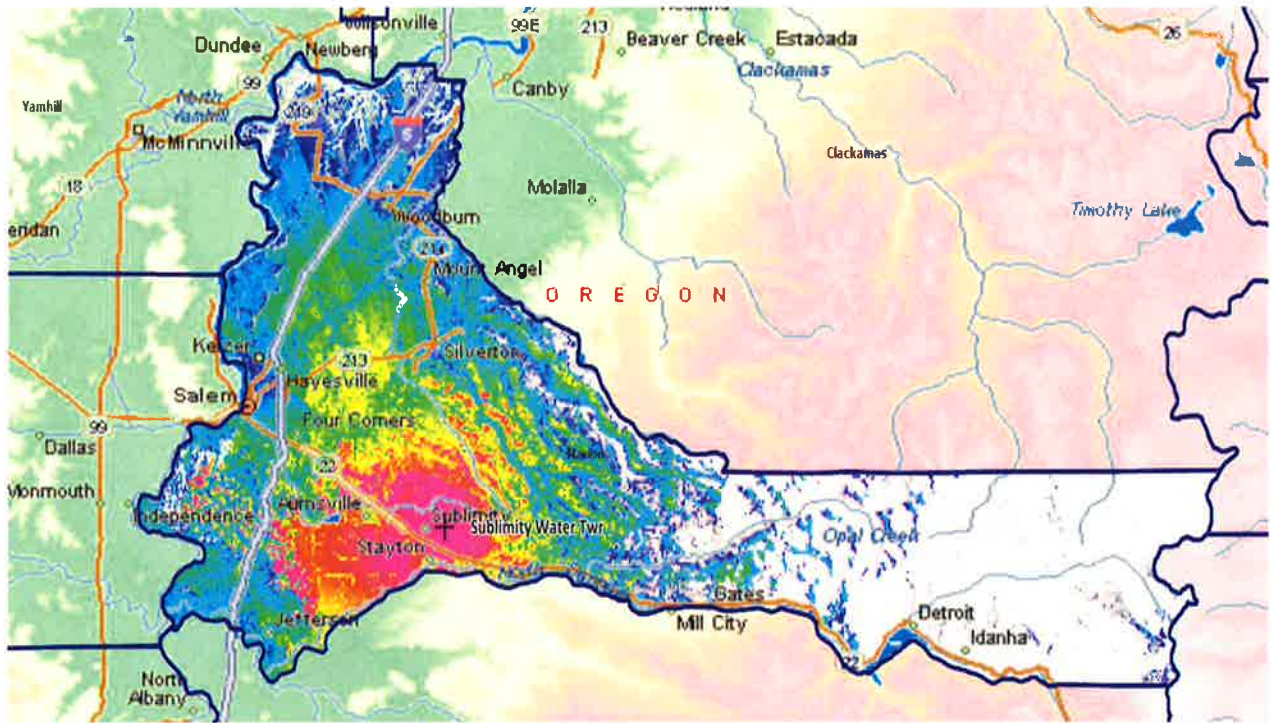
**SOUTH 2 Portable Talk “In”**



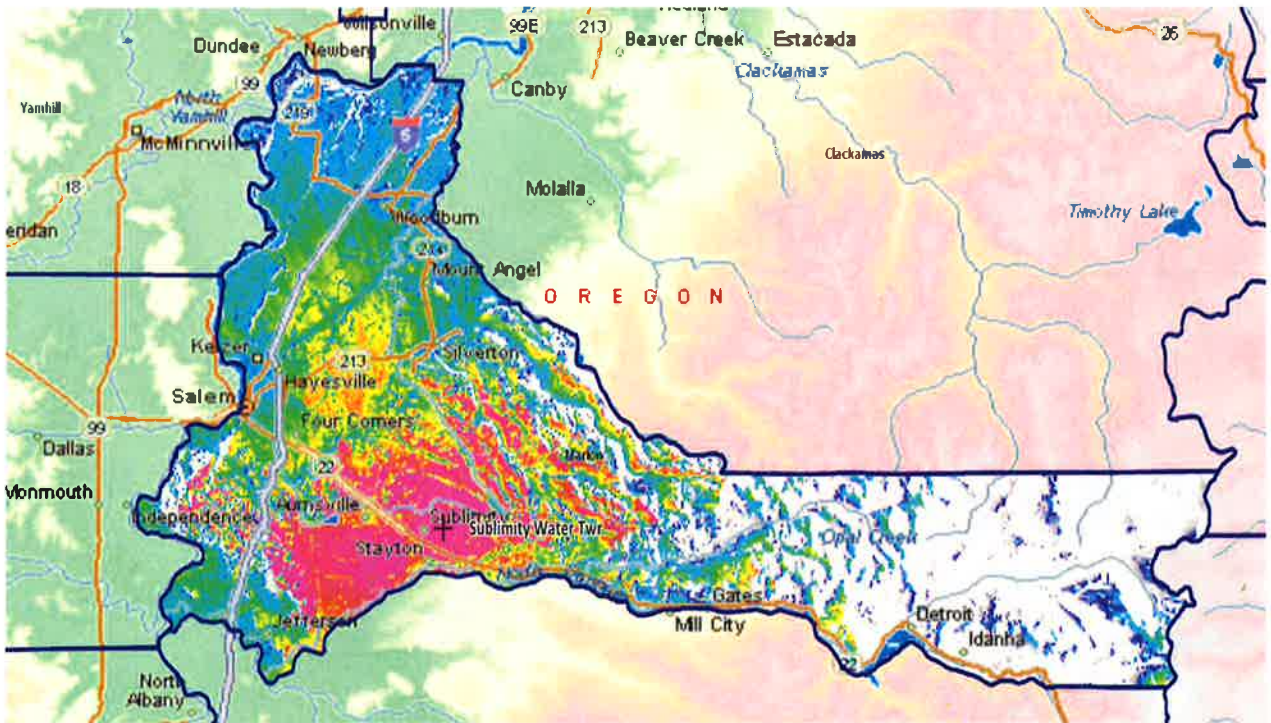
**SOUTH 2 Talk "Out"**



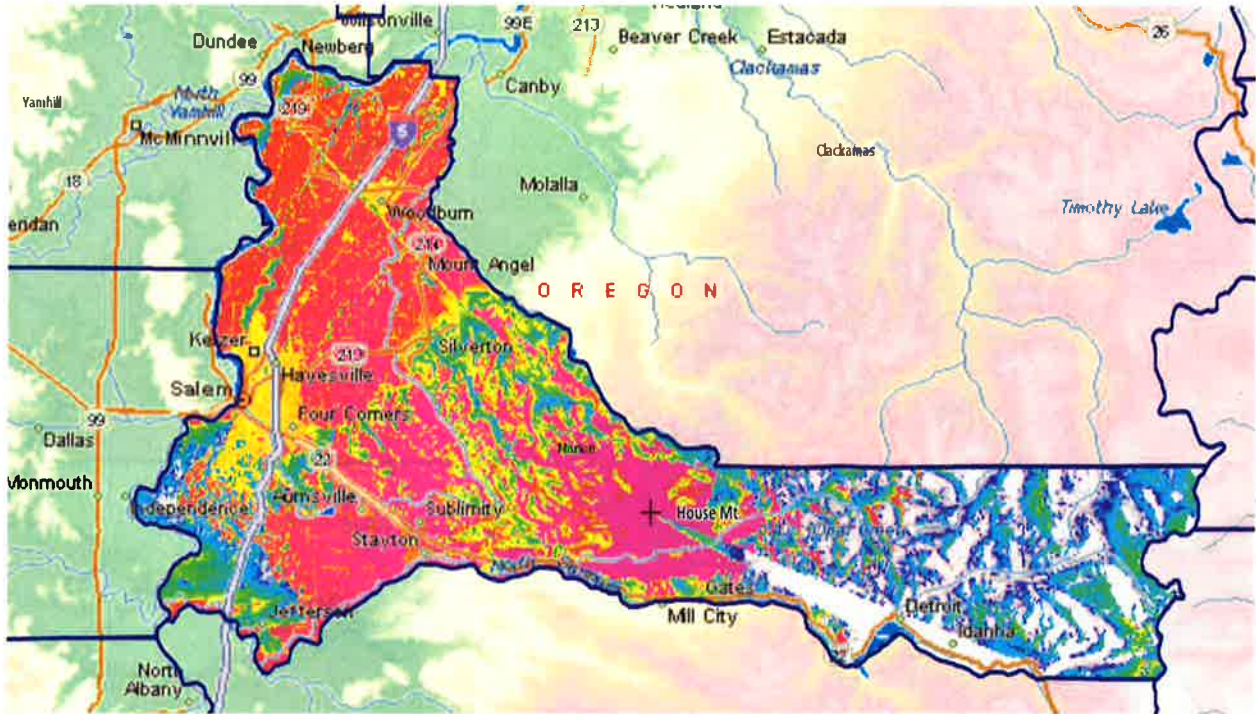
**SOUTH 3 Portable Talk "In"**



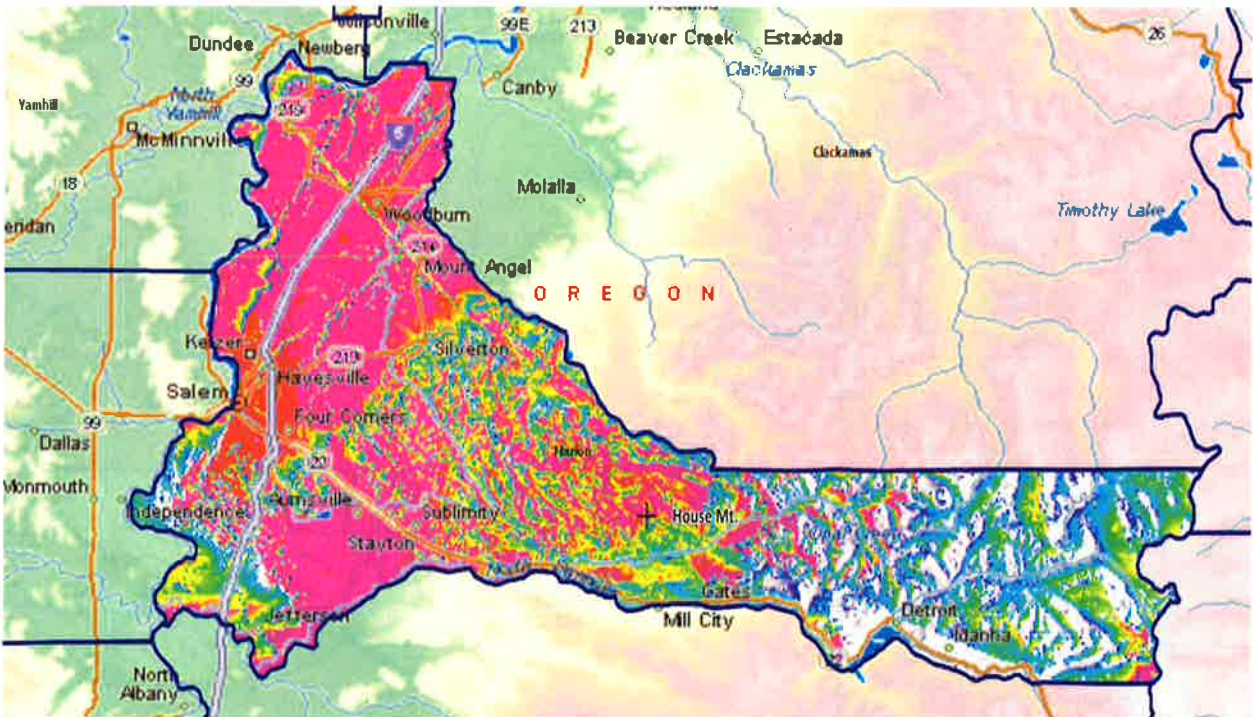
**SOUTH 3 Talk “Out”**



**SOUTH 4 Portable Talk “In”**

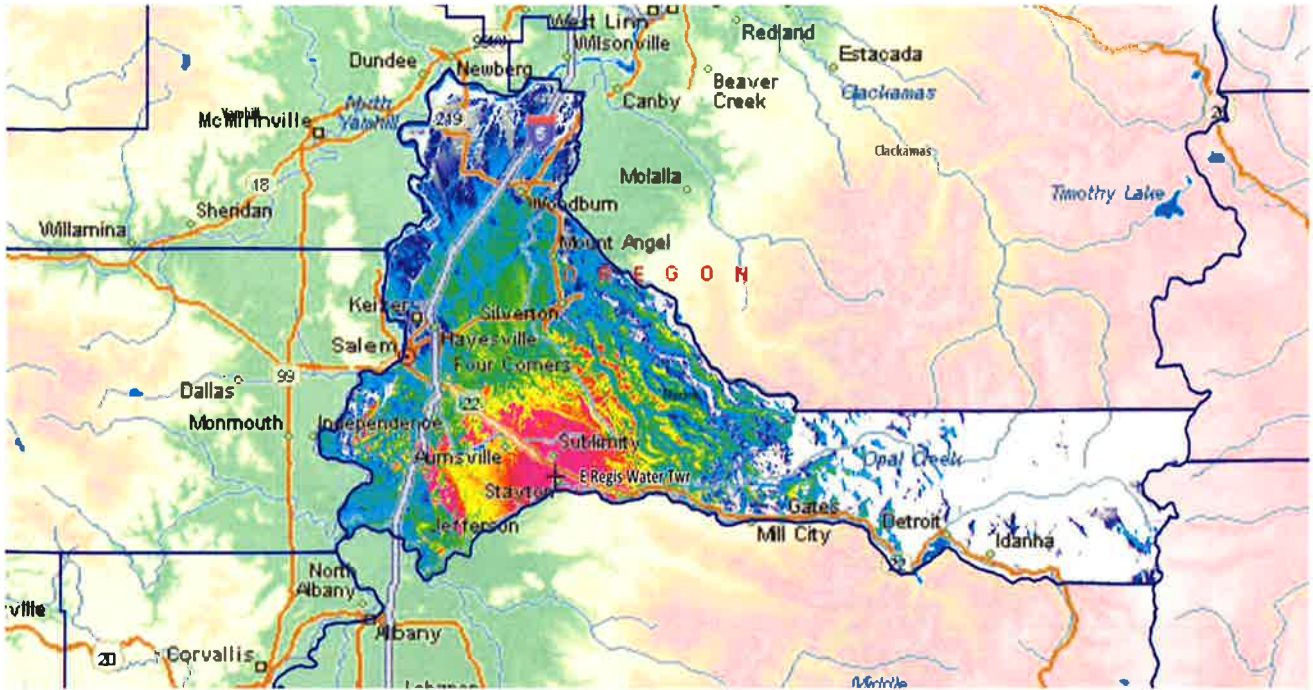


**SOUTH 4 Talk "Out"**

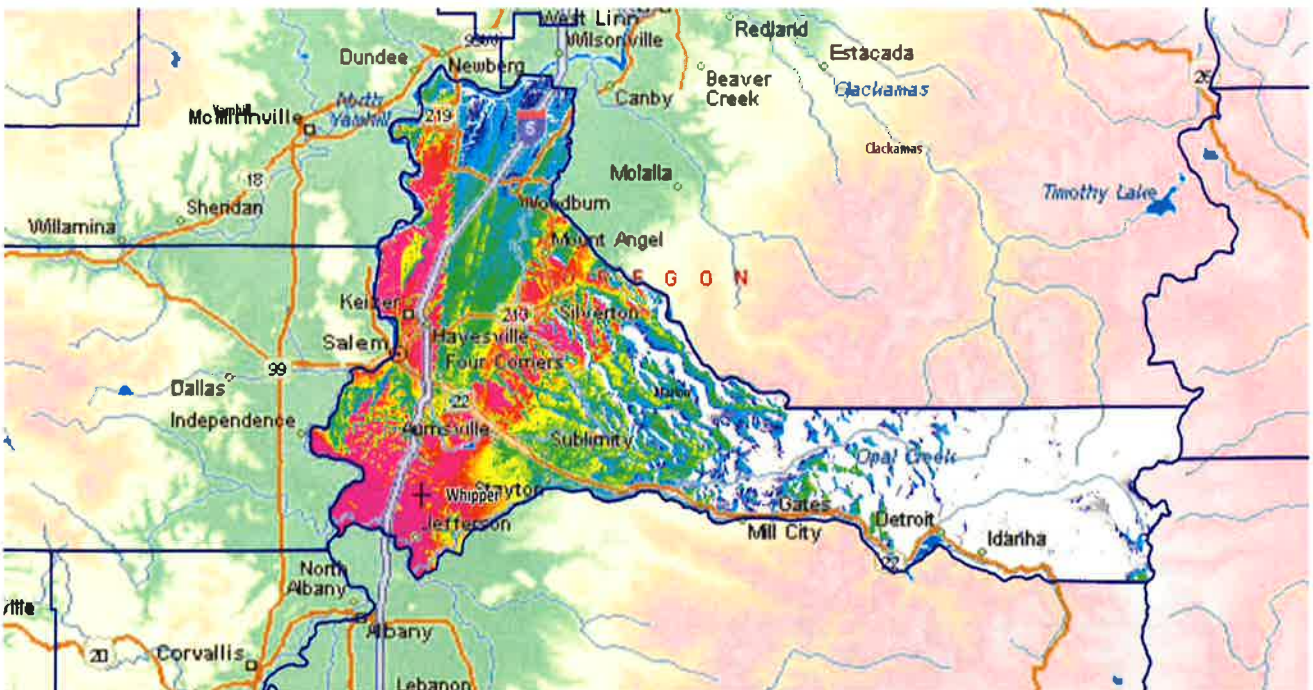


**SOUTH POLICE Portable Talk "In" (Regis)**

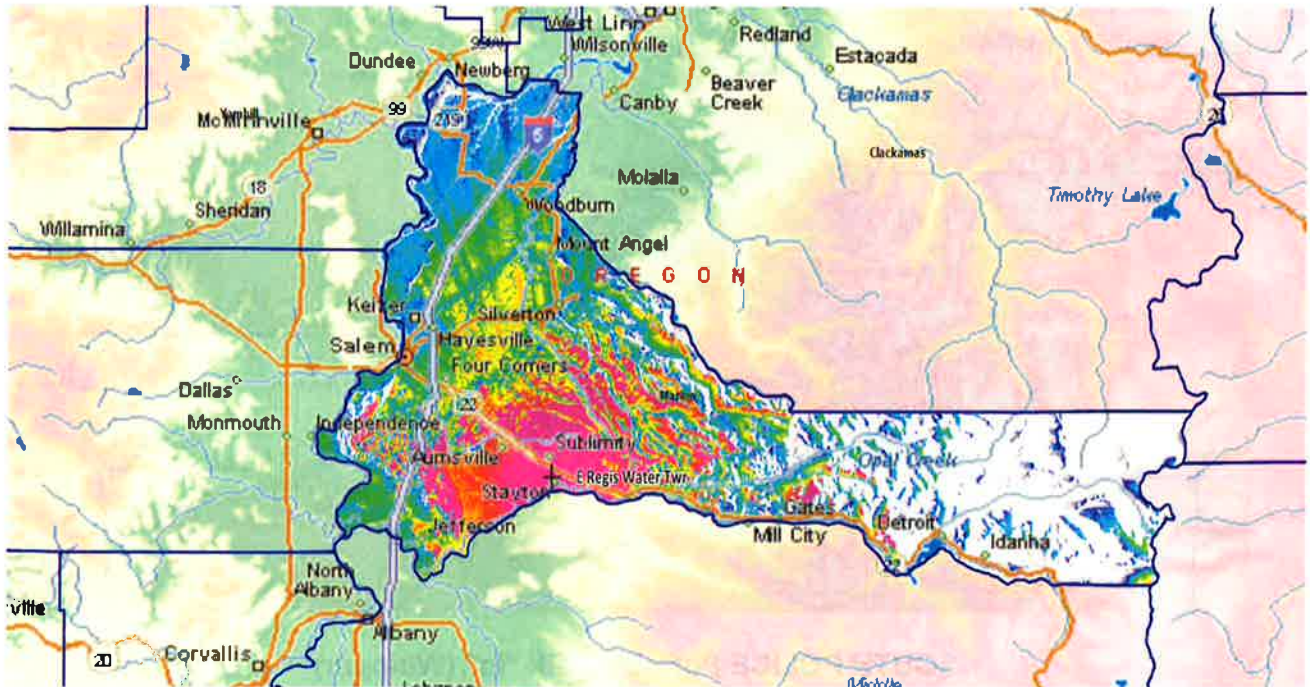




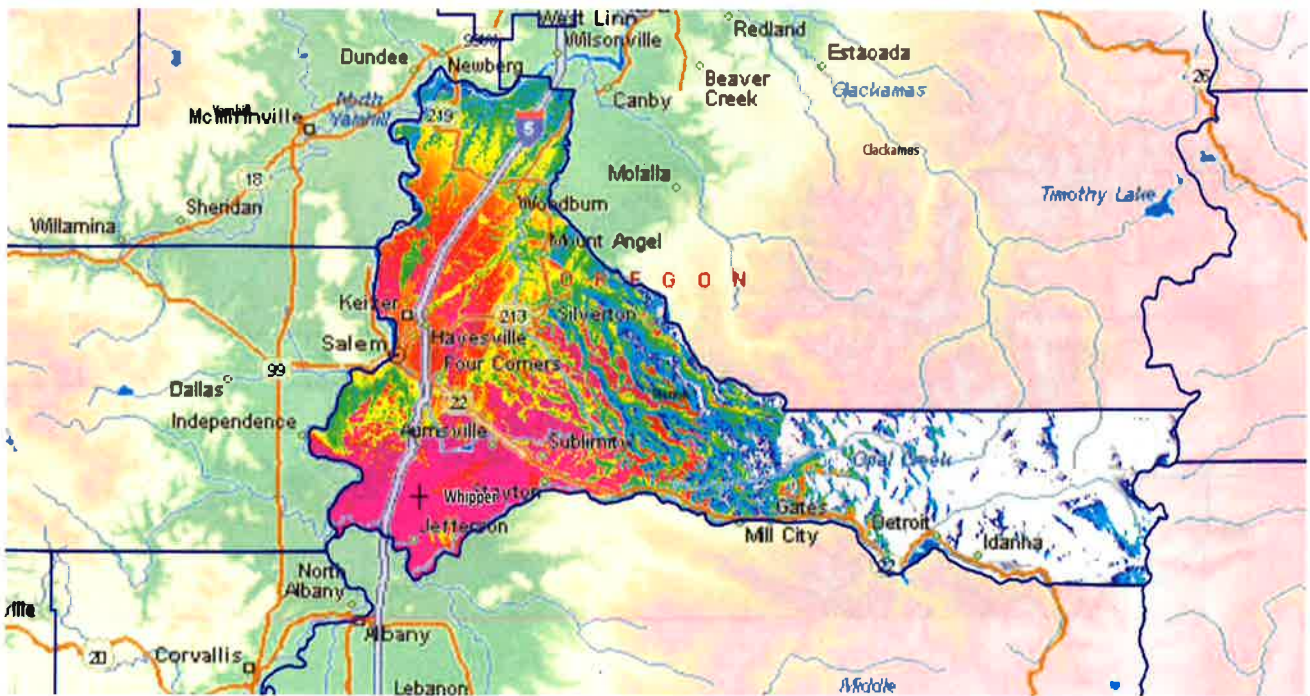
**SOUTH POLICE Portable Talk “In” (Whipper)**



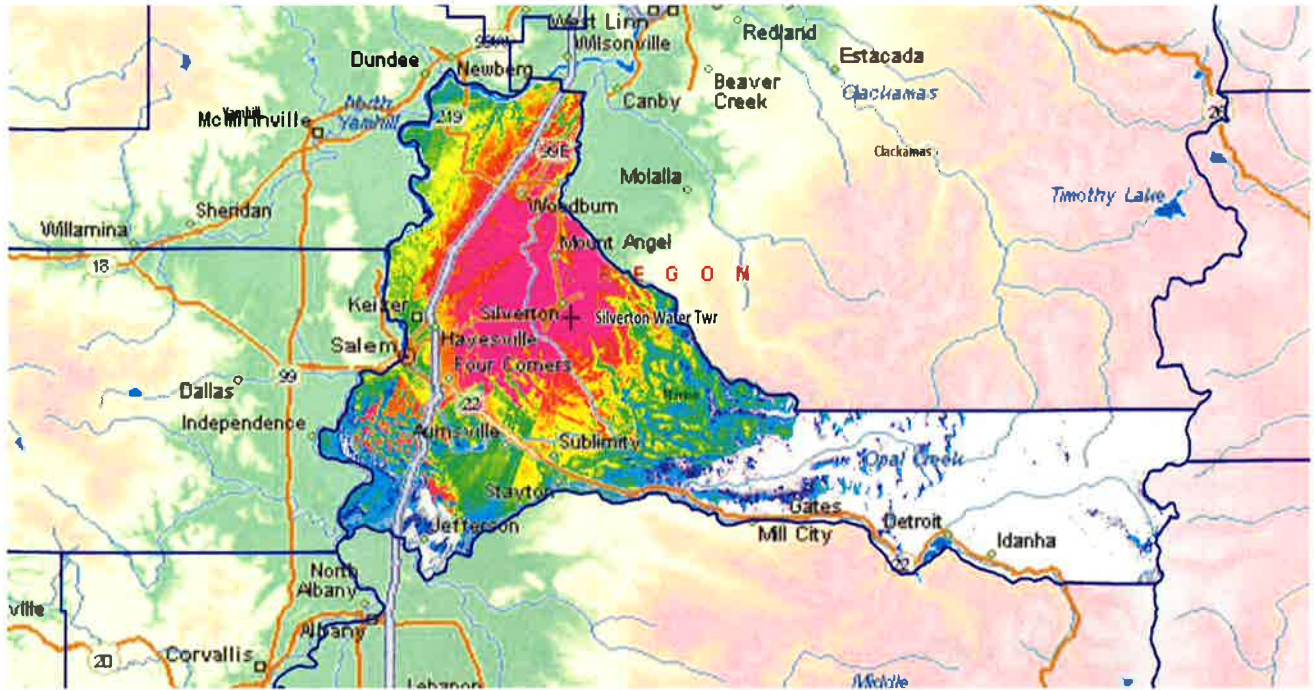
### SOUTH POLICE Talk "Out" (Regis)



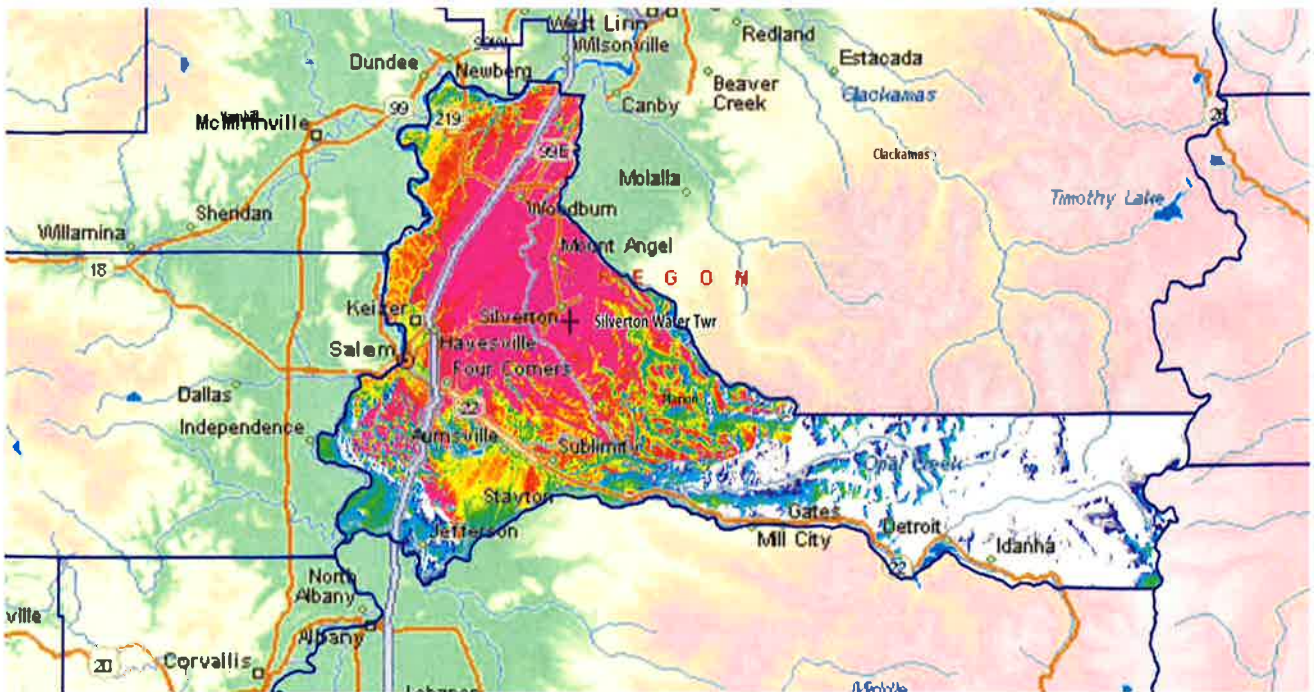
### SOUTH POLICE Talk "Out" (Whipper)



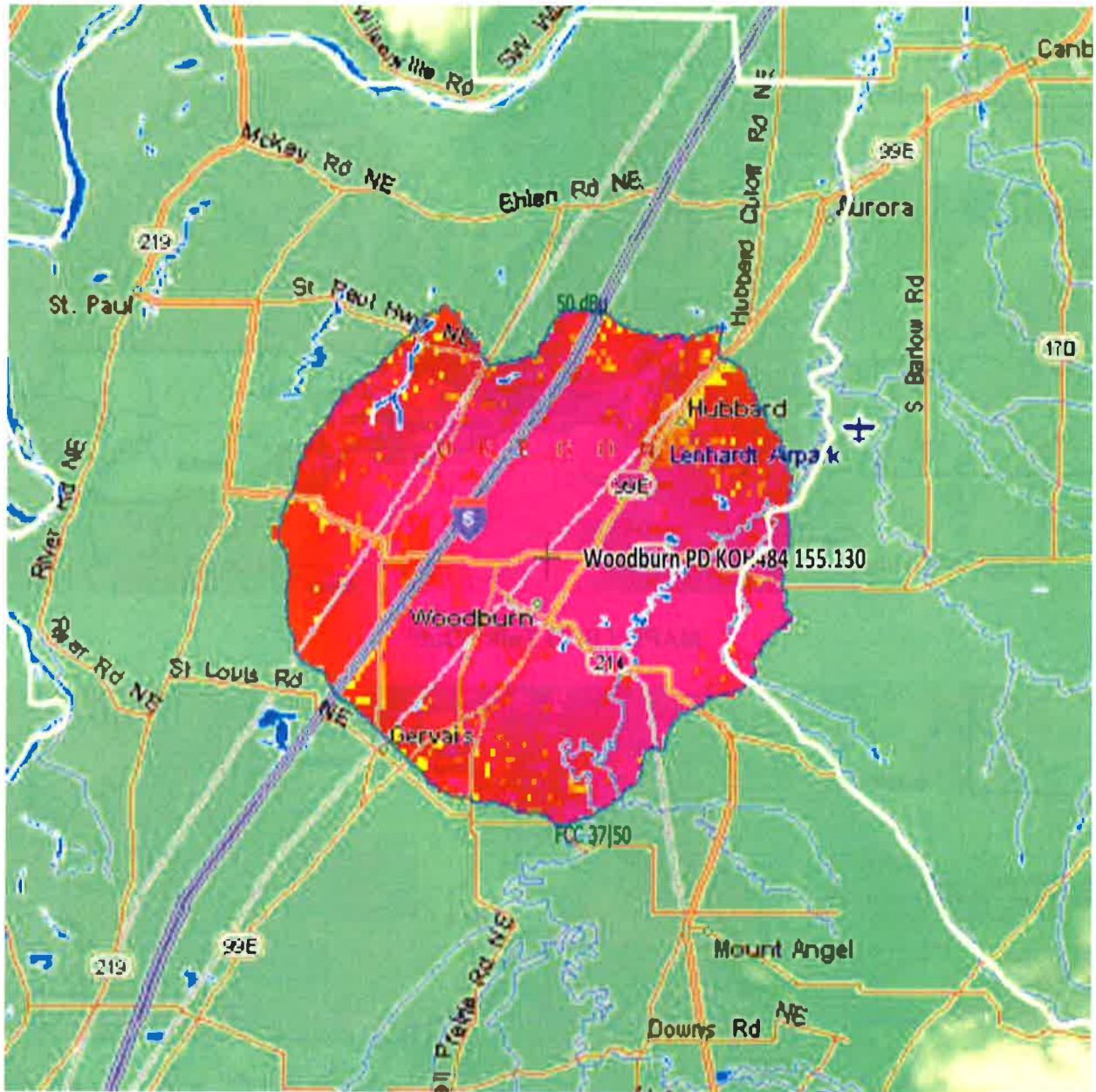
### MAPD/SPD Portable Talk "In"



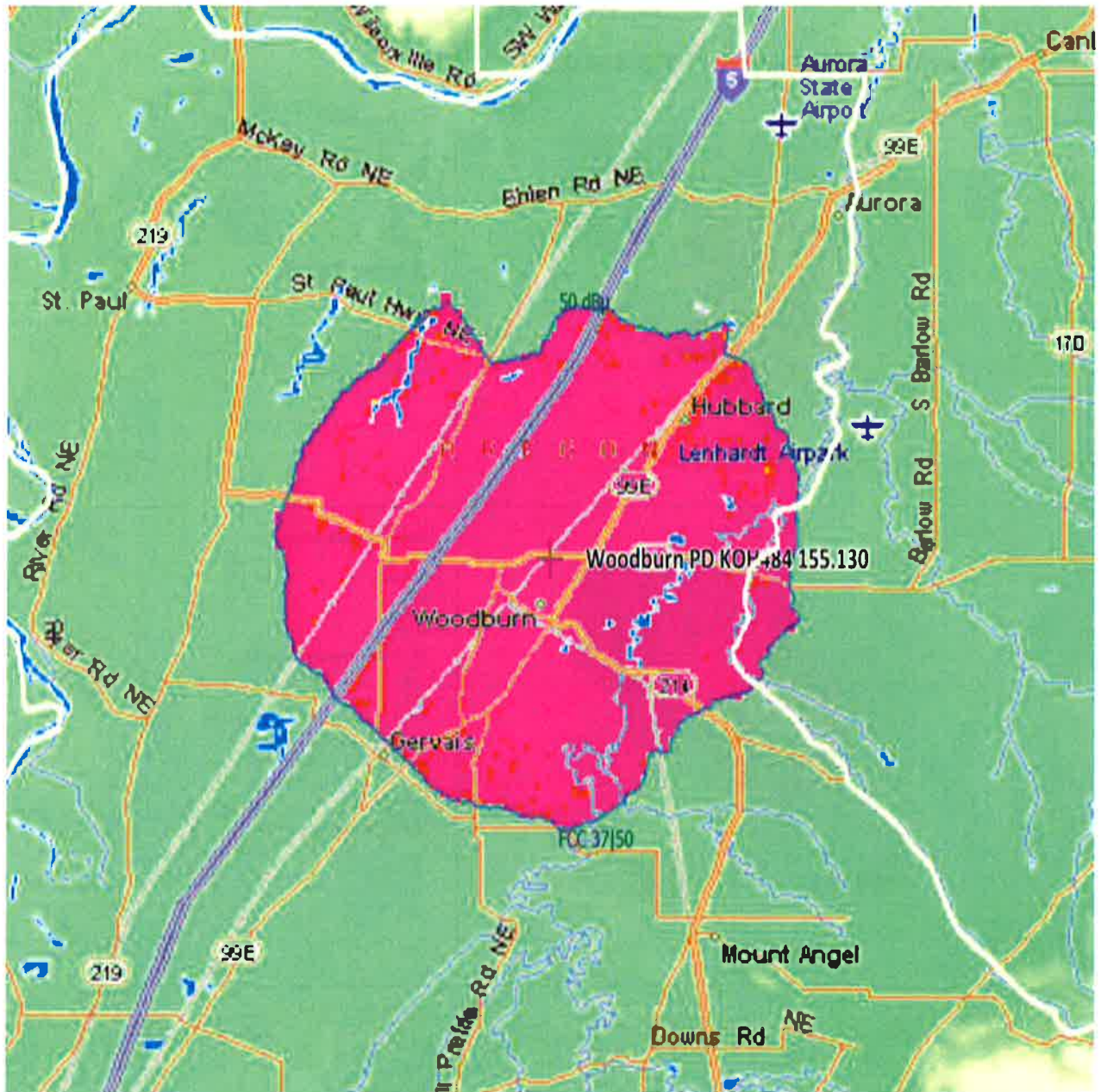
**MAPD / SPD Talk "Out"**



**NORTH PD Portable Talk "In"**



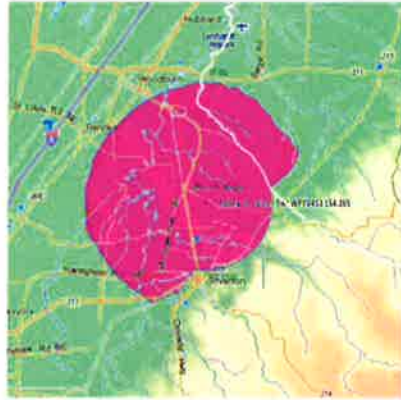
**NORTH PD Talk "Out"**



**MARION COUNTY PROPAGATION STUDY PER SITE**

## Abbey Dr. Water Twr WPYV453 154.265

### Talk Out Matrix



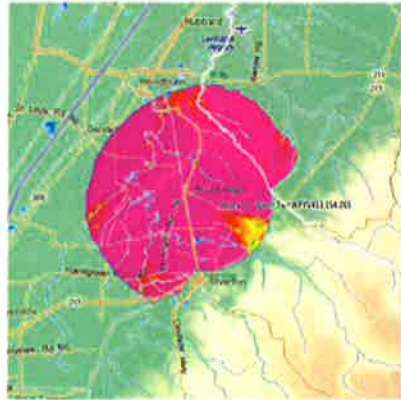
### Site Properties

Frequency	154.265 MHz
Modulation	FM 2.5kHz
Callsign	WPYV453
ERP	25
Latitude	45-03-32.1 N
Longitude	122-46-39.7 W
GE-AMSL	144 m

### TX Antenna Properties

Height	4.5 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	148.5 m

### Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.265 MHz
Modulation	FM 5kHz
Latitude	45-03-32.1 N
Longitude	122-46-39.7 W
GE-AMSL	144 m

### Fixed RX Antenna Properties

Height	4.5 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.265 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].

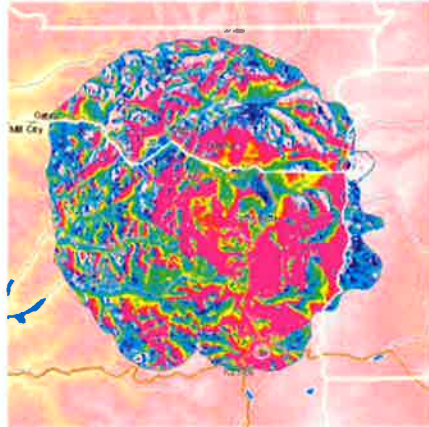


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	...
Minimum HAAT	...

# Coffin Butte

## Talk Out Matrix



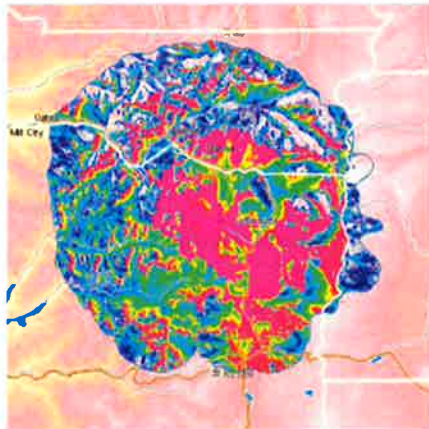
### Site Properties

Frequency	153 MHz
Modulation	FM 5kHz
Callsign	
ERP	25
Latitude	44-37-04.6 N
Longitude	122-02-49.6 W
GE-AMSL	1707 m

### TX Antenna Properties

Height	20 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	1727 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5kHz
Latitude	44-37-04.6 N
Longitude	122-02-49.6 W
GE-AMSL	1707 m

### Fixed RX Antenna Properties

Height	20 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

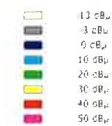
### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than  
or equal to  
[value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Crosby Twr KUZ849 154.980

## Talk Out Matrix



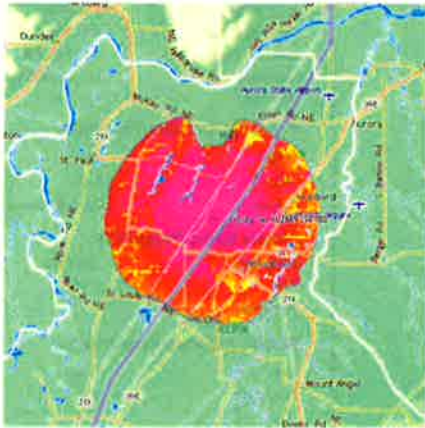
### Site Properties

Frequency	154.98 MHz
Modulation	FM 2.5kHz
Call Sign	KUZ849
ERP	25
Latitude	45-10-17.1 N
Longitude	122-52-12.0 W
GE-AMSL	55 m

### TX Antenna Properties

Height	56 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	111 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.98 MHz
Modulation	FM 5kHz
Latitude	45-10-17.1 N
Longitude	122-52-12.0 W
GE-AMSL	55 m

### Fixed RX Antenna Properties

Height	30 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.98 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
0 1 2 3 4 5

Greater than  
or equal to  
[value].



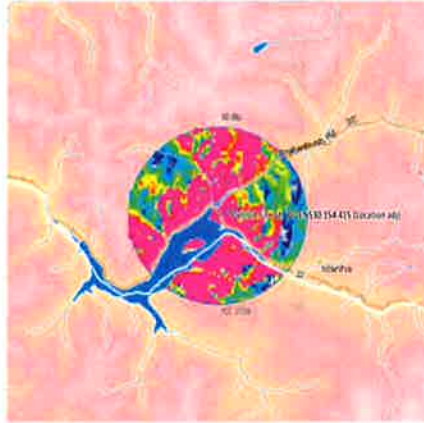
### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	***
Minimum HAAT	***



## Detroit Fire St. WQEN530 154.415 (Location adj)

### Talk Out Matrix



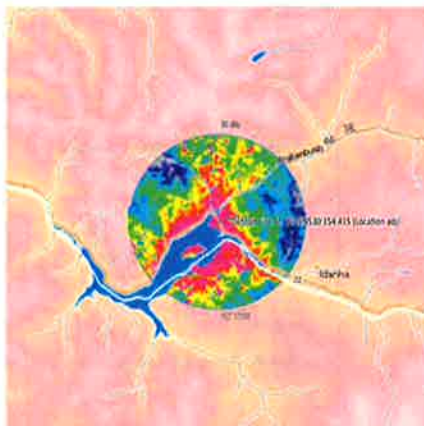
### Site Properties

Frequency	154.415 MHz
Modulation	FM 5kHz
Callsign	WQEN530
ERP	25
Latitude	44-44-07.2 N
Longitude	122-09-04.2 W
GE-AMSL	479 m

### TX Antenna Properties

Height	9 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	488 m

### Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.415 MHz
Modulation	FM 5kHz
Latitude	44-44-07.2 N
Longitude	122-09-04.2 W
GE-AMSL	479 m

### Fixed RX Antenna Properties

Height	9 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.415 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# E Regis Water Twr WNMX428 154.830

## Talk Out Matrix



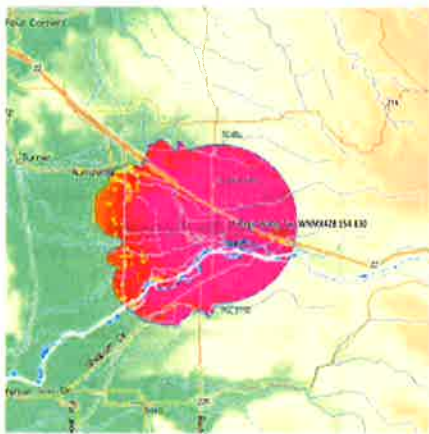
### Site Properties

Frequency	154.83 MHz
Modulation	FM 2.5kHz
Callsgn	WNMX428
ERP	25
Latitude	44-48-27.8 N
Longitude	122-47-22.8 W
GE-AMSL	160 m

### TX Antenna Properties

Height	24 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	184 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.83 MHz
Modulation	FM 5kHz
Latitude	44-48-27.8 N
Longitude	122-47-22.8 W
GE-AMSL	160 m

### Fixed RX Antenna Properties

Height	24 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.83 MHz
ERP	2 W
Modulation	

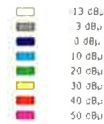
### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers

0 1 2 3 4 5

Greater than  
or equal to  
{value}.

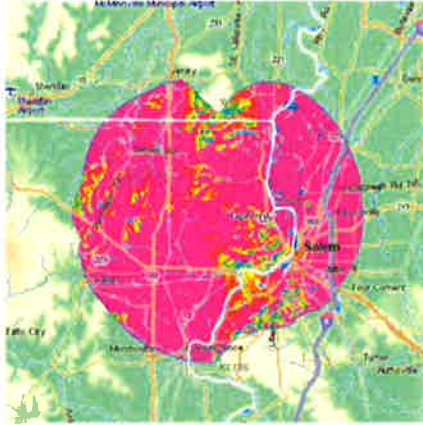


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Eagle Crest

## Talk Out Matrix



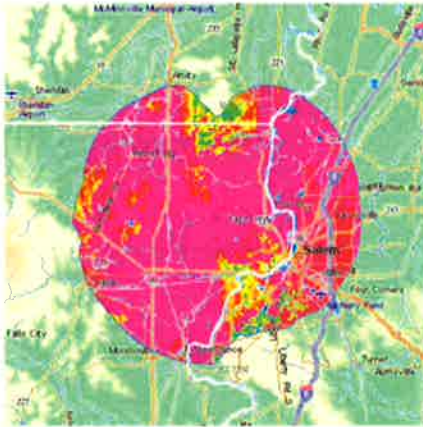
### Site Properties

Frequency	153 MHz
Modulation	FM 5kHz
Call sign	
ERP	25
Latitude	44-58-59.7 N
Longitude	123-08-35.3 W
GE-AMSL	315 m

### TX Antenna Properties

Height	24 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	339 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5kHz
Latitude	44-58-59.7 N
Longitude	123-08-35.3 W
GE-AMSL	315 m

### Fixed RX Antenna Properties

Height	24 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].

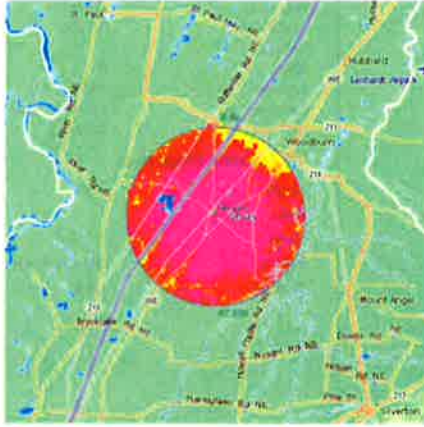


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	---
Minimum HAAT	---

# Gervais

## Talk Out Matrix



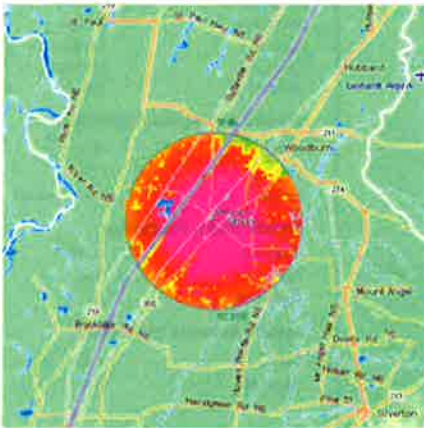
### Site Properties

Frequency	153 MHz
Modulation	FM 5kHz
Callsgn	
ERP	25
Latitude	45-06-20.3 N
Longitude	122-53-41.5 W
GE-AMSL	47 m

### TX Antenna Properties

Height	17 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	64 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5kHz
Latitude	45-06-20.3 N
Longitude	122-53-41.5 W
GE-AMSL	47 m

### Fixed RX Antenna Properties

Height	17 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than  
or equal to  
[value].

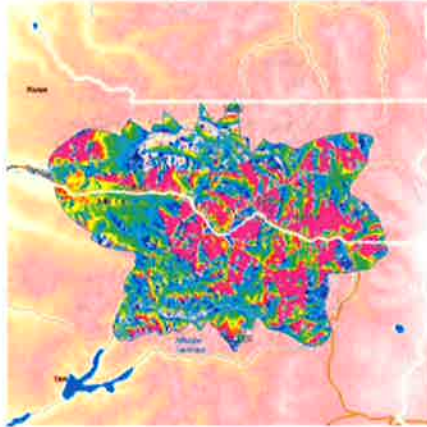


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Hall Ridge

## Talk Out Matrix



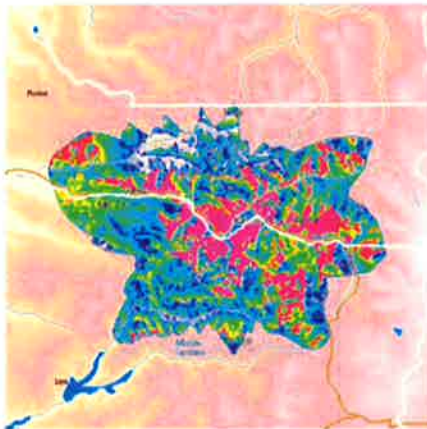
### Site Properties

Frequency	153 MHz
Modulation	FM 5kHz
CallSign	
ERP	25
Latitude	44-43-11.3 N
Longitude	122-13-03.2 W
GE-AMSL	1324 m

### TX Antenna Properties

Height	30 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	1354 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5kHz
Latitude	44-43-11.3 N
Longitude	122-13-03.2 W
GE-AMSL	1324 m

### Fixed RX Antenna Properties

Height	30 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

## Kilometers



Greater than  
or equal to  
[value].

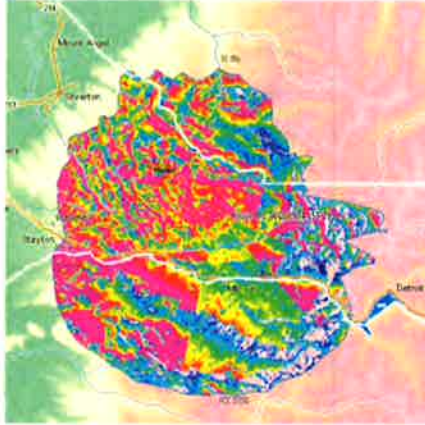


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	...
Minimum HAAT	...

# House Mt. WQUL974 155.295

## Talk Out Matrix



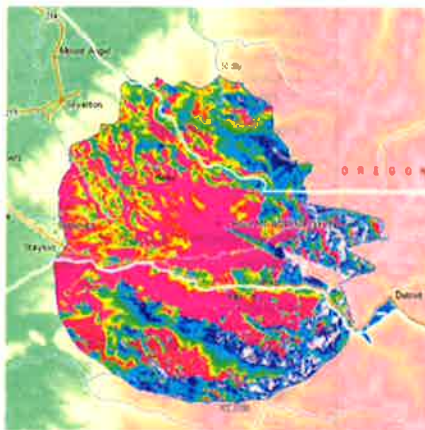
### Site Properties

Frequency	155.295 MHz
Modulation	FM 2.5kHz
Callsign	WQUL974
ERP	25
Latitude	44-50-29.4 N
Longitude	122-28-59.0 W
GE-AMSL	1180.3 m

### TX Antenna Properties

Height	18.2 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	1198.5 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	155.295 MHz
Modulation	FM 5kHz
Latitude	44-50-29.4 N
Longitude	122-28-59.0 W
GE-AMSL	1180.3 m

### Fixed RX Antenna Properties

Height	18 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	155.295 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
0 1 2 3 4 5

Greater than  
or equal to  
[value].

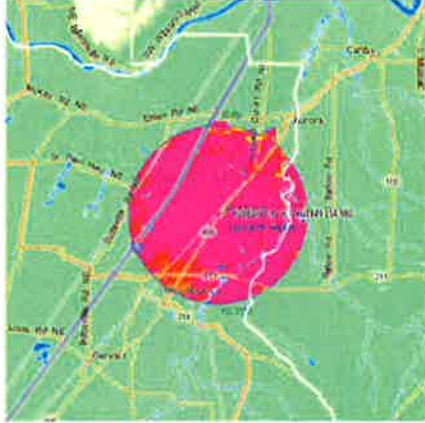


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Hubbard City Hall KUZ849 154.980

## Talk Out Matrix



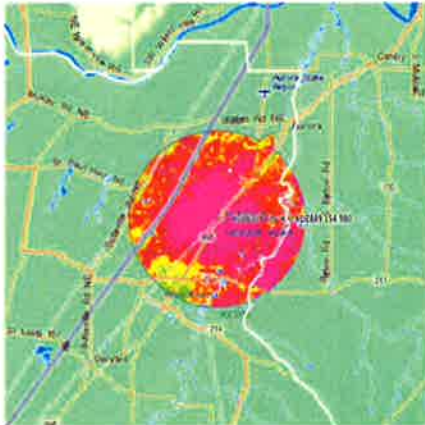
### Site Properties

Frequency	154.98 MHz
Modulation	FM 2.5kHz
Callsign	KUZ849
ERP	25
Latitude	45-10-56.4 N
Longitude	122-48-18.3 W
GE-AMSL	60 m

### TX Antenna Properties

Height	12 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	72 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.98 MHz
Modulation	FM 5kHz
Latitude	45-10-56.4 N
Longitude	122-48-18.3 W
GE-AMSL	60 m

### Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.98 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].

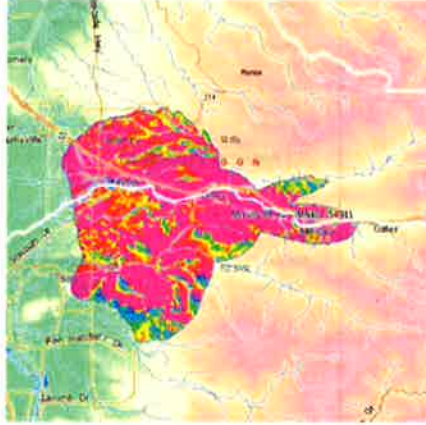


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	---
Minimum HAAT	---

# McCully Mt. Rd. NMN401 154.415

## Talk Out Matrix



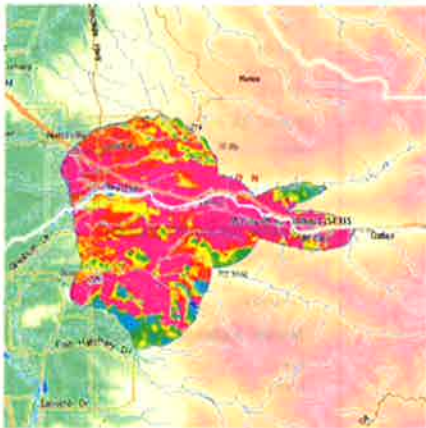
### Site Properties

Frequency	154.415 MHz
Modulation	FM 2.5kHz
Callsign	WNMN401
ERP	25
Latitude	44-45-46.4 N
Longitude	122-37-48.3 W
GE-AMSL	490.4 m

### TX Antenna Properties

Height	27 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	517.4 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.415 MHz
Modulation	FM 5kHz
Latitude	44-45-46.4 N
Longitude	122-37-48.3 W
GE-AMSL	490.4 m

### Fixed RX Antenna Properties

Height	27 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.415 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
0 1 2 3 4 5 6 7 8 9 10

Greater than  
or equal to  
[value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	...
Minimum HAAT	...



# Mt. Angel Ct House WPWV990 158.895

## Talk Out Matrix



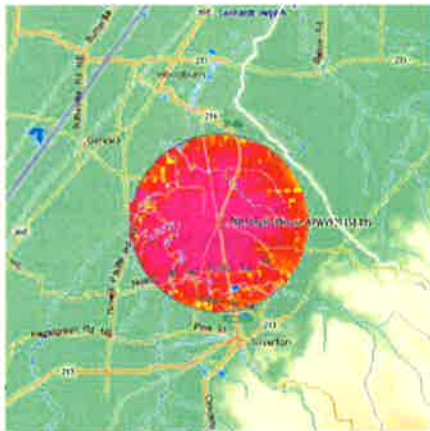
## Site Properties

Frequency	158.895 MHz
Modulation	FM 2.5kHz
Callsign	WPWV990
ERP	25
Latitude	45-04-03.8 N
Longitude	122-47-53.2 W
GE-AMSL	54 m

## TX Antenna Properties

Height	12.2 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	66.2 m

## Talk Back Matrix



## Fixed RX Radio Properties

Frequency	158.895 MHz
Modulation	FM 5kHz
Latitude	45-04-03.8 N
Longitude	122-47-53.2 W
GE-AMSL	54 m

## Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

## Mobile Radio Properties

Frequency	158.895 MHz
ERP	2 W
Modulation	

## Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

## Kilometers



Greater than  
or equal to  
[value].

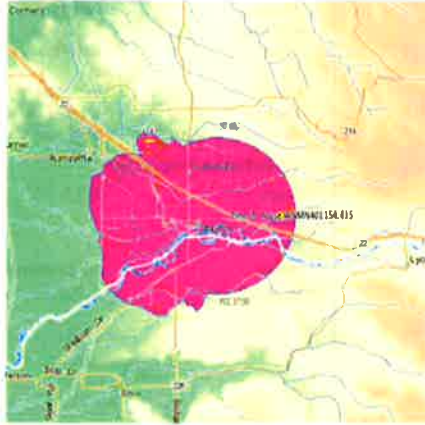


## Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	Urban
Minimum HAAT	100m

# Pine St. House WNMN401 154.415

## Talk Out Matrix



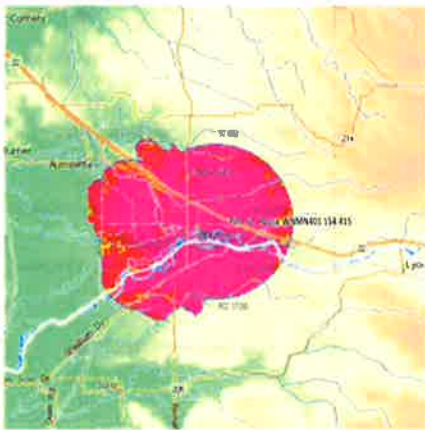
### Site Properties

Frequency	154.415 MHz
Modulation	FM 2.5kHz
CallSign	WNMN401
ERP	25
Latitude	44-48-14.4 N
Longitude	122-46-14.0 W
GE-AMSL	171.3 m

### TX Antenna Properties

Height	24.7 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	196 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.415 MHz
Modulation	FM 5kHz
Latitude	44-48-14.4 N
Longitude	122-46-14.0 W
GE-AMSL	171.3 m

### Fixed RX Antenna Properties

Height	24.7 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.415 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers

1 Km 2 Km 3 Km

Greater than  
or equal to  
[value].

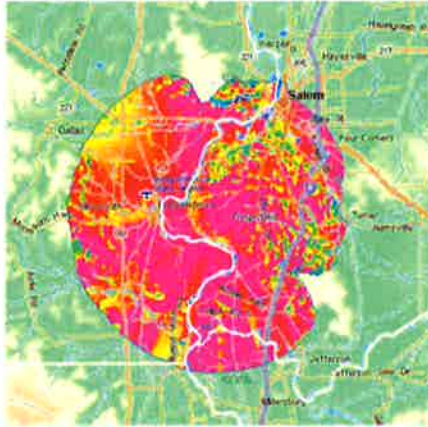


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Prospect Hill

## Talk Out Matrix



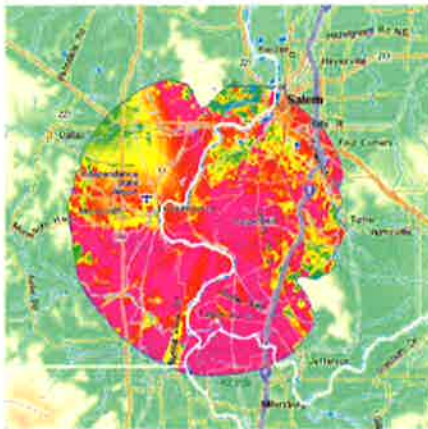
### Site Properties

Frequency	153 MHz
Modulation	FM 5KHz
Callsign	
ERP	25
Latitude	44-50-48.2 N
Longitude	123-06-39.0 W
GE-AMSL	290 m

### TX Antenna Properties

Height	20 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	310 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5KHz
Latitude	44-50-48.2 N
Longitude	123-06-39.0 W
GE-AMSL	290 m

### Fixed RX Antenna Properties

Height	20 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
1000 500 250 0 250 500 1000

Greater than  
or equal to  
[value].

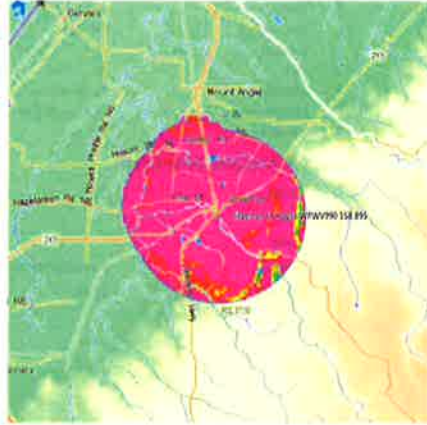


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	---
Minimum HAAT	---

# Silverton Ct House WPWV990 158.895

## Talk Out Matrix



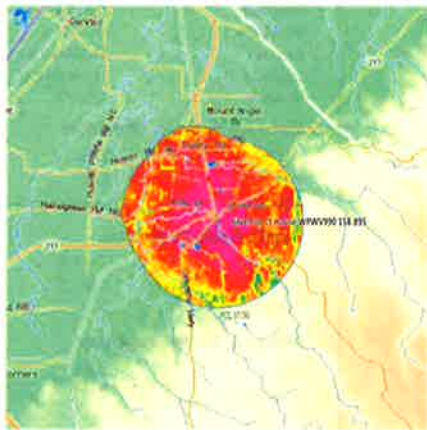
### Site Properties

Frequency	158.895 MHz
Modulation	FM 2.5kHz
CallSign	WPWV990
ERP	25
Latitude	45-00-14.4 N
Longitude	122-46-55.9 W
GE-AMSL	81 m

### TX Antenna Properties

Height	12.2 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	93.2 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	158.895 MHz
Modulation	FM 5kHz
Latitude	45-00-14.4 N
Longitude	122-46-55.9 W
GE-AMSL	81 m

### Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	158.895 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
0 1 2 3 4 5

Greater than  
or equal to  
[value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	***
Minimum HAAT	***

# Silverton Fire St. WPYV453 155.115

## Talk Out Matrix



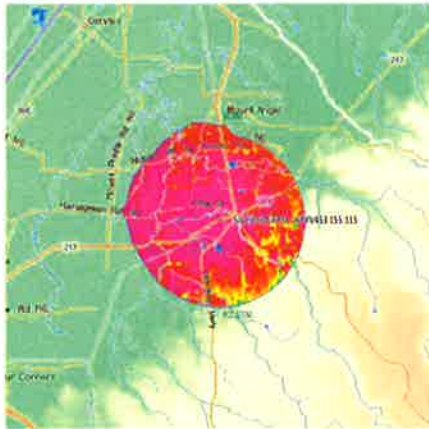
### Site Properties

Frequency	155.115 MHz
Modulation	FM 2.5kHz
Callsign	WPYV453
ERP	25
Latitude	45-00-18.2 N
Longitude	122-47-46.6 W
GE-AMSL	73 m

### TX Antenna Properties

Height	18 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	91 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	155.115 MHz
Modulation	FM 5kHz
Latitude	45-00-18.2 N
Longitude	122-47-46.6 W
GE-AMSL	73 m

### Fixed RX Antenna Properties

Height	18 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	155.115 MHz
ERP	2 W
Modulation	

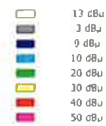
### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than  
or equal to  
[value].

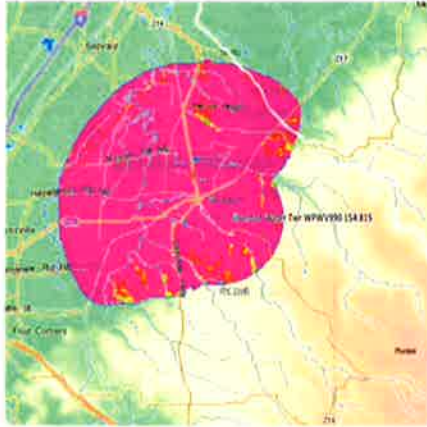


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Silverton Water Twr WPWV990 154.815

## Talk Out Matrix



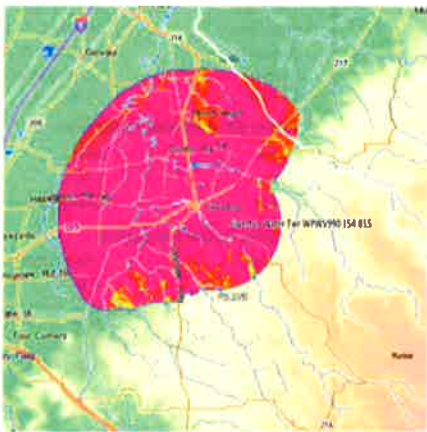
### Site Properties

Frequency	154.815 MHz
Modulation	FM 2.5kHz
Callsign	WPWV990
ERP	25
Latitude	44-59-38.8 N
Longitude	122-45-57.3 W
GE-AMSL	178 m

### TX Antenna Properties

Height	41.1 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	219.1 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.815 MHz
Modulation	FM 5kHz
Latitude	44-59-38.8 N
Longitude	122-45-57.3 W
GE-AMSL	178 m

### Fixed RX Antenna Properties

Height	41 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.815 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	***
Minimum HAAT	***

# St Paul City Hall

## Talk Out Matrix



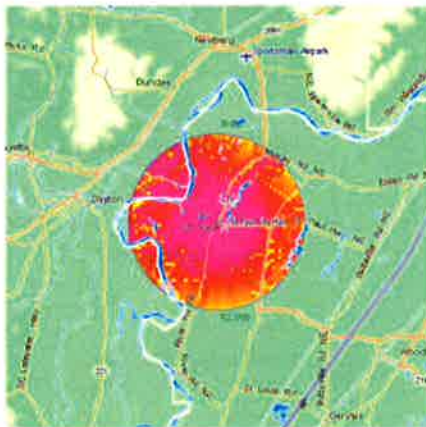
### Site Properties

Frequency	153 MHz
Modulation	FM 5kHz
Callsign	
ERP	25
Latitude	45-12-39.3 N
Longitude	122-58-37.0 W
GE-AMSL	50 m

### TX Antenna Properties

Height	12 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	62 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5kHz
Latitude	45-12-39.3 N
Longitude	122-58-37.0 W
GE-AMSL	50 m

### Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

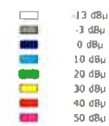
### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].

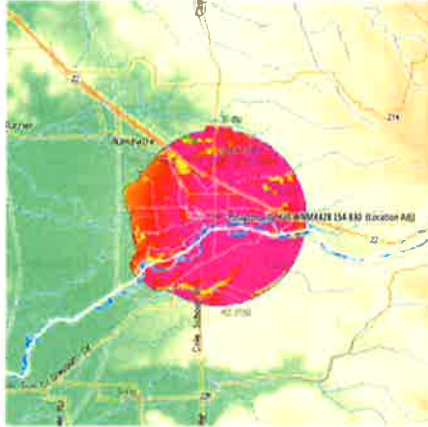


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	---
Minimum HAAT	---

# Stayton City Hall WNMX428 154.830 (Location Adj)

## Talk Out Matrix



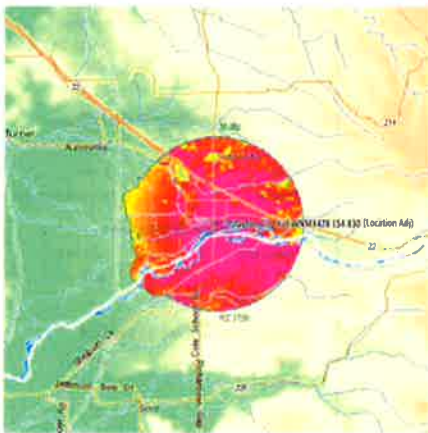
### Site Properties

Frequency	154.83 MHz
Modulation	FM 5kHz
Callsign	WNMX428
ERP	25
Latitude	44-47-51.4 N
Longitude	122-47-31.2 W
GE-AMSL	132 m

### TX Antenna Properties

Height	12 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	144 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.83 MHz
Modulation	FM 5kHz
Latitude	44-47-51.4 N
Longitude	122-47-31.2 W
GE-AMSL	132 m

### Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.83 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].

White	1.3 dBu
Light Blue	3 dBu
Blue	6 dBu
Light Green	10 dBu
Green	20 dBu
Yellow	30 dBu
Orange	40 dBu
Red	50 dBu

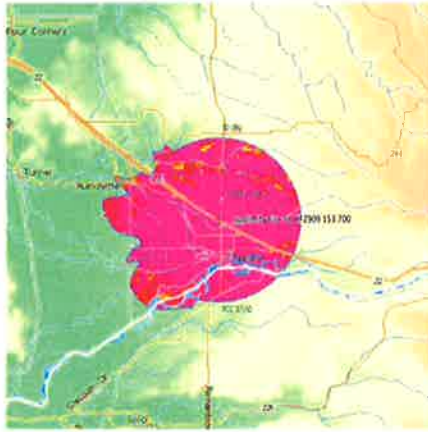
### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	---
Minimum HAAT	---



# Sublimity Fire St. KFZ909 153.700

## Talk Out Matrix



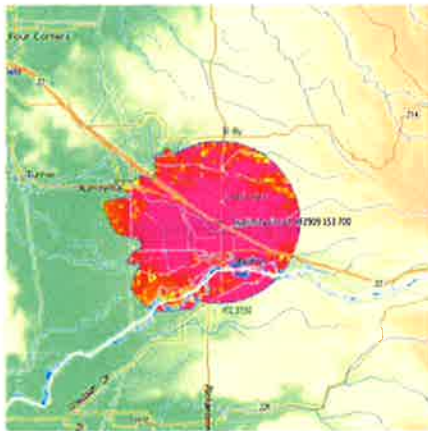
## Site Properties

Frequency	153.7 MHz
Modulation	FM 2.5kHz
Callsign	KFZ909
ERP	25
Latitude	44-49-06.4 N
Longitude	122-47-44.3 W
GE-AMSL	152 m

## TX Antenna Properties

Height	12 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	164 m

## Talk Back Matrix



## Fixed RX Radio Properties

Frequency	153.7 MHz
Modulation	FM 5kHz
Latitude	44-49-06.4 N
Longitude	122-47-44.3 W
GE-AMSL	152 m

## Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

## Mobile Radio Properties

Frequency	153.7 MHz
ERP	2 W
Modulation	

## Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

## Kilometers



Greater than or equal to [value].



## Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	---
Minimum HAAT	---

# Turner Water Twr WNMN401 154.415

## Talk Out Matrix



## Site Properties

Frequency	154.415 MHz
Modulation	FM 2.5kHz
Call sign	WNMN401
ERP	25
Latitude	44-45-26.4 N
Longitude	122-57-33.0 W
GE-AMSL	212.4 m

## TX Antenna Properties

Height	24.4 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	236.8 m

## Talk Back Matrix



## Fixed RX Radio Properties

Frequency	154.415 MHz
Modulation	FM 5kHz
Latitude	44-45-26.4 N
Longitude	122-57-33.0 W
GE-AMSL	212.4 m

## Fixed RX Antenna Properties

Height	24 m
Gain	6 dB
Pattern	Omnidirectional

## Mobile Radio Properties

Frequency	154.415 MHz
ERP	2 W
Modulation	

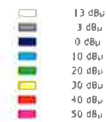
## Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

## Kilometers



Greater than or equal to [value].

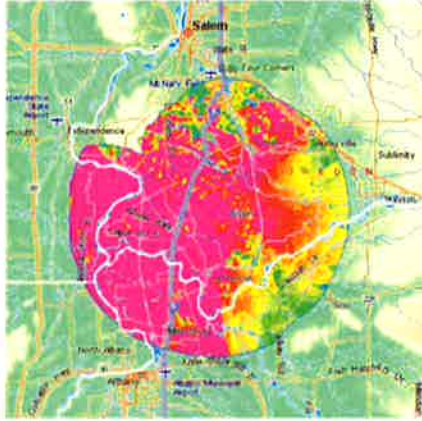


## Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	Urban
Minimum HAAT	100

# Wipper

## Talk Out Matrix



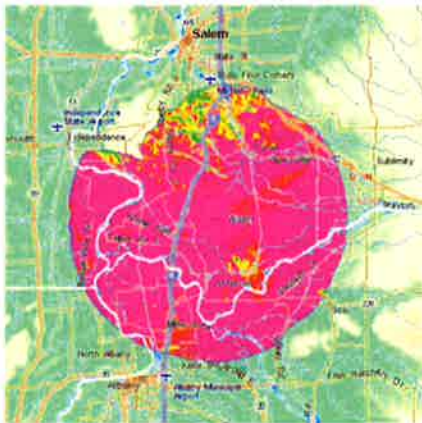
### Site Properties

Frequency	153 MHz
Modulation	FM 5kHz
Callsgn	
ERP	25
Latitude	44-46-58.4 N
Longitude	122-59-48.6 W
GE-AMSL	286 m

### TX Antenna Properties

Height	30 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	316 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	153 MHz
Modulation	FM 5kHz
Latitude	44-46-58.4 N
Longitude	122-59-48.6 W
GE-AMSL	286 m

### Fixed RX Antenna Properties

Height	30 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	153 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
0 5 10 15 20 25 30

Greater than  
or equal to  
[value].

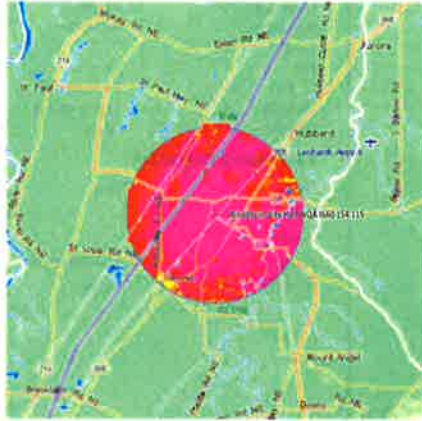


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	...
Minimum HAAT	...

# Woodburn City Hall WQAR660 154.115

## Talk Out Matrix



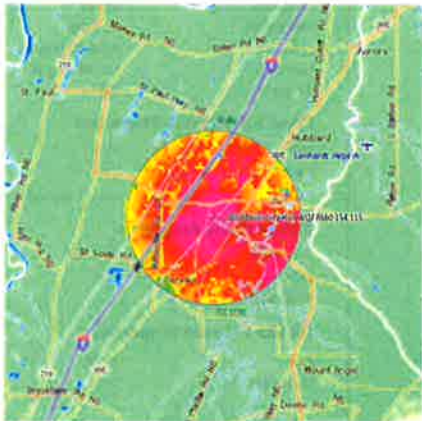
### Site Properties

Frequency	154.115 MHz
Modulation	FM 2.5kHz
Callsign	WQAR660
ERP	25
Latitude	45-08-34.4 N
Longitude	122-51-28.3 W
GE-AMSL	55.8 m

### TX Antenna Properties

Height	10.6 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	66.4 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.115 MHz
Modulation	FM 5kHz
Latitude	45-08-34.4 N
Longitude	122-51-28.3 W
GE-AMSL	55.8 m

### Fixed RX Antenna Properties

Height	10.6 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.115 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].

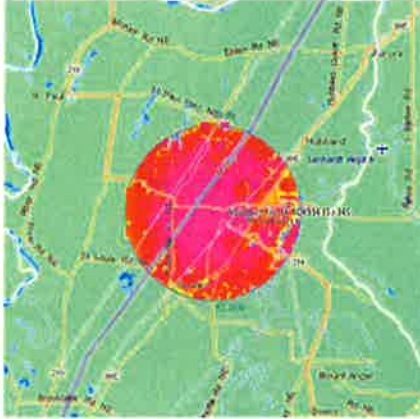


### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	Continental/Temperate
Environment	***
Minimum HAAT	***

# Woodburn Fire St. KOK934 159.345

## Talk Out Matrix



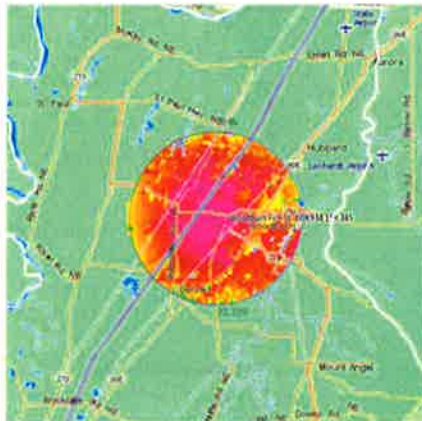
### Site Properties

Frequency	159.345 MHz
Modulation	FM 5KHz
Callsign	KOK934
ERP	25
Latitude	45-08-52.4 N
Longitude	122-52-03.3 W
GE-AMSL	55 m

### TX Antenna Properties

Height	12 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	62 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	159.345 MHz
Modulation	FM 5KHz
Latitude	45-08-52.4 N
Longitude	122-52-03.3 W
GE-AMSL	55 m

### Fixed RX Antenna Properties

Height	12 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	159.345 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers

Greater than  
or equal to  
[value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

# Woodburn PD KOH484 155.130

## Talk Out Matrix



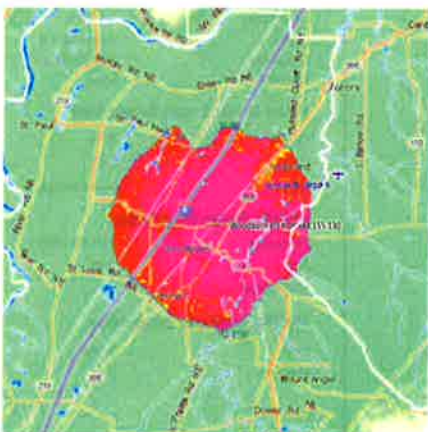
### Site Properties

Frequency	155.13 MHz
Modulation	FM 2.5kHz
Callsgn	KOH484
ERP	25
Latitude	45-09-03.3 N
Longitude	122-50-36.7 W
GE-AMSL	58 m

### TX Antenna Properties

Height	42.7 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	100.7 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	155.13 MHz
Modulation	FM 5kHz
Latitude	45-09-03.3 N
Longitude	122-50-36.7 W
GE-AMSL	58 m

### Fixed RX Antenna Properties

Height	42 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	155.13 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

Kilometers  
11.00 22.00 33.00 44.00

Greater than  
or equal to  
[value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	...
Minimum HAAT	...

# Woodburn Water Twr KUZ849 154.980

## Talk Out Matrix



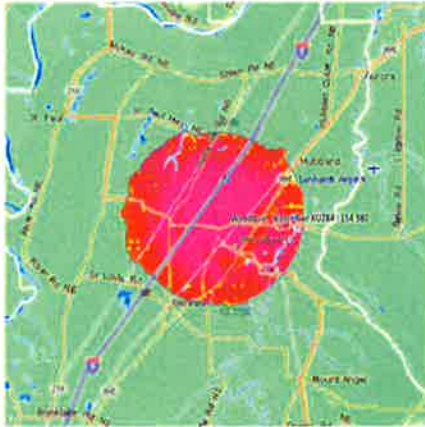
### Site Properties

Frequency	154.98 MHz
Modulation	FM 2.5kHz
Callsgn	KUZ849
ERP	25
Latitude	45-09-17.2 N
Longitude	122-51-40.3 W
GE-AMSL	57.3 m

### TX Antenna Properties

Height	24.4 m
Make	
Model	
Pattern	Omnidirectional
RC-AMSL	81.7 m

## Talk Back Matrix



### Fixed RX Radio Properties

Frequency	154.98 MHz
Modulation	FM 5kHz
Latitude	45-09-17.2 N
Longitude	122-51-40.3 W
GE-AMSL	57.3 m

### Fixed RX Antenna Properties

Height	24 m
Gain	6 dB
Pattern	Omnidirectional

### Mobile Radio Properties

Frequency	154.98 MHz
ERP	2 W
Modulation	

### Mobile Antenna Properties

Gain	0 dBd
Height AGL	2 m

### Kilometers



Greater than or equal to [value].



### Propagation Properties

Propagation Model	Longley Rice
Time Variability %	50
Confidence %	50
Location Variability %	0
Dielectric Constant	15
Climate Type	ContinentalTemperate
Environment	---
Minimum HAAT	---

