

**NOTICE/AGENDA OF PUBLIC MEETING
PIMA COUNTY WIRELESS INTEGRATED NETWORK
BOARD OF DIRECTORS MEETING
November 19, 2015**

Pursuant to A.R.S. § 38-431.02, notice is hereby given to the members of the **PIMA COUNTY WIRELESS INTEGRATED NETWORK (PCWIN) BOARD OF DIRECTORS** and to the general public that the Board of Directors will hold a meeting on **Thursday, November 19, 2015 beginning at 9:00 a.m.** The meeting will be held at the Pima Emergency Communications Operations Center (PECOC), 3434 E. 22nd Street, Tucson, Arizona.

The Pima Communications & Operations Center endeavors to ensure all persons with disabilities accessibility to meetings. Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, by contacting Nicole Burdette at (520) 724-9320. Requests should be made as early as possible to allow time to arrange the accommodation.

- I. CALL TO ORDER AND ROLL CALL** Chairman
- II. APPROVAL OF MINUTE SUMMARY** Chairman
Motion
- Review, discussion, and approval of the Minute Summary from the August 27, 2015 Board Meeting.
- III. EXECUTIVE DIRECTOR'S REPORT** John Voorhees
Information and
Direction to Staff
- The Executive Director will brief the Board on the following topics:
- A. SPECIAL REVENUE FUND UPDATE**
Pima County Finance will brief the Board on the FY 15/16 Special Revenue Fund 1st quarter.
- B. PCWIN STATUS UPDATE**
The Board will be briefed on the progress of the working groups and pertinent network activities.
1. OWG Update
 2. TWG Update
 3. Network Update
- C. INTEROPERABILITY UPDATE**
The Board will be briefed on interoperability discussions in the OWG and Subcommittee Working Group.
- The Executive Director will brief the Board on the FirstNet Federal Consultation that occurred on September 29, 2015.
- IV. FY 16/17 SPECIAL REVENUE FUND DRAFT BUDGET PROPOSAL** John Voorhees
Motion
- The Executive Committee has approved and recommended the FY 16/17 budget to the Board for consideration. This budget provides a one-time contribution to an Infrastructure Replacement Fund and leaves subscriber rates steady in FY 16/17. The Executive Director will recommend approval of the budget.

V. NETWORK CAPACITY DISCUSSION

John Voorhees
**Information and
Direction to Staff**

The North Simulcast has ample capacity during normal operations. However, in a “busy day, busy hour” scenario it is possible that the required grade of service would be exceeded. The Executive Committee has requested the Executive Director examine ways to mitigate risk to grade of service on the North Simulcast. The Executive Director will provide an overview of the discussion to date.

VI. SAFER-C GATEWAY REQUEST

John Voorhees
**Information &
Possible Action**

The Board will review SAFER-C’s request for a Conventional Channel Gateway. SAFER-C will provide a concept of operations and the Executive Director will include pertinent data related to network impact should the concept of operations be approved.

VII. MEMBERSHIP AND PARTICIPANT UPDATE

John Voorhees
Motion

The Executive Director will provide an overview and seek approval of new member applications for participation in PCWIN:

- A. Nursewise – Has taken over responsibility for Mobile Acute Crisis Care from Pasadera Behavioral Health. They have applied for status as an Interoperability Participant.
- B. Pinal County Sheriff’s Department – Applied for status as an Interoperability Participant requesting access to COMMONs 9-16.
- C. Southern Arizona V.A. Healthcare System – Applied for status as an Emergency Medical Service Participant.

VIII. EXECUTIVE COMMITTEE NEW MEMBER

John Voorhees
Motion

The Executive Director will seek approval for the nomination of Assistant Chief Carla Johnson as the new member of the Executive Committee.

IX. EXECUTIVE COMMITTEE & BOARD OF DIRECTORS MEETING SCHEDULE FOR 2016

John Voorhees
Motion

The Board will be asked to approve the Executive Director’s proposed meeting schedule for 2016.

X. NEW BUSINESS – ITEMS FOR FUTURE BOD AGENDAS

John Voorhees
Information

Members may propose agenda items for future Board of Directors Meetings.

XI. CALL TO THE PUBLIC

Those wishing to address the Board need not request permission in advance. Action taken as a result of public comment will be limited to directing staff to study the matter or rescheduling the matter for further consideration and decision at a later date.

John Voorhees
**Information and
Direction to Staff**

XII. DATE/TIME/LOCATION OF BOARD OF DIRECTORS MEETINGS

The next Board of Directors meeting is tentatively scheduled for Thursday, February 18, 2016. The meeting will begin at 9:00 a.m., and held at the Pima Emergency Communications Operations Center, 3434 E. 22nd Street, Tucson, AZ, Conference Room 308.

Board
**Information and
Direction to Staff**

XIII. ADJOURNMENT

A copy of the agenda background material provided to the Board of Directors is available for public inspection at the PCWIN Administrative Office, Pima Emergency Communications & Operations Center or call (520) 724-9320.

Board
Motion

**PIMA COUNTY WIRELESS INTEGRATED NETWORK
(PCWIN)
BOARD OF DIRECTORS MEETING**

Pima Emergency Communications Operations Center
3434 E. 22nd Street
Thursday, August 27, 2015

SUMMARY OF MEETING

I. CALL TO ORDER AND ROLL CALL
Chief Doug Chappell, Drexel Heights Fire District

Chief Chappell called the meeting to order at 9:05 am. Roll call was executed by Nicole Burdette, PCWIN Administration.

Members Present

Drexel Heights Fire District, Chief Doug Chappell (Chair)
Oro Valley Police Department, Chief Daniel Sharp (Vice Chair)
City of Tucson Representative, Ron Lewis
Corona de Tucson Fire District, Assistant Chief Frank Mehay
Golder Ranch Fire District, Assistant Chief Patrick Abel
Green Valley Fire District, Chief Chuck Wunder (Telephonic)
Mountain Vista Fire District, Chief Darin Reid
Pascua Yaqui Tribe, Chief Andre Matus
PCWIN Executive Director, John Voorhees (Non-Voting)
Pima County Representative, Jan Leshner
Rincon Valley Fire District, Chief Jayme Kahle
University of Arizona Police Department, Assistant Chief Keith Brittain

Members Absent

Avra Valley Fire District
City of South Tucson Police Department
Northwest Fire District
Picture Rocks Fire District
Pima Community College DPS
Sahuarita Police Department
Sabino Vista Fire District
Tanque Verde Valley Fire District
Three Points Fire District
Tucson Country Club Estates Fire District

Participating Attendees:

Rick Brown, PCWIN Wireless Services, Chairman, Technical Working Group
Captain Fred Bair, Tucson Fire Department, Vice Chairman, Operations Working Group
Anthony Casella, Pima County Information Technology
Paul Guerrero, Pima County Finance

II. APPROVAL OF MEETING SUMMARY
Chief Doug Chappell, Drexel Heights Fire District

The Chairman called for comments on the May 28, 2015 Board Meeting Summary and heard none. It was moved by Chief Kahle, seconded by Chief Sharp and unanimously carried to approve the Minute Summary.

III. EXECUTIVE DIRECTOR'S REPORT
Mr. John Voorhees, PCWIN Executive Director

A. SPECIAL REVENUE FUND UPDATE

Mr. Paul Guerrero, Pima County Finance, presented the Special Revenue Fund Report for FY 14/15, period ending June 30, 2015. Reports presented were unaudited.

Key elements of the report:

- Total Assets – \$1.684M
- Total Liabilities – \$176,000
- Revenue – \$2.672M
 - Primarily from charges for services
- Expenditures – \$1.774M
 - Most significant were employee compensation, county overhead, payment to other governments, and repair and maintenance.
- Income – approximately \$900,000
- Fund balance – \$1.408M
 - Combination of beginning fund balance and end-of-year balance.

This was the first full year of operation for the Special Revenue Fund; it was over budget in revenue and under budget in expenditures. Audited reports would be available in October.

Discussion and Comments:

Mr. Lewis asked if expenditures for repair and maintenance would increase in coming fiscal years and Mr. Voorhees replied that he expected these expenses to increase and normalize around \$250,000 annually. The repair and maintenance estimate was based on costs experienced by other county operated systems, but because this was a new system, and there was warranty coverage, expenses were less than anticipated. Next year's repair and maintenance costs would remain low and the budget would be adjusted accordingly.

Mr. Lewis inquired about the methodology for allocating county overhead costs. Mr. Guerrero explained that this expense included the cost of support from Human Resources, Procurement, County Attorney's Office, Finance, etc. The costs allocated in FY 15/16 came from FY 13/14 audited numbers and were based on the expenditures of the departments. Finance looked for direct ways to allocate overhead to the departments; for example, the number of warrants issued, number of deposits made, bank activity, etc.

Chief Kahle expressed concern about rolling over 50% of the budget and asked if there would be a significant roll-over next year. He also asked if the budget was high in order to modulate the fee structure. Mr. Voorhees replied that some of it was to modulate the fees and some of it was the unpredictability of expenses. Chief Chappell added that the goal during the first year, while still under warranty, was to build the required 12.5% fund balance.

Mr. Guerrero suggested that the Board consider a policy establishing a fund balance as a percentage of expenditures or revenues.

Options for Special Revenue Fund Balance

Mr. Voorhees presented four options for the remaining fund balance of \$1.4M.

The options presented made the following assumptions:

- Annual fees would consistently rise over the next five years as programmed.
- Spending would remain at budgeted amount.
- No major network expansions.

The only real constraint was the requirement to maintain a 12.5% fund balance. The Board also authorized keeping an additional \$100,000 in the fund for latency in the accounting system. For the current year, a fund balance of \$485,099 would be maintained, leaving almost \$1M of uncommitted funds.

Possible Uses:

- Coverage remediation: Phase II of the PCWIN bond set aside \$680,000 for coverage remediation, however, the availability of those funds was unknown. This year's projected expenses for the bond funds was about \$500,000.
- Network backhaul replacement: Some network components were approaching end-of-life. A strategic plan for network replacement would be needed.
- Stabilize annual fees.
- Purchase other equipment/features (e.g. data services, GPS).

Mr. Voorhees advised that the Executive Committee was briefed on these options and had suggestions on how to strategize the long term fund balance apportionment. However, there was no data to support a specific strategic or systemic savings plan.

Four plausible courses of action:

1. Maintain the current fund balance.
2. Establish an Infrastructure Replacement Fund. Per the Business Plan, this fund was to be established during the first year of operations and continually contributed to.
3. Stabilize or reduce fees for FY16/17.
4. Blend of options above.

Mr. Voorhees presented a Power Point showing the approved FY15/16 budget and how the various options would affect the fund balance. He advised the Board that he was not seeking a vote but rather direction to staff.

Option 1: Maintain the current fund balance:

- Cash balance would remain substantial but would slowly atrophy over the next couple of years.
- A significant cash balance would be maintained.

Option 2: Establish Infrastructure Replacement Fund:

- Executive Committee favored this option but made no formal recommendations pending a strategic spending plan.
- Assumed setting aside \$600,000.
- Maintained predicted cash balance.

Option 3: Reduced Rates

- Reduced the rate of increase.
- Kept rates steady through FY 16/17.
- Still heavy on cash balance.
- With adjustments for maintenance costs, fees may be reduced further.

Option 4: Blended Solution

- Smaller amount to replacement fund.
- Kept rates steady for a year or so.

Mr. Voorhees concluded his presentation and noted that the Executive Committee weighed in heavily on Option 2 but wanted to see a systematic method of savings over time. Mr. Voorhees would work on developing a plan to replace the network infrastructure and the percentage of contributions that should be made to the fund.

Discussion and Comments:

Mr. Lewis stated that he supported the replacement fund allocation and recommended that the working groups provide projections over the next five years and beyond to include life expectancy of equipment and costs.

Mr. Voorhees explained that PCWIN rides on both county and city networks. Both agencies were discussing a plan to work in parallel to update the network technology, and that plan would impact PCWIN. Until a plan was developed, it would be difficult to make decisions.

Chief Chappell added that the fund was not established in the early years because the warranty and low maintenance costs would allow a fund balance to be built. Monthly subscriber fees would have been much higher if the fund was established in the first year.

Chief Kahle stated that these funds should to be restricted in some way. He added that he was in favor of upgrades and the creation of a replacement fund, but stressed that the needs should be identified first.

Mr. Voorhees confirmed that, based on the comments, it was reasonable to consider the infrastructure replacement fund and research the more strategic aspect of saving over time for subsequent budget allocations.

B. OPERATIONS WORKING GROUP (OWG) & TECHNICAL WORKING GROUP (TWG) UPDATES

Mr. Voorhees asked the Chairs of the OWG and TWG to give their respective reports.

OWG Update

Captain Fred Bair, Tucson Fire Department, OWG Vice Chairman

- Emergency Continuity of Operations Policy and Procedure were approved.
- Adding/Changing Radio and Console IDs Procedure was approved.
- Membership application for DMAFB was approved.
- Discussions about interoperability solutions were on-going.
- Network Managing Member measures of effectiveness: Members suggested reports on the number of repeat incidents and turnaround times on work orders.
- AzFirstNet was discussed.
- Coverage remediation concerns were reviewed.

Mr. Voorhees added the following:

Regarding interoperability solutions, the OWG determined that the best course of action would be to add all NIFOG frequencies to a VHF zone. They looked at using legacy systems but preferred to use frequencies that agencies already had programmed. If technically feasible, low cost or no cost solutions would be put in service and connected via gateway.

The Executive Committee tasked the working groups to develop measures to determine the effectiveness of the maintenance providers since the Motorola warranty had expired. The working groups were looking at statistics and higher level reporting that could be presented to the Executive Committee to demonstrate that the maintenance providers were effective at doing their jobs and meeting subscriber needs.

TWG Update

Mr. Rick Brown, Pima County Wireless Services, TWG Chairman

- Process and procedures for rebanding were discussed.
- Continue to discuss technical control procedure to improve communications.
- Reviewed Encryption Management Procedure and user guide for the same.
- Discussed reporting on Network Managing Member measures of effectiveness. Sample reports will be provided at the next Board meeting.

Mr. Brown confirmed that he would review potential impacts to the system as a result of adding VHF frequencies.

C. PCWIN STATUS UPDATE

Mr. Rick Brown, Pima County Wireless Services

Rebanding

- Started on July 28th and is scheduled to continue through December 2015.
- To date, approximately 1800 radios have been rebanded (mobiles and portables).
- 80 plus locations around the county will be visited in the next 3 months.
- Mr. Brown thanks the agencies for their cooperation during this challenging process.

Mr. Brown introduced Maria Zepeda, new administrative assistant for Wireless Services.

Coverage Remediation

Mr. Voorhees referred members to the coverage remediation spreadsheet. He noted that the Executive Committee requested an update on the concerns but there were no updates at that time. He had since been informed that Dietrich De Boer, Wireless Services, had already researched most of the concerns. Mr. De Boer's observations were noted on the spreadsheet.

As Mr. De Boer documented, many of these issues were related to programming. For example, TPD was having issues on the northwest side because they were taken of the North Simulcast. Rebanding and user preference would resolve most of these issues. Other issues were related to user error.

Hospitals and the University of Arizona remained a coverage concern. The county administrator requested that private agencies be engaged first to determine if they had the funds and means available to resolve coverage concerns in accordance with building and fire code. If that was not feasible and the building was of high interest to the community, staff would come to the Board for permission to expend funds from the bond or Special Revenue Fund.

IV. PINAL COUNTY INTEROPERABILITY

Mr. John Voorhees, PCWIN Executive Director

Mr. Voorhees and Mr. Brown recently met with Pinal County IT and Sheriff's Communications to discuss interoperability solutions as Pinal County prepared to implement their own trunked radio system. They issued an RFP to build a 700 MHz digitally trunked TDMA system specifically for the Pinal County Sheriff. The RFP included a request for an ISSI connection to PCWIN for interoperability. Input on the RFP was anticipated in September.

In anticipation of the new system and interoperability with PCWIN, they purchased a large number of dual band radios and submitted an application for interoperability on the COMMONS which would be vetted by the working groups in September.

Chief Sharp thanked Mr. Voorhees for his continued work with Pinal County, adding that this was very important to the agencies in the northern parts of the county.

V. SITE SECURITY CAMERA UPDATE
Mr. Anthony Casella, Pima County Information Technology

Mr. Casella reported that after much research on the various options it was decided to install 29 cameras at 21 sites, both indoors and outdoors, with video coming back to a central location. The only difference with this option versus recording local at the site was a yearly recurring charge. This cost was necessary because the video would traverse the network and space would be needed to store the video for one week.

He referred members to the two spreadsheets provided. One listed all the sites and quantity of cameras along with the kind of equipment at the sites; and the other was a breakdown of the costs of the system. There was approximately \$35,000 for recurring costs which, spread across 7800 radios, equated to a 23 cent increase per radio, per year. The one time capital expense of \$163,000 was previously approved by the Board but current cost estimates for cameras and equipment were approximately \$120,000.

The Executive Committee recommended approval of the recurring cost and if approved by the Board, IT would start with a pilot at one remote key site to determine performance before expending the full amount.

Mr. Voorhees pointed out that when the bond expenditure was approved by the Board, it was not known how the storage or transport of the camera imagery would take place but it was assumed that imagery could be stored on site; however, that did not meet Pima County IT standards. Therefore, it was recommended that imagery be transported back to a central storage location.

Ms. Leshar asked if the Executive Committee recommended the bond expenditure or the recurring fee. Mr. Voorhees clarified that the Executive Committee approved expending the bond money, as well as the recurring annual cost.

Mr. Voorhees advised the Board that this was an item for possible action.

Motion: It was moved by Mr. Lewis and seconded by Chief Sharp to adopt the Committees' recommendation. Upon further discussion, the item was re-opened.

Chief Sharp clarified that subscriber fees would not be increased as a result of the security cameras. The cost would be included as a line item in the preliminary budget, at which time he expected more discussion and the results of the pilot program.

Chief Reid asked if using one network connection or a broadcast would reduce costs and Mr. Casella replied that connectivity was not an issue; the issue was bringing back that much bandwidth across the network. This option also allowed the flexibility to view camera footage at dispatch sites.

Chief Kahle expressed concern about the recurring charge and asked if third party storage options were considered. Mr. Voorhees responded that only county options were explored.

Mr. Casella added that the county would not allow third parties on the network for security reasons. Because the cameras would not be manned by staff, the video feed needed to be stored. Pima County Network Operations Center would monitor for alarms and correlate with the video as necessary. For that to work, the video needed to travel on the network. The annual fee was a combination of: individual network connections (port charges), charges for any kind of data riding on the network, and the amount of storage.

Chief Chappell called for a vote. Chief Kahle voted nay. Motion passed.

VI. AGENCY HANDBOOK UPDATE
Mr. John Voorhees, PCWIN Executive Director

106-D Emergency Continuity of Operations Policy

This policy identified the roles and responsibilities of key PCWIN staff during a system outage.

Ultimately, it was the responsibility of the Network Managing Member to report and remediate system failures affecting end-users. It was also expected that county and city maintenance providers would do their best to allocate resources as required to restore the system to full operations.

The Executive Committee requested additional language stating that any existing IGAs or MOUs would still hold preference.

Motion: It was moved by Chief Sharp, seconded by Ms. Leshner and carried unanimously to adopt the Emergency Continuity of Operations Policy.

VII. MEMBERSHIP AND PARTICIPANT UPDATE
Mr. John Voorhees, PCWIN Executive Director

Davis Monthan Air Force Base (DMAFB) submitted an application for interoperability participation. Several options for linking the two systems were explored, including gateways, but PCWIN did not conform to the same federal guidelines for information assurance.

DMAFB elected to purchase their own radios and become interoperability participants. They specifically needed interoperability with Tucson Fire and Police because those agencies had jurisdiction on the base over civilian matters. Interoperability was also important for communication in real time in the event of a large scale incident.

The application requested the operation of 27 radios, but the current request was for 22. Mr. Voorhees recommended authorization for the 27 radios to accommodate any future expansion. This also dovetailed off an MOU between the base and the City of Tucson for mutual aid and incident management.

Motion: It was moved by Chief Matus, seconded by Chief Kahle and unanimously carried to approve the Davis Monthan Air Force Base application for participation as an interoperability participant with 27 radios on the network as requested on the application.

Tucson Airport Authority: Mr. Voorhees reported that this application was still pending. The CEO was requesting more information mostly related to finances.

Northwest and Golder Ranch Fire Districts Request for Gateway Connection:

Mr. Voorhees referred the members to the memo submitted jointly by the fire districts stating their intent to purchase a significant amount of radios to increase their participation on PCWIN. Golder Ranch was intending to purchase 31 radios bringing their total up to 62. Northwest Fire had already purchased 45 radios and would purchase additional radios to bring their total to 104 radios.

With this memo came the request for a gateway connection for their VHF system for interoperability and mutual aid concerns. A gateway connection would also allow communications in the far reaches of the CON for Golder Ranch.

The Executive Committee had requested data on system usage but the VHF system was not monitored to that level. Data might be available from the few months they were connected to PCWIN during cut-over but that was not confirmed.

Mr. Voorhees noted that PCWIN was currently working at 29 to 31% of capacity on the North Simulcast. In addition, user site preference was now being manipulated, so capacity shouldn't be an issue. There would, however, need to be site restrictions at Bigelow and Lemmon due to limited capacity.

Mr. Voorhees added that the system was designed with the intent for the northwest fire districts to be operating on it, so it was unlikely that putting subscriber units on now would cause any problems. More information would be presented in November.

Mr. Voorhees noted that this item was not for a motion but open for discussion.

Discussion and Comments:

Chief Kahle asked if the VHF gateway would be available throughout the system. Mr. Voorhees responded that, to the extent talk groups are allowed to connect to PCWIN, it was available. It might be possible to control how many talk groups were connected and thereby control the resources. Northwest Fire was looking for full connection so they could operate without having to carry two different radios.

Chief Kahle stated that his agency had the same need. They border against three other agencies that were all on the VHF band, so they also had to carry two radios; therefore, they were not receiving the full economic advantage of PCWIN. It would be extremely valuable to the agency to have the VHF gateway as well.

Mr. Voorhees replied that this would establish precedence and other agencies could make a similar case. This was one of the reasons that the working groups were researching the NIFOG channels as a way to increase interoperability with neighboring counties and agencies. Golder Ranch's concern was different in that PCWIN didn't cover their whole CON.

Chief Kahle commented that the system was designed for interoperability and this was a step in the right direction.

Assistant Chief Hamblen added that precedence for gateway use by fire departments had already been set. It would be required for house package alerting in the same manner as Tucson Fire currently used.

Chief Wunder asked if there were any other concerns.

Mr. Voorhees replied that to his knowledge there were no other technical considerations. The only concern might be capacity if other legacy systems were connected to PCWIN; however, that was unlikely to happen given the way PCWIN was configured.

Mr. Voorhees added that Golder Ranch and Northwest Fire were well vested in supporting the operations and maintenance of the PCWIN system. That was a concern before, but was no longer the case; therefore, there was no compelling reason to oppose the request other than doing due diligence in researching the impact it would have on system capacity.

Chief Wunder concurred and stated that he supported their request for a gateway connection.

Chief Chappell stated that the Board would wait for the Executive Committee to make a recommendation.

VIII. NEW BUSINESS – ITEMS FOR FUTURE BOD AGENDAS

Chief Chappell referred to the Board for new business. The following items were noted:

Mr. Voorhees requested to add the AzFirstNet update to the agenda so he could brief the Board on the Federal consultation scheduled in September.

Chief Sharp confirmed that the FY 16/17 budget would be included in the agenda.

Chief Kahle requested staff to research new digital paging technology to determine if it would be feasible to implement into PCWIN.

IX. CALL TO THE PUBLIC

Chief Chappell asked if anyone in the audience wanted to address the Board. No one appeared.

X. DATE-TIME-LOCATION OF NEXT BOARD OF DIRECTORS' MEETING

The next Board of Directors meeting was scheduled for **Thursday, November 19, 2015**. The meeting would begin **at 9:00 a.m.**, and held at the Pima Emergency Communications Operations Center, 3434 E. 22nd Street, Tucson, AZ, Conference Room 308.

XI. ADJOURNMENT

Motion: It was moved by Chief Sharp, seconded by Chief Matus and unanimously carried to adjourn the meeting. 10:25 am

DEPARTMENT INFORMATION PACKET

Office of Emergency Management

FUND 2101

BUREAU B242

Period 4 Ending October 31, 2015

Office of Emergency Management

FUND 2101

BUREAU B242

TABLE OF CONTENTS

1	MONTHLY FINANCIAL SUMMARY	EXHIBIT 1
2	MONTHLY BUDGET TO ACTUAL SUMMARY	EXHIBIT 2
3	MONTHLY BUREAU REVENUE FORECAST	EXHIBIT 3
4	MONTHLY BUREAU EXPENDITURE FORECAST	EXHIBIT 4

Office of Emergency Management
 Monthly Financial Summary
 B242 OEM Radio System SRF - Fund 2101
 B265 IT Radio System - Fixed Network Equipment (Personnel Only) - Fund 2101
 FOR PERIOD ENDING October 31, 2015

	FY15/16 YTD	FY15/16 Adopted Budget	FY15/16 Revised Budget	Forecast	Variance (Revised vs. Forecast)
Revenue	\$ 1,447,095	\$ 2,847,427	\$ 2,847,427	\$ 2,907,702	\$ 60,275
Expenditures					
Personnel Services*	324,930	1,165,551	1,165,551	980,910	184,641
Operating Expenditures	219,979	1,894,825	1,894,825	1,826,477	68,348
Capital Equipment	-	-	-	-	-
Total Expenditures	544,909	3,060,376	3,060,376	2,807,387	252,989
Operating Transfers In					
Operating Transfers In	-	-	-	-	-
Total Operating Transfers In	-	-	-	-	-
Operating Transfers Out					
Operating Transfers Out	-	-	-	-	-
Total Operating Transfers Out	-	-	-	-	-
Net Fund Impact	902,186	(212,949)	(212,949)	100,315	313,264

*Personnel Services is a combination of B242 and B265.

Office of Emergency Management
 Monthly Budget to Actual Summary
 B242 OEM Radio System SRF - Fund 2101
 FOR PERIOD ENDING October 31, 2015

Expenditures by Unit	FY15/16 YTD	FY15/16 Adopted Budget	FY15/16 Revised Budget	% of Budget Spent	Target	Budget less YTD Actuals
<u>Unit 0876 - Radio System</u>						
Personnel Services	\$ 83,088	\$ 278,248	\$ 278,248	30%	33%	\$ 195,160
Operating Expenditures	219,979	1,894,825	1,894,825	12%	33%	1,674,846
Capital Equipment >\$5,000	-	-	-	0%	0%	-
Unit 0876 Total	303,067	2,173,073	2,173,073	14%	33%	1,870,006
<u>Unit 2330 - Fixed Network Equipment - Radio System</u>						
Personnel Services	241,842	887,303	887,303	27%	33%	645,461
Operating Expenditures	-	-	-	0%	0%	-
Capital Equipment >\$5,000	-	-	-	0%	0%	-
Unit 2330 Total	241,842	887,303	887,303	27%	33%	645,461
<u>Office of Emergency Management Fund 2101</u>						
Personnel Services	324,930	1,165,551	1,165,551	28%	33%	840,621
Operating Expenditures	219,979	1,894,825	1,894,825	12%	33%	1,674,846
Capital Equipment >\$5,000	-	-	-	0%	0%	-
Office of Emergency Management Department Total	\$ 544,909	\$ 3,060,376	\$ 3,060,376	18%	33%	\$ 2,515,467

Office of Emergency Management
 Monthly Bureau Revenue Forecast
 B242 OEM Radio System SRF - Fund 2101
 FOR PERIOD ENDING October 31, 2015

Revenue Source Code - Name	FY14/15 Actuals	July	Aug	Sep	Oct	FY15/16 YTD	FY15/16 Adopted Budget	FY15/16 Revised Budget	Forecast	Variance (Revised vs. Forecast)
4200 - General Government Fees	\$ 1,490,136	\$406,593	\$392,634	\$ 495	\$ 13,068	\$ 812,790	\$ 1,591,920	\$ 1,591,920	\$ 1,625,976	\$ 34,056
4247 - Interdepartmental Revenue	1,120,185	301,554	-	-	301,554	603,108	1,189,188	1,189,188	1,206,216	17,028
4400 - Rent and Royalties	55,481	12,251	6,174	6,254	3,810	28,489	63,916	63,916	64,680	764
4401 - Sales Tax Collect- Rental Prop	(0)	-	-	-	-	-	-	-	-	-
4404 - Other Misc Revenue - Operating	196	-	-	-	-	-	-	-	-	-
4407 - Int. Rev-Pooled Inv. - Operating	5,963	-	-	1,853	854	2,708	2,403	2,403	10,830	8,427
4415 - Late Fees and Interest Charges on Overdue Receivable	660	-	-	-	-	-	-	-	-	-
TOTAL REVENUES	\$ 2,672,622	\$720,398	\$398,808	\$ 8,603	\$ 319,286	\$1,447,095	\$ 2,847,427	\$ 2,847,427	\$ 2,907,702	\$ 60,275
4702 - Transfer-in from General Fund	1,248	-	-	-	-	-	-	-	-	-
TOTAL OPERATING TRANSFERS IN	1,248	-	-	-	-	-	-	-	-	-
TOTAL REVENUES AND OPERATING TRANSFERS IN	\$ 2,673,870	\$720,398	\$398,808	\$ 8,603	\$ 319,286	\$1,447,095	\$ 2,847,427	\$ 2,847,427	\$ 2,907,702	\$ 60,275

Office of Emergency Management
 Monthly Bureau Expenditure Forecast
 B242 OEM Radio System SRF - Fund 2101
 FOR PERIOD ENDING October 31, 2015

Object Codes	FY14/15 Actuals	July	Aug	Sep	Oct	FY15/16 YTD	FY15/16 Straightline Projection	Encumbrances	FY15/16 YTD Obligations	FY15/16 Adopted Budget	FY15/16 Revised Budget	Forecast	Variance (Revised vs. Forecast)
Personnel Services													
5400 - Salaries & Wages	\$ 148,341	\$ 13,278	\$ 12,448	\$ 13,147	\$ 13,147	\$ 52,021	\$ 156,062	\$ -	\$ 52,021	\$ 150,102	\$ 150,102	\$ 154,808	\$ (4,706)
5409 - Social Security & Medicare	11,615	1,000	939	1,062	963	3,964	11,893	-	3,964	11,483	11,483	11,681	(198)
5410 - Unemployment Insurance	218	13	13	13	13	53	158	-	53	153	153	158	(5)
5411 - Health Insurance Premiums	12,157	1,763	711	745	745	3,964	11,891	-	3,964	6,045	6,045	6,045	-
5412 - Workers Compensation	340	31	29	30	30	120	359	-	120	345	345	356	(11)
5413 - Life Insurance	120	6	5	6	6	23	68	-	23	128	128	128	-
5416 - Arizona State Retirement	17,460	1,530	1,428	1,508	1,508	5,974	17,923	-	5,974	17,217	17,217	17,764	(547)
5422 - Dental Insurance Premiums	160	4	4	4	4	17	50	-	17	55	55	55	-
5423 - Interdepartmental Salaries - Charged out	(14,026)	-	-	-	-	-	-	-	-	-	-	-	-
5424 - Interdepartmental Salaries - Charged in	3,354	2,814	4,838	1,338	2,486	11,476	34,427	-	11,476	62,860	62,860	39,557	23,303
5426 - Interdepartmental Fringe - Charged in	1,280	1,181	1,655	655	1,169	4,660	13,979	-	4,660	26,940	26,940	15,360	11,580
5428 - Intra departmental Fringe - Charged in	5,090	30	28	28	36	122	366	-	122	217	217	217	-
5430 - Intra departmental Salaries - Charged in	16,473	171	160	161	203	696	2,088	-	696	2,703	2,703	2,703	-
5441 - Vacation Payout	4,165	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL PERSONNEL SERVICES	206,746	21,822	22,258	18,698	20,310	83,088	249,265	-	83,088	278,248	278,248	248,832	29,416
Operating Expenses													
5000 - Office Supplies	3,871	-	-	108	-	108	325	61	169	10,000	10,000	10,000	-
5003 - Food Supplies	100	-	-	-	-	-	-	-	-	500	500	500	-
5007 - Fuel & Oil	-	-	-	-	-	-	-	-	-	1,000	1,000	1,000	-
5008 - Books, Subscriptions, & Videos	-	-	-	-	-	-	-	-	-	1,500	1,500	1,500	-
5010 - Repair & Maintenance Supplies	27,805	-	466	13,798	7,424	21,687	65,062	16,811	38,498	240,615	240,615	138,800	101,815
5018 - Other Operation Supplies	3,888	-	-	225	-	225	675	-	225	15,000	15,000	15,000	-
5020 - Tools & Equip Under \$1,000	1,859	-	-	511	-	511	1,532	-	511	20,000	20,000	19,137	863
5021 - Furniture Under \$1,000	-	-	-	863	-	863	2,590	-	863	-	-	863	(863)
5121 - Accounting and Auditing Services	12,000	-	-	-	3,500	3,500	10,500	500	4,000	6,000	6,000	6,000	-
5125 - Software Maintenance and Support	32,171	-	-	26,916	-	26,916	80,749	-	26,916	35,000	35,000	35,000	-
5138 - In State Training	4,255	-	-	-	30	30	90	-	30	-	-	250	(250)
5139 - Out of State Training	-	-	-	-	194	194	582	-	194	5,500	5,500	5,250	250
5140 - In State Travel	12	-	-	-	-	-	-	-	-	5,500	5,500	4,571	929
5141 - Out of State Travel	-	-	-	-	929	929	2,787	-	929	-	-	929	(929)
5142 - Postage & Freight	59	-	536	-	-	536	1,608	-	536	5,000	5,000	2,144	2,856
5143 - Printing & Microfilming	1,119	-	-	-	-	-	-	-	-	1,000	1,000	1,000	-

Office of Emergency Management
 Monthly Bureau Expenditure Forecast
 B242 OEM Radio System SRF - Fund 2101
 FOR PERIOD ENDING October 31, 2015

Object Codes	FY14/15 Actuals	July	Aug	Sep	Oct	FY15/16 YTD	FY15/16 Straightline Projection	Encumbrances	FY15/16 YTD Obligations	FY15/16 Adopted Budget	FY15/16 Revised Budget	Forecast	Variance (Revised vs. Forecast)
5147 - Leases & Rentals	94,284	-	-	-	-	-	-	30,000	30,000	-	-	-	-
5148 - Leases & Rentals - Real Estate	-	27,603	6,823	9,223	6,823	50,472	151,416	30,398	80,870	112,044	112,044	110,520	1,524
5149 - R&M Machinery & Equipment Svcs	6,658	3	4,979	3,816	1,731	10,529	31,586	70,294	80,823	885,655	885,655	1,111,833	(226,178)
5152 - Other Professional Services	15,510	-	-	-	-	-	-	15	15	-	-	15	(15)
5162 - Advertising	928	-	-	-	-	-	-	-	-	1,000	1,000	1,000	-
5203 - Interdepartmental Supplies & Services - Charged in	563	652	138	413	810	2,012	6,036	-	2,012	-	-	10,000	(10,000)
5206 - County Administrative Overhead	190,721	13,048	13,048	13,048	13,048	52,194	156,581	-	52,194	156,581	156,581	156,581	-
5300 - Telephone & Internet	29,466	3,560	1,964	2,490	1,945	9,957	29,872	-	9,957	58,080	58,080	58,080	-
5301 - Electricity	42,735	4,181	3,854	4,013	5,313	17,361	52,083	1,284	18,645	71,200	71,200	53,870	17,330
5306 - Motor Pool Charges	50,406	4,237	4,200	4,195	4,190	16,822	50,466	-	16,822	54,528	54,528	54,528	-
5309 - Dues and Memberships	-	-	-	-	-	-	-	-	-	1,200	1,200	1,200	-
5312 - Other Miscellaneous Charges	840	70	-	140	-	210	630	-	210	840	840	840	-
5314 - Payments To Governments	181,016	-	-	-	-	-	-	190,000	190,000	181,016	181,016	-	181,016
5318 - General Liability Insurance Premiums	13,860	-	-	-	-	-	-	-	-	-	-	-	-
5319 - Property Damage Insurance Premiums	140	-	-	-	-	-	-	-	-	-	-	-	-
5351 - Computer Hardware - ISF Charges	-	-	-	-	3,102	3,102	9,306	-	3,102	18,606	18,606	18,606	-
5353 - Software - ISF Charges	-	455	455	455	455	1,820	5,460	-	1,820	5,460	5,460	5,460	-
5504 - Office Machines & Computers - Non-Capital	416	-	-	-	-	-	-	-	-	1,000	1,000	1,000	-
5508 - Other Machines & Equipment - Non-Capital	15,223	-	-	-	-	-	-	-	-	1,000	1,000	1,000	-
TOTAL OPERATING EXPENDITURES	729,904	53,809	36,462	80,214	49,494	219,979	659,937	339,363	559,342	1,894,825	1,894,825	1,826,477	68,348
Capital Equipment >\$5,000													
SUB TOTAL EXPENDITURES	\$ 936,650	\$ 75,630	\$ 58,721	\$ 98,912	\$ 69,804	\$ 303,067	\$ 909,201	\$ 339,363	\$ 642,430	\$ 2,173,073	\$ 2,173,073	\$ 2,075,309	\$ 97,764
Transfers Out													
Contra Assets													
Depreciation													
TOTAL EXPENDITURES AND OPERATING TRANSFERS OUT	\$ 936,650	\$ 75,630	\$ 58,721	\$ 98,912	\$ 69,804	\$ 303,067	\$ 909,201	\$ 339,363	\$ 642,430	\$ 2,173,073	\$ 2,173,073	\$ 2,075,309	\$ 97,764

Information Technology
 Monthly Bureau Expenditure Forecast
 B265 Radio System - Fixed Network Equipment
 FOR PERIOD ENDING October 31, 2015

Object Codes	FY14/15 Actuals	July	Aug	Sep	Oct	FY15/16 YTD	FY15/16 Straightline Projection	Encumbrances	FY15/16 YTD Obligations	FY15/16 Adopted Budget	FY15/16 Revised Budget	Forecast	Variance (Revised vs. Forecast)
Personnel Services													
5400 - Salaries & Wages	\$ 615,954	\$ 57,690	\$ 52,910	\$ 55,048	\$ 48,133	\$ 213,781	\$ 641,344	\$ -	\$ 213,781	\$ 670,835	\$ 670,835	\$ 656,579	\$ 14,256
5409 - Social Security & Medicare	45,517	4,308	3,952	4,645	3,385	16,290	48,869	-	16,290	51,319	51,319	49,652	1,667
5410 - Unemployment Insurance	860	57	54	63	46	220	660	-	220	685	685	685	-
5411 - Health Insurance Premiums	71,506	10,215	4,762	7,501	4,488	26,965	80,896	-	26,965	84,671	84,671	83,004	1,667
5412 - Workers Compensation	1,345	133	122	141	104	500	1,501	-	500	1,543	1,543	1,543	-
5413 - Life Insurance	538	27	26	28	25	106	318	-	106	640	640	640	-
5414 - Employer Paid Benefit Fees	-	-	-	-	-	-	-	-	-	36	36	36	-
5416 - Arizona State Retirement	70,696	6,649	6,069	6,314	5,521	24,552	73,657	-	24,552	76,945	76,945	75,278	1,667
5422 - Dental Insurance Premiums	527	45	41	49	42	177	531	-	177	629	629	629	-
5423 - Interdepartmental Salaries - Charged out	49,381	-	-	-	-	-	-	-	-	-	-	-	-
5424 - Interdepartmental Salaries - Charged in	514	-	-	-	-	-	-	-	-	-	-	-	-
5425 - Interdepartmental Fringe - Charged out	16,279	-	-	-	-	-	-	-	-	-	-	-	-
5426 - Interdepartmental Fringe - Charged in	101	-	-	-	-	-	-	-	-	-	-	-	-
5427 - Intra departmental Fringe - Charged out	(20,673)	(1,381)	(2,427)	(2,335)	(3,170)	(9,313)	(27,939)	-	(9,313)	-	-	(34,491)	34,491
5428 - Intra departmental Fringe - Charged in	11,826	-	-	-	-	-	-	-	-	-	-	-	-
5429 - Intra departmental Salaries - Charged out	(60,865)	(4,932)	(9,386)	(8,899)	(11,803)	(35,020)	(105,059)	-	(35,020)	-	-	(105,059)	105,059
5430 - Intra departmental Salaries - Charged in	35,986	-	-	-	-	-	-	-	-	-	-	-	-
5441 - Vacation Payout	1,809	-	-	6,448	(2,866)	3,582	10,747	-	3,582	-	-	3,582	(3,582)
TOTAL PERSONNEL SERVICES	841,301	72,811	56,123	69,003	43,905	241,842	725,525	-	241,842	887,303	887,303	732,078	155,225
Operating Expenses													
Capital Equipment >\$5,000													
SUB TOTAL EXPENDITURES	\$ 841,301	\$ 72,811	\$ 56,123	\$ 69,003	\$ 43,905	\$ 241,842	\$ 725,525	\$ -	\$ 241,842	\$ 887,303	\$ 887,303	\$ 732,078	\$ 155,225
Contra Assets													
Depreciation													
Transfers Out													
TOTAL EXPENDITURES AND OPERATING TRANSFERS OUT	\$ 841,301	\$ 72,811	\$ 56,123	\$ 69,003	\$ 43,905	\$ 241,842	\$ 725,525	\$ -	\$ 241,842	\$ 887,303	\$ 887,303	\$ 732,078	\$ 155,225

FY16-2017 BUDGET STATEMENT FORM

Organization: B242 & B265
Fund: 2101
PCWIN Special Revenue Fund

Single Contribution to Infrastructure
Replacement Fund

	FY2014-15 Actuals	FY2015-16 Revised Budget	FY2015-16 Forecast	FY2016-17 Requested	FY2017-18 Forecasted	FY2018-19 Forecasted	FY2019-20 Forecasted	FY2020-21 Forecasted
FULL TIME EQUIVALENT - FTE	-	12	12	12	12	12	12	12
REVENUES								
4200 4200 - GEN GOV FEES	1,490,136	1,591,920	1,625,976	1,629,936	1,679,328	1,728,720	1,827,504	1,876,896
4247 4247 - INTER DEPT REV	1,120,185	1,189,188	1,206,216	1,206,216	1,242,768	1,279,320	1,352,424	1,388,976
4400 4400 - RENT & ROYALTIES	55,481	63,916	64,962	66,131	67,326	68,546	69,793	71,067
4404 4404 - MISC REV OPR	197	-	-	-	-	-	-	-
4407 4407 - INT POOL OPR	5,963	2,403	11,121	5,180	4,849	4,619	4,732	4,538
4415 4415 - LATE INTRST FEE	660	-	-	-	-	-	-	-
4702 4702 - TRFR IN GEN FND	1,248	-	-	-	-	-	-	-
TOTAL REVENUE	2,673,870	2,847,427	2,908,275	2,907,463	2,994,271	3,081,205	3,254,453	3,341,477
EXPENSES								
5000 5000 - OFFICE SUPPLIES	3,871	10,000	10,000	5,000	5,000	5,000	5,000	5,000
5003 5003 - FOOD SUPPLIES	100	500	500	500	500	500	500	500
5007 5007 - FUEL & OIL	-	1,000	1,000	2,500	2,575	2,652	2,732	2,814
5008 5008 - BKS SBSCPTN VDS	-	1,500	1,500	1,500	1,500	1,500	1,500	1,500
5010 5010 - R & M SUPPLIES	27,805	240,615	138,800	120,000	132,000	145,200	159,720	175,692
5018 5018 - OTH OPER SUP	3,889	15,000	15,000	5,000	5,000	5,000	5,000	5,000
5020 5020 - TOOLS & EQ<1000	1,859	20,000	19,137	5,000	5,500	6,050	6,655	7,321
5021 5021 - FURNITURE<1000	-	-	863	-	-	-	-	-
5121 5121 - ACCNTG & AUDT	12,000	6,000	6,000	12,000	12,000	13,000	14,000	15,000
5125 5125 - SFTWR MNT & SFP	32,170	35,000	35,000	35,000	35,000	35,000	35,000	35,000
5138 5138 - TRAINING IN AZ	4,255	-	250	5,000	5,000	5,000	5,000	5,000
5139 5139 - OUT AZ TRAINING	-	5,500	5,500	-	-	-	-	-
5140 5140 - TRAVEL IN AZ	12	5,500	250	250	275	303	333	366
5141 5141 - OUT AZ TRAVEL	-	-	1,000	5,000	5,000	5,000	5,000	5,000
5142 5142 - POSTAGE & FRGHT	59	5,000	2,144	2,200	2,200	2,200	2,200	2,200
5143 5143 - PRNTG & MICRFLM	1,119	1,000	1,000	1,000	1,000	1,000	1,000	1,000
5148 5148 - RENT - REAL EST	94,284	112,044	110,520	116,438	117,288	118,165	119,068	119,998
5148 ARIVACA - ASLD	-	2,400	2,400	2,400	2,400	2,400	2,400	2,400
5148 BEACON - Crown Castle	-	11,802	11,802	12,156	12,520	12,896	13,283	13,681
5148 BIGELOW - SAT	-	15,735	15,735	16,207	16,693	17,194	17,710	18,241
5148 CONFIDENCE - TEP	-	5,000	5,000	5,000	5,000	5,000	5,000	5,000
5148 HAYSTACK - ASLD	-	1,800	2,400	2,400	2,400	2,400	2,400	2,400
5148 KEYSTONE - AZ DPS	-	10,000	4,356	4,356	4,356	4,356	4,356	4,356
5148 LEMMON - AZ DPS	-	4,356	4,356	4,356	4,356	4,356	4,356	4,356
5148 MILDRED - ASLD	-	2,400	3,400	2,400	2,400	2,400	2,400	2,400
5148 PECOC - Pima County	-	16,091	16,091	16,091	16,091	16,091	16,091	16,091
5148 RVFD - Rincon Valley Fire District	-	12,000	14,520	14,520	14,520	14,520	14,520	14,520
5148 MISSION ROAD - Pima County	-	30,460	30,460	36,552	36,552	36,552	36,552	36,552
5149 5149 - R & M MACH & EQ	187,674	885,655	1,076,833	1,199,398	1,205,914	1,022,908	1,067,719	1,083,752
5149 Motorola SUA II	-	617,816	617,816	683,136	687,244	691,781	696,407	701,196
5149 Motorola LMR Tech Support	-	119,500	119,500	120,695	121,902	123,121	128,046	133,168
5149 NICE Audio Logging Service	-	86,238	86,238	86,238	86,238	86,238	120,224	125,033
5149 Consultation Expense (T&M)	-	28,000	28,000	28,000	28,000	28,000	28,000	28,000
5149 Logicial Microwave Maintenance	-	-	-	16,000	16,000	16,000	16,000	16,000
5149 Test Equipment Repair	-	7,500	7,500	7,500	7,500	7,500	7,500	7,500
5149 Facilities Site Maintenance (Contracted Labor)	-	-	-	40,050	41,252	42,489	43,764	45,077
5149 Netclock Maintenance	-	865	865	865	865	865	865	865
5149 Toshiba Copier	-	1,178	1,178	1,178	1,178	1,178	1,178	1,178
5149 CoT Smartnet CTM (IGA)	-	2,587	2,587	2,587	2,587	2,587	2,587	2,587
5149 CoT Sonet (IGA)	-	23,149	23,149	23,149	23,149	23,149	23,149	23,149
5149 CoT Network Sharing (IGA)	-	-	190,000	190,000	190,000	190,000	190,000	190,000
5152 5152 - NON MED PRO SRV	15,510	-	15	-	-	-	-	-
5162 5162 - ADVERTISING	928	1,000	1,000	1,000	1,000	1,000	1,000	1,000
5203 5203 - INTER SPL SV DR	562	-	10,000	10,850	11,176	11,511	11,856	12,212
5206 5206 - ADMIN OH	190,721	156,581	156,581	190,000	199,500	209,475	219,949	230,946
5300 5300 - PHONE INTERNET	29,465	58,080	58,080	92,005	93,038	94,101	95,197	96,326
5300 PCITD Port Charges	-	15,912	15,912	15,912	15,912	15,912	15,912	15,912
5300 Security Camera Port Charges/Storage	-	-	-	34,425	35,458	36,521	37,617	38,746
5300 Pima County Smartnet	-	25,468	25,468	25,468	25,468	25,468	25,468	25,468
5300 Long Distance	-	500	500	-	-	-	-	-
5300 Cell Phone w/data	-	16,200	16,200	16,200	16,200	16,200	16,200	16,200
5301 5301 - ELECTRICITY	42,735	71,200	50,470	55,517	58,293	61,207	64,268	67,481
5301 BEACON - Crown Castle	-	8,000	3,650	4,015	-	-	-	-
5301 BIGELOW - SAT	-	6,000	1,440	1,584	-	-	-	-
5301 EAGLE	-	12,500	8,360	9,196	-	-	-	-
5301 KEYSTONE - AZ DPS	-	3,600	-	-	-	-	-	-
5301 LEMMON - AZ DPS	-	3,600	-	-	-	-	-	-
5301 RVFD - Rincon Valley Fire District	-	12,500	8,040	8,844	-	-	-	-
5301 SWAN	-	12,500	11,880	13,068	-	-	-	-
5301 TUMAMOC - AZ Public Media	-	12,500	17,100	18,810	-	-	-	-
5306 5306 - MOTOR POOL CHG	50,406	54,528	54,528	57,254	60,117	63,123	66,279	69,593
5309 5309 - DUES MEMBERSHPS	-	1,200	1,200	1,000	1,000	1,000	1,000	1,000
5312 5312 - MISC CHARGES	840	840	840	840	840	840	840	840
5314 5314 - PMTS TO GOV	-	181,016	-	-	-	-	-	-
5318 5318 - GEN LIAB INS PR	13,860	-	-	13,860	14,276	14,704	15,145	15,600
5319 5319 - PROPRTY DMG INS	140	-	-	140	144	149	153	158
5351 5351 - ISFCOMPCHAR	-	18,606	18,606	19,000	19,570	20,157	20,762	21,385
5353 5353 - ISFSOFTWARE	-	5,460	5,460	5,500	5,665	5,835	6,010	6,190
5404 5404 - OFF MCH CMPT NC	416	1,000	1,000	1,000	500	500	500	500
5508 5508 - OTH EQUIP NC	15,224	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Subtotal Operating Expenses	729,904	1,894,825	1,784,077	1,964,752	2,001,870	2,043,080	2,124,386	2,179,372
PCWIN Admin								
5400 5400 - SALARY & WAGES	148,342	150,102	154,808	155,381	158,489	161,659	164,892	168,190
5409 5409 - FICA & MEDICARE	11,615	11,483	11,681	13,061	13,452	13,856	14,272	14,700
5410 5410 - UNEMPLOYMENT	217	153	158	163	168	173	179	184
5411 5411 - HLTH INS PREM	12,157	6,045	6,045	9,068	9,340	9,620	9,909	10,206
5412 5412 - WORKERS COMP	340	345	356	368	379	391	402	414
5413 5413 - LIFE INSURANCE	120	128	128	69	71	73	75	78
5416 5416 - RETR AZ ST	17,459	17,217	17,764	18,356	18,907	19,474	20,058	20,660
5422 5422 - DENTAL INS PREM	159	55	55	51	52	54	55	57
5423 5423 - INTER SALARY CR	(14,026)	-	-	-	-	-	-	-
5424 5424 - INTER SALARY DR	3,354	62,860	39,557	45,542	47,819	50,210	52,720	55,356
5426 5426 - INTER FRINGE DR	1,280	26,940	15,360	17,251	18,114	19,020	19,971	20,969
5428 5428 - LDFRDR	5,091	217	217	-	-	-	-	-
5430 5430 - LDSALDR	16,472	2,703	2,703	-	-	-	-	-
5431 5431 - BUDGTD BENEFITS	-	-	-	-	-	-	-	-
5441 5441 - VACTN PAYOUT	4,165	-	-	-	-	-	-	-
Subtotal	206,745	278,248	248,833	259,311	266,792	274,530	282,533	290,814
Wireless Service								
5400 5400 - SALARY & WAGES	615,957	670,835	614,302	670,835	684,252	697,937	711,896	726,133
5409 5409 - FICA & MEDICARE	45,516	51,319	44,546	52,859	54,444	56,078	57,760	59,493
5410 5410 - UNEMPLOYMENT	859	685	685	706	727	749	771	794
5411 5411 - HLTH INS PREM	71,506	84,671	77,898	87,211	89,827	92,522	95,298	98,157
5412 5412 - WORKERS COMP	1,345	1,543	1,543	1,589	1,637	1,686	1,737	1,789
5413 5413 - LIFE INSURANCE	539	640	640	659	679	699	720	742
5414 5414 - EMPLYR PD BENFT	-	36	36	37	38	39	41	42
5416 5416 - RETR AZ ST	70,695	76,945	70,172	79,253	81,631	84,080	86,602	89,200
5422 5422 - DENTAL INS PREM	528	629	629	648	667	687	708	729
5423 5423 - INTER SALARY CR	49,381	-	-	-	-	-	-	-
5424 5424 - INTER SALARY DR	514	-	-	-	-	-	-	-
5425 5425 - INTER FRINGE CR	16,280	-	-	-	-	-	-	-
5426 5426 - INTER FRINGE DR	101	-	-	-	-	-	-	-
5427 5427 - LDFRCR	(20,674)	-						

	FY2014-15 Actuals	FY2015-16 Revised Budget	FY2015-16 Forecast	FY2016-17 Requested	FY2017-18 Forecasted	FY2018-19 Forecasted	FY2019-20 Forecasted	FY2020-21 Forecasted
5431 5431 - BUDGTD BENEFITS	-	-	-	-	-	-	-	-
5441 5441 - VACTN PAYOUT	1,809	-	6,448	-	-	-	-	-
Subtotal	841,302	887,303	693,545	893,797	913,903	934,477	955,532	977,079
Subtotal Personnel Services	1,048,047	1,165,551	942,378	1,153,108	1,180,695	1,209,007	1,238,066	1,267,894
TOTAL EXPENSE	1,777,951	3,060,376	2,726,454	3,117,860	3,182,565	3,252,087	3,362,451	3,447,266
OPERATING INCOME / LOSS	895,919	(212,949)	181,821	(210,396)	(188,295)	(170,882)	(107,999)	(105,789)
FUND IMPACT								
BEGINNING FUND BALANCE	508,371	1,403,815	1,403,815	1,285,636	1,075,240	886,945	716,063	608,065
CHANGE IN RESERVE FOR INVENTORY INFRASTRUCTURE REPLACEMENT FUND	(475)	-	(300,000)	-	-	-	-	-
ENDING FUND BALANCE	1,403,815	1,190,866	1,285,636	1,075,240	886,945	716,063	608,065	502,276
REQUIRED OPERATIONAL FUND BALANCE	222,244	382,547	340,807	389,732	397,821	406,511	420,306	430,908
PROJECTED ENDING FUND BALANCE AFTER RESERVE REQUIREMENT IS MET (UNRESERVED FUND BALANCE)	1,181,571	808,319	944,829	685,507	489,124	309,553	187,758	71,368
Annual Fee Rate			\$33	\$33	\$34	\$35	\$37	\$38

EC Recommended (Draft)

SAFER-C

Request to Increase Subscriber Quantities and Proposal to
Interconnect SAFER-C VHF Network with PCWIN via Conventional Channel Gateway

Busy Hour/Busy Day Traffic Capacity Analysis

Chief Paul Wilson, Vice Chair PCWIN Executive Committee

October 20, 2015

Introduction

The fire districts of the SAFER-C consortium have stated their intention to increase the number of subscribers operated on the PCWIN radio network and have submitted a proposal for consideration of the Executive Committee and Board of Directors to interconnect the SAFER-C VHF radio network with the PCWIN 800 MHz network via a conventional channel gateway.

To attempt to meet the requirement for an impact assessment in cases such as this, I have undertaken an effort to analyze the impact of the SAFER-C proposal on the PCWIN network. The results of the analysis indicate that PCWIN will be unable to maintain the desired grade of service during the Busy Hour/Busy Day with the current number of talk paths at NORTH SIMULCAST, KEYSTONE and BIGELOW. The results of the analysis also illustrate that without the additional SAFER-C traffic, there is still need for additional channels or implementation of additional talk group management options to achieve the desired GOS at these sites.

PCWIN IGA to Operate, Maintain, Sustain, Improve and Finance the PCWIN

PCWIN IGA Section 4.2.2.4 Existing Member Capacity and Coverage Upgrade, specifies Members requesting to increase the number of subscriber units, talkgroups, roaming profiles, or coverage individually or cumulatively, by more than ten percent (10%) will be subject to a special assessment to cover the cost of an Impact Assessment to determine impact of the request on the existing infrastructure and Members.

The Impact Assessment study is specified to determine the cost and benefits of the request and assess the impact on existing infrastructure including, but not limited to, controllers, base stations, facility capacity, traffic capacity, roaming capacity, microwave/fiber capacity, and overall coverage.

No one has directed the required Impact Assessment, therefore this analysis was undertaken to inform the work of the Executive Committee.

SAFERC Proposal

The SAFER-C agencies are requesting to interconnect a VHF radio network operated and maintained by SAFER-C to the PCWIN 800MHz radio network via a Conventional Channel Gateway (CCGW). SAFER-C requests to interconnect and permanently patch 2 VHF channels to 2 PCWIN talk groups. 1 VHF channel will be used to support wide area communications for dispatch and 1 VHF channel will be used to support emergency medical services. 3 additional VHF channels will be interconnected to the network for tactical hazard zone communications and would be patched on an as needed basis; 1 specifically supports communications in Pinal County. The dispatch patch will also support their fire station alerting systems which deliver audio and data control commands to the various fire stations.

SAFERC Concept of Operations

The Northwest and Golder Ranch Fire Districts intend to increase the number of PCWIN subscribers they operate to a level that will equip all of their in service apparatus and fire fighters to operate on the PCWIN network. The total increase is approximately 77 radios (56% increase). The Mountain Vista Fire District already possesses equipment that would allow its personnel to operate fully on the PCWIN network.

It is the intent of the Northwest, Golder Ranch and Mountain Vista Fire Districts that they will use the PCWIN network for a majority of their dispatch and routine communications in Pima County. However, the Golder Ranch Fire District has service areas in Pinal County which also require radio service coverage provided by the SAFER-C VHF network. They intend to operate on the VHF network when performing services in Pinal County. The VHF network would also continue to support communications for the Avra Valley Fire District in their service areas in Pinal County.

Additionally, the SAFER-C agencies intend to conduct hazard zone communications on the VHF network in Pima County as they do not have confidence in the performance of the PCWIN 800MHz system for in building coverage for hazard zone communications.

The Avra Valley, Picture Rocks and Three Points Fire Districts are unable to fully participate in PCWIN because of a lack of equipment and the recurring expense to do so. However, there remains an operational need for all of the SAFER-C agencies to be able to communicate with one another to support mutual aid and dispatch services. Patching the VHF channels to PCWIN talk groups would facilitate dispatch communications and would provide more dispatch console resources from which TFD can provide dispatch services, thereby maximizing staffing efficiencies for their operation.

Ownership and maintenance of the SAFER-C VHF network would continue to be the responsibility of the SAFER-C agencies. The PCWIN Network Managing Member and Maintenance Providers would gain responsibility for maintaining the link from the Control Channel Gateway into the PCWIN network and for troubleshooting problems when they arise.

A block diagram of the SAFER-C proposal is included in Attachment #1.

Traffic & Roaming Capacity

A key element in the overall design of a radio network is determination of the number of channels or talk paths required to meet a specified Grade of Service for the expected voice traffic load. **Grade of Service** is a system benchmark that provides a measure of a system's ability to provide a user access to a trunked system during the busiest hour. The mathematical model used to perform this calculation is termed "Erlang C," and involves a set of parameters estimated through statistical analysis. The goal should be to provide communications sites with an adequate number of channels to support **Busiest Hour/Busiest Day** traffic loads. This assessment is specific to the predicted busy hour (worst case scenario), not to other traffic load periods. PCWIN design specifications defined the Busiest Hour/Busiest Day as a condition when all subscriber units are simultaneously registered on the network. The goal was to maintain a high level of system performance when it is needed most.

The Erlang C methodology is described in greater detail in the article included in Attachment #2, *Ready, set calculate!*, Urgent Communications, April 1, 2001. An Erlang C calculator provided by the author of the article, Mark A. Gutowski is used for the analysis in this report.

For the purposes of this report, the capacity analysis is limited to the sites that provide coverage for the service area of the SAFER-C agencies which encompasses areas highlighted in Attachment #3 northwest, west and southwest of the Tucson metropolitan area, and north into Pinal County. The PCWIN communication sites that provide coverage for this service area are NORTH SIMULCAST, KEYSTONE, CONFIDENCE, GOLDBER, and BIGELOW. The North Simulcast cell is comprised of four sites: BEACON, WALKER, GEASA LIBRARY, and ORO VALLEY PD. For purposes of the analysis, the North Simulcast sites

are treated as one. Coverage maps illustrating mobile radio coverage for the affected sites are included in Attachment #4. Relevant site affiliation maps from the PCWIN Coverage Acceptance Tests validating the selection of sites for the target coverage area are included in Attachment #5.

Other factors that contribute to the use of radio channel resources also need to be considered.

The number of talk groups dictate the number of users that might simultaneously compete for channel resources to communicate on the network. This analysis only considers traffic loading on the primary talk groups where the majority of communications occur. A total of 21 departments operate within the same coverage area. Combined, they have several hundred talk groups. For example, the Northwest Fire District has 34 agency specific talk groups assigned. The agencies operating in the coverage area of study include (roamers not included):

- Northwest Fire District
- Golder Ranch Fire District
- Mountain Vista Fire District
- Picture Rocks Fire District
- Avra Valley Fire District
- Three Points Fire District
- Drexel Heights Fire District
- Green Valley Fire District
- Corona de Tucson Fire District
- Rincon Valley Fire District
- Arivaca Fire District
- Elephant Head Volunteer Fire Department
- Helmet Peak Fire Department
- Oro Valley Police Department
- Pima College Department of Public Safety
- Pima County Sheriff's Department
- Rural Metro
- Sahuarita Police Department
- Mt. Lemmon Fire Department
- Pascua Pueblo Fire Department
- Pascua Yaqui Police Department

Most agencies, including SAFER-C dispatch on a single dispatch talk group with wide area calling. The nature of wide area calling drives the assignment of system resources. For instance, we would expect the majority of PTTs from the SAFER-C agencies to come from the larger fire districts operating on the NORTH SIMULCAST cell, but one cannot correctly assume that the only channel resources that will be used to support the SAFER-C dispatch talk group are in the NORTH SIMULCAST cell. If just one user has a radio registered onto KEYSTONE or another of the high mountain sites to monitor SAFER-C dispatch traffic, the same channel usage will occur on each of those sites as well. This is likely to be a frequent occurrence. KEYSTONE is the preferred site for the Three Points Fire District and the topology of the service area will undoubtedly cause radios to roam to CONFIDENCE and GOLDER. BIGELOW is less likely to be used if the Golder Ranch Fire District refrains from using PCWIN resources when operating in Pinal County.

As the PCWIN subscribers are being reprogrammed, we are implementing new roaming parameters which attempt to manage traffic on the high mountain sites by steering radios to alternative sites with more channel resources. In the programming, individual radios are told to prefer or not prefer certain sites. Where a site is “preferred”, the radio will first look to operate on the designated site before roaming to another when travelling throughout the network service area. Conversely, when a radio begins to seek a site with better signal as it roams out of the coverage area of the current selection, it will first look for a site not marked as “least preferred”. This is a new strategy being employed to manage traffic across the network by steering it, where possible, to sites with more channel resources. However, this does not prohibit radios from roaming to the high mountain sites when there are no other sites with suitable signal strength. Because of the topology and geography of individual agency service areas, some are actually steered to the high mountain sites, and others will naturally roam to them because there is no other site available. It is therefore reasonable to assume that some percentage of users will always be making use of the high mountain sites, and that the wide area calling requirements for the vast majority of our dispatch talk groups will continue to dictate use of system resources from the high mountain sites. Distribution of traffic among the various sites is a subjective process. The analysis in this report attempts to reasonably distribute traffic as intended by the new roaming parameters.

The PCWIN User Site Preference Matrix is included as Attachment #6.

The goal of the analysis is to predict if a specified GOS can be maintained based on the conditions input. PCWIN design intent was to make sure that no more than one percent (1%) of push-to-talk attempts were queued because of a lack of channel resource, and those that were would receive a channel grant within one (1) second of being queued. Assuming this is still the desired grade of service, the input parameters are:

Delayed Call Grade of Service (GOS) Percent of PTTs that may expect to be queued.	1%
Maximum Call Delay PTTs that are queued will receive a channel grant within a specified period of time.	1 second
Average Call Length Actual PCWIN average from PCWIN Network Managing Member	8 seconds
Number of Calls Actual derived from July 2015 Monthly System Report ((Total PTTs/Total Member Radios)/4.5 Weeks)/40 Hrs. = 2.45 per Hour	2.45 calls/unit/hour

As noted above, PCWIN design specifications defined the busiest hour as all subscriber units simultaneously registered on the network. An exercise to identify the quantities of radios that might operate under these conditions within the coverage area of interest was undertaken. This involved identifying the PCWIN member agencies that operate within the coverage area, then estimating the quantity of their radios that would be distributed throughout the coverage area during the busy hour/busy day scenario. The estimates were reviewed by members of Pima County, City of Tucson and the SAFER-C agencies to verify validity of the assumptions. The radio quantities and site distribution are identified in the spreadsheets in Attachment #7.

Attachment #7 contains the results of two analysis using different input parameters for number of users.

Analysis #1 – All Subscribers in Coverage Area Registered on Network

This analysis is based on traffic loads expected from the definition of a Busy Hour/Busy Day described above; all radios simultaneously registered on the network. In this scenario, the analysis indicates that PCWIN **will be unable to maintain the desired grade of service during the Busy Hour/Busy Day with the current number of talk paths highlighted in Table 1.**

TABLE 1

Talk Paths	Grade of Service (1% or less desired)				
	NORTH	GOLDER	CONFIDENCE	KEYSTONE	BIGELOW
1	1209.9%	120.6%	199.6%	803.5%	160.4%
2	809.4%	39.5%	83.6%	504.2%	60.8%
3	526.0%	10.8%	30.7%	303.7%	19.8%
4	330.8%	2.5%	9.8%	174.6%	5.5%
5	200.4%	0.5%	2.7%	95.1%	1.3%
6	116.4%	0.1%	0.7%	48.9%	0.3%
7	64.5%	0.0%	0.1%	23.6%	0.0%
8	34.0%	0.0%	0.0%	10.6%	0.0%
9	16.9%	0.0%	0.0%	4.5%	0.0%
10	8.0%	0.0%	0.0%	1.7%	0.0%
11	3.5%	0.0%	0.0%	0.6%	0.0%
12	1.5%	0.0%	0.0%	0.2%	0.0%
13	0.6%	0.0%	0.0%	0.1%	0.0%

Note: Even without the addition of SAFER-C, the analysis suggests a need to evaluate need for additional channels or implementation of additional talk group management options to achieve the desired GOS at NORTH SIMULCAST, KEYSTONE and BIGELOW.

See the spreadsheets in Attachment #7 for more information.

Analysis #2 – Law Enforcement Radio Quantities Reduced by 50%

The second dataset analyzes traffic loads based on reduced quantities of law enforcement radios. These were reduced by half, assuming that during a busy hour/busy day scenario, the agencies would probably manage staff rest periods by going to 12 hour shifts. In this scenario, the analysis also indicates that PCWIN **will be unable to maintain the desired grade of service with the current number of talk paths highlighted in Table 2.**

TABLE 2

Talk Paths	Grade of Service (1% or less desired)				
	NORTH	GOLDER	CONFIDENCE	KEYSTONE	BIGELOW
1	787.7%	78.7%	109.3%	475.2%	95.1%
2	492.5%	20.0%	33.9%	266.4%	27.1%
3	295.4%	4.0%	8.7%	140.0%	6.3%
4	168.9%	0.7%	1.8%	68.4%	1.2%
5	91.5%	0.1%	0.3%	30.8%	0.2%
6	46.7%	0.0%	0.0%	12.7%	0.0%
7	22.3%	0.0%	0.0%	4.8%	0.0%
8	10.0%	0.0%	0.0%	1.7%	0.0%
9	4.1%	0.0%	0.0%	0.5%	0.0%
10	1.6%	0.0%	0.0%	0.2%	0.0%
11	0.6%	0.0%	0.0%	0.0%	0.0%
12	0.2%	0.0%	0.0%	0.0%	0.0%
13	0.1%	0.0%	0.0%	0.0%	0.0%

Note: Even without the addition of SAFER-C, the analysis suggests a need to evaluate need for additional channels or implementation of additional talk group management options to achieve the desired GOS at NORTH SIMULCAST, KEYSTONE and BIGELOW.

See the spreadsheets in Attachment #7 for more information.

Controllers

The SAFER-C proposal does not require additional controllers. The existing zone controllers are more than adequate to handle the network traffic from the additional subscribers.

Base Stations

SAFER-C does not propose adding base stations, although that may be necessary to support the PCWIN Grade of Service. Each of the affected sites are expandable as follows.

Site	Current Talk Paths	Expansion Capability
NORTH SIMULCAST	8	1 radio/2 talk paths w/o additional combining or antenna equipment
GOLDER	6	2 radios/4 talk paths w/o additional combining or antenna equipment
CONFIDENCE	6	2 radios/4 talk paths w/o additional combining or antenna equipment
KEYSTONE	8	1 radio/2 talk paths w/o additional combining or antenna equipment
BIGELOW	4	3 radios/6 talk paths w/o additional combining or antenna equipment

Facility Capacity

If a determination is made to add base stations at any of the affected sites, a review of available rack space, electric service and battery system capacity will have to be made at individual sites to determine if current facilities will support the additional equipment.

Microwave/Fiber Capacity

The SAFER-C VHF network includes a backhaul communications link to the Thomas Price Service Center (TOPSC). This link currently supports connectivity to the VHF network from the SAFER-C dispatch consoles. It is assumed no additional backhaul services to connect to the VHF network are needed.

PCWIN has established a backhaul link between the TOPSC and the Pima Emergency Communications & Operations Center (PECOC). This link carries voice traffic to the PCWIN network and the backup dispatch consoles at PECOC. The links are not currently active, but are in place and can be activated without substantial effort.

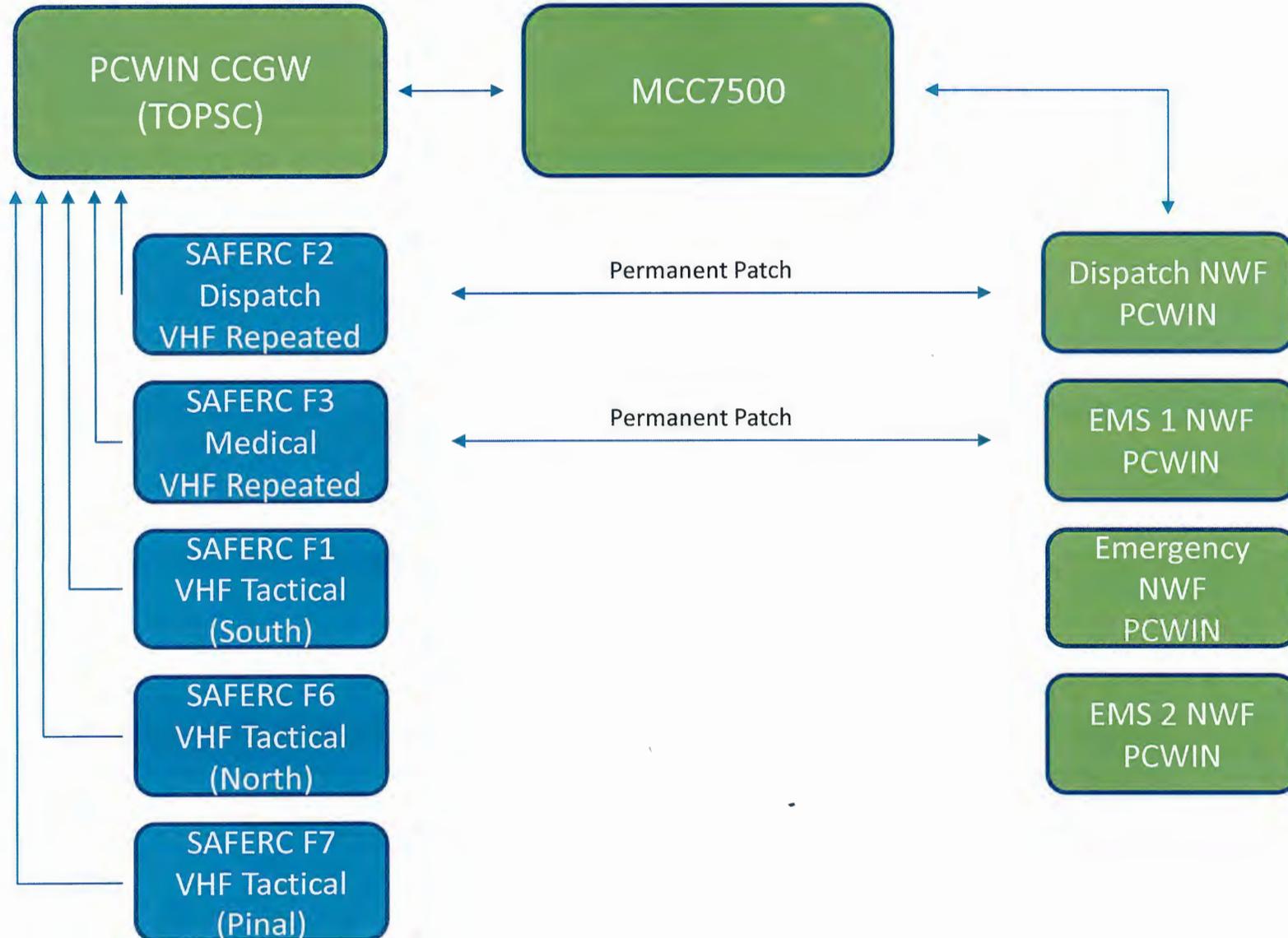
The Network Managing Member reports there is no need for additional microwave/fiber circuits to support the SAFER-C proposal.

Coverage

The SAFER-C proposal does not require any new coverage from the PCWIN network. There will be no impact.

ATTACHMENT #1

Proposed Conventional Channel Gateway Configuration for SAFERC



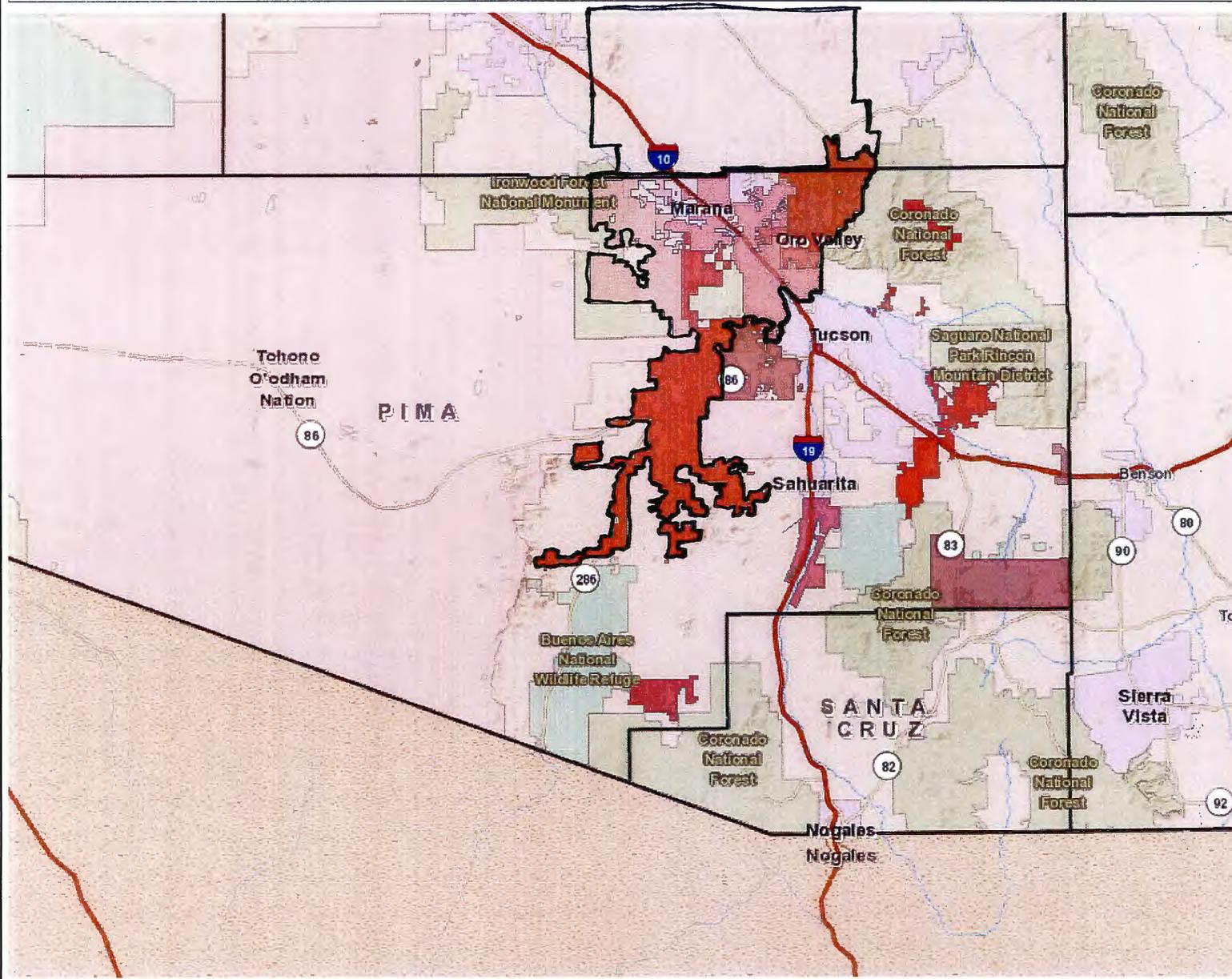
SAFERC Agency Call Numbers Annually

Northwest	13,751	43.0%
Golder Ranch	10,779	33.7%
Three Points	1,093	3.4%
Avra Valley	1,397	4.4%
Picture Rocks	1,130	3.5%
Mt Vista	3,847	12.0%
Total	31,997	100.00%

- Only working fires and areas not covered by PCWIN infrastructure would cause NWFD, GRFD, and MVFD to not use PCWIN Channels as a primary means of daily operations
- Working fires account for less than 1% of total call volume

ATTACHMENT #2

PimaMaps Print

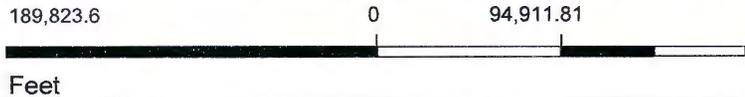


Legend

- Fire Taxation Districts**
- Arivaca
 - Avra Valley
 - Corona de Tucson
 - Drexel Heights
 - Golder Ranch
 - Green Valley
 - Hidden Valley
 - Mescal-J6
 - Mount Lemmon
 - Mountain Vista
 - Northwest
 - Picture Rocks
 - Rincon Valley
 - Sabino Vista
 - Sonoita Elgin
 - South Tucson
 - Tanque Verde
 - Three Points
 - Tucson
 - Tucson Country Club Estates
 - Why



Notes:



This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map are subject to Pima County's ITD GIS disclaimer and use restrictions.

10/7/2015

ATTACHMENT #3

[print](#) | [close](#)

Ready, set calculate!

[Urgent Communications](#)

Mark A. Gutowski

Sun, 2001-04-01 12:00

If you're involved in the design or support of land mobile radio systems, you've probably heard of the "three Cs": *coverage, capacity and cost*.

Designers typically try to meet coverage requirements by strategically locating sites, optimally specifying and configuring antenna systems, and controlling transmit power and other technical parameters.

System capacity, or the ability of the system to carry user messages, involves quite a different approach.

Of course, improving system coverage or capacity (or both) almost always increases system cost.

Whether you're evaluating a potential new trunked radio system, or operating an existing system, it's important to understand the basics of trunked system capacity.

In effectively forecasting requirements, your goal should be to provide your sites with an adequate number of channels to support peak user load. This will avoid user complaints about "not getting through" or "excessive queuing" and also allow for future expansion of your wireless network. An overall understanding of traffic planning and capacity modeling can also help identify factors that contribute to capacity problems on an existing system.

Basic concepts

Land-mobile radio systems rely on the concept of *trunking* to accommodate a large number of users with a small number of radio channels. It's similar to how a small number of telephone trunk lines connecting telephone central office switches can be shared by a large number of individual users.

System control logic differentiates various trunked system architectures. Two types of trunking include: dedicated control channel (*centralized* trunking) and subaudible signaling control (scan-based or *decentralized* trunking). Com-Net Ericsson's EDACS and Motorola's Smartnet systems use dedicated control channels. Systems using E.F. Johnson LTR technology use subaudible signaling.

In the dedicated control-channel architecture, when the user presses the push-to-talk button, his radio requests a *traffic channel* (or working channel) by sending a message on a control channel for the serving site. If all available traffic channels for this site are in use, the user is usually placed in a *queue* until a channel becomes available. In analyzing trunked system capacity, this queuing process is usually the limiting factor.

Trunking theory definitions

Trunking theory fundamentals are applied to capacity analysis using statistical tools created by A. K. Erlang, a 19th-century Danish mathematician. Today, the measure of traffic intensity bears his name.

One *Erlang* is defined as the amount of traffic intensity carried by a channel that is fully occupied. For example, a channel that is completely occupied for 15 minutes during an hour timeframe carries 0.25 Erlangs of traffic.

The *grade of service* is a common system benchmark that provides a measure of a system's ability to provide a user access to a trunked system during the busiest hour. The term *busy hour* refers to an arbitrary period but is important because it provides a worst-case result. The actual "busy hour" depends on your particular use patterns over time. For example, an urban SMR operator may specify 5 p.m. to 6 p.m. on Fridays, while the busy hour for a natural gas company using a trunked LMR system may coincide with a 3:30 p.m.-4:30 p.m. shift change on the first Monday of the month.

Table 1. Performance parameters.

Symbol	Units	Description
GOS	%, s	Grade of service
t	s	Desired queue delay
H	s	Average PTT duration
f	PTTs/s	Average PTTs per second
U		Number of users
C		Number of traffic channels

Specifically, for trunked architectures that support queuing, the GOS represents the probability that any given call experiences a delay greater than a specified *queue time*. A typical system GOS requirement might be stated as follows: "We desire that no more than 2% of our user's call requests, or PTTs, be delayed in a queue for longer than three seconds."

Applying the theory

To create capacity estimates that ultimately determine the number of required channels to support a specified GOS, several performance characteristics need to be provided, as shown in Table 1 at the left.

When designing a new system, these parameters come from:

- estimates provided by mobile users or dispatchers.
- engineering studies or experiments to gather over-the-air statistics from an existing system.
- published industry studies.

The first step in applying trunking theory is to calculate the *offered load per user* — that is, how much traffic, in Erlangs, a given talk group or individual user service generates. Using the parameters defined in Table 1, the offered load per user, A_u , is expressed as:

$$A_u = f \times H$$

As an example, assume a user's average PTT duration, H , is five seconds, and each user, on average, PTTs 10 times during the busy hour. Note the extra term below that converts PTTs/hr to PTTs/s:

In this example, the user offers 0.0139 Erlangs of traffic to the system. Remember that one Erlang represents a fully occupied channel during busy hour, so this user, if he had his way, would require 1.39% of one channel's capacity during a one-hour timeframe.

For a system that contains U users, the *total offered load*, A , is the number of users multiplied by the offered load per user:

$$A = U \times A_u$$

Assume the example system is a single-site trunked system with 100 users during the busy hour, so the total offered load, A , is simply 1.39 Erlangs. Based on the definition of an Erlang, one could easily (and *incorrectly*) assume that at least two traffic channels would support the offered load.

But recall that one Erlang is a *completely* filled channel; it's unrealistic to have competing users completely occupy a channel. Doing so would require every user to PTT every instant a channel becomes available.

To determine a more realistic channel requirement to support the offered load, an Erlang formula or table is typically used for trunking systems.

The Erlang-C model

In the Erlang-C trunking model, or *blocked calls delayed*, a queue is provided to hold calls that are blocked. When a channel resource is not immediately available, the PTT request may be delayed until one becomes available. The GOS for this model represents the likelihood that a call would be delayed after waiting a specific time in the queue.

To determine the GOS, two calculations are needed. The first is the probability that a call will be delayed, which is derived from the following Erlang-C formula:

The second formula provides the probability that, once the call is in a queue, the delay will be t seconds:

The GOS is merely the product of the Erlang-C probability and the conditional probability, $QDelay$, of exceeding a delay of t seconds:

$$GOS = ErC \times QDelay$$

Computer programs can readily compute these formulas. To help make capacity analysis easy, I have implemented these calculations into a Microsoft Excel spreadsheet that you can request by email from *MRT* (email: mrt@intertec.com). It makes use of Excel's built-in Poisson function, the underlying basis for the Erlang models.

It should be noted that an Erlang-B model also exists to calculate the probability that a blocked call would be dropped. This formula should be used when trunking systems do not use a queue.

Bringing it all together

In the preceding example, a set of 100 users presented a total offered load of 1.39 Erlangs. Assuming the GOS requirement restricts a maximum of 2% of calls to be delayed in a queue for longer than three seconds, the simple calculator portion of the spreadsheet can be used to specify the input parameters ($H = 5$ s and $t = 3$ s) as well as U and f :

Users	Avg dur. (s)	PTTs/user	Offered Load (A Erlangs)
100	5	10	1.389

The spreadsheet calculates the offered load and the corresponding GOS for a range of systems having one to 10 channels. The results, shown below, show that, to meet a 2% GOS requirement, four traffic channels are required:

GOS	Channels
175.4%	1
39.4%	2
7.6%	3
1.2%	4
0.2%	5
0.0%	6
0.0%	7
0.0%	8
0.0%	9
0.0%	10

Assumptions

The preceding example, as capacity planning does in general, makes several assumptions. The Erlang models were designed with the assumption that call arrivals will follow what's known as a *Poisson distribution*. A random process characterizes this type of distribution and requires that the times between successive events (or PTTs) be exponentially distributed.

Another key requirement in modeling traffic behavior is to determine an average call transmission length. Statistics gathered from an [FCC](#) study (under contract RC10056) support five seconds as a reasonable average transmission length. Your actual average may vary depending on user needs and the actual mix of voice, data and interconnect calls.

One point to remember about traffic analysis, as in many disciplines, is that the results you obtain are estimates of the assumptions that you've provided. The "answer" can only be as good as your assumptions. The more detailed your investigations are to acquire the input parameters, the more accurate your results will be.

Modeling a wide-area system

Estimating capacity for a wide-area trunked system requires special consideration. Several complex, and debatable, factors contribute to user load.

Your initial task should be to determine the quantity of users (whether mobile, portable or fixed) and their anticipated operational service area. For many systems, this can become subjective.

For each system talk group, estimate the number of users, and determine a reasonable estimate for the average call duration, *H*, and the anticipated number of PTTs per user, *f*, during the busy hour. The wide-area spreadsheet calculator includes an example, shown in Table 2 on page 48, that lists six such talk group sets for electric and gas divisions in three counties (Oakland, Macomb, and Wayne). The spreadsheet calculates the offered load, *A*, for each talk group set.

The example analysis is for a fictitious five-site trunked system and includes the Pontiac, Northville, Macomb, Armada, and Howell sites. Under each site in the spreadsheet is a cell to distribute the offered load, as a percentage, from a given source to each individual site.

Talk groups deserve special consideration when analyzing capacity. This is because, unlike in cellular, users of trunked system talk groups can load a site with traffic even if they're just "logged-in" and listening.

The spreadsheet distribution percentages, then, reflect the probability that at least one user will log into that particular site and bring with it the corresponding traffic load of all talk group users for the entire busy hour. Be certain to take overlapping coverage into consideration; neighboring sites will almost always receive a portion of each other's traffic.

Other types of calls that typically load a trunked system include data, individual and private calls, and telephone interconnect calls. The example in Table 2 includes private call users, interconnect users and data users, who are assumed to be equally distributed throughout the system.

Table 2. Estimating wide-area system GOS

Talkgroup or traffic source	Users	Avg. duration (s)	PTTs/user	Erlangs (A)	Distribution of traffic among sites (%)					Offered load (Erlangs)				
					Pontiac	Northville	Macomb	Armada	Howell	Pontiac	Northville	Macomb	Armada	Howell
Oakland Gas	40	6	12	0.800	100	90	50	45	70	0.800	0.720	0.400	0.360	0.560
Macomb Gas	20	6	12	0.400	50	50	100	50	40	0.200	0.200	0.400	0.200	0.160
Wayne Gas	25	6	12	0.500	70	100	50	30	80	0.350	0.500	0.250	0.150	0.400
Oakland Elect.	20	5	8	0.222	100	90	50	45	70	0.222	0.200	0.111	0.100	0.156
Macomb Elect.	10	5	8	0.111	50	50	100	50	40	0.056	0.056	0.111	0.056	0.044
Wayne Electric	15	5	8	0.167	70	100	50	30	80	0.117	0.167	0.083	0.050	0.133
Private Calls	10	6	8	0.133	20	20	20	20	20	0.027	0.027	0.027	0.027	0.027
Interconnect	5	25	6	0.208	20	20	20	20	20	0.042	0.042	0.042	0.042	0.042
Data Calls	100	3	20	1.667	20	20	20	20	20	0.333	0.333	0.333	0.333	0.333
Total (Erlangs):										2.146	2.244	1.757	1.317	1.855

Finally, the spreadsheet sums the offered load for each site to determine the site's total offered load. Table 3, as shown on page 50, then presents a GOS matrix, calculated from the ErC and QDelay equations, for the maximum acceptable queue delay, *t*, of three seconds.

From the table, we can conclude that to meet or exceed a 2% GOS, there should be six traffic channels at Pontiac and Northville, five at Macomb and Howell, and four at the Armada site.

Other considerations

Exploring the specifics of your trunked technology (EDACS, Smartnet, MPT-1327 or LTR) may help you to understand how the spreadsheet calculator can be customized for the services and traffic sources of your particular system.

Some areas that require further work to provide a more thorough analysis may include:

- factoring-in call setup time (typically between 250ms and 400ms).
- considering hang time (if used).
- providing data calls to be specified in terms of individual application messages or bytes.
- addressing application-specific packet and network-layer data overhead.

This analysis does not account for two main aspects of capacity. One is that, in dedicated control channel systems, the carrier-sense multiple-access scheme for the control channel itself can limit capacity. The second factor involves the blocking probabilities of central switching and network equipment. Usually, however, unless you're dealing with a large system, user load itself vs. the available channels is the major concern.

Table 3. GOS Matrix

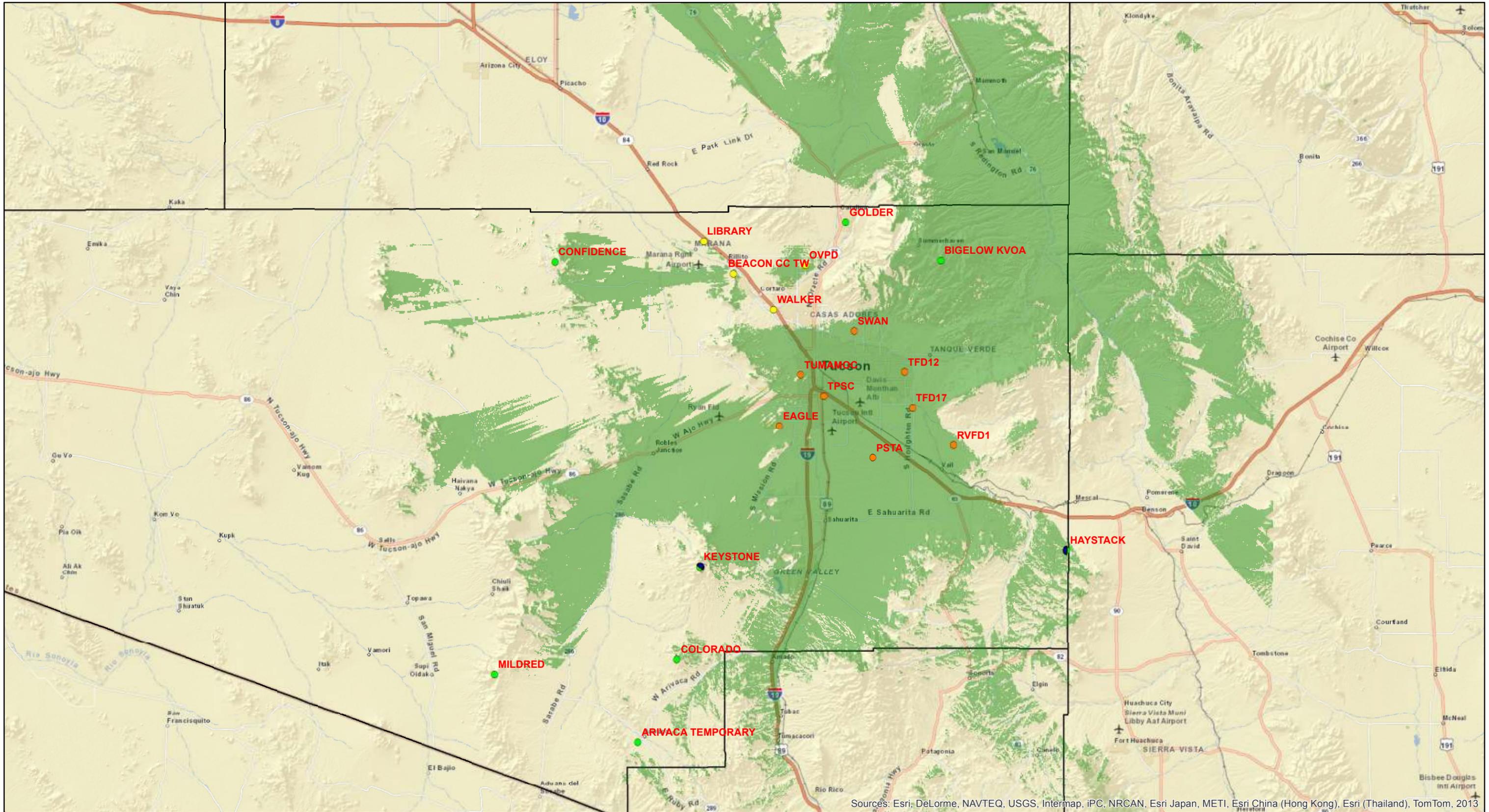
Grade of service					
Channels	Site				
	(Total Erlangs)				
	Pontiac (2.146)	Northville (2.244)	Macomb (1.757)	Armada (1.317)	Howell (1.855)
1	426.9%	473.3%	276.8%	159.3%	309.8%
2	121.3%	137.3%	71.0%	34.7%	81.8%
3	30.9%	35.9%	16.0%	6.4%	19.0%
4	7.0%	8.3%	3.1%	1.0%	3.9%
5	1.4%	1.7%	0.5%	0.1%	0.7%
6	0.2%	0.3%	0.1%	0.0%	0.1%
7	0.0%	0.1%	0.0%	0.0%	0.0%
8	0.0%	0.0%	0.0%	0.0%	0.0%
9	0.0%	0.0%	0.0%	0.0%	0.0%
10	0.0%	0.0%	0.0%	0.0%	0.0%

Gutowski is senior RF engineer at Consumers Energy Company in Jackson, MI. He can be reached by email at: mark@gutowski.com

Source URL: <http://urgentcomm.com/mag/ready-set-calculate>

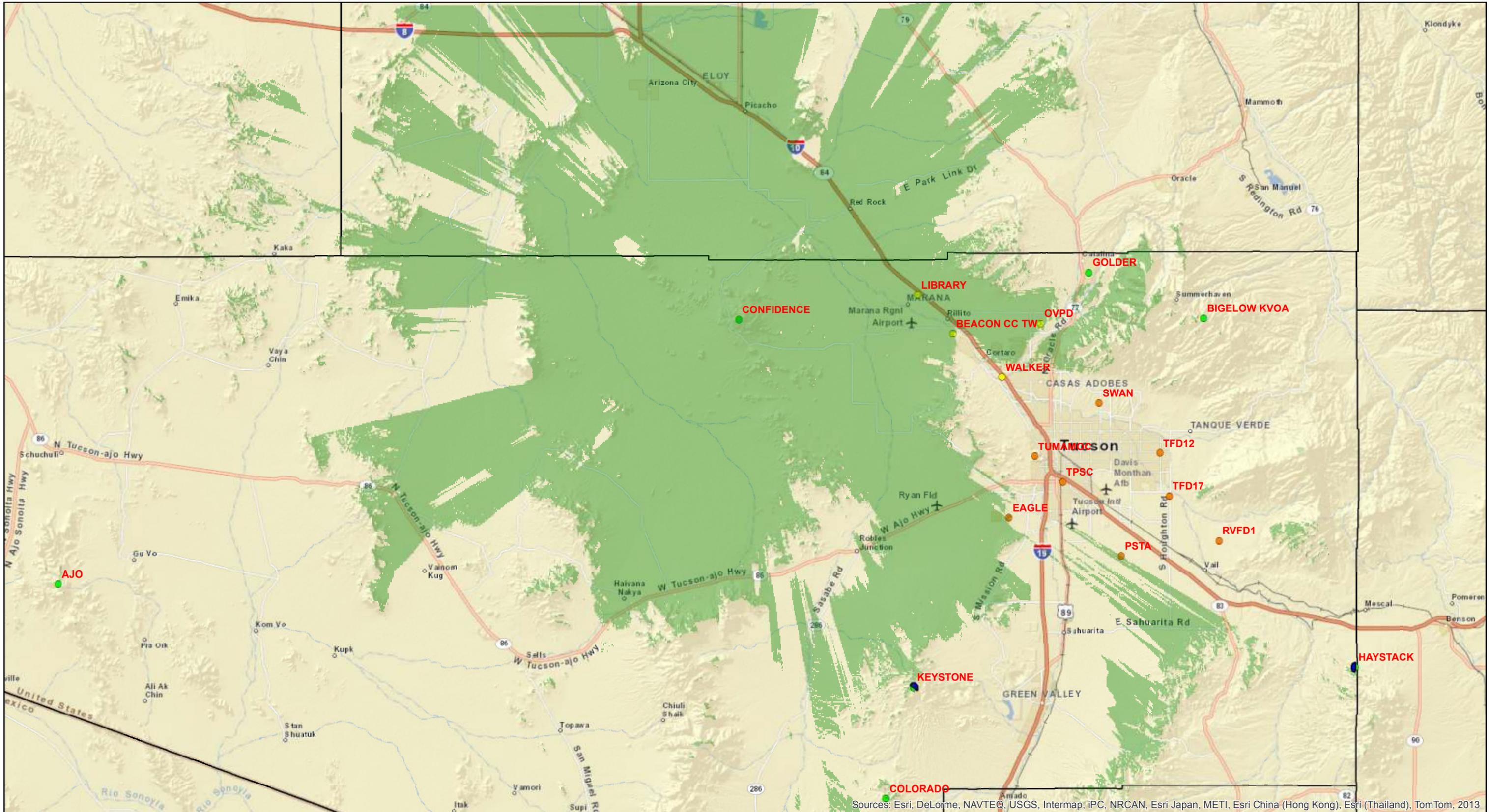
ATTACHMENT #4

Mt. Bigelow Mobile Coverage



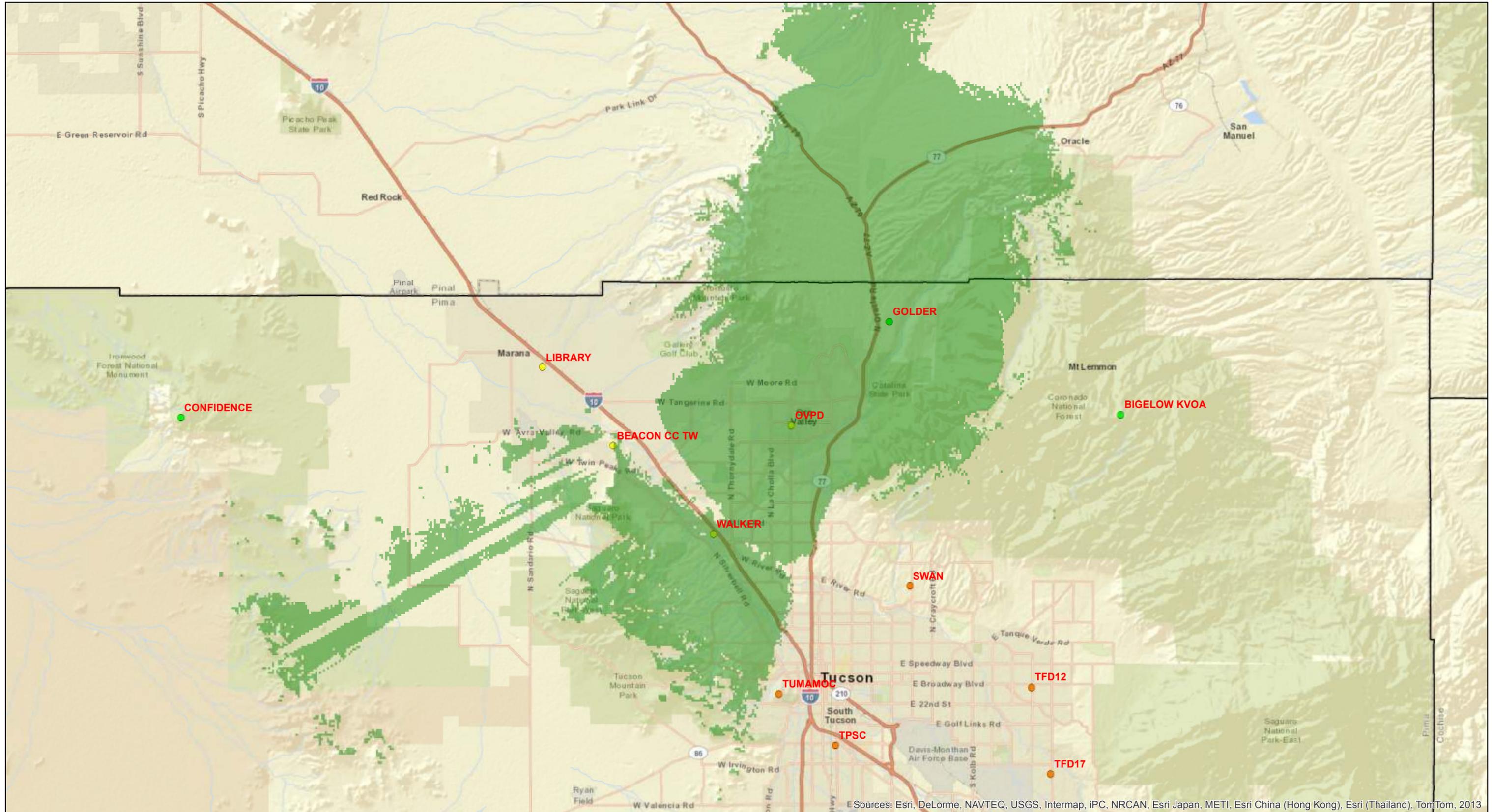
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Confidence Peak Mobile Coverage



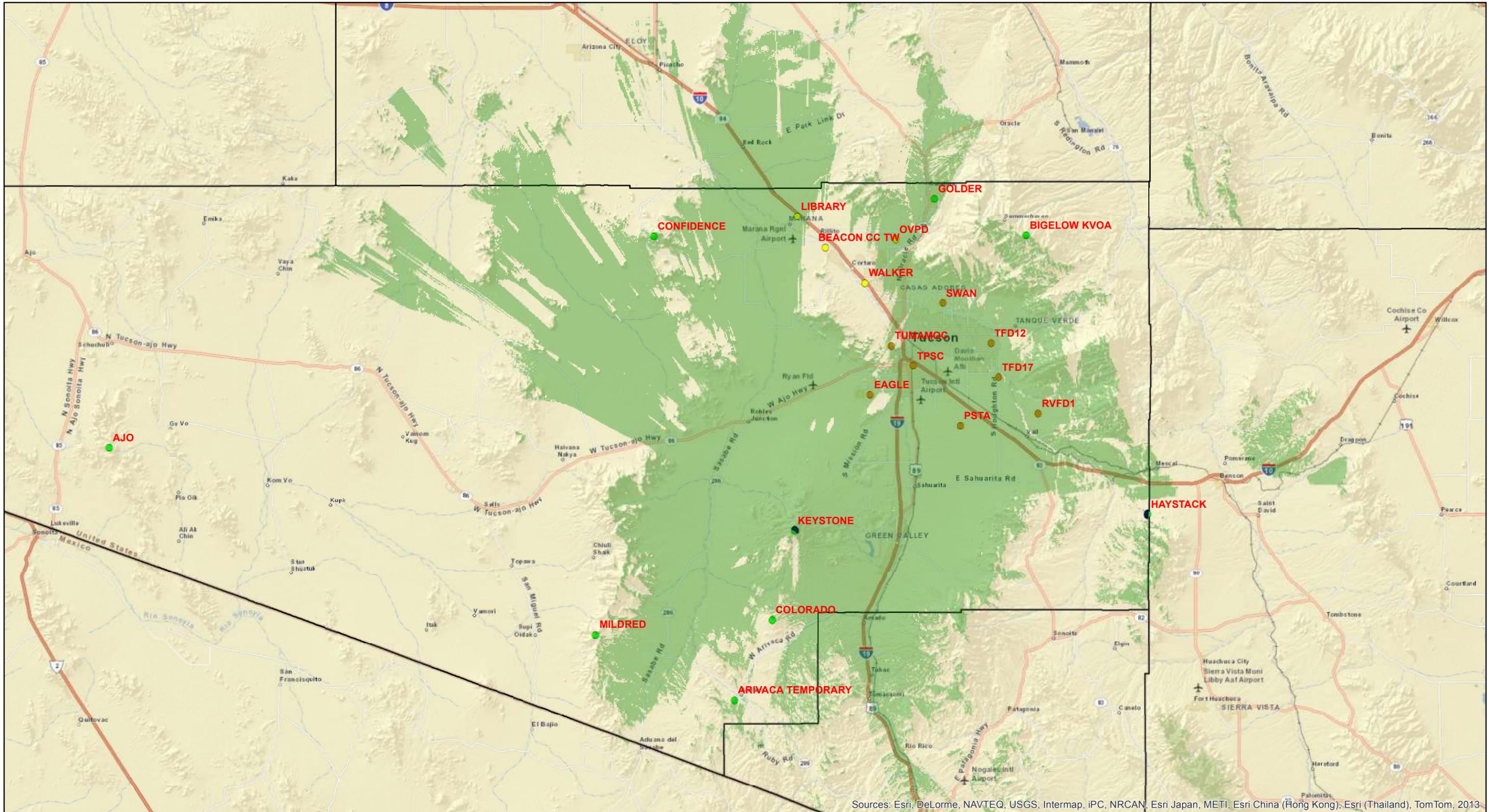
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Golder Mobile Coverage



© Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

Keystone Mobile Coverage



Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

ATTACHMENT #5

Figure 5.1-2 Test Sector 1 Heavy Building Site Affiliation

CLIENT: PCWIN

PROJECT NO: 60176071

DATA SOURCE AND NOTES:

Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location within a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 25 FEB 2014

DRAWN: GDM - 25 FEB 2014

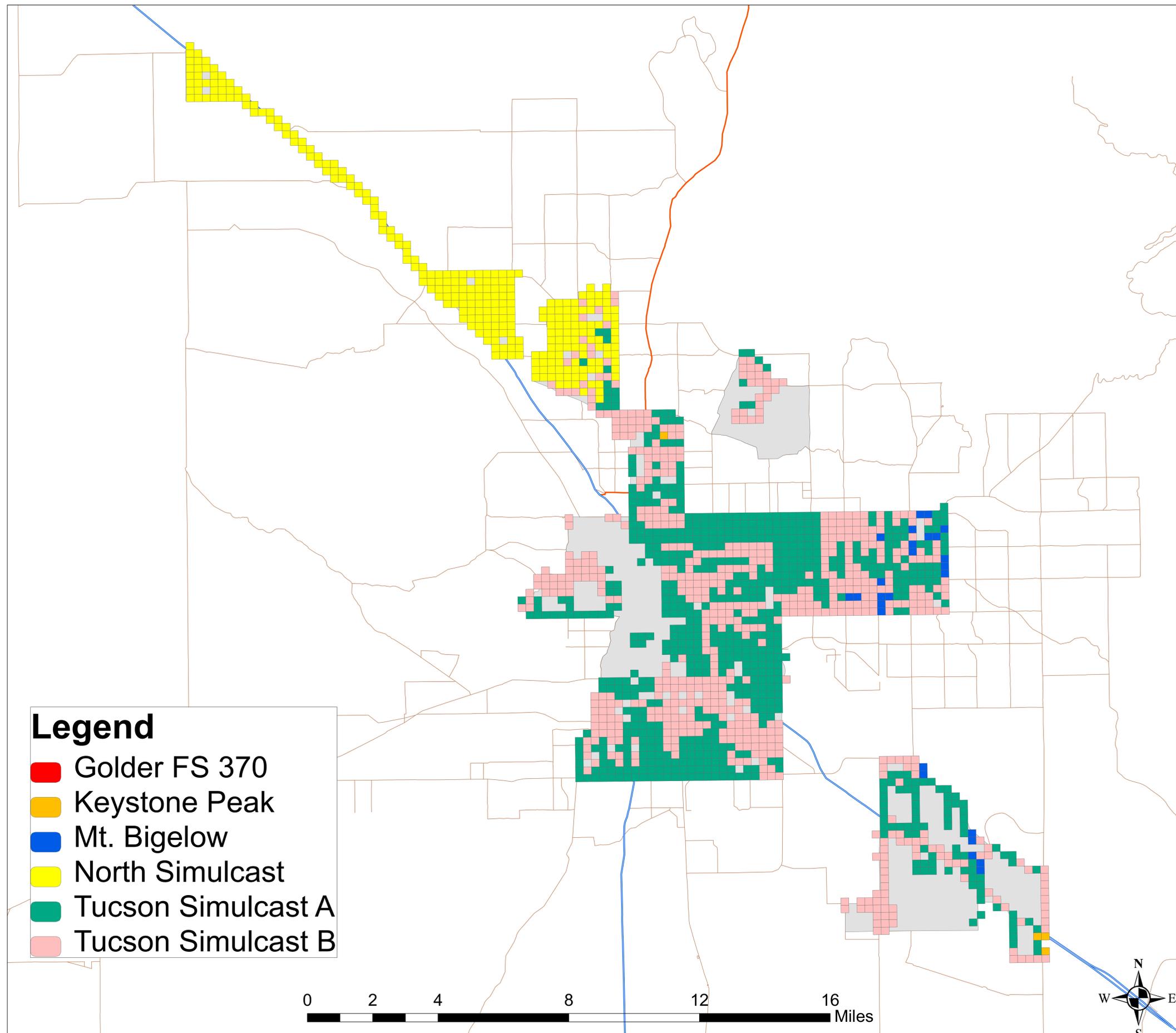
CHECKED: DRA - 25 FEB 2014

APPROVED: MDM - 25 FEB 2014

REV	DATE	APPROVED BY



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 AECOM TECHNICAL SERVICES, INC.
 20715 TIMBERLAKE ROAD SUITE 106
 LYNCHBURG, VA 24502
 (434) 239-9200 www.aecom.com



Legend

- Golder FS 370
- Keystone Peak
- Mt. Bigelow
- North Simulcast
- Tucson Simulcast A
- Tucson Simulcast B

Figure 5.2-2 Test Sector 2 Medium Building Site Affiliation

CLIENT: PCWIN

PROJECT NO: 60176071

DATA SOURCE AND NOTES:

Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location within a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 24 FEB 2014

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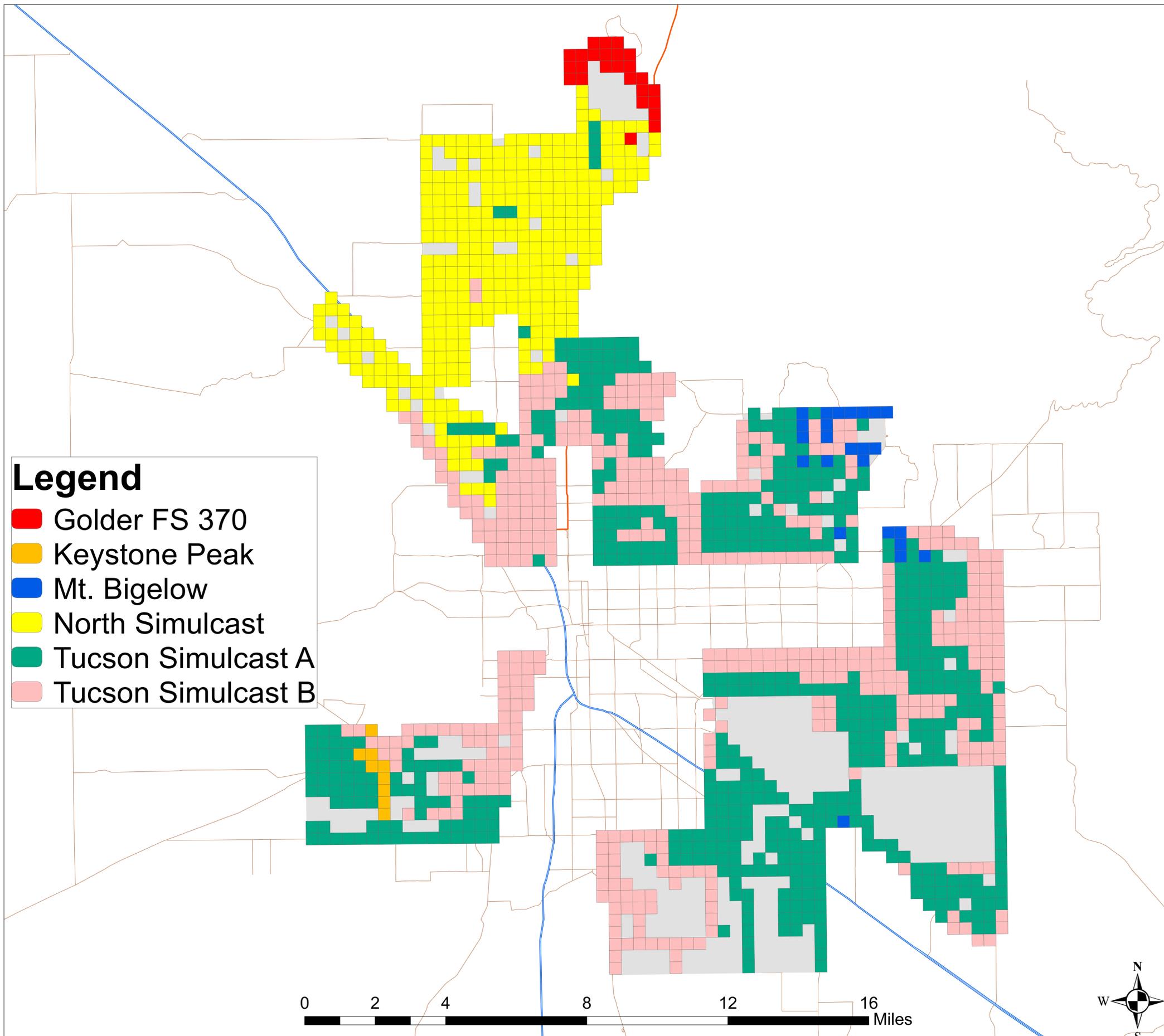
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 (434) 239-9200 www.aecom.com



Legend

- Golder FS 370
- Keystone Peak
- Mt. Bigelow
- North Simulcast
- Tucson Simulcast A
- Tucson Simulcast B

Figure 5.3-2 Test Sector 3 Light Building Site Affiliation

CLIENT: PCWIN

PROJECT NO: 60176071

DATA SOURCE AND NOTES:

Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location within a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 25 FEB 2014

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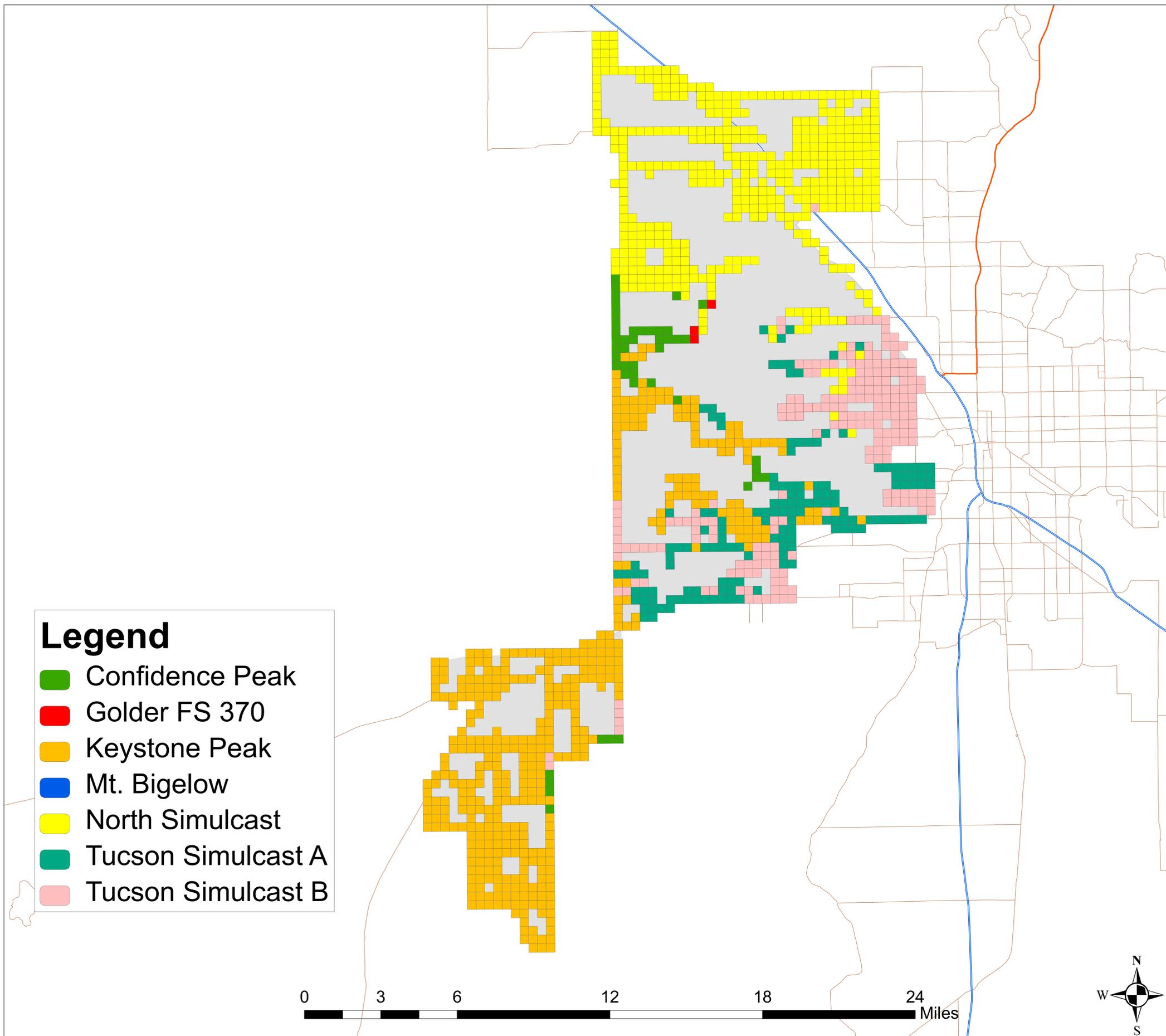
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Legend

- Confidence Peak
- Golder FS 370
- Keystone Peak
- Mt. Bigelow
- North Simulcast
- Tucson Simulcast A
- Tucson Simulcast B

Figure 5.6-2 Test Sector 6 Portable On Street Site Affiliation

CLIENT: PCWIN

PROJECT NO: 60176071

DATA SOURCE AND NOTES:

Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location within a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 25 FEB 2014

DRAWN: GDM - 25 FEB 2014

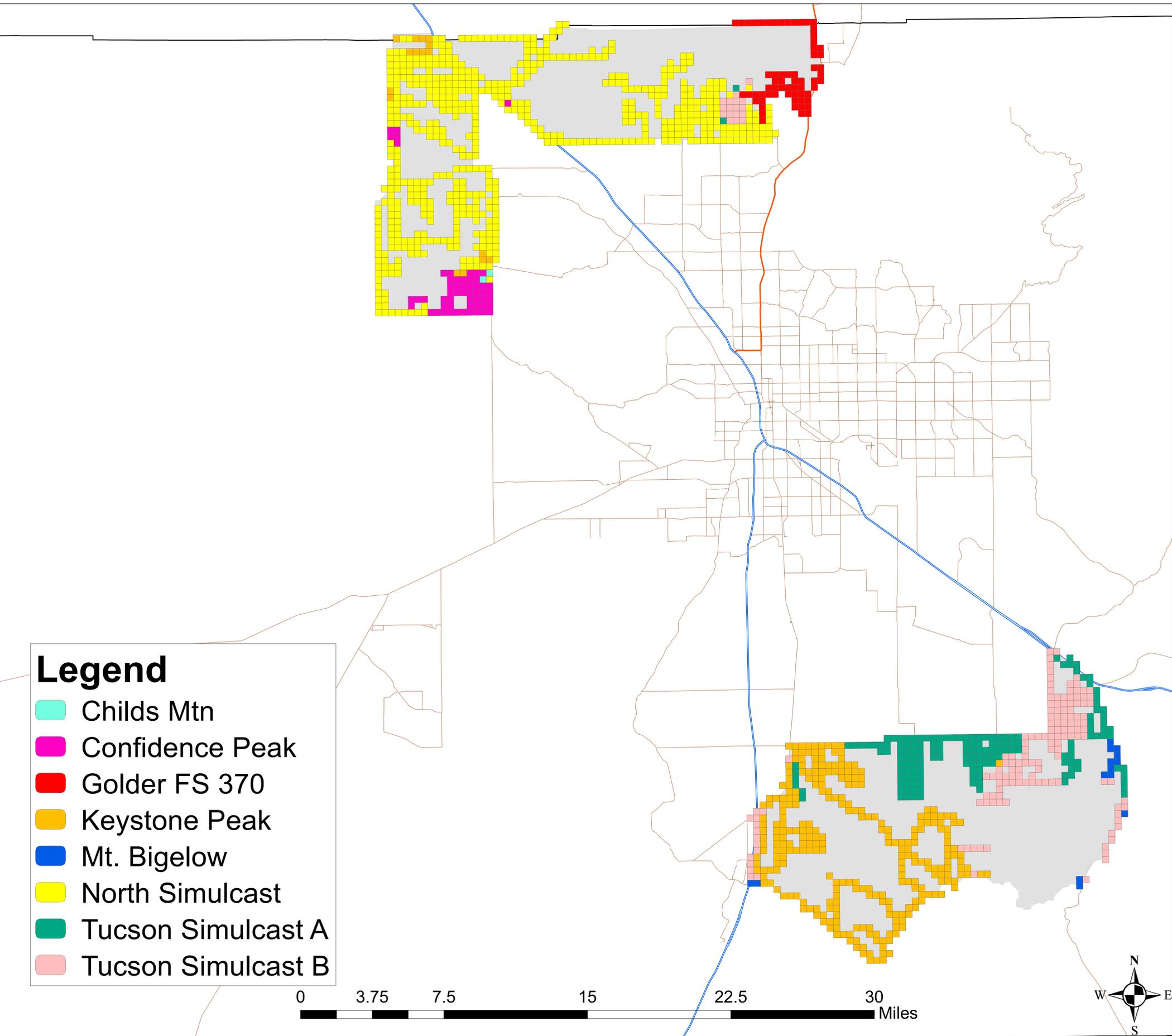
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- Legend**
- Childs Mtn
 - Confidence Peak
 - Golder FS 370
 - Keystone Peak
 - Mt. Bigelow
 - North Simulcast
 - Tucson Simulcast A
 - Tucson Simulcast B

Figure 5.9-2 Test Sector 9 Mobile Site Affiliation

CLIENT: PCWIN

PROJECT NO: 60176071

DATA SOURCE AND NOTES:

Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location within a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 25 FEB 2014

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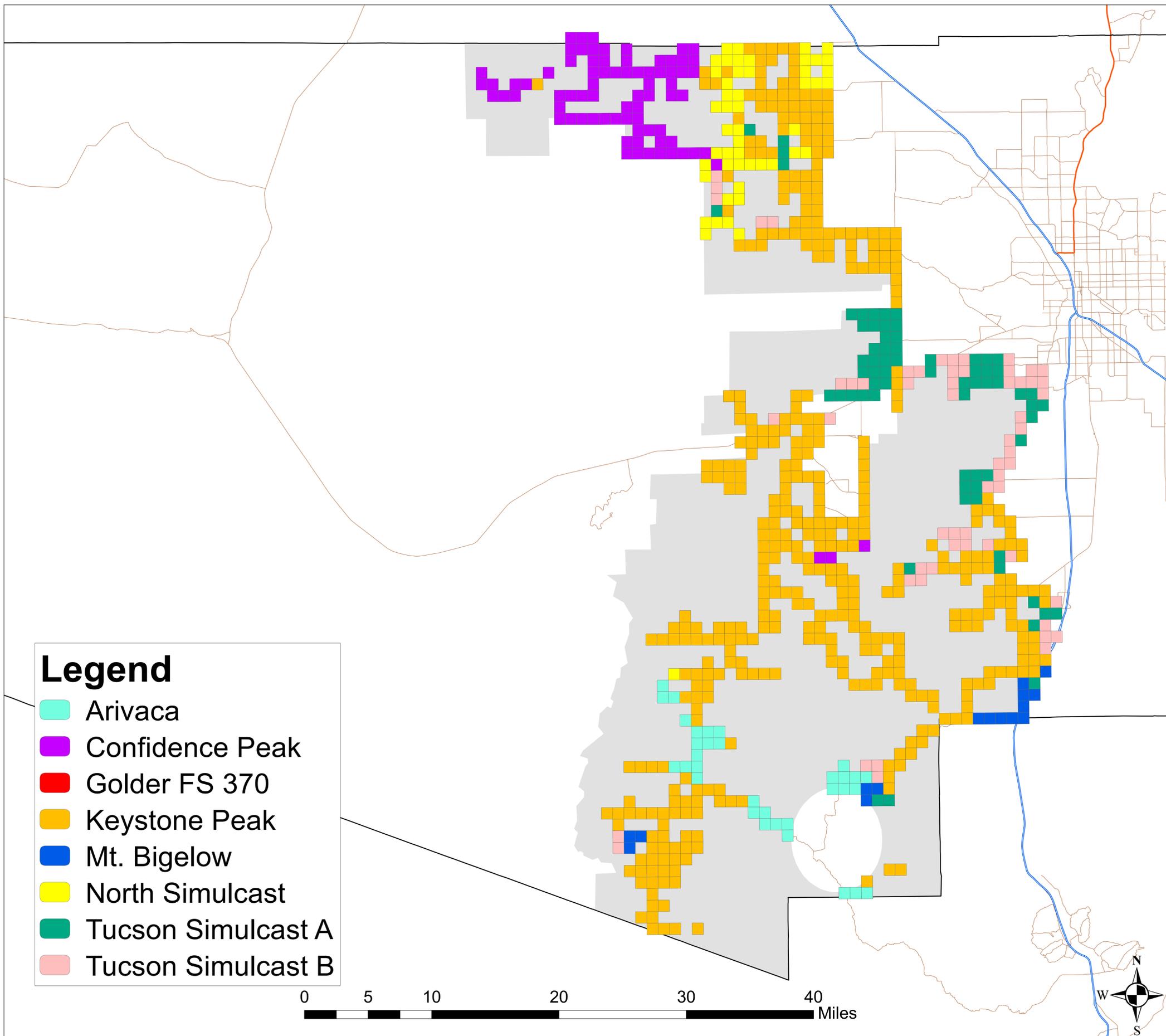
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Legend

- Arivaca
- Confidence Peak
- Golder FS 370
- Keystone Peak
- Mt. Bigelow
- North Simulcast
- Tucson Simulcast A
- Tucson Simulcast B

0 5 10 20 30 40 Miles



Figure 3
Pinal 1
Portable On Street
Site Affiliation

CLIENT: PCWIN
PROJECT NO: 60176071

DATA SOURCE AND NOTES:
Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location within a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 17 MAR 2014
DRAWN: GAD - 17 MAR 2014
CHECKED: DRA - 17 MAR 2014
APPROVED: MDM - 17 MAR 2014

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- Legend**
- Confidence Peak
 - Golder FS 370
 - Keystone Peak
 - Mt. Bigelow
 - North Simulcast

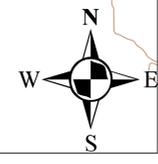
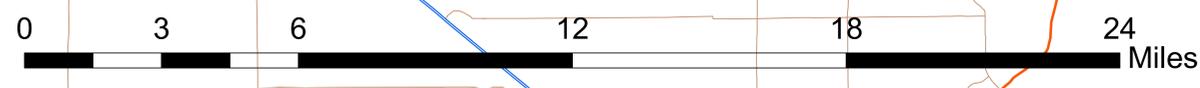
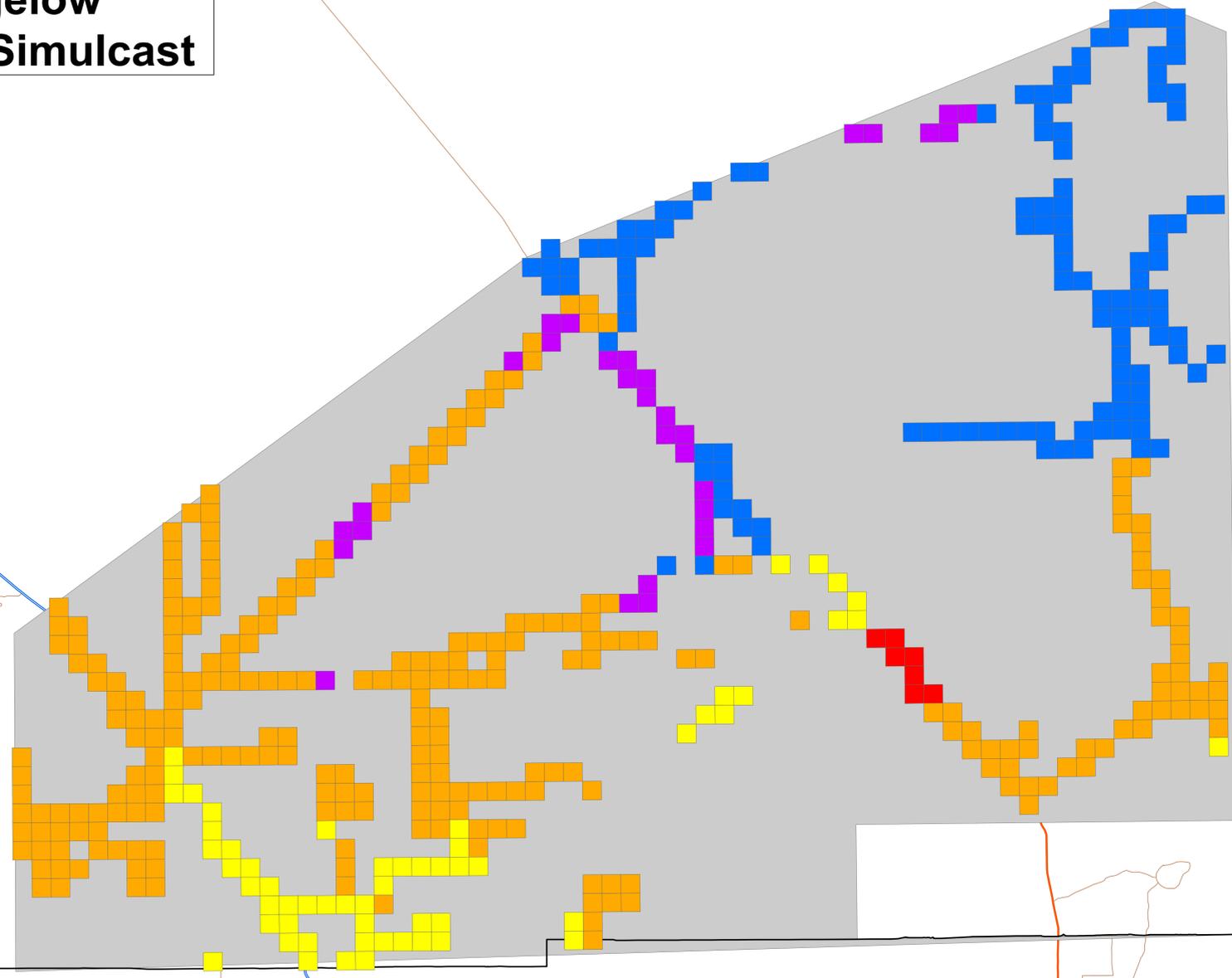


Figure 7 Pinal 2 Portable in Medium Building Site Affiliation

CLIENT: PCWIN

PROJECT NO: 60176071

DATA SOURCE AND NOTES:

Site affiliation data is based on mobile transmit frequency measured during the talk-in portion of the DAQ testing. Site affiliation can vary based on location with a tile, and path taken to get to the test point.

Shape File data provided by ESRI

DESIGN: GAD - 7 MAR 2014

DRAWN: GDM - 7 MAR 2014

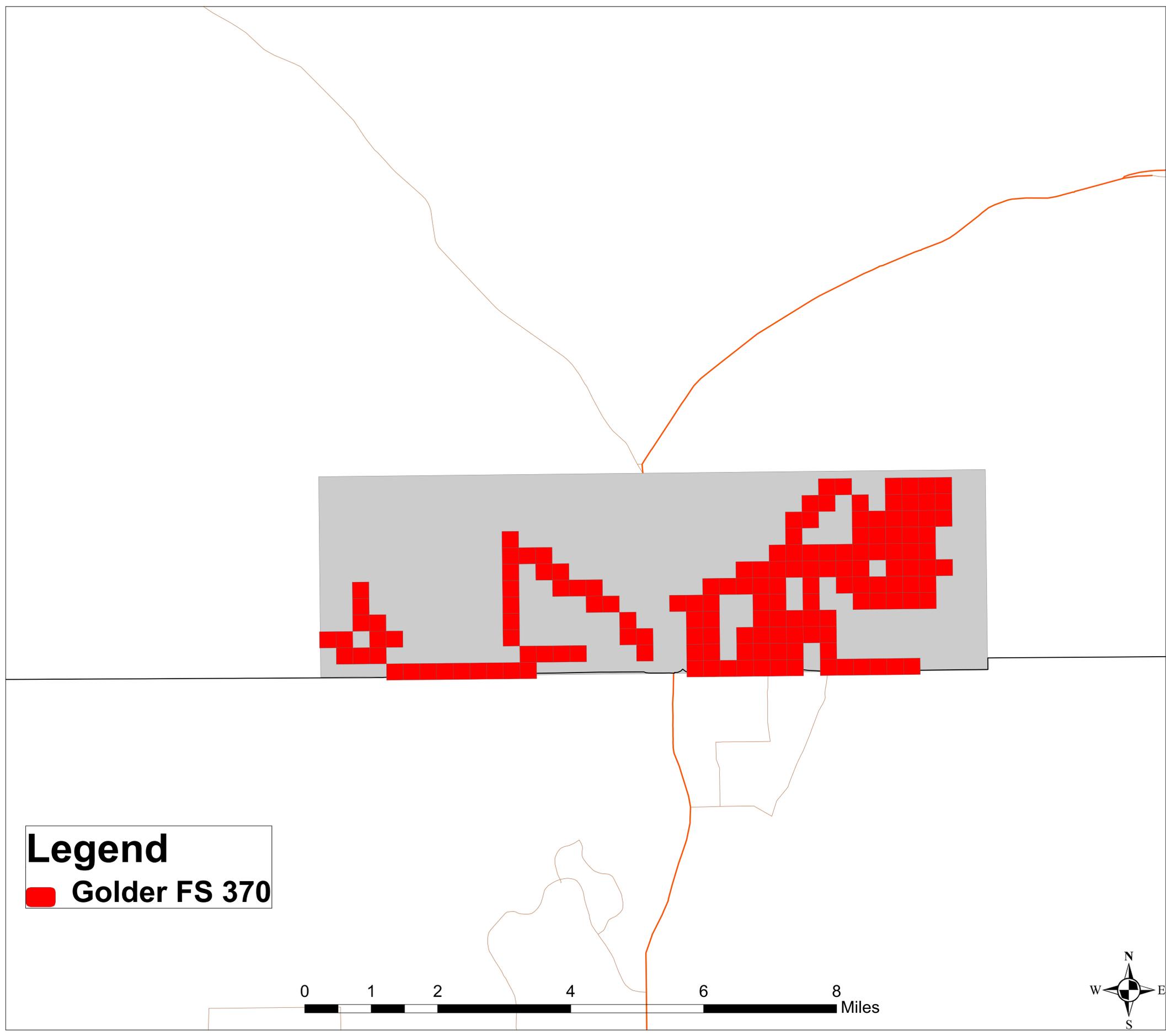
CHECKED: DRA - 7 MAR 2014

APPROVED: MDM - 7 MAR 2014

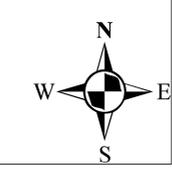
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Legend
■ Golder FS 370



ATTACHMENT #6

Agency	Simulcast A	Simulcast B	North Simulcast	Arivaca	Childs	Confidence	Haystack	Keystone	Bigelow	Golder
Ajo Ambulance, Inc.	Least Preferred		Least Preferred	Least Preferred	Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred
Ajo Justice Courts		Least Preferred	Least Preferred	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred
Ajo/Gibson Volunteer Fire Department	Least Preferred		Least Preferred	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred
Arivaca Fire District	Least Preferred		Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Avra Valley Fire District	Least Preferred		Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	
Bureau of Land Management		Least Preferred								
Common						Least Preferred	Least Preferred		Least Preferred	
Corona de Tucson Fire District	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Counter Narcotics Alliance	Preferred						Least Preferred		Least Preferred	
Drexel Heights Fire District	Least Preferred		Least Preferred		Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Elephant Head Volunteer Fire District	Least Preferred		Least Preferred		Least Preferred	Least Preferred	Least Preferred	Preferred	Least Preferred	Least Preferred
Federal Bureau of Investigations	Preferred	Least Preferred					Least Preferred		Least Preferred	
FD Interop	Least Preferred						Least Preferred		Least Preferred	
Golder Ranch Fire District	Least Preferred		Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	
Green Valley Fire District	Least Preferred		Least Preferred		Least Preferred	Least Preferred	Least Preferred	Preferred	Least Preferred	Least Preferred
Helment Peak Fire District	Least Preferred		Least Preferred		Least Preferred	Least Preferred	Least Preferred	Preferred	Least Preferred	Least Preferred
Hidden Valley Fire District (Rural Metro)	Least Preferred	Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	
High Intensity Drug Trafficking Areas	Preferred	Least Preferred					Least Preferred		Least Preferred	
Hospital and Meds	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred
LE Interop		Least Preferred					Least Preferred		Least Preferred	
Media	Least Preferred	Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Mount Lemmon Fire District	Least Preferred		Least Preferred	Preferred	Least Preferred					
Mountain Vista Fire District (Rural Metro)	Least Preferred			Least Preferred						
National Forest Service	Preferred	Least Preferred							Least Preferred	
National Parks Service	Preferred	Least Preferred							Least Preferred	
Northwest Fire District	Least Preferred		Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	
Oro Valley Police Department		Least Preferred	Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	
Pascua Yaqui Fire Department	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Pascua Yaqui Police Department	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Picture Rocks Fire District	Least Preferred		Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	
Pima Community College Police Department	Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	
Pima County Adult Probation	Preferred	Least Preferred								
Pima County Animal Care	Preferred	Least Preferred					Least Preferred		Least Preferred	

Agency	Simulcast A	Simulcast B	North Simulcast	Arivaca	Childs	Confidence	Haystack	Keystone	Bigelow	Golder
South Tucson Police Department	Preferred	Least Preferred					Least Preferred	Least Preferred	Least Preferred	
Tanque Verde Fire District (Rural Metro)	Least Preferred	Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	
Three Points Fire District	Least Preferred		Least Preferred		Least Preferred	Least Preferred				
Tohono O'odham Fire Department	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	Least Preferred
Tucson County Club Estates Fire District (Rural Metro)	Least Preferred	Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	
Tucson Fire Department	Least Preferred	Preferred					Least Preferred	Least Preferred	Least Preferred	
Tucson Police Department	Preferred	Least Preferred					Least Preferred	Least Preferred	Least Preferred	
U.S. Customs	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred
U.S. Marshalls Office	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred
Union Pacific Railroad Police	Preferred	Least Preferred		Least Preferred	Least Preferred	Least Preferred	Least Preferred		Least Preferred	
University of Arizona Police Department	Preferred	Least Preferred					Least Preferred	Least Preferred	Least Preferred	
Why Fire District	Least Preferred		Least Preferred	Least Preferred	Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred	Least Preferred

ATTACHMENT #7

Analysis #1 - All Subscribers in Coverage Area Registered on Network

Wide Area GOS Calculator for Erlang-C Trunked Systems

Talkgroup or traffic source	Users (U)	Avg dur. (H sec.)	PTTs/user (μ)	Erlangs (A)	Distribution of traffic among sites (percent)					Offered load (Erlangs)				
					NORTH	GOLDER	CONFIDENCE	KEYSTONE	BIGELOW	NORTH	GOLDER	CONFIDENCE	KEYSTONE	BIGELOW
SAFER-C Disp (35%)	46	8	2.45	0.250	100	100	100	100	5	0.250	0.250	0.250	0.250	0.013
SAFER-C Med (60%)	76	8	2.45	0.414	80	40	20	20	5	0.331	0.166	0.083	0.083	0.021
SAFER-C Tac1 (2.5%)	4	8	2.45	0.022	80	40	20	20	5	0.017	0.009	0.004	0.004	0.001
SAFER-C Tac2 (2.5%)	4	8	2.45	0.022	80	40	20	20	0	0.017	0.009	0.004	0.004	0.000
VECC Disp (35%)	117	8	2.45	0.635	0	0	5	100	10	0.000	0.000	0.032	0.635	0.063
VECC Med (60%)	201	8	2.45	1.094	0	0	5	60	15	0.000	0.000	0.055	0.657	0.164
VECC Tac1 (2.5%)	8	8	2.45	0.045	0	0	5	60	15	0.000	0.000	0.002	0.027	0.007
VECC Tac2 (2.5%)	8	8	2.45	0.045	0	0	5	60	15	0.000	0.000	0.002	0.027	0.007
PCSD NORTH	274	8	2.45	1.492	100	50	50	5	0	1.492	0.746	0.746	0.075	0.000
PCSD WEST	230	8	2.45	1.252	0	0	50	100	0	0.000	0.000	0.626	1.252	0.000
PCSD SOUTH w/SPD	263	8	2.45	1.432	0	0	0	100	0	0.000	0.000	0.000	1.432	0.000
PCSD EAST	202	8	2.45	1.100	0	0	0	0	100	0.000	0.000	0.000	0.000	1.100
PC Public Works	885	8	2.45	4.818	20	0	0	5	0	0.964	0.000	0.000	0.241	0.000
PC Waste Water	248	8	2.45	1.350	100	0	0	0	0	1.350	0.000	0.000	0.000	0.000
OPVD Disp	237	8	2.45	1.290	100	0	0	0	0	1.290	0.000	0.000	0.000	0.000
PCCDPS Disp	91	8	2.45	0.495	20	0	0	0	0	0.099	0.000	0.000	0.000	0.000
Mt. Lemmon Fire Disp	24	8	2.45	0.131	0	0	0	0	100	0.000	0.000	0.000	0.000	0.131
PPFD Disp	25	8	2.45	0.136	0	0	0	0	10	0.000	0.000	0.000	0.014	0.000
PYPD Disp	80	8	2.45	0.436	0	0	0	0	10	0.000	0.000	0.000	0.044	0.000
Rural Metro	143	8	2.45	0.779	5	0	0	5	0	0.039	0.000	0.000	0.039	0.000
Roamers (5% of balance)	254	8	2.45	1.383	30	0	0	0	10	0.415	0.000	0.000	0.138	0.000
		8	2.45	0.000						0.000	0.000	0.000	0.000	0.000
Private Calls	0	0	0	0.000	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000
Interconnect	0	0	0	0.000	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000
Data Calls	0	0	0	0.000	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000

Input Parameters:	(sec.)
Queue delay (t)	1
Avg. duration (H)	8

PCWIN Actual - 8 sec/call

Users (U)	Avg dur. (H sec.)	PTTs/user (μ)	Ofrd. Load (A Erlangs)	GOS	Total (Er.)	6.265	1.179	1.805	4.921	1.506
					Talk Paths	Grade of service				
0	0	0	0.000	0.0%	1	1209.9%	120.6%	199.6%	803.5%	160.4%
				0.0%	2	809.4%	39.5%	83.6%	504.2%	60.8%
				0.0%	3	526.0%	10.8%	30.7%	303.7%	19.8%
				0.0%	4	330.8%	2.5%	9.8%	174.6%	5.5%
				0.0%	5	200.4%	0.5%	2.7%	95.1%	1.3%
				0.0%	6	116.4%	0.1%	0.7%	48.9%	0.3%
				0.0%	7	64.5%	0.0%	0.1%	23.6%	0.0%
				0.0%	8	34.0%	0.0%	0.0%	10.6%	0.0%
				0.0%	9	16.9%	0.0%	0.0%	4.5%	0.0%
				0.0%	10	8.0%	0.0%	0.0%	1.7%	0.0%
				0.0%	11	3.5%	0.0%	0.0%	0.6%	0.0%
				0.0%	12	1.5%	0.0%	0.0%	0.2%	0.0%
				0.0%	13	0.6%	0.0%	0.0%	0.1%	0.0%
				0.0%	14	0.2%	0.0%	0.0%	0.0%	0.0%
				0.0%	15	0.1%	0.0%	0.0%	0.0%	0.0%
				0.0%	16	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	17	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	18	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	19	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	20	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	21	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	22	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	23	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	24	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	25	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	26	0.0%	0.0%	0.0%	0.0%	0.0%

The Simple Calculator (lt. Blue) calculates the Offered Load (A) and GOS for given Input Parameters, U, H, and μ

Notes:
PCWIN design specifications defined Busy Hour/Busy Day as having all subscribers simultaneously registered onto the network. PCSD subscriber quantities only include those units that would be expected to operate in the coverage area of analysis.

Analysis #2 - Law Enforcement Radio Quantities Reduced by 50%

Wide Area GOS Calculator for Erlang-C Trunked Systems

Talkgroup or traffic source	Users (U)	Avg dur. (H sec.)	PTTs/user (μ)	Erlangs (A)	Distribution of traffic among sites (percent)					Offered load (Erlangs)				
					NORTH	GOLDER	CONFIDENCE	KEYSTONE	BIGELOW	NORTH	GOLDER	CONFIDENCE	KEYSTONE	BIGELOW
SAFER-C Disp (35%)	46	8	2.45	0.250	100	100	100	100	5	0.250	0.250	0.250	0.250	0.013
SAFER-C Med (60%)	76	8	2.45	0.414	88	40	12	12	5	0.364	0.166	0.050	0.050	0.021
SAFER-C Tac1 (2.5%)	4	8	2.45	0.022	88	40	12	12	5	0.019	0.009	0.003	0.003	0.001
SAFER-C Tac2 (2.5%)	4	8	2.45	0.022	88	40	12	12	0	0.019	0.009	0.003	0.003	0.000
VECC Disp (35%)	117	8	2.45	0.635	0	0	5	100	10	0.000	0.000	0.032	0.635	0.063
VECC Med (60%)	201	8	2.45	1.094	0	0	5	60	15	0.000	0.000	0.055	0.657	0.164
VECC Tac1 (2.5%)	8	8	2.45	0.045	0	0	5	60	15	0.000	0.000	0.002	0.027	0.007
VECC Tac2 (2.5%)	8	8	2.45	0.045	0	0	5	60	15	0.000	0.000	0.002	0.027	0.007
PCSD NORTH	137	8	2.45	0.746	100	50	50	5	0	0.746	0.373	0.373	0.037	0.000
PCSD WEST	115	8	2.45	0.626	0	0	50	100	0	0.000	0.000	0.313	0.626	0.000
PCSD SOUTH w/SPD	132	8	2.45	0.716	0	0	0	100	0	0.000	0.000	0.000	0.716	0.000
PCSD EAST	101	8	2.45	0.550	0	0	0	0	100	0.000	0.000	0.000	0.000	0.550
PC Public Works	885	8	2.45	4.818	20	0	0	5	0	0.964	0.000	0.000	0.241	0.000
PC Waste Water	248	8	2.45	1.350	100	0	0	0	0	1.350	0.000	0.000	0.000	0.000
OVPD Disp	119	8	2.45	0.645	100	0	0	0	0	0.645	0.000	0.000	0.000	0.000
PCCDPS Disp	46	8	2.45	0.248	20	0	0	0	0	0.050	0.000	0.000	0.000	0.000
Mt. Lemmon Fire Disp	24	8	2.45	0.131	0	0	0	0	100	0.000	0.000	0.000	0.000	0.131
PPFD Disp	25	8	2.45	0.136	0	0	0	0	10	0.000	0.000	0.000	0.014	0.000
PYPD Disp	40	8	2.45	0.218	0	0	0	0	10	0.000	0.000	0.000	0.022	0.000
Rural Metro	143	8	2.45	0.779	5	0	0	5	0	0.039	0.000	0.000	0.039	0.000
Roamers (5% of balance)	254	8	2.45	1.383	30	0	0	0	10	0.415	0.000	0.000	0.138	0.000
		8	2.45	0.000						0.000	0.000	0.000	0.000	0.000
Private Calls	0	0	0	0.000	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000
Interconnect	0	0	0	0.000	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000
Data Calls	0	0	0	0.000	0	0	0	0	0	0.000	0.000	0.000	0.000	0.000

Input Parameters:	(sec.)
Queue delay (t)	1
Avg. duration (H)	8

PCWIN actual - 8 sec/call

Users (U)	Avg dur. (H sec.)	PTTs/user (μ)	Ofrd. Load (A Erlangs)	GOS	Total (Er.)	4.861	0.806	1.082	3.484	0.956
					Talk Paths	Grade of service				
0	0	0	0.000	0.0%	1	787.7%	78.7%	109.3%	475.2%	95.1%
				0.0%	2	492.5%	20.0%	33.9%	266.4%	27.1%
				0.0%	3	295.4%	4.0%	8.7%	140.0%	6.3%
				0.0%	4	168.9%	0.7%	1.8%	68.4%	1.2%
				0.0%	5	91.5%	0.1%	0.3%	30.8%	0.2%
				0.0%	6	46.7%	0.0%	0.0%	12.7%	0.0%
				0.0%	7	22.3%	0.0%	0.0%	4.8%	0.0%
				0.0%	8	10.0%	0.0%	0.0%	1.7%	0.0%
				0.0%	9	4.1%	0.0%	0.0%	0.5%	0.0%
				0.0%	10	1.6%	0.0%	0.0%	0.2%	0.0%
				0.0%	11	0.6%	0.0%	0.0%	0.0%	0.0%
				0.0%	12	0.2%	0.0%	0.0%	0.0%	0.0%
				0.0%	13	0.1%	0.0%	0.0%	0.0%	0.0%
				0.0%	14	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	15	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	16	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	17	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	18	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	19	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	20	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	21	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	22	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	23	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	24	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	25	0.0%	0.0%	0.0%	0.0%	0.0%
				0.0%	26	0.0%	0.0%	0.0%	0.0%	0.0%

The Simple Calculator (lt. Blue) calculates the Offered Load (A) and GOS for given Input Parameters, U, H, and μ

Notes:

PCWIN design specifications defined Busy Hour/Busy Day as having all subscribers simultaneously registered onto the network. For purposes of this analysis, the subscribers assigned to the law enforcement agencies were decreased by 50% assuming that in a busy hour/busy day scenario, law enforcement agencies would operate on 12 hour shifts to manage manage rest and that when officers are off duty, their radios would not be in service.

New Member Application



PCWIN Form 301-A

PCWIN is a public safety/public service digital trunked radio network and cooperative. While it is our intent to accommodate the voice radio needs of as many organizations as possible, a deliberate discovery and planning process is required to ensure a prospective member's participation meets the needs and intent of PCWIN. Please fill out the following application with as much detail as possible. This information will be used to determine the best level of participation for your agency and whether any fees will be assessed.

Applicant's Use:

Organization Name

Organization Address

Point of Contact

POC Email Address

POC Phone Number

Organization Type

Will PCWIN be your primary means of communication?

Is your agency being sponsored by a PCWIN member?

Name of PCWIN Sponsoring Agency

If applicable, is the Sponsoring Agency providing radios for your use?

What level of participation do you anticipate on PCWIN

Daily

Weekly

Monthly

Will you use another agency's talkgroups to communicate on PCWIN?

Will you require the establishment of talkgroups for your agency's use?

Will any of those talkgroups require encryption?

If applicable, how many talkgroups will you require?

Clear Voice Recorded Encrypted

How many radios do you plan to use on the PCWIN Network?

Portables Mobiles Consoles

Have you coordinated for your agency's Emergency Alert function to be monitored by a PCWIN agency? (which one)

Are your agency's radios programmed to use Over The Air Programming/Rekeying?

OTAP OTAR

What make and model of radio equipment do you wish to program on the PCWIN network?
(currently only Motorola products are permitted to connect to PCWIN)

How many radio transmissions does your agency average per hour?

What is the average length of your agency's radio transmissions?

Will your agency be connected to another network with the same radios?

Briefly describe the network

Will your agency require the dispatch services of a PCWIN agency?

What date would your agency like to begin using PCWIN?

Please provide a brief statement of your agency's Concept of Operations on the PCWIN Network

Comments (Special Requirements)

Signature/Date

PCWIN Staff Use:

Network Impact

Expected Site Affiliations

Will the Applicant's
Concept of
Operations Require
Additional
Infrastructure?

Additional
Required
Infrastructure
Locations

Will there be special
equipment
requirements?

Explain

What are the applicant's
programming requirements?

Talkgroup Recording
OTAR
OTAP
Encryption
Talkgroup Creation

What PCWIN talkgroups will need to
be programmed?

Have the requested PCWIN
agencies given permission to
program the applicant's radios?

Which PCWIN Agencies have
granted talkgroup sharing
permission?

Fiscal Impact:

Does the Applicant offer any potential revenue? (explain)

Does the Applicant offer any potential cost savings? (explain)

What costs to PCWIN will the cooperative incur by permitting the Applicant's inclusion on the network?

What O&M burden will the Applicant be expected to pay? (Explain)

What additional fees is the Applicant expected to pay?

- Fleetmap Development Fee
- Radio Programming Fee
- Encryption Fee
- Coverage Remediation Fee
- Equipment Purchase Fee
- Maintenance Agreement Fee
- Annual PM through PCWIN Fee
- Advanced Application Research/Processing Fee

Total fees incurred with this application

Overall Recommendation:

What is the PCWIN staff's recommended level of participation for the Applicant?

(refer to page 14 of the Sept 12 PCWIN Business Plan for guidance)

Operations Working Group recommendation

Date

Technical Working Group recommendation

Date

What is the Applicant's recommended "Go-Live" date?

If applicable, what is the termination date of the Applicant's PCWIN network connection?

What is the Applicant's code plug?

Further Comments

Executive Director Signature / Date

Board of Directors approval date / comments

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Technical Working Group recommendation

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Further Comments

Executive Director Signature / Date

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Further Comments

Executive Director Signature / Date

Board of Directors approval date / comments



Ready to Protect, Proud to Serve

tel: 520-791-4441
fax: 520-791-5491
www.ci.tucson.az.us/police/
270 S. Stone Avenue
Tucson, Arizona 85701-1917

September 21, 2015

Mr. John Voorhees
PCWIN Executive Director
Pima Emergency Communications Operations Center
3434 East 22nd Street
Tucson, AZ 85713-2353

Dear Director Voorhees:

As stated in the *PCWIN (Pima County Wireless Integrated Network) Cooperative Business Plan*, the Board of Directors appoints members to the PCWIN Executive Committee. Currently, Captain David Azuelo represents the Tucson Police Department on that committee. With Captain Azuelo's retirement on October 2, 2015, I have selected Assistant Chief Carla Johnson to be his replacement. Assistant Chief Johnson commands the Administrative Services Bureau, and has been a member of the Tucson Police Department for 29 years.

I understand that the Executive Committee must create a motion to approve and forward this recommendation to the Board of Directors. If there is anything I can do to facilitate this process or to answer any questions concerning my selection, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Roberto A. Villaseñor".

Roberto A. Villaseñor
Chief of Police

RAV:KR

Date: November 19, 2015

From: John Voorhees
PCWIN Executive Director

To: PCWIN Board of Directors

Re: PCWIN Executive Committee/ Board of Directors 2016 Meeting schedule

I propose the following schedule for Executive Committee and Board of Directors 2016 meetings:

January 21, 2016 – Executive Committee

February 18, 2016 – Board of Directors

March 24, 2016 – Executive Committee

April 21, 2016 – Executive Committee

May 26, 2016 – Board of Directors

June 23, 2016 – Executive Committee

July 21, 2016 – Executive Committee

August 25, 2016 – Board of Directors

September 22, 2016 – Executive Committee

October 20, 2016 – Executive Committee

3rd Thursday in November and/or 1st Thursday in December – Board of Directors (Executive Committee as needed)

The September 2012 Business Plan states that, “The Executive Committee will conduct regularly scheduled meetings. These meetings shall be held at least once monthly prior to the Board of Directors’ meeting”. It also states, “The Board of Directors shall hold regular meetings monthly, except to the extent that, and for such periods of time as, the Board of Directors shall determine that regular meetings should be held more or less frequently”.

I believe this schedule meets the intent to regularly meet and have an active and engaged Governance structure. With your permission I will implement this new schedule. The Business Plan also states that the members of either committee may call additional meetings as needed.

Respectfully,

