# ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

## APPENDICES

## VOLUME TWO

## MARCH 2004

MARICOPA ASSOCIATION of GOVERNMENTS

# APPENDICES TO THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

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**March 2004**

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## ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

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MARCH 2004

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Maricopa Association of Governments
May 2002

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## Abbreviations

| | |
|---|---|
| ADEQ | Arizona Department of Environmental Quality |
| ADOT | Arizona Department of Transportation |
| AIRS | Aerometric Information Retrieval System |
| AZMET | Arizona Meteorological Network |
| CAAA | Clean Air Act Amendments of 1990 |
| DWM | UAM Diagnostic Wind Model |
| EPA | U. S. Environmental Protection Agency |
| EPS2.0 | UAM Emissions Preprocessor System version 2.0 |
| GIS | Geographic Information System |
| I/M | Inspection and Maintenance |
| MAG | Maricopa Association of Governments |
| MAGBEIS2 | Modified UAM Biogenic Emissions Inventory System version two for MAG |
| MCESD | Maricopa County Environmental Services Department |
| MCFCD | Maricopa County Flood Control Department |
| MIXEMUP | Mixing-Height Estimation Methodology for UAM Purposes |
| NAAQS | Nation Ambient Air Quality Standards |
| NOx | Oxides of Nitrogen |
| NWS | National Weather Service |
| PRISMS | Phoenix Realtime Instrumentation for Surface Meteorological Studies |
| RVP | Reid Vapor Pressure |
| SIP | State Implementation Plan |
| UAM | Urban Airshed Model |
| VOC | Volatile Organic Compound |

# 1. COMPUTER MODELING STUDY DESIGN

## 1.1 Background

In accordance with the 1990 Clean Air Act Amendments (CAAA) [1], the Maricopa County Nonattainment Area was initially classified as Moderate for ozone pollution. A 1993 State Implementation Plan (SIP) for the nonattainment area was submitted to the U.S. Environmental Protection Agency (EPA). On December 8, 1997, the nonattainment area was reclassified to serious. The attainment date for serious areas to attain the one-hour ozone National Ambient Air Quality Standard (NAAQS) was November 15, 1999. Because the Maricopa County Nonattainment Area has not exceeded the one-hour ozone standard during any days since 1997, monitor data indicate that the area has attained the standard. Effective May 30, 2001, EPA finalized its determination of attainment for the Phoenix area for the one-hour ground-level ozone NAAQS. However, EPA has not yet redesignated the area as an attainment area for the one-hour ozone standard. An ozone air quality maintenance plan is one of several requirements necessary for EPA to redesignate the Maricopa County Nonattainment Area to attainment. As the designated regional air quality planning agency, the Maricopa Association of Governments (MAG) conducts the emissions and concentration modeling, and prepares the air quality plans necessary for the redesignation to attainment. This protocol is developed to detail and formalize procedures for conducting all phases of the modeling study for the one-hour ozone maintenance plan. The modeling study will be performed to demonstrate maintenance of the one-hour ozone NAAQS.

The primary requirement of the ozone maintenance plan is that the plan demonstrates the one-hour ozone standard be maintained for at least ten years after the area is officially redesignated to attainment by EPA. In determining the amount of lead time to allow, EPA indicated that 18 months, as granted in section 107(d)(3)(D) of the Clean Air Act Amendments, should be assumed for EPA to approve a redesignation request [2]. Due to uncertainties regarding when the area will be redesignated to attainment, the year 2015 will be modeled to assure that the one-hour ozone standard is maintained at least ten years after an official notice of redesignation to attainment by the EPA.

On January 29, 2002, EPA announced the official release of the MOBILE6 model and triggered the two-year grace period for local agencies to utilize MOBILE6 in SIP revisions and transportation conformity analyses. In order to provide a 2006 budget of onroad mobile source emissions for conformity purposes, the year 2006 will also be modeled and included in the maintenance plan.

## 1.2 Core Air Quality Model

Several air quality models that could form the core of the ozone simulations were reviewed and evaluated. The Variable-grid Urban Airshed Model (UAM-V) was eliminated from the regulatory ozone modeling study for its proprietary nature. The Urban Airshed Model

version IV (UAM-IV), the Comprehensive Air quality Models with Extensions (CAMx), and the Community Multi-scale Air Quality (CMAQ) models were evaluated according to the selection criteria listed in Table 1.1. A simple scoring system was used for the evaluation. The score ranges from 0 to 3 with 0 the lowest score and 3 the highest.

All three models treat all of the components that contribute to the urban ozone plumes. Unlike UAM-IV which has been widely used in the regulatory ozone applications for many years, the CAMx and CMAQ models have been evaluated and tested by very limited user groups and the model performance still lacks confidence. Therefore, CAMx and CMAQ receive a low score for model performance. The UAM modeling system has been well established and applied in the CO and PM-10 plans at MAG so would be the easiest to use. However, the other models are also fairly easy to use so receive just a slightly lower score. All three models have similar data requirements. The UAM-IV is the most computationally efficient, whereas the CMAQ model is the least. The overall scores resulted from the above evaluation show that UAM-IV is most appropriate for use in the present study. The EPA also confirmed [3] that the recommendation [4] of using the Urban Airshed Model (UAM) [5,6,7,8] as the guideline model for photochemical modeling applications for urban scaled modeling domains remains valid.

Table 1.1 Scoring attributes of candidate air quality models

| Attribute | UAM-IV | CAMx | CMAQ |
|---|---|---|---|
| Treatment of Ozone Components | 3 | 3 | 3 |
| Model Performance | 2 | 1 | 1 |
| Ease of Use | 3 | 2 | 2 |
| Data Requirements | 2 | 2 | 2 |
| Computation Requirements | 3 | 2 | 1 |
| Total | 13 | 10 | 9 |

Procedures described in this protocol are intended to satisfy the CAAA maintenance demonstration requirements for the nonattainment area and to foster confidence in the modeling study.

### 1.3 Preprocessor Programs

UAM-IV assigns emissions by grid square within the specified modeling grid. The user may specify the output interval (e.g., every one hour) for which average concentrations are calculated. At each time step, the model calculates concentrations in all grid cells for all species. For this analysis, the calculated concentrations output from the model can be used to generate contour maps of one-hour average concentrations in, for example, parts

per million (ppm).

Figure 1.1 depicts the MAG air quality modeling chain. Most of the UAM input files will be prepared using the standard UAM preprocessor programs. The input files containing information on air quality and meteorology will be based on measured data where available. The mixing depths will be calculated using the Mixing-Height Estimation Methodology for UAM Purpose (MIXEMUP) [13] procedure. The wind fields will be generated using the Diagnostic Wind Model (DWM) [7] which is included in the UAM program package. The UAM Emissions Preprocessor System (EPS2.0) [6] will be used to process the emission inventory where the onroad mobile emissions will be generated by the EPA MOBILE6 model and M6Link, a MAG software developed to be applied at the regional level to examine transportation and related air quality issues. More detailed discussions on the preparation of emission inventory, wind field specification, and mixing depths will be provided later in this protocol.

### 1.4 Analysis Objectives

Key objectives to be accomplished in this protocol document are the following:

1. enhance technical credibility,

2. encourage the participation of all interested parties,

3. lay out responsibilities of all participants,

4. provide for consensus building among all interested parties concerning modeling issues, and

5. provide documentation for technical decisions made in applying the model as well as the procedures followed in reaching these decisions.

The protocol details and formalizes procedures for conducting all phases of the modeling study such as:

1. stating the background, objectives, tentative schedule, and organizational structure for the study,

2. developing the necessary input data bases,

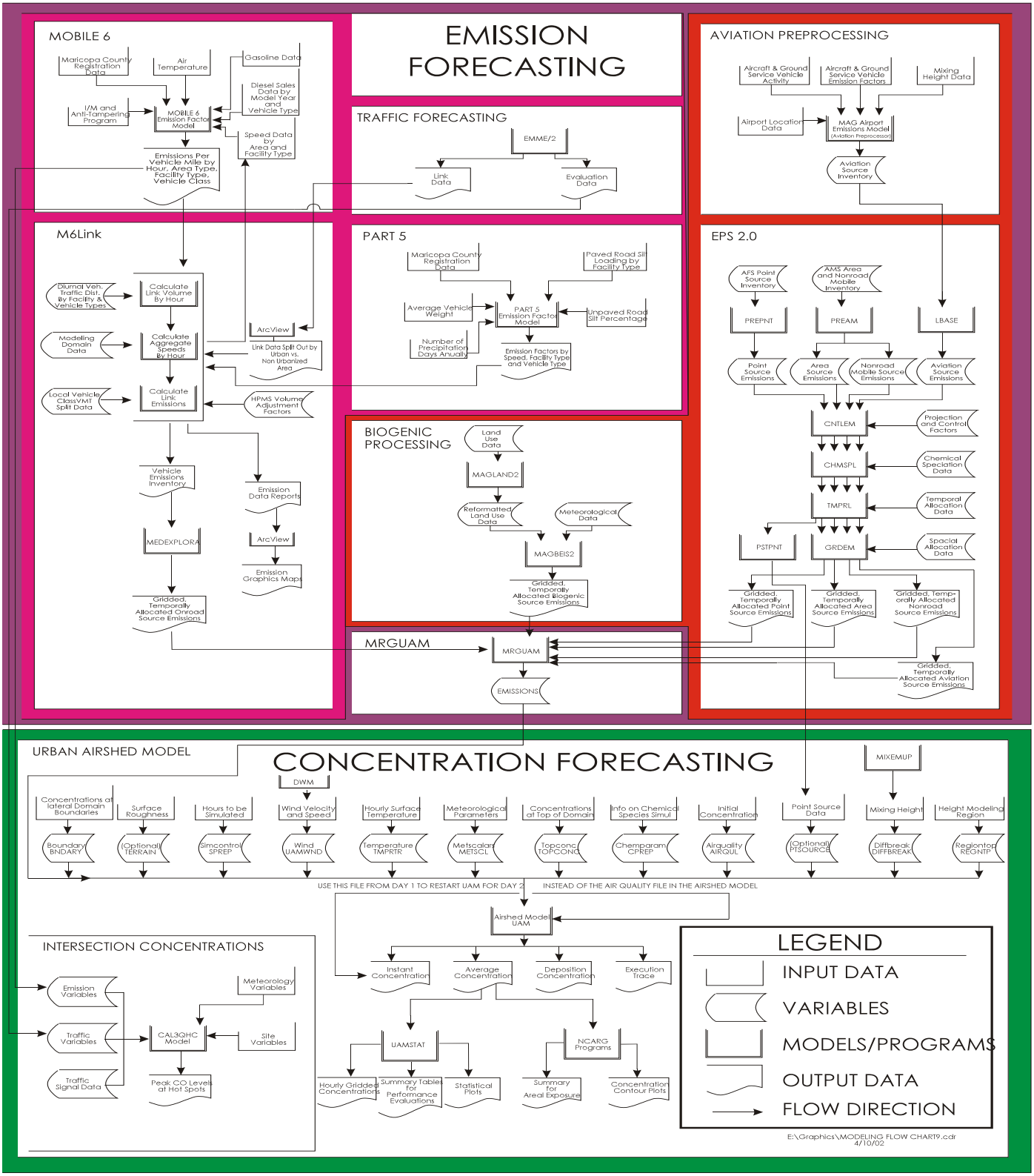


Figure 1.1. MAG air quality modeling chain.

3. conducting quality assurance and diagnostic model analyses,

4. conducting model performance evaluations and interpreting modeling results, and

5. describing procedures for using the model to demonstrate whether adopted control strategies are sufficient to demonstrate maintenance of the one-hour ozone standard.

The 2006 and 2015 future year emission inventories will include the committed measures where appropriate from the Addendum to the MAG 1993 Moderate Area Ozone Plan [9], Revised MAG 1999 Serious Area Carbon Monoxide Plan [10], and Revised MAG 1999 Serious Area Particulate Plan for PM-10 [11], to determine if the current committed measures are sufficient to demonstrate maintenance of the standard. If the modeling effort outlined in this protocol does not demonstrate maintenance of the standard with the existing committed control measures, the technical support document will be revised to include documentation of additional activities that will be necessary to maintain the standard (i.e. establishing reduction goals, evaluating additional control measures, etc.).

**1.5 Schedules**

The ozone air quality analysis for the Maricopa County Nonattainment Area will be comprised of the following tasks:

1. Prepare a protocol document (this document) that describes the purpose, background, analysis objectives, and the procedures to be followed in the remainder of the analysis. This document also specifies the modeling domain and recommends a primary modeling episode. (TARGET DATE: April 2002)

2. The ozone emission inventory reported in "*1999 Base Year Ozone Emission Inventory*" [12] will be input into the Emission Preprocessor System 2.0 which will reformat the data into the appropriate UAM input files for the 1999 episode. (TARGET DATE: August 2002)

3. Prepare onroad mobile source emissions using MOBILE6 and M6Link for the 1999 episode. (TARGET DATE: August 2002)

4. Develop meteorological and air quality UAM inputs for the 1999 episode. (TARGET DATE: August 2002)

5. Run UAM and evaluate model performance for the 1999 base case episode period. (TARGET DATE: November 2002)

6. The ozone emission inventory reported in "*1999 Base Year Ozone Emission Inventory*" [12] will be input into the Emission Preprocessor System 2.0 which will

reformat the data into the appropriate UAM input files for the 1998 episode. (TARGET DATE: November 2002)

7. Prepare onroad mobile source emissions using MOBILE6 and M6Link for the 1998 episode. (TARGET DATE: November 2002)

8. Develop meteorological and air quality UAM inputs for the 1998 episode. (TARGET DATE: November 2002)

9. Run UAM and evaluate model performance for the 1998 base case episode period. (TARGET DATE: February 2003)

10. Select the day with the overall best model performance for modeling the future years. Develop emission inventories for both 2006 and 2015 years. (TARGET DATE: April 2003)

11. Perform UAM simulations for 2006 and 2015 years. (TARGET DATE: May 2003)

12. Complete maintenance demonstration and write a technical support document (TSD) summarizing the analysis. (TARGET DATE: June 2003)

13. Submit the plan for external review. (TARGET DATE: October 2003)

14. Complete final revisions to the plan. (TARGET DATE: November 2003)

15. Submit the plan to ADEQ. (TARGET DATE: December 2003)

The schedule for these tasks is presented graphically in Figure 1.2.

**1.6 Management Structure/Technical Committees**

Technical oversight for this project will be provided by the Regional Air Quality Planning Team. This team includes staff representatives from the Maricopa Association of Governments (MAG), the Arizona Department of Environmental Quality (ADEQ), the Arizona Department of Transportation (ADOT), and the Maricopa County Environmental Services Department (MCESD). The activities of this working group are directed by a Memorandum of Agreement among the ADEQ, ADOT, MCESD, and MAG (see Attachment I). Representatives of other agencies, including EPA and the U.S. Department of Transportation, will be consulted in technical matters as needed. The Air Quality Planning Team will meet as needed during the ozone modeling effort. Periodic reports on the status and progress of various phases of the

| Ozone Modeling Task List | 2002 | | | | | | | | | | 2003 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Prepare protocol document | | ✯ | | | | | | | | | | | | | | | | | | | | |
| ***Ozone Episode 1*** (Aug. 24, 1999) | | | | | | | | | | | | | | | | | | | | | | |
| Base Year Emission Inventory (EI) preparation | | | | | | ✯ | | | | | | | | | | | | | | | | |
| MOBILE 6 modeling for onroad mobile emissions | | | | | | ✯ | | | | | | | | | | | | | | | | |
| Meteorological and air quality UAM inputs preparation | | | | | | ✯ | | | | | | | | | | | | | | | | |
| UAM modeling and base case performance evaluation | | | | | | | | | ✯ | | | | | | | | | | | | | |
| ***Ozone Episode 2*** (Jul. 17, 1998) | | | | | | | | | | | | | | | | | | | | | | |
| Base year EI preparation | | | | | | | | | ✯ | | | | | | | | | | | | | |
| MOBILE 6 modeling for onroad mobile emissions | | | | | | | | | ✯ | | | | | | | | | | | | | |
| Meteorological and air quality UAM inputs preparation | | | | | | | | | ✯ | | | | | | | | | | | | | |
| UAM modeling and base case performance evaluation | | | | | | | | | | | | ✯ | | | | | | | | | | |
| Develop EI for 2006 and 2015 | | | | | | | | | | | | | | ✯ | | | | | | | | |
| UAM simulations for 2006 and 2015 | | | | | | | | | | | | | | | ✯ | | | | | | | |
| Complete maintenance demonstration and write TSD | | | | | | | | | | | | | | | | ✯ | | | | | | |
| External review | | | | | | | | | | | | | | | | | | | | ✯ | | |
| Final revisions | | | | | | | | | | | | | | | | | | | | | ✯ | |
| Submit to ADEQ/EPA | | | | | | | | | | | | | | | | | | | | | | ✯ |

Figure 1.2. Tasks and target time schedule of the ozone air quality analysis for the Maricopa County nonattainment area.

modeling work will be presented at these meetings, and technical issues will be discussed and resolved.

MAG has responsibilities for regional involvement in a number of planning issues, and has established an extensive mechanism for ensuring coordinated policy direction from elected officials, coordinated management and technical input, advice from the appropriate agency staff, as well as direct citizen input. Figure 1.3 displays the MAG Policy Structure and Figure 1.4 shows the MAG Committee Structure. All policy committees and formal technical committees follow the Arizona open meeting law which requires, among other things, the posting of meeting notices and agendas at least 24 hours prior to any meeting.

Public Input

The MAG Regional Council is the governing body of MAG. It is comprised of elected officials from each member agency, two ex-officio members representing the Arizona State Transportation Board, and a representative from the Citizens Transportation Oversight Committee. This composition of elected officials is a reflection of citizen input at the local government level. The MAG Regional Council agenda includes a call to the audience, providing the opportunity for public comments at each monthly meeting.

MAG holds at least one formal public meeting prior to the adoption of any update to the nonattainment area plan. Formal public meetings are advertised locally at least 30 days prior to the meeting date and documentation is available for public review during this 30-day period. Draft documents are distributed to appropriate federal, state, and local agencies for review and comment during this period. Comments received are analyzed with a staff response for consideration by the MAG Regional Council before taking approval action. Documentation of the comments and responses are incorporated into the plan document.

Due to the technical complexity of many MAG programs, committees consisting of professional experts are often needed to assist in program development. The Air Quality Technical Advisory Committee is composed of representatives from eight MAG member agencies, citizens, environmental interests, health interests, automobile industry, fuel industry, utilities, public transit, trucking industry, rock products industry, construction firms, housing industry, architecture, agriculture, industry, business, parties to the Air Quality Memorandum of Agreement, and various State and Federal agencies. The role of the Technical Advisory Committee is to review and comment on technical information generated during the planning process and make recommendations to the Management Committee.

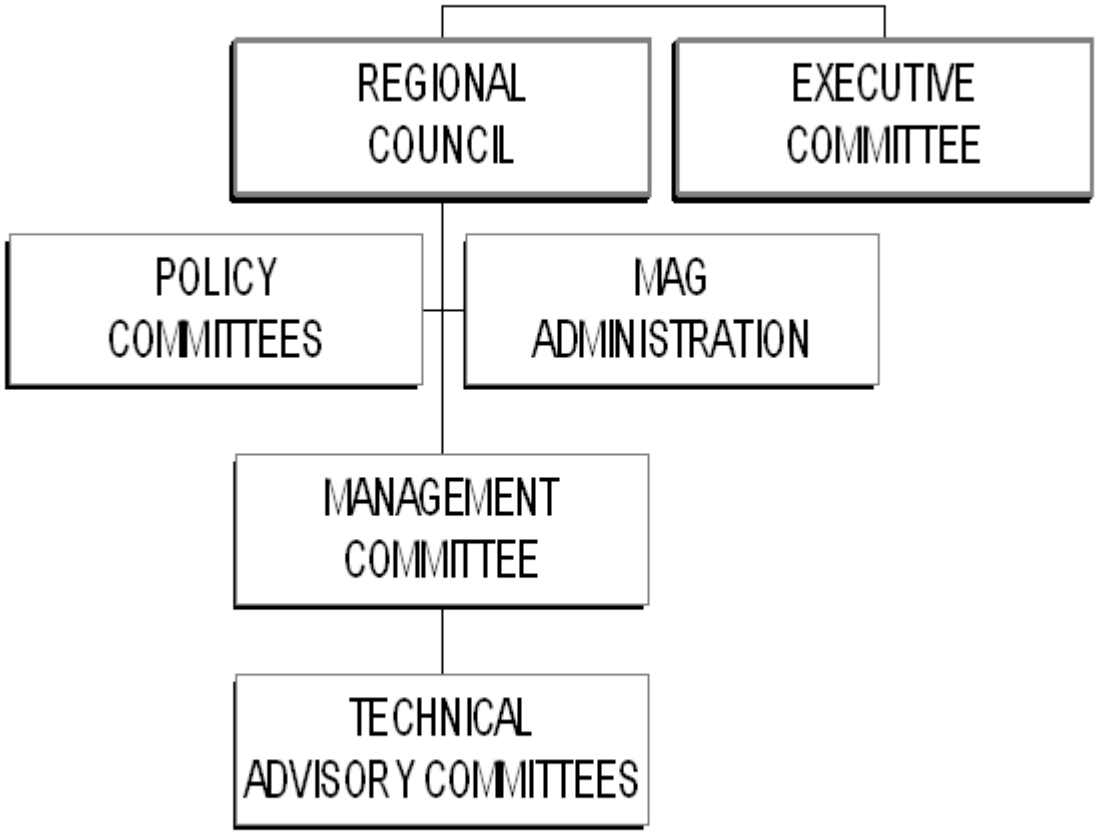


Figure 1.3. MAG policy structure.

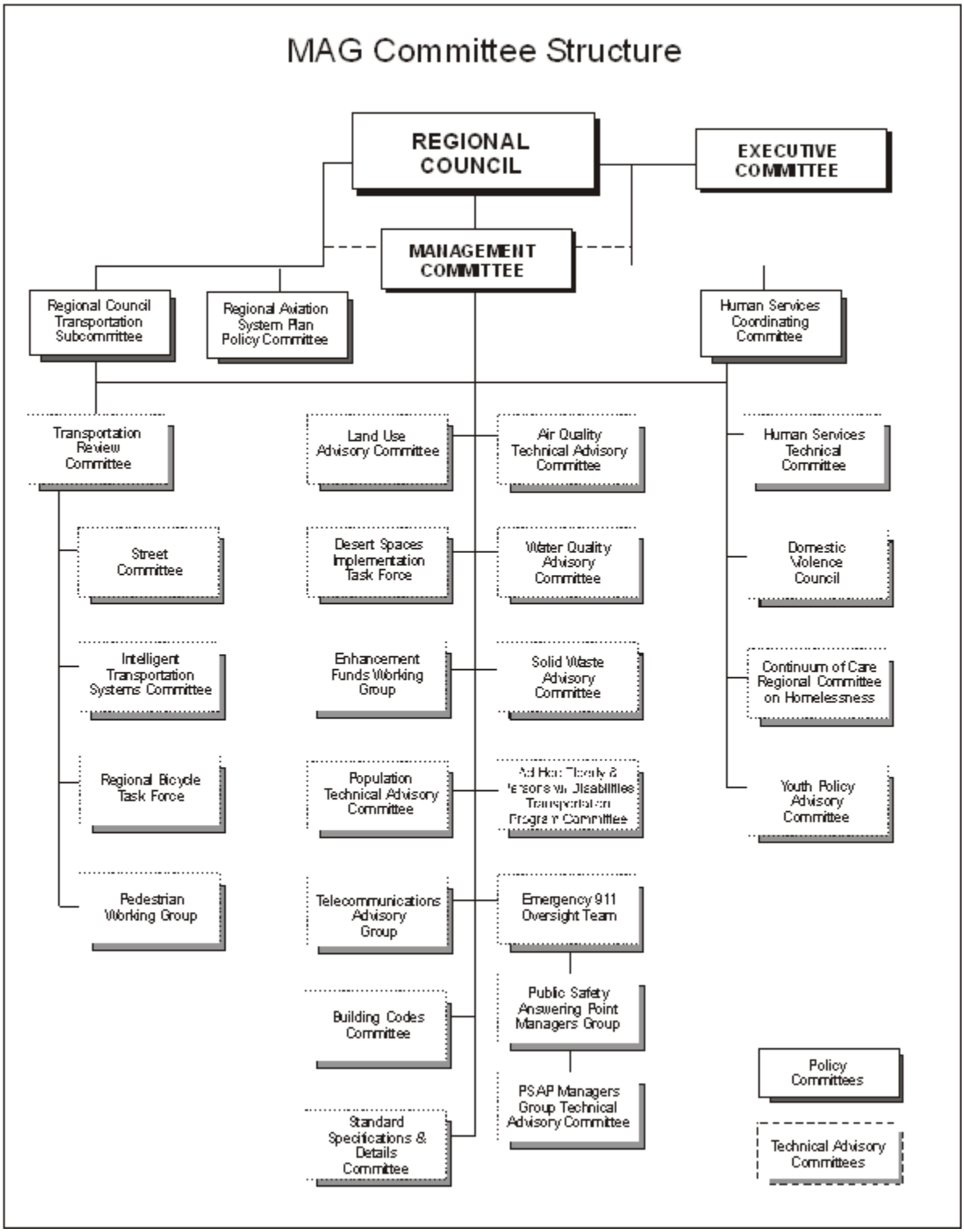


Figure 1.4. MAG committee structure.

# 2. DOMAIN AND DATA BASE ISSUES

## 2.1 Aerometric Data Bases

Meteorological and air quality data to be used for the UAM modeling applications will be collected from all available valid monitoring sites in or around the nonattainment area. The Arizona Department of Environmental Quality (ADEQ) and the Maricopa County Environmental Services Department (MCESD) maintain networks collecting both air quality and meteorological data. Additional surface meteorological data will be collected from other monitoring networks including those maintained by Maricopa County Flood Control Department (MCFCD), National Weather Services (NWS), Phoenix Realtime Instrumentation for Surface Meteorological Studies (PRISMS), and AriZona METeorological network (AZMET). It should be noted that there is no upper air station in the domain under consideration. The available upper air station closest to the domain is in Tucson which is about 110 miles south of Phoenix. Special effort will be devoted to identifying any available additional sources of upper air data for the present study.

Air quality data generally serve two purposes. First, data are used to specify initial and boundary concentrations. Second, ambient measurements are used to assess the ability of the model to replicate a historical episode, that is, to evaluate model performance for the base case. These topics are addressed in the relevant sections of the modeling protocol.

## 2.2 Base Meteorological Episode Selection

Elevated ozone episodes that occurred during the ozone season period of 1998 through 2000 were considered in the selection of episodes for this modeling analysis. Because there were no exceedances of the standard in any of the three years, the ozone episodes were selected due to the relatively elevated and widespread readings in this domain.

The historical patterns of ozone episodes and the fundamental meteorological regimes conducive to ozone formation in the area were taken into account in evaluating and justifying the selection of episodes for the present modeling study. The episodes selected represent different meteorological regimes observed to correspond to ozone greater or equal to 108 ppb, a cutoff number representing 90% of the concentration level of the ozone standard (120 ppb). Wind flow patterns (e.g., well defined transport winds vs. light and variable winds) were the primary consideration for distinguishing among meteorological regimes. Region-wide temperature observations (e.g., high temperatures vs. less extreme temperatures) were also considered as a factor in selecting a set of modeling episodes. High ozone days were partitioned into major meteorological regimes. The detailed procedures were documented in the MAG memorandum dated March 25, 2002, "*Review of 1998-2000 Ozone Episodes in the Maricopa County Nonattainment Area*" in Attachment II. The review suggests July 17, 1998 (Friday) and August 24, 1999 (Tuesday) be used in the present ozone modeling study and the previous days of the primary episode days be used for initialization.

## 2.3 Modeling Domain

Selection of the modeling domain took into account the distribution of major emissions sources, the locations of the meteorological and air quality monitoring sites, and the prevailing winds associated with ozone episodes. A series of emission density plots from the previous MAG Moderate Area Ozone Plan [9] were examined and provided in Attachment III. A map of the modeling domain for this application is presented in Figure 2-1. The map also indicates locations of the air quality and meteorological monitoring sites (as listed in Tables 2-1 and 2-2) and major power plants (as listed in Table 2-3) in and around the modeling domain. The shaded area represents the EPA-designated nonattainment area for ozone. The modeling domain consists of 92 grid cells in the west-east direction and 43 grid cells in the south-north direction, with a horizontal grid spacing of two kilometers. The origin, which is the southwest corner of the domain, is at 297 km easting and 3675 km northing in UTM zone 12. The domain under consideration will have an area of 184 km by 86 km, that is 15,824 $km^2$.

## 2.4 Horizontal Grid Resolution

The horizontal grid resolution to be applied to the modeling domain is two kilometers by two kilometers which is the finest grid cell size recommended in the EPA Guideline [4]. The 2-km grid spacing should allow sufficient resolution of the major emissions sources.

## 2.5 Number of Vertical Layers

The number of layers in the vertical direction to be used in the Urban Airshed Model simulations is proposed to be five, with at least three layers above the morning mixing height.
(which is called “diffusion break” in UAM) following EPA Guidelines [4]. The top of the modeling domain (which is called “region top” in UAM) will be specified above the mixing height by at least the depth of one upper layer cell. This will be done by setting the region top value equal to the maximum mixing depth plus the minimum depth of the upper layer cells. Minimum vertical cell size will be 50 m below the diffusion break and 100 m above it.

## 2.6 Emission Inventory

The UAM Emissions Preprocessor System (EPS2.0) [8] will be used to process the emission inventory. The emission inventory consists of emissions from various sources including stationary points, area, onroad mobile, nonroad mobile, and biogenic sources. The starting point for the emission inventory will be the 1999 periodic inventory for ozone developed by MCESD [12]. The 1999 inventory will be updated to reflect the latest land use data available for MAG. This inventory will be factored down to the episode days in 1998 and projected to 2006 and 2015. The emissions will be temporally adjusted and spatially allocated in the grid cells using EPS2.0.

The EPS2.0 consists of a set of FORTRAN programs (modules) that are executed

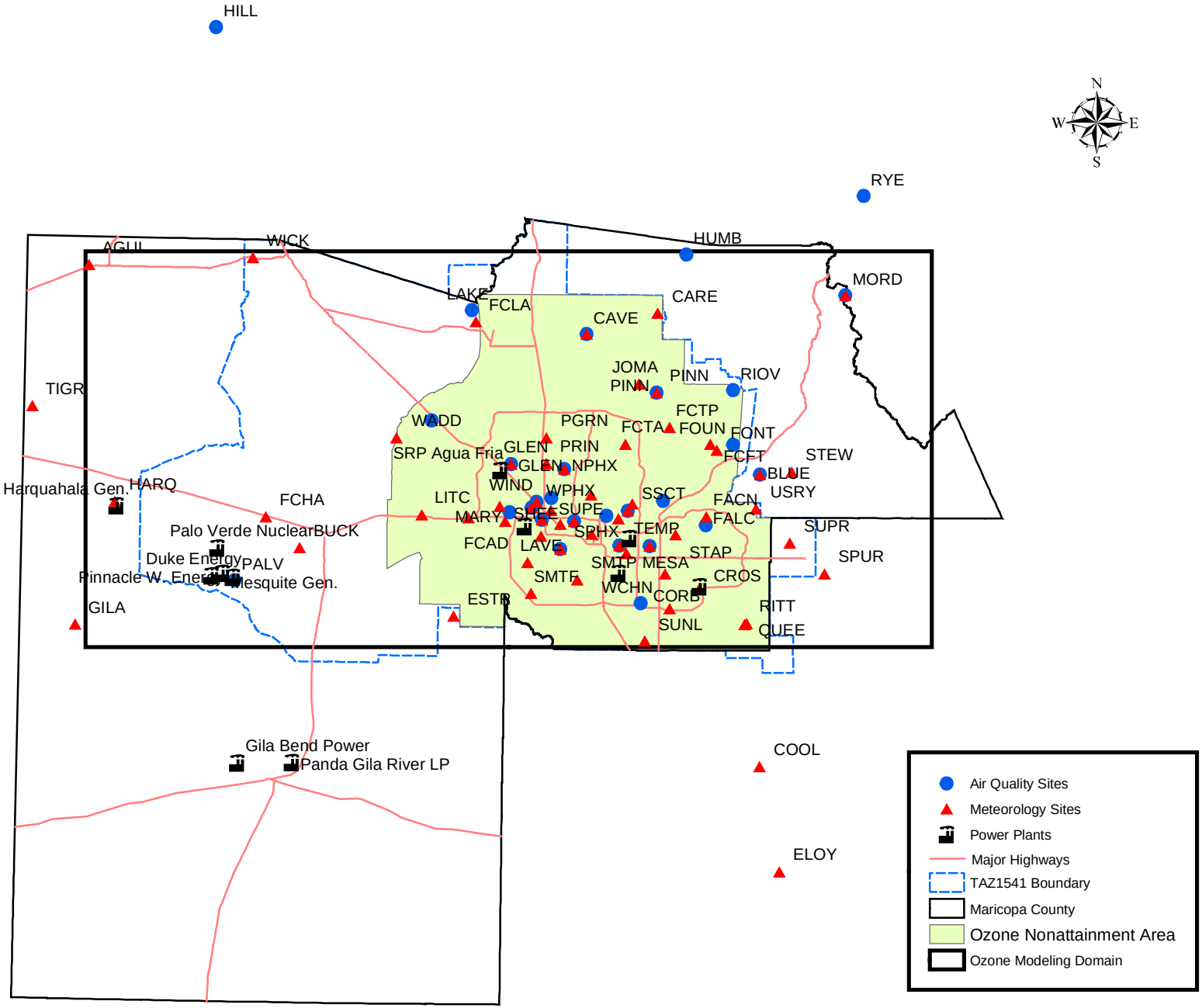


Figure II-1 The one-hour ozone modeling domain

Table 2-1.Ozone monitoring sites.

| Abbr. | Name | Site Operator | Location | UTM (Zone 12, km) Easting | Northing | Wind | O3 | CO | NO | $NO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| BLUE | Blue Point | MCESD | Usery Pass & Bush Highway | 443644 | 3712520 | ✓ | ✓ | | | |
| CPHX | Central Phoenix | MCESD | 1845 East Roosevelt | 403224 | 3702365 | ✓ | ✓ | ✓ | ✓ | ✓ |
| CHAN | Chandler | MCESD | 1475 E. Pecos Rd. | 423957 | 3683327 | ✓ | | | | |
| EMGM | Emergency Management | MCESD | 52nd St. & Mcdowell Rd. | 410191 | 3703607 | | ✓ | | | |
| FALC | Falcon Field | MCESD | 4530 East Mckellips | 431884 | 3701512 | ✓ | ✓ | | | |
| FOUN | Foutain Hills | MCESD | 16426 East Palisades | 437732 | 3719033 | ✓ | ✓ | | | |
| GLEN | Glendale | MCESD | 6000 West Olive | 389475 | 3714845 | ✓ | ✓ | ✓ | | |
| LAKE | Lake Pleasant | MCESD | 41402 North 87th Ave. | 380958 | 3748299 | | ✓ | | | |
| MARY | Maryvale | MCESD | 6180 West Encanto | 389221 | 3704348 | | ✓ | ✓ | | |
| MESA | Mesa | MCESD | 370 South Brooks | 419633 | 3696938 | ✓ | ✓ | ✓ | | |
| NPHX | North Phoenix | MCESD | 601 East Butler | 401095 | 3713719 | ✓ | ✓ | ✓ | | |
| PALV | Palo Verde | ADEQ | 36248 W. Elliot Rd. | 329369 | 3689549 | | ✓ | | ✓ | ✓ |
| PINN | Pinnacle Peak | MCESD | 25000 Windy Walk Way | 421092 | 3730363 | ✓ | ✓ | | | |
| RIOV | Rio Verde | MCESD | North Forest Rd. & Del Ray Ave. | 437815 | 3730948 | | ✓ | | | |
| SRPI | Salt River - Pima | ADEQ | 10005 E. Osborn | 422593 | 3706837 | | ✓ | | ✓ | ✓ |
| SSCT | South Scottsdale | MCESD | 2857 North Miller Rd. | 414851 | 3704625 | ✓ | ✓ | ✓ | ✓ | ✓ |
| SPHX | South Phoenix | MCESD | Central Ave & Broadway | 400209 | 3696337 | ✓ | ✓ | ✓ | | |
| SUPR | Supersite | ADEQ | 4530 N. 17th Ave. | 398290 | 3707463 | | ✓ | ✓ | ✓ | ✓ |
| WCHN | West Chandler | MCESD | 163 South Price Rd. | 417697 | 3684573 | | ✓ | ✓ | | |
| WPHX | West Phoenix | MCESD | 3847 West Earll Rd. | 393893 | 3705301 | ✓ | ✓ | ✓ | ✓ | ✓ |
| HUMB | Humboldt Mountain | ADEQ | Tonto National Forest | 427644 | 3760390 | | ✓ | | | |
| MORD | Mt. Ord | ADEQ | Mazatzal Mountains | 462223 | 3751473 | | ✓ | | | |
| HILL[1] | Hillside | ADEQ | Sheriff's Repeater Station | 325385 | 3809798 | | ✓ | | | |
| RYE[2] | Rye | ADEQ | No Address Available | 466178 | 3773110 | ✓ | ✓ | | | |

[1]HILL located outside of Maricopa County therefore was not used for the ozone episode day selection.

[2]RYE located outside of Maricopa County therefore was not used for the ozone episode day selection.

Table 2-2.Meteorological monitoring stations.

| Abbr. | Name | Site Operator | Location | UTM Zone 12 (m) | |
|---|---|---|---|---|---|
| | | | | Easting | Northing |
| AGUI | Aguila | AZMET | 0.96 km NW of Aguila City | 297716 | 3758206 |
| ALAM | Alameda | PRISM | Southern Ave & Dorsey Ln | 414518 | 3695417 |
| ARCA | Arcadia | PRISM | Bamelback Rd & 40th St. | 406863 | 3708085 |
| BNKO | Bank One | ADEQ | 201 N. Central | 400242 | 3701788 |
| BUCK | Buckeye | AZMET | 3.5 km south of exit 109 from I-10 | 343451 | 3696706 |
| CARE | Carefree Ranch | FCDMC | 3.5 mi NE of Skyranch Airport | 421380 | 3747596 |
| CHAN | Chandler | MCESD | 1475 E Pecos Rd. | 423957 | 3683327 |
| COLL | Collier | PRISM | 107th Ave & I-10 | 380172 | 3703143 |
| COOL | Coolidge | AZMET | 4.3 mi from Rt. 87 on Coolidge Rd. | 443495 | 3649041 |
| CORB | Corbell | PRISM | McQueen Rd. & Guadalupe Rd | 422957 | 3690973 |
| CPHX | Central Phoenix | MCESD | 1845 East Roosevelt | 403224 | 3702365 |
| CROS | Crossroads Park | FCDMC | 0.5 mi NW of Ray and Greenfield | 430480 | 3687682 |
| DURA | Durango Complex | FCDMC | 27th Ave and Durango St. | 395955 | 3699110 |
| ELOY | Eloy | AZMET | E of 11 mile corner road on Arica Rd | 447839 | 3626168 |
| ENCA | Phx. Encanto | AZMET | Encanto Golf Course | 398132 | 3704754 |
| ESTR | Estrella Fan | FCDMC | El Mirage and Germann Rd | 376983 | 3681775 |
| FACN | Falcon | PRISM | McDowell Rd & Greenfield Rd | 431961 | 3703348 |
| FCAD[1] | ACDC@67th Ave | FCDMC | 67th Ave. Bridge at Arizona Canal | 388433 | 3720910 |
| FCFT[1] | Fountain Hills Fire | FCDMC | Palisades Blvd Fire Station | 432767 | 3719080 |
| FCHA[1] | Hassy R. @I-10 | FCDMC | I-10 Bridge over Hassayampa River | 336173 | 3703389 |
| FCLA | Lake Pleasant - FCDMC | FCDMC | On New Waddell Dam | 381783 | 3745757 |
| FCTA[1] | Thunderbird Academy | FCDMC | Thunderbird Rd. & Scottsdale Rd. | 414393 | 3719165 |
| FCTP[1] | Thompson Peak | FCDMC | Thompson Peak | 423984 | 3722842 |
| FONT | Fountain | PRISM | Coyote Dr & El Lago Blvd. | 434202 | 3717838 |
| GILA | Gila Bend Mountains | FCDMC | 16 mi NW of Painted Rock Dam | 294659 | 3679991 |
| GILB | Gilbert | MCESD | Guadalupe & Linsey Rd. | 428468 | 3691346 |
| GLEN | Glendale | MCESD | 6000 West Olive | 389475 | 3714845 |
| GREE | Greenwood | MCESD | 27th Ave & I-10 | 396213 | 3702738 |
| HARQ | Harquahala | AZMET | 1.8 Km No or Courhouse Rd | 303333 | 3706683 |
| IBWI | IBW@Indian School | FCDMC | Indian School & Hayden Rd | 415875 | 3705908 |
| JOMA | Pima@ Jomax | FCDMC | 1/8 mi NW of Pima and Jomax Rd | 417263 | 3732168 |
| LAVE | Laveen | AZMET | 3921 W. Baseline Rd. | 393025 | 3693413 |
| LITC | Litchfield | AZMET | 1.6 km N of McDowell Rd | 370084 | 3703767 |
| MESA | Mesa | MCESD | 370 South Brooks | 419633 | 3696938 |
| MORD | Mt. Ord | ADEQ | Mazatzal Mountains | 462223 | 3751473 |

Table 2-2. Meteorological monitoring stations. (Continued)

| | | | | UTM Zone 12 (m) | |
|---|---|---|---|---|---|
| Abbr. | Name | Site Operator | Location | Easting | Northing |
| NPHX | North Phoenix | MCESD | 601 East Butler | 401095 | 3713719 |
| PERA | Pera | PRISM | McDowell Rd & Cross Cut Canal | 412777 | 3702948 |
| PGRN | Phx. Greenway | AZMET | Cave Creek Golf Course | 397191 | 3720535 |
| PINN | Pinnacle Peak | MCESD | 25000 Windy Walk Way | 421092 | 3730363 |
| PRIN | Pringle | PRISM | 23rd Ave & Dunlap Rd | 397208 | 3714898 |
| QUEE | Queen Creek | AZMET | Queen Creek Rd & Ellsworth Rd. | 440232 | 3679918 |
| RITT | Rittenhouse | PRISM | Ellsworth Rd & Queen Creek Rd | 440647 | 3680162 |
| SHEE | Sheely | PRISM | 71st Ave & Osborn Rd | 386991 | 3705648 |
| SKYH | Sky Harbor Intl Airport | NWS | Sky Harbor Intl Airport | 407040 | 3699582 |
| SMTF | South Mountain Fan | FCDMC | Ray Rd & 35th Ave in S. Mtn. Park | 393856 | 3686689 |
| SMTP | South Mountain Park | FCDMC | Elliot Rd & 24th St. | 403868 | 3689634 |
| SPHX | South Phoenix | MCESD | Central Ave & Broadway | 400209 | 3696337 |
| SPUR | Spurlock | PRISM | US 60 & Kings Ranch Rd. | 457642 | 3690913 |
| SSCT | South Scottsdale | MCESD | 2857 North Miller Road | 414851 | 3704625 |
| STAP | Stapley | PRISM | Stapley Dr & Consolidated Canal | 425245 | 3699424 |
| STEW | Stewart Mountain | PRISM | Near Stewart Mountain Dam | 450493 | 3713121 |
| SUNL | Sun Lakes | PRISM | Dobson Rd & Riggs Rd | 418543 | 3676318 |
| SUPR | Superstition | PRISM | Cactus Rd & Junction St. | 450104 | 3697632 |
| TIGR | Tiger Wash Fan | FCDMC | Eagle Eye Rd & Salome Highway | 285360 | 3727594 |
| USRY | Usery Park WS | FCDMC | Crismon Rd. & Thomas Rd | 442761 | 3705064 |
| WADD | Waddell | AZMET | Cotton Ln and Greenway Rd. | 364589 | 3720570 |
| WICK | Wickenburg Airport | FCDMC | 4.5 mi W of US 60/US 93 Junction | 333310 | 3759732 |
| WIND | West Indian School | MCESD | 33rd Ave. & W. Indian Sch. Rd. | 395007 | 3706551 |
| WPHX | West Phoenix | MCESD | 3847 West Earll Road | 393893 | 3705301 |

[1] Only temperature data are available from the sites.

Table 2-3. Major power plants in the Maricopa County.

| Power Plant | Location | City | UTM (Zone 12, km) | |
|---|---|---|---|---|
| | | | Easting | Northing |
| APS West Phoenix Power Plant | Hadley St. | Phoenix | 392414 | 3701190 |
| Duke Energy Arlington Valley LLC. | Elliot Rd. | Arlington | 324282 | 3690470 |
| Harquahala Generating Co. LLC. | Harquahala Valley Rd. | N/A[a] | 303688 | 3705787 |
| Mesquite Generating Station | Elliot Rd. | Arlington | 326602 | 3691016 |
| Ocotillo Power Plant | University Dr. | Tempe | 415224 | 3698573 |
| Palo Verde Nuclear Generating Station | Wintersburg Rd. | Tonopah | 325615 | 3696527 |
| Panda Gila River LP. | Watermelon Rd. | Gila Bend | 341737 | 3649850 |
| Pinnacle West Energy Corp. | 363rd Ave. | Arlington | 328940 | 3690200 |
| Santan Generatin Plant | Val Vista Dr. | Gilbert | 430407 | 3688183 |
| SRP Agua Fria | Northern Ave. | Glendale | 387108 | 3713387 |
| SRP Kyrene Steam Plant | KyreneRd. | Tempe | 412877 | 3691004 |
| Gila Bend Power Generation Station | Citrus Valley Rd. | Gila Bend | 329845 | 329845 |

[a] Harquahala Generating Co. LLC is in an unincorporated section of Maricopa Cty., near the intersection of Courthouse and Harquahala Valley Rds.

sequentially in order to prepare the gridded emissions inventory for use by UAM. The programs are as follows:

| | |
|---|---|
| PREPNT: | Prepares annual or seasonal point source inventory for further processing; identifies which sources are to be treated as elevated by the UAM. |
| PREAM: | Prepares annual or seasonal county-level area and mobile source emissions for further processing. |
| LBASE: | Prepares link-based mobile source emission estimates for further processing and disaggregates total emissions into individual components (used exclusively for aviation-related emissions). |
| CNTLEM: | Adjusts emission levels to reflect the effects of anticipated growth or implementation of proposed controls. |
| CHMSPL: | Assigns input hydrocarbon emissions to chemical species expected by the chemical mechanism. |
| TMPRL: | Temporally adjusts emissions from annual, seasonal, or typical season day to episodic levels. |
| GRDEM: | Spatially allocates emissions based on source location, link location, or gridded spatial surrogate indicators; converts to a UAM-ready inventory of low-level emissions. |
| PSTPNT | Reformat elevated point sources to be UAM-ready. |
| MRGUAM: | Merges several files for area, mobile, and low-level point source emissions into one UAM-ready emissions file. |
| RPRTEM: | Summarizes emission totals for the modeling domain by category. |

The EPS2.0 is described in detail in the User's Guide [8].

### 2.6.1 Consistency With Periodic Emission Inventories

The CAAA of 1990 requires that periodic ozone emission inventories be prepared at three-year intervals for all ozone nonattainment areas. The final 1999 periodic inventory was prepared by the Maricopa County Environmental Services Department in November, 2001 [12]. Table 2.4 lists the ozone season day emissions reported in the periodic inventory for the five source categories. The 1998 modeling emission inventory will be backcast from the 1999 periodic inventory by MCESD. The EPA guidance document on the emission inventory requirements [15] was used in the development of the inventory. Another EPA guidance document [16] will be used to process the emission inventory for use with UAM. That is, the inventory will be adjusted to be consistent with the meteorological conditions (e.g. the seasons) during the selected episode days. Then, the resulting episode day emissions will be adjusted to reflect control programs and activity levels prevailing during the modeling episode days. These adjustments will result in modeling inventories of the base year episode days for ozone.

The base year modeling inventory will be adjusted to reflect emissions expected to occur in 2006 and 2015. The general methodology for creating future-year baseline emission inventories will be based on the EPA guidance on the preparation of emission projections [17]. This adjustment will entail the use of growth factors, ongoing control programs, and retirement rates for obsolete sources of emissions. The resulting modeling inventories will represent the 1998 and 1999 base years, and the 2006 and 2015 base case inventories. Committed measure modeling runs will be prepared by applying credit for appropriate committed control measures to the 2006 and 2015 base case inventories. The growth factors used for the 2006 and 2015 inventories will reflect draft interim county population forecasts prepared by the Arizona Department of Economic Security based on the 2000 Census.

Documentation will be provided to show that emission data used in the modeling have been made available in the periodic emission inventories in accordance with applicable guidance and regulations.

### 2.6.2 Treatment of Mobile Sources

On January 29, 2002, EPA announced the official release of the MOBILE6 model for regulatory use outside of California. MOBILE6 is the latest update to the MOBILE model developed by EPA for the purposes of estimating motor vehicle emission factors for hydrocarbons, carbon monoxide, and oxides of nitrogen. The onroad mobile source emissions for the maintenance plan will be developed using the MOBILE6 model. It should be noted that the onroad mobile source portion of the 1999 Periodic Ozone Inventory [12] was developed using the MOBILE5a model. Since MOBILE6 includes major revisions in emission factors for onroad mobile sources, it is expected that there will be noticeable differences between the periodic and modeling inventories for onroad mobile sources.

MOBILE6 uses a variety of inputs. Each modeled scenario will require at least ten runs: a minimum of one Inspection and Maintenance (I/M) run and a non-I/M run for each of the five area types included in the air quality modeling area; central business district, urban, urban fringe, suburban, and rural. The results from these runs will be weighted appropriately to reflect the actual proportions of I/M and non I/M vehicles within the nonattainment area. In addition, the inputs for each run will include Reid Vapor Pressure (RVP), oxygen, and sulfur gasoline content values appropriate for the summer ozone season. The temperature range used will reflect episode day conditions in Maricopa County, Arizona for the episode chosen. Note that these values may be updated depending upon the final episode day choice. The 2015 committed measure package runs will reflect control measure assumptions for the pertinent commitments contained in the MAG Moderate Area Ozone Plan [9] and Serious Area Plans for both CO and PM-10 [10,11], where appropriate.

MOBILE6 generates emission factors which incorporate local vehicle speeds, episodic temperature, and hot/cold operating modes. These emission factors will be utilized by the M6Link program in estimating onroad motor vehicle emissions for the MAG region. The M6Link system is briefly described below.

Table 2.4 Summary of 1999 ozone season daily emissions in the Maricopa County Nonattainment Area. [12]

| | NOx | | VOC | | CO | |
|---|---|---|---|---|---|---|
| | tons/day | % | tons/day | % | tons/day | % |
| Area | 23 | 7.77 | 91 | 28.53 | 46 | 3.92 |
| Nonroad Mobile | 95 | 32.09 | 67 | 21.00 | 485 | 41.38 |
| Onroad Mobile | 147 | 49.66 | 90 | 28.21 | 634 | 54.10 |
| Biogenic | 10 | 3.38 | 49 | 15.36 | NA | NA |
| Point | 21 | 7.09 | 22 | 6.90 | 7 | 0.60 |
| Total | 296 | 100.00 | 319 | 100.00 | 1172 | 100.00 |

The M6Link system is a FORTRAN-based series of two programs (M6Link1 and M6Link2) that may be applied at the regional level to examine transportation and related air quality issues. The system is designed to first read in files created by the MAG EMME/2 transportation models, and extract the relevant data needed for an air quality analysis, including data needed to run the MOBILE6 model. The M6Link1 extracts data such as roadway link speeds, locations, and vehicle miles of travel (VMT) and assigns link VMT to the correct hour and air quality grid cell accordingly. M6Link1 also factors link VMT to be consistent with Highway Performance Monitoring System VMT by functional system. This first program also outputs summary data.

The MOBILE6 program is run using the output from M6Link1 as part of its input data. The output from MOBILE6 is then used as one of the inputs to M6Link2, the second program of the M6Link system. M6Link2 combines the output from M6Link1 and the output of MOBILE6 to produce hourly gridded emissions, suitable for input to the Urban Airshed Model (UAM). These results incorporate locally-derived hourly VMT splits, vehicle speed data, VMT by four vehicle classes by area and roadway type, fuel characteristics, and temperatures to ensure results appropriate to local conditions.

In addition to UAM-ready files, M6Link2 produces tables summarizing vehicle miles traveled (VMT) and vehicle hours traveled (VHT) by facility type and area type. Also, tables summarizing emission totals by hour, facility type, or emissions source (i.e. exhaust vs. evaporative) are produced. The UAM EPS2.0 will be used to combine the M6Link output with the emissions of other source categories (e.g., point, area, and biogenic source emissions) to create the EMISSIONS file used by UAM.

### 2.6.3 Treatment of Biogenic Emissions

MAGBEIS2 will be used to prepare the biogenic emissions. MAGBEIS2 was developed for MAG by Sonoma Technology, Inc. [19], and is a modification of the EPA UAM-BEIS2 [20] program. It allows hydrocarbons emitted by vegetation and $NO_x$ emitted by soil to be included in the emissions inventory.

MAGBEIS2 uses local land use data and gridded, hourly temperature data to calculate emissions of VOCs and $NO_x$ in each grid cell of the modeling domain for each hour of the modeling period. The most recent land use data compiled by MAG for transportation and planning purposes will be used in preparing the biogenic emissions. Procedures for development of the biogenic emissions will be consistent with those documented in the 1999 periodic ozone inventory [12] which can be referred to for technical details.

The biogenic emissions are generated in the UAM-ready format and may be merged with the other emission files for input to UAM. Further description of the use of the files associated with MAGBEIS2 may be found in the report prepared by Sonoma Technology, Inc. in July 1996 [19].

### 2.6.4 Temporal Allocation of Emissions

The 1998 modeling emission inventory will be prepared according to the emission inventory backcasted from 1999 to 1998 by MCESD. Emissions in the MCESD 1999 inventory are provided either as annual averages or as typical peak ozone season day values except for peaking power plants. Emissions from the peaking power plants for the modeling purposes will be based on the actual operating schedule provided by MCESD. All other point sources, along with area, nonroad mobile, and aviation sources will be resolved temporally based on profiles for seasonal activity, activity provided by day of week, and diurnal patterns of activity. The UAM EPS2.0 will be used to convert to episode day values by applying monthly and day-of-week adjustment factors. Typical peak ozone season day emissions correspond to an average weekday during the summer season, defined as July through September in the 1999 Periodic Inventory. To convert these values to average July weekday values in 1998, or August weekday values in 1999, EPS2.0 applies an adjustment factor representing the ratio of August or July emissions to average summer emissions for each source type.

For the 2006 and 2015 future years, the major point sources will be allocated according to projected operating schedule data where available. For other point, area, and nonroad mobile sources, the EPS2.0 program CNTLEM will be used to project the base case inventory to future years by multiplying appropriate growth factors. The growth factors will be based on socioeconomic surrogates and population projections.

The modeling inventories for the 1998 and 1999 base cases and the committed measure package for the 2006 and 2015 future years will reflect the impact of the committed control measures where appropriate. The 2015 inventory will be used for the modeling analysis to demonstrate the modeled maintenance status. The modeling inventories will be compared to the 1999 periodic inventory to ensure that the most appropriate assumptions for building modeling inventories are used.

### 2.6.5 Spatial Allocation of Emissions

Point sources will be spatially allocated according to the coordinates (e.g. UTM or latitude/longitude) of each source. Area and nonroad mobile source emissions will be spatially distributed based on surrogate factors that indicate emission level or activity. For this analysis, projections based on the data from the U. S. Census, appropriate land use data, and general plan data will be used for the spatial allocation factors for all of the area and nonroad mobile sources.

## 2.7 Specification of Initial and Boundary Conditions

Available air quality data collected within or around the modeling domain will be used to derive the initial concentrations. A distance-weighted interpolation will be used to generate horizontal gridded initial concentrations for the surface layer. Some pseudo sites at or near the lateral boundaries will be set up in the domain. The EPA recommended background values will be assigned to the pseudo sites to bring interpolated values of pollutant concentrations down near the values consistent with those in the BOUNDARY file. The use of pseudo sites with an interpolation method results in a smoother transition from urban to rural concentrations. A constant vertical concentration

profile will be specified for each grid column assuming that concentrations were well mixed below the region top of the modeling domain during the first simulation hour.

When appropriate air quality monitoring data are available, hourly boundary conditions except for the first hour will be derived from the monitoring data. Boundary conditions for the first hour will be set to the EPA recommended background values. When no monitoring data are available, boundary values for all layers will be set to EPA recommended background values.

### 2.8 Wind Field Specification

Following the EPA Guideline [4], the EPA recommended Diagnostic Wind Model (DWM) [7] will be used to generate the UAM gridded wind fields. This model incorporates available observations and provides information on terrain-induced air flows in regions where observations are absent. The modeling domain for DWM will be a few cells larger at the four boundaries than the UAM domain. The wind fields for the UAM applications will be a subset of the DWM wind fields. This approach will further diminish the errors propagating from the boundaries to the area of interest. If sensitivity analyses show that wind fields derived from another model are more representative of the domain scale flows, then these wind fields may be used in lieu of the DWM wind fields.

### 2.9 Mixing Depths

The mixing depths contained in the UAM DIFFBREAK file will be calculated using the MIXEMUP procedure [13]. The procedure, which is based on a one-dimensional model developed by Benkley and Schulman (1979) [21], consists of subjective and objective (computer-based) analysis of the data. Using this technique, hourly mixing heights are calculated for a given surface location using a nearby, representative upper-air sounding and the local hourly surface data. During the nighttime hours, when mixing is primarily mechanical, the mixing-height is a function of wind speed. A daytime convective mixing scheme is employed after sunrise. The height of the daytime mixed layer is estimated to be that point at which a dry-adiabatic air parcel anchored at the surface temperature intersects the 1200 GMT (0500 MST) sounding. The time of sunrise and sunset are specified as the hour at which the solar zenith angle, supplied by the SUNFUNC program (included with the UAM package) [6] becomes less than and greater than 90 degrees, respectively. If sensitivity analyses show that mixing depths derived from another model are more representative of the domain scale mixing, then these mixing depths may be used in lieu of the MIXEMUP mixing depths.

### 2.10 Sources of Other Input Data

Other input variables are required as input to UAM, such as:

- cloud cover,
- water vapor,

- UV radiation,
- surface temperature,
- terrain, and land use and surface characteristics.

These input variables will be prepared according to locally measured data if validated and available for the modeling episodes. Otherwise, the values recommended by EPA will be used in the simulations.

## 3. QUALITY ASSURANCE AND DIAGNOSTIC ANALYSES

This chapter discusses the procedures to be followed for quality assurance of component data input fields and diagnostic testing of the base case episode. The purpose is to uncover potential data input gaps that, when corrected, lead to improved model results. The quality assurance helps users of the modeling results to have some measure of confidence in the ability of the model to capture key meteorological features in order to predict future ozone concentration levels.

### 3.1 Quality Assurance Tests of Input Components

The purpose of this testing is to establish that apparently good model results are the result of valid model inputs and assumptions, and not the result of compensating errors in input data. Prior to conducting a base case simulation, individual air quality, meteorological, and emissions fields will be reviewed for consistency and obvious omission errors. Both spatial and temporal characteristics of the data will be evaluated. Examples of component testing include:

- Air Quality: Check for correct order of magnitude; compare values with monitored data; assure reasonable speciation.
- Emissions: The emissions inventory will be tabulated, plotted, and examined. The quality assurance procedures will include documentation of major assumptions, careful accounting of emissions totals throughout the development process, verification of spatial distribution of emissions against known source locations and emission strengths, and identification of missing or unreasonable data values.
- Meteorology: If data are available, plot surface and elevated wind vectors and compare with monitoring stations and weather maps for consistent patterns; compare mixing height fields with sounding data; check temperature fields.

It is very important to perform the quality assurance tests prior to performing model simulation, because errors uncovered by the quality assurance testing of component input fields might be extremely difficult to diagnose later on in the modeling process where errors could arise from any subset of the data inputs.

### 3.2 Diagnostic Tests of Base Case Simulation

After conducting the above quality assurance tests, UAM will be conducted for the base case episode. Emphasis will be placed on correctly depicting the areawide distribution and timing of observed ozone concentrations. Spatial and time series plots will be used to assess model behavior.

To aid the interpretation of simulation results, predicted and observed ozone concentration maps will be constructed for each base case episode. Concentration maps present spatial information on the structure of the ozone plume. Maps at one or two hour intervals will be constructed over periods of the ozone plume and over periods of most interest. While a typical period might be defined as early morning to late afternoon for the day of highest ozone concentration, it is useful to look at most time intervals under recirculation, stagnation, and transport conditions. Consideration will also be given to constructing a map which depicts the highest predicted daily maximum ozone value for each grid cell. Examples of various mapping techniques are described in Tesche et al [22]. The predicted concentration to be used in the time-series plots will be defined using the same method for deriving predicted concentrations for the model performance evaluation. This method consists of a four-cell weighted average using bilinear interpolation of the predictions from the nearest four grid cells to the monitor location and is also based on Tesche et al [22].

If feasible, time-series plots will be developed for NOx, as well as for VOC species at selected locations, particularly for cases in which ozone time-series or mapping results do not appear consistent with expectations. Comparisons of calculated ozone precursor concentrations with any available observations will be done for concentration levels above the detection limits of the monitoring equipment.

Additional diagnostic tests for the base case will also be considered depending on the availability of time and resources. The basic diagnostic tests can be considered part of a standard operational model evaluation and therefore complement and extend the various numerical and graphical measures of model performance by providing a straightforward measure of model robustness. A number of sensitivity simulations will be conducted to determine the response in ozone concentrations to changes in key inputs such as emissions and DIFFBREAK. The simulations will include some of the following as recommended in the guidance document [4] for areawide ozone modeling:

- **Zero Boundary Conditions**. Inflow concentrations at the lateral boundaries and top of the modeling domain will be reduced to zero. Sensitivity of the concentrations in the inner core and downwind portions of the modeling domain provide a measure of the influence of the boundary conditions. This simulation will provide assurance that the upwind extent of the domain is adequate.

- **Zero Initial Conditions**. Initial concentrations for all grid cells will be reduced to zero. Sensitivity of concentrations within the modeling domain provide a measure of the influence of the initial conditions. Changes of less than a few percent indicate that the

initial conditions are not dominating concentration estimates within the domain.

- **Diffusion Break Heights**. Diffusion break heights will be doubled for one simulation and halved for another. Sensitivity of the concentrations within the modeling domain provide a measure of the influence of diffusion break heights. These simulations will provide assurance that the diffusion break heights are adequate.

More elaborate diagnostic analysis tests involve sensitivity-uncertainty studies that examine model responses to a range of variation in input parameters (e.g., various changes in emission levels, in emission speciation, etc.). All diagnostic steps will be documented to avoid misinterpretation of model performance results. Once confidence is gained that the simulation is based on reasonable interpretations of observed data, and model concentration fields generally track, spatially and temporally, known urban plumes, a performance evaluation based on numerical measures will be conducted for each base case episode.

### 3.3 Test Results/Input Modifications

Following the diagnostic modeling analyses, the simulation results will be carefully examined for possible modification or refinement of the input components. On a case-by-case basis, the performance of UAM for each base case simulation will be evaluated to determine whether or not it is acceptable, with or without input modifications. The model performance criteria listed in the EPA guidance [4], also presented in the next chapter (Chapter 4), will be used in the evaluation.

## 4. MODEL PERFORMANCE EVALUATION

### 4.1 Performance Evaluation Tests

Simulated and observed one-hour average ozone concentrations at each monitoring station will be utilized in statistical performance goals. Some general model performance guidelines have been outlined in the EPA guidance [4]. Among the general guidelines are the following statistical performance goals:

- **Unpaired highest-prediction accuracy** - percentage difference between domain wide simulated and observed peak unpaired in space or time. EPA recommended range: ±20%.

- **Normalized bias test** - provides a measure of the ability of the model to replicate observed patterns during the times of day when available monitoring and modeled data are most likely to represent similar spatial scales. EPA recommended range: ±15%.

- **Gross error of all pairs above 60 ppb** - in conjunction with bias, this metric provides and overall assessment of base case performance and may be used as a reference to other modeling applications. Gross error may be interpreted as precision. EPA recommended range: ±35%.

In general, performance measures that fall within or below these ranges would be considered acceptable. However, results from the above three statistical measures alone may not be sufficient to fully assess the capability of the model in reproducing the chemical and physical processes governing urban-scale ozone concentrations. Therefore, the model performance evaluation procedures will be expanded to include additional numerical and graphical measures recommended by Tesche et al [22].

The additional seven numerical measures include temporally and spatially paired peak estimates, temporally or spatially paired peak estimates, average station peak estimates, bias and gross error, and variance. The additional graphical measures include time series plots and "spatial" time series plots, time series displaying highest and lowest estimates by sites, ground level isopleths, and scatter plots of estimates and observations.

If the statistical results do not meet the recommended performance criteria, and graphical analyses also indicate poor model performance, an alternative episode will be chosen or the EPA regional office will be contacted for review and approval of the base case episode before any future-year simulations are undertaken.

## 5. MAINTENANCE DEMONSTRATION

### 5.1 Identification of Future Years

The primary purpose of conducting areawide modeling is to demonstrate control strategy effectiveness in maintaining the NAAQS for ozone for at least ten years after the Maricopa County Nonattainment Area has been redesignated to attainment status. In determining the amount of lead time to allow, EPA indicated that 18 months, as granted in section 107(d)(3)(D) of CAAA, should be assumed for EPA to approve a redesignation request [2]. Due to uncertainties regarding the time that the area will be redesignated to attainment, 2015 will be modeled to assure that the ozone NAAQS is maintained at least ten years past an official notice of redesignation to attainment by EPA.

In addition to 2015, a second year of 2006 will be modeled and included in the maintenance plan in order to provide an interim mobile source emissions budget for conformity purposes.

### 5.2 Identification of Control Measures

The committed control measures already implemented for ozone will be evaluated. If additional control measures are needed, they will be submitted to the MAG Air Quality Technical Advisory Committee for consideration for the Suggested List of Measures. Following Regional Council approval of the Suggested List of Measures, the local jurisdictions and the Legislature will be requested to consider the implementation of the measures under their respective authorities. Each jurisdiction determines which measures are feasible for implementation by that jurisdiction. These measures then become the committed measures. The committed control measure package will be incorporated into the emission inventory for UAM. Based upon the results of the UAM simulations, it will be determined if the control strategies demonstrate maintenance of the ozone standard.

If additional control measures are needed, the procedures for selecting the control strategy scenarios will conform to the State Implementation Plans (SIPs) [9,10,11], follow current EPA guidance [4] or any deviation from the guidance will be fully justified, and incorporate our present understanding of the urban/regional ozone problem. The 2015 future base case runs will reflect control measure assumptions for the commitments contained in the SIPs [9,10,11], where appropriate.

### 5.3 Determination of Maintenance Demonstration

To demonstrate maintenance of the one-hour ozone NAAQS, the results from the urban airshed modeling analyses should not show predicted one-hour maximum ozone concentrations greater than 0.124 ppm anywhere in the modeling domain for the episode modeled. The maintenance demonstration will follow the deterministic procedure prescribed in the EPA Guideline [4].

### 5.3.1 Modeling Reliability and Uncertainties

UAM is considered the appropriate regulatory tool available for projecting the future air quality effect of projected emission changes [3]. However, future year modeling results should not be considered absolute guarantees of future air quality. Uncertainties in the models used and their inputs, along with meteorological variability, may result in actual future air quality that differs from predicted air quality. Higher concentrations than those modeled may occur for any of the following reasons:

- Meteorological variability - In selecting a modeling episode, the goal is to select periods that represent worst-case conditions. If episodes with more severe stagnation occur in the future, emission controls designed to reach attainment for a historical episode may not be adequate.

- Emissions variability - Emission estimates are based on average source usage, taking into account seasonal, diurnal, and day-of-week factors. Onroad mobile emissions take into account day-specific temperatures as well. However, emissions on a given day may be greater than average due to greater than average usage, lower temperatures, or other factors.

- Uncertainty in growth projections - If growth projections underestimate true growth rates, future year emissions may be greater than projected emissions.

- Uncertainty in control measure effectiveness - If actual emission reductions from a given control measure are smaller than the estimated emission reductions, future concentration will be greater than modeled concentrations.

- Model performance - If the model under predicted concentrations at a particular site, or has failed to capture a particular aspect of the meteorology, then a level of emission reduction that appeared to be adequate during modeling may not actually be adequate.

By similar reasoning, future measured concentrations may be lower than modeled concentrations because of these variabilities and uncertainties. In addition, future measured concentrations will still be limited to monitoring sites. Since a maintenance demonstration based on grid modeling requires concentrations at all grid cell within the domain to be below the standard, it is likely that simulated concentrations at all monitoring locations will be well below the standard.

As a result, although for regulatory purposes a modeled peak ozone concentration below 0.125 ppm is adequate to demonstrate maintenance, modeling results are better thought of as a point on a probability distribution. If the modeled peak value is far below 0.125 ppm, the probability that maintenance will result, even under differing conditions, is high. If the modeled peak is very close to 0.125 ppm, however, the probability that maintenance will result may be well below 100 percent given the probabilistic nature of the modeling process.

## 6. SUBMITTAL PROCEDURES

The following items will be delivered to the EPA regional office during the modeling study:

- Modeling protocol (this document)
- Technical Support Document which addresses the entire modeling analysis, including UAM input preparation and application, and maintenance demonstration.

MAG will provide this protocol document to the Air Quality Planning Team and the EPA Region IX Office for review and comments.

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ATTACHMENT I

Interagency Memorandum of Agreement

# MEMORANDUM OF AGREEMENT
# AMONG
# THE ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
# AND
# THE ARIZONA DEPARTMENT OF TRANSPORTATION
# AND
# MARICOPA COUNTY, BY AND THROUGH THE MARICOPA COUNTY ENVIRONMENTAL QUALITY AND COMMUNITY SERVICES AGENCY
# AND
# THE MARICOPA ASSOCIATION OF GOVERNMENTS

## PURPOSE

The purpose of this Memorandum of Agreement is to provide the framework and guidelines to promote coordinated decision making in planning, development, and implementation, and enforcement of those actions necessary to attain and maintain the National Ambient Air Quality Standards in Maricopa County, hereafter referred to as the Nonattainment Area Plan, or NAP. This Memorandum is required pursuant to A.R.S. 49-406 D. and E. The Memorandum also provides the framework and guidelines for preparing plans designed to address other air pollution problems of regional concern.

## SCOPE

This Memorandum is designed to address the control of the following pollutants: Carbon Monoxide, Ozone, Particulates, and Other Air Pollution Problems of Regional Concern.

The geographical area of concern is Maricopa County or the area specifically designated by the Administrator of the U.S. Environmental Protection Agency as not having attained the National Ambient Air Quality Standards for one or more of the pollutants named above.

## RESPONSIBILITIES AND AUTHORITIES

The Arizona Department of Environmental Quality (ADEQ) has the primary authority in the State of Arizona for air pollution control and abatement. ADEQ is charged with preparation, development and maintenance of the State Implementation Plan (A.R.S. § 49-404); designation of areas of the state with respect to compliance with the National Ambient Air Quality Standards (A.R.S. § 49-405); and assuring that nonattainment area plans are implemented (A.R.S. § 49-406 J.). ADEQ has original jurisdiction and control over portable, mobile, and specific types of stationary air pollution sources (see A.R.S. § 49-402 A.). In addition, ADEQ is responsible for development of stationary source permitting procedures and standards (see A.R.S. § 49-480 B.). ADEQ is also responsible for providing technical assistance to political subdivisions of the State for implementing air pollution control programs (A.R.S. § 49-424 A.8.), conducting research on the amounts of hazardous air pollutants in ambient air and their impacts on human health (A.R.S. § 49-426.06); management and implementation of programs under the Air Quality Fee Fund (A.R.S. § 49-551), implementation of the Vehicle Emissions Inspections Program (A.R.S. § 49-521 through 550), and conducting research on vehicular emissions and clean burning fuels (A.R.S. § 49-553). The Department may delegate authority to a county for implementing air pollution control statutes (A.R.S. § 49-424 B.)

The Arizona Department of Transportation (ADOT) has exclusive control over state highways and all other state owned transportation systems (A.R.S. § 28-104). This includes the responsibility of multi-modal state transportation planning, cooperation with local governments, coordination of transportation planning with local governments, investigation of new transportation systems, and advising local governments concerning the development and operation of public transit systems (A.R.S. § 28-104).

The ADOT Director shall also enter into agreements on behalf of the state with political subdivisions for the improvement, maintenance and construction of mass transit systems, and shall provide rules for the application for and expenditure of all mass transit funds (A.R.S. § 28-108).

In addition, ADOT is authorized to conduct demonstration projects to evaluate the effectiveness of new, extended, improved or integrated public transportation services and carpooling or vanpooling activities in meeting regional transportation needs or in improving air quality (A.R.S. § 28-2611). These projects are funded by an annual distribution of $400,000 from the air quality fund (A.R.S. § 49-551). ADOT must also support ADEQ on reporting to the Legislature results of mobile source emissions Research, where applicable, per A.R.S. § 49-553.

The Maricopa County Environmental Quality and Community Services Agency (MC EQ&CSA) is the local air pollution control department for Maricopa County. The Agency has jurisdiction over air pollution sources not explicitly reserved for state jurisdiction (A.R.S. § 49-402); the Agency is delegated authority from the State of Arizona to regulate certain portable air pollution sources initially reserved for state jurisdiction (A.R.S. § 49-424); the Agency operates the Regional Travel Reduction Program (A.R.S. § 49-582 et seq), and is the principal government sponsor for the Voluntary No Drive Days Program (A.R.S. § 49-506). The Agency is also responsible for monitoring the ambient air quality of the region (A.R.S. § 49-473) through collecting and analyzing air quality data.

Within the Maricopa County Environmental Quality and Community Services Agency, the Assistant County Manager of the Agency is designated as the Air Pollution Control Officer. The Air Pollution Control Officer has the responsibility and authority to enforce the provisions of Article 3, Chapter 3, Title 49, "County Air Pollution Control", Arizona Revised Statutes. The Control Officer also has the responsibility for assuring adequate nonattainment plan implementation as prescribed by A.R.S. § 49-406.

The Maricopa Association of Governments (MAG) is a nonprofit Arizona corporation composed of elected officials from twenty-four cities and towns, Maricopa County, Gila River Indian Community, and the Arizona Department of Transportation. MAG has been designated by the Governor of Arizona as the lead planning organization for Maricopa County that, together with the State, is responsible for determining which elements of the State Implementation Plan revision will be planned, implemented, and enforced by State and local governments in Arizona (Governor Wesley Bolin, February 7, 1978; Clean Air Act § 174(a); and A.R.S. 49-406)). MAG is responsible for providing assistance to the Maricopa County Travel Reduction Regional Task Force and for recommending third and following year travel reduction targets, policies, standards and criteria for the Maricopa County Travel Reduction Program (A.R.S. § 49-582 and 49-588). Related directly to air quality, MAG is the official designated metropolitan transportation planning organization, and the designated agency for preparing population estimates and projections for the Maricopa County area. MAG is also responsible for making transportation/air quality conformity determinations, subject to the consultation procedures as provided by law (Clean Air Act § 176).

## UNDERSTANDING/AGREEMENTS

In recognition and to facilitate the accomplishment of the foregoing, IT IS HEREBY AGREED that:

1. The Arizona Department of Environmental Quality; Arizona Department of Transportation; Maricopa County Environmental Quality and Community Services Agency; and Maricopa Association of Governments will work through a coordinated effort to prepare the MAG regional air quality plans as described in Attachments One, Three, Four, and Five. Attachment One contains a description of the generalized roles and areas of expertise of the agencies, the MAG Air Quality Planning Team, and the MAG Air Quality Policy Team. Attachment Three contains the general implementation authorities for measures in the air quality plans. Attachment Four includes provisions for tracking plan implementation; determining reasonable further progress; assurances for adequate plan implementation, and adoption of control measures. Attachment Five contains the Work Programs for Preparing Air Quality Plans.

2. The Maricopa Association of Governments will maintain the MAG Regional Air Quality Planning Process for decision making as described in Attachment Two. This Attachment contains the roles of the MAG Regional Council, MAG Management Committee, MAG Air Quality Policy Committee, and ad hoc Working Groups. MAG will coordinate the preparation of the NAPs. Representatives from ADEQ, ADOT and MC EQ&CSA will be included as ex-officio members of the MAG Air Quality Policy Committee, and active members of all working groups associated with this MAG committee.

3. The Arizona Department of Environmental Quality; Arizona Department of Transportation; Maricopa County Environmental Quality and Community Services Agency; Maricopa Association of Governments will pursue commitments to implement the measures in the NAPs. The aforementioned agencies will continue to evaluate and pursue the implementation of additional air pollution control measures as a result of the evaluations performed as described in Attachment Four.

## EFFECTIVE DATE

The Agreement and all Amendments shall become effective on the date it has been signed by all parties to it.

## TERM

This Agreement shall remain in effect from the effective date of the Agreement until such time it is terminated or superseded by a subsequent agreement. This Agreement may be terminated by any party to it, providing written notice of intent to terminate is provided to all other parties to the Agreement thirty days prior to the effective date of withdrawal of that party from the Agreement.

## AMENDMENT

This Agreement may be amended at any time upon mutual written agreement of all parties. No agent, employee or other representative of any party to this Agreement is empowered to alter any of the terms of the Agreement, unless it is done in writing and signed by the Designated Officers of the respective parties, their authorized representatives, or duly appointed successors.

## ATTEST

All terms of this Memorandum of Agreement are hereby acknowledged and agreed, as certified by the signatures of the Designated Officers affixed hereto:

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

By _____
Edward Z. Fox, Director, Arizona Department of Environmental Quality

Date NOV 9, 1992

ARIZONA DEPARTMENT OF TRANSPORTATION

By _____
James Creedon, Acting Director, Arizona Department of Transportation

Date Nov 9, 1992

MARICOPA COUNTY, BY AND THROUGH THE MARICOPA COUNTY ENVIRONMENTAL QUALITY AND COMMUNITY SERVICES AGENCY

By _____
Betsy Bayless, Chairman, Maricopa County Board of Supervisors

Date 11.2.92

MARICOPA ASSOCIATION OF GOVERNMENTS

By _____
John J. DeBolske, Secretary, Maricopa Association of Governments

Date 11.2.92

# MAG REGIONAL AIR QUALITY PLANNING TECHNICAL PROCESS

- All MAG regional air quality plans are prepared through a coordinated effort among the Arizona Department of Environmental Quality, Arizona Department of Transportation, Maricopa County Environmental Quality and Community Services Agency, and Maricopa Association of Governments.

## MAG AIR QUALITY POLICY TEAM

*Composition: Director of Arizona Department of Environmental Quality; Director of Arizona Department of Transportation; Air Pollution Control Officer of Maricopa County; MAG Secretary*

- Oversees preparation of plans and overall technical planning effort
- Resolves technical problems and issues

## MAG AIR QUALITY PLANNING TEAM

*Composition: Staff from the Arizona Department of Environmental Quality, Arizona Department of Transportation; Maricopa County Environmental Quality and Community Services Agency; Maricopa Association of Governments*

Agency Roles

- Arizona Department of Environmental Quality - air quality modeling and technical assistance, mobile source emissions research and inventory, input for the comprehensive list of measures and feasibility analysis, information relating to the Vehicle Emission Inspection Maintenance Program, stationary and portable source control strategies, air quality research studies, State Air Quality Fund administration, adoption and submittal of State Implementation Plans to the Environmental Protection Agency, tracking plan implementation, assurances, special purpose air quality and meteorological monitoring for plan development and compliance
- Arizona Department of Transportation - State Transportation Improvement Program, other transportation plans and programs, input for the comprehensive list of measures and feasibility analysis
- Maricopa County Environmental Quality and Community Services Agency - stationary source emissions inventory and controls, coordinating the comprehensive emissions inventory, air quality monitoring data,input for comprehensive list of measures and feasibility analysis, mandatory travel reduction program, trip reduction data, voluntary no drive days program, tracking plan implementation, reasonable further progress, assurances, special purpose air quality and meteorological monitoring for plan development and compliance
- Maricopa Association of Governments - demographic projections and socioeconomic data, transportation modeling, air quality modeling, Regional Transportation Improvement Program, Regional Transportation Plan, other transportation plans and programs, congestion mangement system, conformity, input for comprehensive list of measures and feasibility analysis, development of the air quality plans, interface with state, county, and local entities, recommending future year travel reduction goals, policies, and standards to Maricopa County, assistance to Maricopa County for the mandatory travel reduction program, review reasonable further progress made to reduce air pollution and plan adjustments if necessary, review plan implementation

***The technical planning work is closely coordinated with EPA Region IX staff, Federal Highway Administration, and Federal Transit Administration.***

ATTACHMENT TWO

# MAG REGIONAL AIR QUALITY PLANNING PROCESS

## MAG REGIONAL COUNCIL

*Composition: Elected officials from 24 cities and towns, Maricopa County, Gila River Indian Community, and Arizona Department of Transportation, Regional Public Transportation Authority*

- Reviews all pertinent air quality data
- Adopts regional air quality plans
- Formally requests that state, county, local, and other appropriate agencies implement measures in the plans
- Approves trip reduction goals and policies and recommends to Maricopa County
- Determines conformity, subject to the consultation procedures as provided by law (Clean Air Act § 176)
- Maintains an air quality/transportation planning process consistent with federal law

## MAG MANAGEMENT COMMITTEE

*Composition: Managers from 24 cities and towns, Maricopa County, Gila River Indian Community, and Arizona Department of Transportation, Regional Public Transportation Authority*

- Reviews all pertinent air quality and transportation data
- Recommends regional air quality and transportation plans
- Recommends trip reduction goals and policies

## MAG AIR QUALITY POLICY COMMITTEE

*Composition: 10 elected officials from cities and towns and Maricopa County and 9 citizen representatives + ex-officio representatives from Arizona Department of Environmental Quality, Arizona Department of Transportation, and Maricopa County Environmental Quality and Community Services Agency*

- Reviews all pertinent air quality data from the technical planning process
- Reviews air quality research studies conducted by MAG, Arizona Department of Environmental Quality, EPA, Maricopa County Environmental Quality and Community Services Agency, etc.
- Reviews related data generated from other MAG regional planning areas such as transportation, transit, population, regional development, water quality, solid waste, etc.
- Studies in detail a comprehensive list of control measures. Data on the measures includes: description of the measures, air quality impacts, complementary measures, implementation responsibility, costs, advantages and disadvantages, etc.
- Recommends air quality measures for the plans
- Conducts public hearings on the plans
- Formally recommends regional air quality plans and control measures
- Recommends trip reduction goals and policies
- Conducts conformity reviews, subject to the consultation procedures as provided by law (Clean Air Act § 176)
- Reviews reasonable further progress made to reduce air pollution and recommends plan adjustments if necessary
- Provides input on the MAG congestion management system

## ADDITIONAL WORKING GROUPS AS NECESSARY

ATTACHMENT THREE

# IMPLEMENTATION OF MAG REGIONAL AIR QUALITY PLANS
## GENERAL IMPLEMENTATION AUTHORITIES

### STATE - ARIZONA DEPARTMENT OF ADMINISTRATION

- Travel reduction and adjusted work hours for state employees

### STATE - ARIZONA DEPARTMENT OF COMMERCE

- Capitol Ridesharing Program

### STATE - ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

- Mobile source emissions controls
- Mobile source emissions research
- Portable and some major stationary source controls
- Ambient air quality monitoring and research
- Assurances

### STATE - ARIZONA DEPARTMENT OF TRANSPORTATION

- State and interstate transportation system planning, development and management (includes High Occupancy Vehicle Lanes, Freeway Management Systems, etc.)
- Vehicle registration and licensing
- Transit Assistance Grants

### STATE - ARIZONA DEPARTMENT OF WEIGHTS AND MEASURES

- Oxygenated fuels
- Other fuel quality regulation (e.g. Reid Vapor Pressure)
- Stage I and Stage II vapor recovery

### MARICOPA COUNTY - ENVIRONMENTAL QUALITY AND COMMUNITY SERVICES AGENCY

- Stationary source controls
- Delegated portable source controls
- Area source controls (e.g. *de minimis* sources, materials storage and handling, construction)
- Open burning control
- Mandatory Travel Reduction Program (TRP) and Voluntary No Drive Days
- Other transportation control measures in unincorporated areas
- Ambient air monitoring
- County roadways system planning, development and management
- Planning and zoning (unincorporated areas)
- Assurances

### MAG CITIES AND TOWNS

- Municipal roadways system planning, development and management
- Transportation control measures (besides TRP)
- Planning and zoning
- Some area source controls (e.g. vacant land, construction practices)
- Public transit (including Regional Public Transportation Authority)

- Future year travel reduction goals, policies, standards, and criteria
- Ridesharing program
- Conformity determinations, as provided by law (Clean Air Act § 176)
- Allocation of Congestion Mitigation Air Quality Improvement Program Funds and Surface Transportation Program Funds

* As noted in the MAG regional air quality plans, the action taken by the MAG Regional Council to approve the Suggested Measures and Adopted Plan Measures does not commit each jurisdiction to implement those measures. As indicated in the resolutions and commitments, each jurisdiction determines which measures are reasonably available for implementation by that jurisdiction.

# OTHER IMPLEMENTATION AND ADOPTION FUNCTIONS

This attachment includes provisions for tracking plan implementation and determining reasonable further progress; assurances for adequate plan implementation, and procedures and responsibilities for adoption of control measures and emissions limitations.

## TRACKING PLAN IMPLEMENTATION AND DETERMINING REASONABLE FURTHER PROGRESS

Each agency is afforded a review and comment period for each ongoing portion of a plan or revision to a plan being prepared by another agency. Every effort will be made to incorporate the comments of the reviewing agency into each portion of the plan being prepared by another agency.

Maricopa County will develop monitoring guidelines with respect to reasonable further progress which will be consistent with the needs of the Arizona Department of Environmental Quality and U.S. EPA. Maricopa County will be responsible for tracking emissions from point, area and non-road mobile sources and for tracking implementation of control strategies. MAG will be responsible for tracking on-road mobile source emissions and conformity. Maricopa County will integrate the MAG information and reports with the Maricopa County information and submit it to the Arizona Department of Environmental Quality.

For the EPA, the primary means of demonstrating the rate of progress will be through the periodic inventories (i.e., complete, actual inventories) submitted every 3 years. EPA has indicated in the General Preamble Section III.A.3 (d) that they currently intend to rely on existing reporting requirements such as emission statements, periodic inventories, annual Aerometric Information Retrieval System update, and conformity reviews.

## ASSURANCES FOR ADEQUATE PLAN IMPLEMENTATION

In order to comply with the Clean Air Act, State law provides an approach for assurances that State and local committed measures will be adequately implemented (A.R.S. §49-406 I. and J.). If any person (includes State, County, local governments, regional agencies, and other entities) fails to implement a committed measure, the County would file an action in Superior Court to have the court order that the measure be implemented. Likewise, the ADEQ Director will backstop the County if it fails to implement a committed measure or if the County fails to backstop the local governments and regional agencies.

Regarding committed measures, A.R.S. §49-406 G. requires that each agency that commits to implement any control measure contained in the State Implementation Plan must describe the commitment in a resolution. The resolution must be adopted by the appropriate governing body of the agency. State law also requires the resolution to specify the following: (1) Its authority for implementing the limitation or measure as provided in statute, ordinance or rule; (2) A program for the enforcement of the limitation or measure; and (3) The level of personnel and funding allocated to the implementation of the measure.

As noted in the MAG regional air quality plans, the action taken by the MAG Regional Council to approve the Suggested Measures and Adopted Plan Measures does not commit each jurisdiction to implement those measures. As indicated in the resolutions and commitments, each jurisdiction determines which measures are reasonably available for implementation by that jurisdiction.

## PROCEDURES AND RESPONSIBILITIES FOR ADOPTION OF CONTROL MEASURES AND EMISSIONS LIMITATIONS

According to A.R.S. §49-404 B., the ADEQ Director may adopt rules that describe procedures for adoption of revisions to the State Implementation Plan. The State, in accordance with these rules, and the governing body of the metropolitan planning organization (MAG) are required to adopt the nonattainment area plans (A.R.S. §49-406 H.).

ATTACHMENT II

Review of Ozone Episodes

MARICOPA ASSOCIATION OF GOVERNMENTS

**OFFICE MEMO**

March 25, 2002

TO: Ruey-in Chiou, Air Quality Modeling Program Manager

FROM: Scott DiBiase, Engineer II

SUBJECT: REVIEW OF 1998-2000 OZONE EPISODES IN THE MARICOPA COUNTY NONATTAINMENT AREA

This memorandum is a review of the characteristics of monitored one hour average ozone ($O_3$) concentration episodes which have occurred in the Maricopa County Nonattainment Area (MCNA) over the three ozone summer season periods of 1998-2000. It is important to note that there were no exceedances of the standard in 1998, 1999, and 2000. Therefore, the ozone episodes recommended in this memo do not include any exceedance days. This memo includes information on: 1) the characteristics of the ozone episodes reflected by the monitored ozone data; 2) the meteorological conditions associated with days having high ozone concentrations; and 3) recommendations of possible ozone modeling episodes.

The MCNA has experienced no exceedances since 1997, therefore, the 1-hour ozone National Ambient Air Quality Standard (NAAQS) of 120 ppb can no longer serve as the cut-off point for screening high ozone days. 90% of the NAAQS of 120 ppb, that is 108 ppb, was used as the cut-off point instead. As a result of the combined consideration of the rank of ozone readings, spatial and temporal patterns of elevated ozone readings, and meteorological conditions associated with the high ozone days, it is recommended that July 17, 1998 and August 24, 1999 be used as the ozone modeling episodes and the previous days be used as the start-up days.

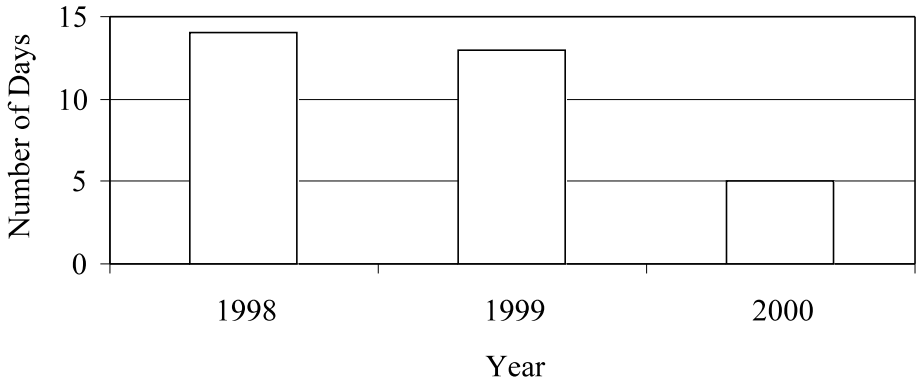
## CHARACTERISTICS OF OZONE EPISODES IN THE MARICOPA COUNTY NONATTAINMENT AREA

### Temporal Patterns

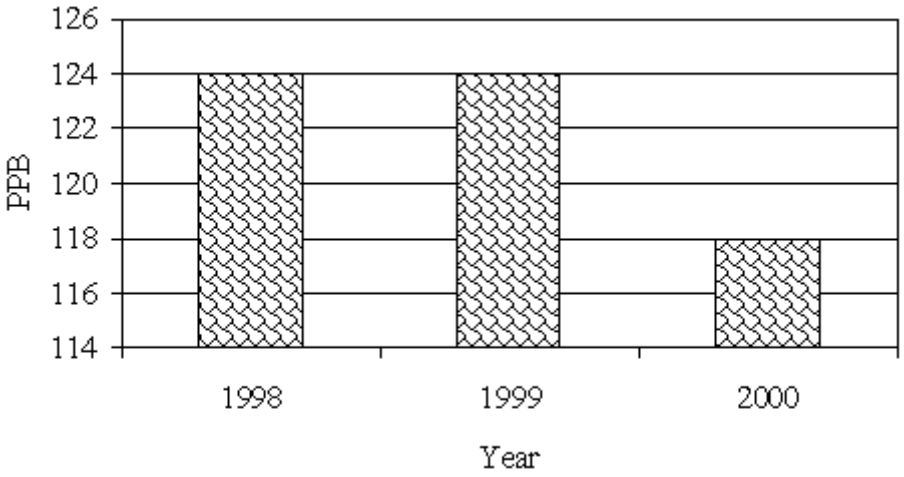
Annual Distribution

Ozone annual trends between 1998 and 2000 are illustrated in Figure 1. The dates, ozone readings, and sites recording ozone concentrations exceeding 108 ppb from 1998 through 2000 are listed in Table 1. The data were obtained from 25 ozone air quality monitoring sites within the Maricopa County area (Table 2 and Figure 2). Numbers below the ID's of the monitoring sites in Figure 2 indicate number of high ozone days (readings in excess of 108 ppb) between 1998 to 2000. All of the reported concentrations in excess of 108 ppb for ozone were recorded at 15 of the 25 monitoring sites.

**Figure 1.** Ozone annual trends for 1998-2000.




(a) Number of high ozone days by year for 1998-2000.




(b) Maximum recorded ozone concentration (ppb) by year for 1998-2000.

**Table 1.** High ozone data for 1998-2000 (readings are in ppb).

| 1998 | | | | | | | 1999 | | | | | | | 2000 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M | D | Day | Julian | Hr | Site | PPB | M | D | Day | Julian | Hr | Site | PPB | M | D | Day | Julian | Hr | Site | PPB |
| 6 | 28 | Sun | 98179 | 13 | NPHX | 109 | 5 | 26 | Wed | 99146 | 18 | BLUE | 108 | 5 | 9 | Tue | 00130 | 17 | RIOV | 117 |
| 6 | 29 | Mon | 98180 | 15 | PINN | 108 | 7 | 5 | Mon | 99186 | 16 | WPHX | 115 | 8 | 1 | Tue | 00214 | 18 | MTOR | 111 |
| 7 | 11 | Sat | 98192 | 14 | NPHX | 112 | 7 | 5 | Mon | 99186 | 15 | MARY | 112 | 8 | 5 | Sat | 00218 | 16 | FOUN | 118 |
| 7 | 15 | Wed | 98196 | 15 | SRPI | 108 | 7 | 19 | Mon | 99200 | 17 | MESA | 110 | 8 | 5 | Sat | 00218 | 15 | PINN | 117 |
| 7 | 17 | Fri | 98198 | 17 | WPHX | 118 | 7 | 19 | Mon | 99200 | 16 | EMGM | 108 | 8 | 5 | Sat | 00218 | 16 | BLUE | 108 |
| 7 | 17 | Fri | 98198 | 18 | MARY | 113 | 7 | 23 | Fri | 99204 | 17 | FOUN | 113 | 8 | 5 | Sat | 00218 | 15 | RIOV | 109 |
| 7 | 17 | Fri | 98198 | 16 | NPHX | 108 | 7 | 24 | Sat | 99205 | 16 | EMGM | 110 | 8 | 9 | Wed | 00222 | 17 | MTOR | 109 |
| 7 | 27 | Mon | 98208 | 15 | NPHX | 113 | 7 | 24 | Sat | 99205 | 17 | MESA | 109 | 8 | 10 | Thu | 00223 | 18 | NPHX | 108 |
| 7 | 27 | Mon | 98208 | 16 | PINN | 112 | 8 | 17 | Tue | 99229 | 17 | EMGM | 110 | | | | | | | |
| 8 | 5 | Wed | 98217 | 20 | HUMB | 116 | 8 | 17 | Tue | 99229 | 17 | CPHX | 110 | | | | | | | |
| 8 | 12 | Wed | 98224 | 15 | PINN | 114 | 8 | 17 | Tue | 99229 | 15 | WPHX | 110 | | | | | | | |
| 8 | 19 | Wed | 98231 | 17 | BLUE | 112 | 8 | 17 | Tue | 99229 | 18 | MESA | 109 | | | | | | | |
| 8 | 23 | Sun | 98235 | 15 | NPHX | 120 | 8 | 19 | Thu | 99231 | 17 | MESA | 112 | | | | | | | |
| 8 | 23 | Sun | 98235 | 14 | WPHX | 113 | 8 | 22 | Sun | 99234 | 13 | NPHX | 108 | | | | | | | |
| 8 | 25 | Tue | 98237 | 17 | FOUN | 124 | 8 | 23 | Mon | 99235 | 16 | PINN | 119 | | | | | | | |
| 8 | 25 | Tue | 98237 | 17 | BLUE | 115 | 8 | 23 | Mon | 99235 | 17 | RIOV | 112 | | | | | | | |
| 8 | 25 | Tue | 98237 | 16 | SRPI | 115 | 8 | 24 | Tue | 99236 | 17 | MESA | 124 | | | | | | | |
| 8 | 25 | Tue | 98237 | 17 | FALC | 112 | 8 | 24 | Tue | 99236 | 16 | PINN | 120 | | | | | | | |
| 8 | 25 | Tue | 98237 | 14 | NPHX | 108 | 8 | 24 | Tue | 99236 | 16 | EMGM | 118 | | | | | | | |
| 8 | 27 | Thu | 98239 | 17 | FOUN | 110 | 8 | 24 | Tue | 99236 | 17 | SRPI | 116 | | | | | | | |
| 8 | 28 | Fri | 98240 | 16 | MARY | 114 | 8 | 24 | Tue | 99236 | 17 | FOUN | 115 | | | | | | | |
| 8 | 28 | Fri | 98240 | 17 | WPHX | 112 | 8 | 24 | Tue | 99236 | 17 | NPHX | 124 | | | | | | | |
| 9 | 12 | Sat | 98255 | 16 | NPHX | 109 | 8 | 26 | Thu | 99238 | 17 | GLEN | 109 | | | | | | | |
| | | | | | | | 10 | 12 | Tue | 99285 | 15 | WPHX | 109 | | | | | | | |
| | | | | | | | 10 | 14 | Thu | 99287 | 16 | WPHX | 108 | | | | | | | |

**Table 2.** Ozone monitoring sites.

| Abbr. | Name | Site Operator | Location | UTM (Zone 12, km) Easting | Northing | Wind | O3 | CO | NO | $NO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| BLUE | Blue Point | MCESD | Usery Pass & Bush Highway | 443644 | 3712520 | ✓ | ✓ | | | |
| CAVE[a] | Cave Creek | MCESD | 32nd St & Carefree Highway | 405866 | 3743086 | ✓ | ✓ | | | |
| CPHX | Central Phoenix | MCESD | 1845 East Roosevelt | 403224 | 3702365 | ✓ | ✓ | ✓ | ✓ | ✓ |
| EMGM | Emergency Management | MCESD | 52nd St. & Mcdowell Rd. | 410191 | 3703607 | | ✓ | | | |
| FALC | Falcon Field | MCESD | 4530 East Mckellips | 431884 | 3701512 | ✓ | ✓ | | | |
| FOUN | Foutain Hills | MCESD | 16426 East Palisades | 437732 | 3719033 | ✓ | ✓ | | | |
| GLEN | Glendale | MCESD | 6000 West Olive | 389475 | 3714845 | ✓ | ✓ | ✓ | | |
| LAKE | Lake Pleasant | MCESD | 41402 North 87th Ave. | 380958 | 3748299 | | ✓ | | | |
| MARY | Maryvale | MCESD | 6180 West Encanto | 389221 | 3704348 | | ✓ | ✓ | | |
| MESA | Mesa | MCESD | 370 South Brooks | 419633 | 3696938 | ✓ | ✓ | ✓ | | |
| NPHX | North Phoenix | MCESD | 601 East Butler | 401095 | 3713719 | ✓ | ✓ | ✓ | | |
| PALV | Palo Verde | ADEQ | 36248 W. Elliot Rd. | 329369 | 3689549 | | ✓ | | ✓ | ✓ |
| PINN | Pinnacle Peak | MCESD | 25000 Windy Walk Way | 421092 | 3730363 | ✓ | ✓ | | | |
| RIOV | Rio Verde | MCESD | North Forest Rd. & Del Ray Ave. | 437815 | 3730948 | | ✓ | | | |
| SRPI | Salt River - Pima | ADEQ | 10005 E. Osborn | 422593 | 3706837 | | ✓ | | ✓ | ✓ |
| SSCT | South Scottsdale | MCESD | 2857 North Miller Rd. | 414851 | 3704625 | ✓ | ✓ | ✓ | ✓ | ✓ |
| SPHX | South Phoenix | MCESD | Central Ave & Broadway | 400209 | 3696337 | ✓ | ✓ | ✓ | | |
| SUPR | Supersite | ADEQ | 4530 N. 17th Ave. | 398290 | 3707463 | | ✓ | ✓ | ✓ | ✓ |
| SURP[b] | Surprise | MCESD | 18600 North Reems Rd. | 372268 | 3724340 | | ✓ | ✓ | | |
| TEMP | Tempe Site | MCESD | Apache Blvd. & College Ave | 413060 | 3697069 | ✓ | ✓ | ✓ | ✓ | ✓ |
| WCHN | West Chandler | MCESD | 163 South Price Rd. | 417697 | 3684573 | | ✓ | ✓ | | |
| WPHX | West Phoenix | MCESD | 3847 West Earll Rd. | 393893 | 3705301 | ✓ | ✓ | ✓ | ✓ | ✓ |
| HUMB | Humboldt Mountain | ADEQ | Tonto National Forest | 427644 | 3760390 | | ✓ | | | |
| MORD | Mt. Ord | ADEQ | Mazatzal Mountains | 462223 | 3751473 | | ✓ | | | |
| HILL[c] | Hillside | ADEQ | Sheriff's Repeater Station | 325385 | 3809798 | | ✓ | | | |
| RYE[d] | Rye | ADEQ | No Address Available | 466178 | 3773110 | ✓ | ✓ | | | |

[a]Cave Creek went into operation in 2001 therefore was not used for the ozone episode day selection.

[b]Surprise went into operation in 2000 and with the limited observations was not used for the ozone episode day selection.

[c]HILL located outside of Maricopa County therefore was not used for the ozone episode day selection.

[d]RYE located outside of Maricopa County therefore was not used for the ozone episode day selection.

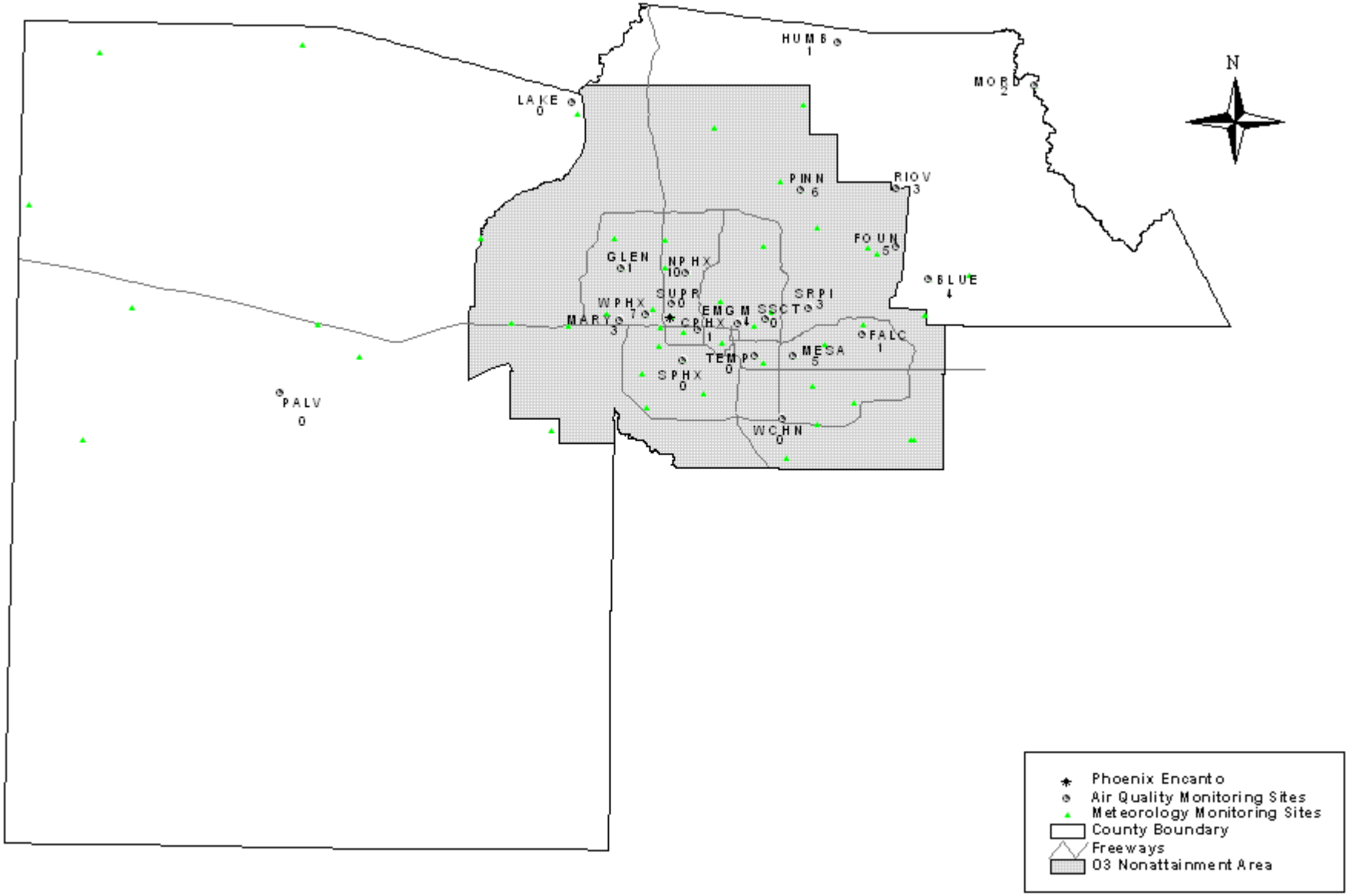



**Figure 2.** Ozone monitoring sites in the Maricopa County area. Number at each site indicates the number of high ozone days (ozone concentration ≥ 108 ppb) for 1998-2000. Note: HILL and RYE are located outside of the Maricopa County and not shown herein.

Seasonal Distribution

The ozone season in the Maricopa County area extends, in the present analysis, from May through October. High ozone days are not evenly distributed throughout these months, as shown in Figure 3. The majority of high ozone days occurred in August with occasional high ozone days in the remaining months of the ozone season.

Daily Distribution

During the 1998-2000 period, high ozone readings occurred on every day of the week. Figure 4 shows distribution of high ozone days by day of week for the three-year period. Most high ozone days occurred on Tuesday and Wednesday (six times).

Diurnal Trends

Monitored ozone concentrations in the Maricopa County area exhibit a typical concentration pattern. All of the high hourly ozone readings during 1998-2000 occurred between the hours of 1300 and 2000 (ending hour, i.e. 1 p.m. to 8:00 p.m.) with the highest number of occurrences at hours 1600 and 1700, as shown in Figure 5. Figure 6 is a graph of the hourly variation in ozone concentration at the MESA site on August 24, 1999. This was the day of the highest ozone concentration in 1999.

Duration

The duration of an ozone episode is the number of consecutive days on which ozone exceedances were recorded. During the 1998-2000 period, there was no ozone exceedances recorded in the Maricopa County area. Therefore, no duration can be reported for this time.

**Spatial Patterns**

The spatial distribution of 1998-2000 high ozone readings in the Maricopa County area is illustrated in Table 4 and Figure 2. Figure 2 indicates the number of days on which ozone readings exceeded 108 ppb at each of the monitoring sites for the three-year period. The spatial pattern of high ozone days varies from year to year. The three sites with the highest number of ozone readings exceeding 108 ppb are NPHX (10 high ozone days), WPHX (7 high ozone days), and PINN (6 high ozone days). The average annual number of recorded high ozone days at each monitoring station for the three-year period are sorted and listed in Table 4.

**Maximum Ozone Hourly Concentrations**

The maximum ozone concentrations for 1998-2000 period are shown in Figure 1(b). The maximum concentration during 1998-2000 was 124 ppb which occurred on August 25, 1998 at FOUN, August 24, 1999 at MESA and NPHX.

## METEOROLOGICAL CONDITIONS ASSOCIATED WITH OZONE EPISODES

This section describes the synoptic-scale and regional-scale meteorology associated with ozone episodes that occurred in the Maricopa County area during the 1998-2000 analysis period.
Due to several factors including frequent null or missing data, sparse network, and date taken and averaged at a short period of time, the National Weather Services site, Sky Harbor Airport, was not used for analyzing the meteorological conditions. Instead, Phoenix Encanto which is a site from the Arizona Meteorological Network (AZMET) was used due to completeness of the data, fair density of the AZMET network, and intensive samples for the hourly average readings.

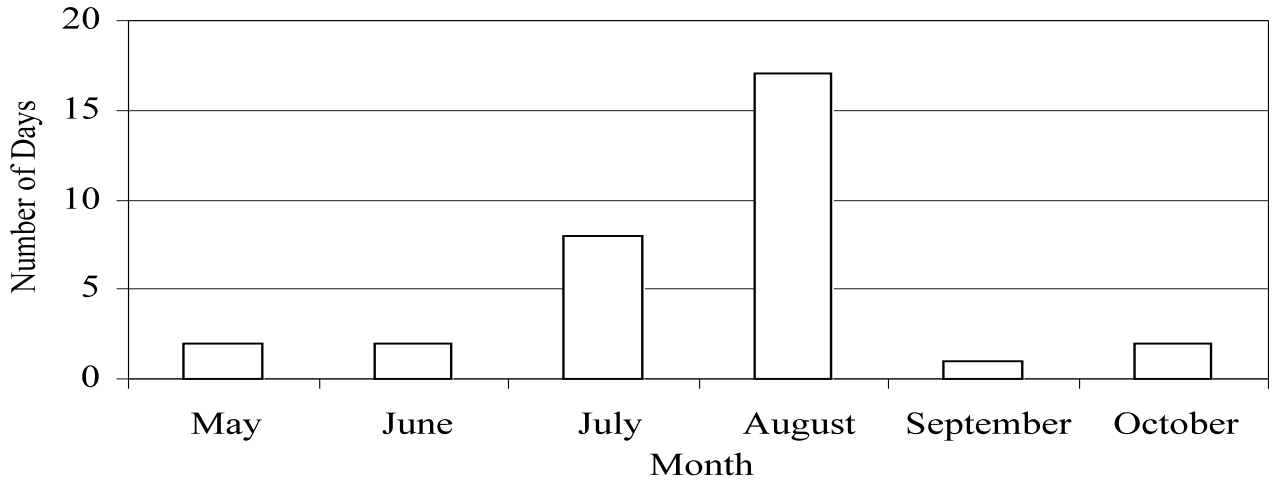



**Figure 3.** Distribution of the high ozone days by month for 1998-2000.

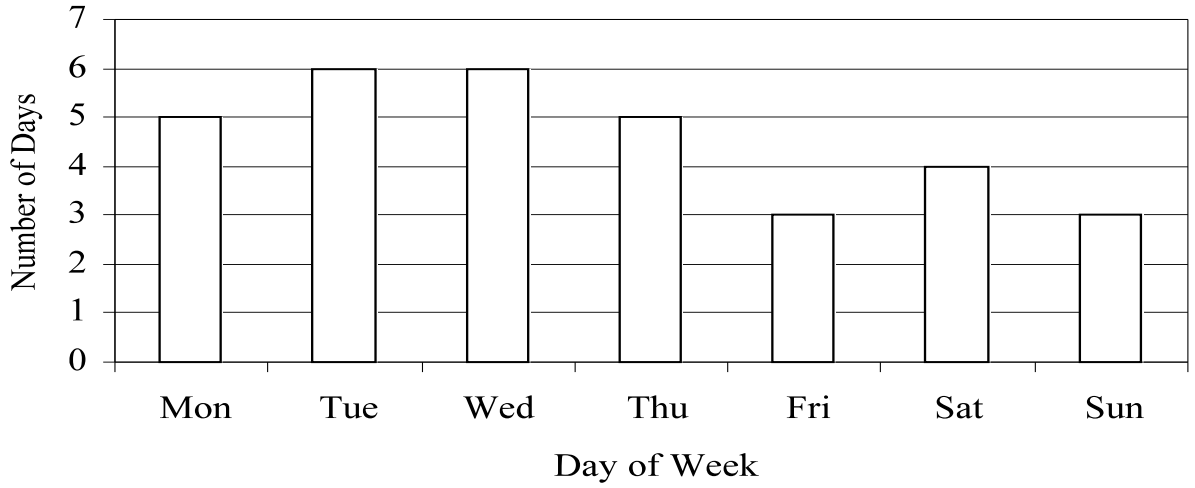



**Figure 4.** Distribution of the high ozone days by day-of-week for 1998-2000**.**

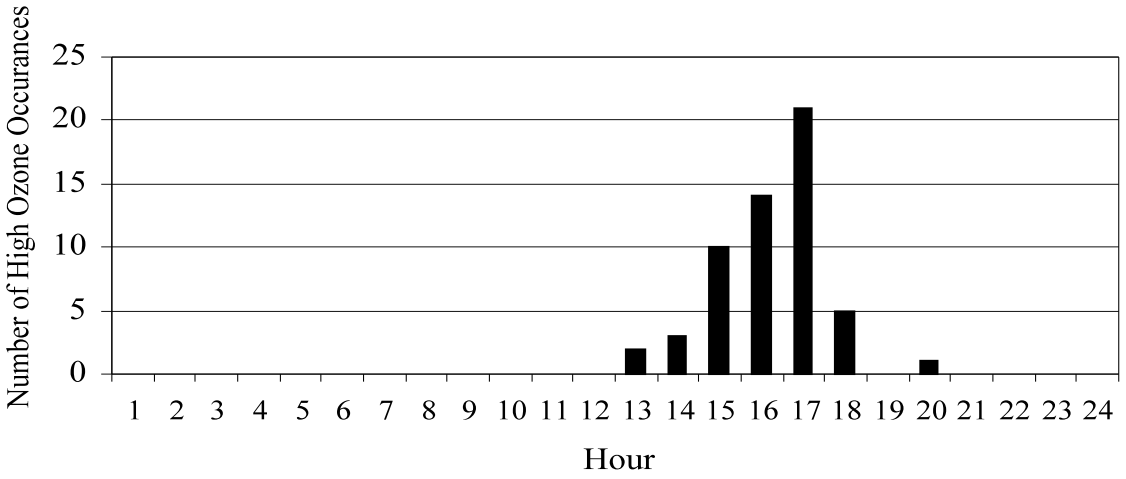



**Figure 5.** Distribution of observed high ozone concentrations by hour of day for 1998-2000.

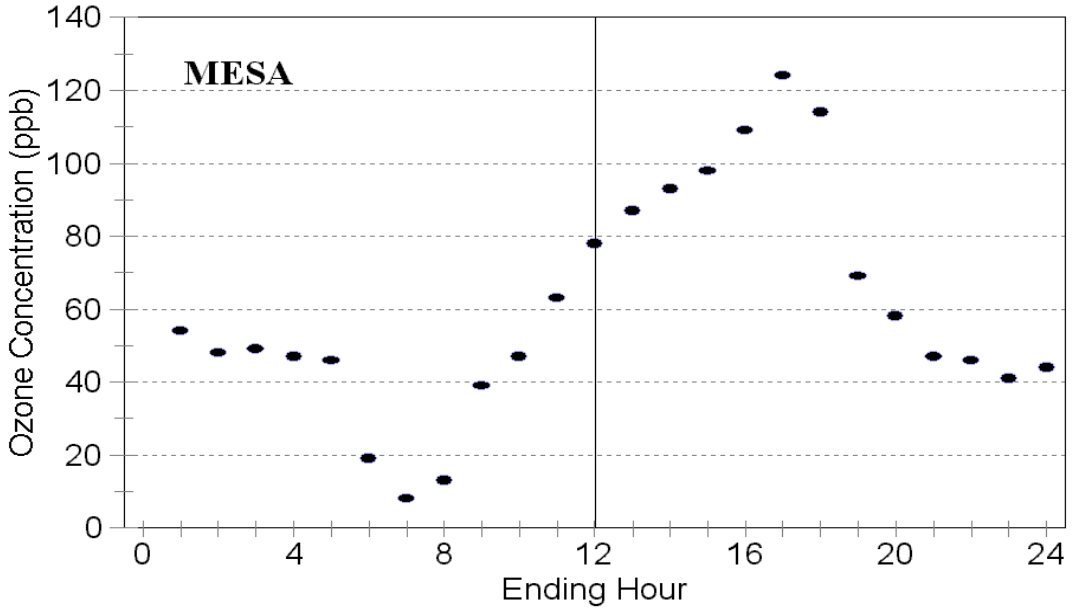



**Figure 6.** Diurnal hourly variation in ozone concentrations at the MESA site on August 24, 1999.

**Table 4.** 1998-2000 three-year period high ozone day total and annual averages by station.

| STATION | 1998-2000 High ozone days Per Site | |
|---|---|---|
| | Total | Average |
| NPHX | 10 | 3.33 |
| WPHX | 7 | 2.33 |
| PINN | 6 | 2.00 |
| MESA | 5 | 1.67 |
| FOUN | 5 | 1.67 |
| BLUE | 4 | 1.33 |
| EMGM | 4 | 1.33 |
| RIOV | 3 | 1.00 |
| MARY | 3 | 1.00 |
| SRPI | 3 | 1.00 |
| MORD | 2 | 0.67 |
| HUMB | 1 | 0.33 |
| CPHX | 1 | 0.33 |
| GLEN | 1 | 0.33 |
| FALC | 1 | 0.33 |
| HILL | 0 | 0.00 |
| LAKE | 0 | 0.00 |
| PALV | 0 | 0.00 |
| RYE | 0 | 0.00 |
| SSCT | 0 | 0.00 |
| SUPR | 0 | 0.00 |
| TEMP | 0 | 0.00 |
| WCHN | 0 | 0.00 |
| SPHX | 0 | 0.00 |

## Regional Meteorology

Temperature

Temperature data from the AZMET Phoenix Encanto site were reviewed for the ozone seasons. Table 5 provides daily maximum, minimum, and average temperatures for the high ozone days of 1998-2000. The daily minimum temperatures ranged from 60 to 85 degrees Fahrenheit, and the daily maximum temperatures ranged from 95 to 113 degrees Fahrenheit.

Air Flow Pattern

Surface wind data from the AZMET Phoenix Encanto site were examined for all of the high ozone days in 1998 through 2000. For these days, a common pattern was noted:

- Winds during the morning hours were light and mainly easterly to southeasterly
- Wind flow was southwesterly during the afternoon hours
- Wind flow either remained southwesterly or changed to light and variable for the evening hours

## Classification of Synoptic Regimes

The meteorology associated with ozone episode days will be described on the basis of synoptic regimes. Meteorological classification of ozone episodes is used for selecting episodes for air quality modeling.

Visual examination combined with the quantitative analysis based on Appendix B of the UAM EPA Guidelines (EPA, 1991) were used to identify the different types of surface synoptic regimes. Meteorological classification of ozone episodes provides a basis for examining the correlation between certain types of synoptic regimes and ozone episodes, as well as the relationship between these regimes and episode severity. It should be noted that the synoptic-scale meteorology is constantly evolving and definitions of meteorology regimes can vary. Therefore, classification of the synoptic regimes on the high ozone days can be subjective.

The National Meteorological Center surface and 500 mb analyses for several high ozone days during the 1987-1993 period were previously examined by Systems Applications International in order to classify the synoptic pattern associated with the high ozone days. The daily surface weather maps for all the high ozone days in the 1998-2000 three-year period were also examined and provided in Attachment I. Only one type of synoptic regime representative of the examined high ozone days was identified by examine the surface maps. This pattern is characterized by a surface (thermal) low pressure system over southwestern Arizona, ridging at 500 mb over the southwestern United States. Maximum temperature readings during ozone episodes were normally around or greater than 100$^{o}$ F in the metropolitan area. Most ozone episodes are typified by easterly and southeasterly wind flow during the morning hours.

The approach for selecting episode days recommended in the EPA guideline (July 1991) was further applied to examine the meteorological regimes and ozone episode days. A climatological windrose (Figure 8) for AZMET Phoenix Encanto of all high ozone days was constructed to identify the meteorological regimes. The climatological windrose of all high ozone days was constructed by grouping the resultant wind velocities into eight compass directions plus calm. The resultant wind velocity for the morning hours from 7 am to 10 am was calculated using the equations listed below:

$$V_e = -\frac{1}{N} \Sigma\ u_i\ SIN(\theta_i)$$ Mean east-west component of wind

$$V_n = -\frac{1}{N} \Sigma\ u_i\ COS(\theta_i)$$ Mean north-south component of wind

where

$u_i$ = wind speed;
$\theta_i$ = wind direction in degrees with 0 degree resenting northerly winds; and
$N$ = number of valid observations.

The resultant mean wind speed and direction are:

$$\overline{U_{RV}} = ((V_e)^2 + (V_n)^2)^{1/2}$$ Resultant mean wind speed

$$\overline{\theta_{RV}} = Tan^{-1}(V_e/V_n) + FLOW$$ Resultant mean wind direction

where

FLOW = +180; for $Tan^{-1}$ $(V_e/V_n) < 180$, and
FLOW = -180; for $Tan^{-1}$ $(V_e/V_n) > 180$ .

Since the majority of the resultant wind velocities are under 1.5 meters per second (m/s), the threshold of 1.5 m/s used in the Guideline for defining the "calm" winds is not applied in the current analysis. "Calm" winds herein are defined as those with zero wind speeds or null wind directions. As shown in Figure 8, the predominant wind directions (PWD) from this analysis are easterly and southeasterly winds.

Table 6 breaks down the Predominant wind direction by high ozone day. Regime 1 covers PWD from the northeast, east or southeast and accounts for 25 of the 32 high ozone days. The remainder of high ozone days are in Regime 2.

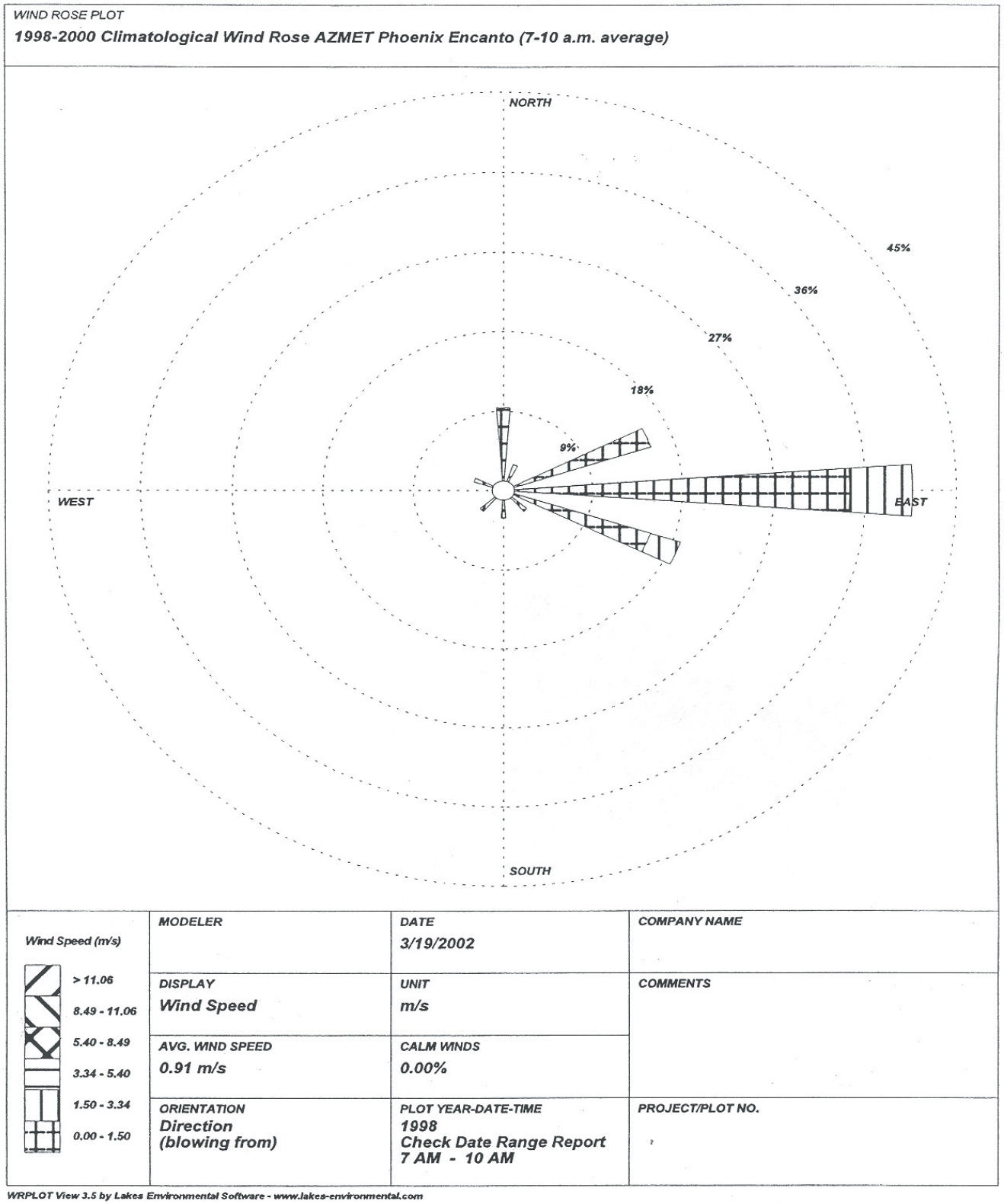



**Figure 8.** 1998-2000 Climatological Wind Rose for AZMET Phoenix Encanto Site. Note: due to limitation of the plotting software 16 wind direction bins were used instead of the 9 bins (Including 8 compass points and calm or null winds) mentioned in Appendix B of the UAM EPA Guidelines.

**Table 5.** Daily average, maximum and minimum surface temperatures (° F) from the AZMET Phoenix Encanto for the high ozone days 1998-2000.

| DATE (YYMMDD) | TEMPERATURE (° F) | | |
|---|---|---|---|
| | MAX | MIN | AVG |
| 980628 | 108 | 68 | 90 |
| 980629 | 108 | 71 | 92 |
| 980711 | 110 | 80 | 97 |
| 980715 | 113 | 75 | 96 |
| 980717 | 108 | 85 | 96 |
| 980727 | 110 | 80 | 96 |
| 980805 | 105 | 82 | 94 |
| 980812 | 102 | 77 | 89 |
| 980819 | 100 | 78 | 89 |
| 980823 | 107 | 85 | 96 |
| 980825 | 98 | 79 | 88 |
| 980827 | 107 | 80 | 93 |
| 980828 | 111 | 81 | 95 |
| 980912 | 100 | 76 | 87 |
| 990526 | 96 | 66 | 82 |
| 990705 | 107 | 80 | 92 |
| 990719 | 99 | 73 | 87 |
| 990723 | 100 | 80 | 89 |
| 990724 | 98 | 81 | 88 |
| 990817 | 106 | 75 | 92 |
| 990819 | 103 | 81 | 90 |
| 990822 | 109 | 79 | 94 |
| 990823 | 104 | 83 | 95 |
| 990824 | 106 | 84 | 94 |
| 990826 | 104 | 77 | 91 |
| 991012 | 100 | 60 | 79 |
| 991014 | 96 | 62 | 77 |
| 000509 | 95 | 64 | 81 |
| 000801 | 105 | 83 | 95 |
| 000805 | 109 | 81 | 95 |
| 000809 | 103 | 79 | 92 |
| 000810 | 104 | 82 | 93 |

**Table 6.** AZMET Phoenix Encanto Wind Rose Classification by Regime

| M | D | Yr | Day | Julian | Hr | Site | PPB | PWD* |
|---|---|---|---|---|---|---|---|---|
| Regime 1<br>PWD =Northeast, East or Southeast | | | | | | | | |
| **8** | **25** | **98** | **Tue** | **98237** | **17** | **FOUN** | **124** | **3** |
| 8 | 25 | 98 | Tue | 98237 | 17 | BLUE | 115 | 3 |
| 8 | 25 | 98 | Tue | 98237 | 16 | SRPI | 115 | 3 |
| 8 | 25 | 98 | Tue | 98237 | 17 | FALC | 112 | 3 |
| 8 | 25 | 98 | Tue | 98237 | 14 | NPHX | 108 | 3 |
| 8 | 23 | 98 | Sun | 98235 | 15 | NPHX | 120 | 3 |
| 8 | 23 | 98 | Sun | 98235 | 14 | WPHX | 113 | 3 |
| 7 | 17 | 98 | Fri | 98198 | 17 | WPHX | 118 | 3 |
| 7 | 17 | 98 | Fri | 98198 | 18 | MARY | 113 | 3 |
| 7 | 17 | 98 | Fri | 98198 | 16 | NPHX | 108 | 3 |
| 8 | 5 | 00 | Sat | 00218 | 16 | FOUN | 118 | 3 |
| 8 | 5 | 00 | Sat | 00218 | 15 | PINN | 117 | 3 |
| 8 | 5 | 00 | Sat | 00218 | 16 | BLUE | 108 | 3 |
| 8 | 5 | 00 | Sat | 00218 | 15 | RIOV | 109 | 3 |
| 5 | 9 | 00 | Tue | 00130 | 17 | RIOV | 117 | 3 |
| 8 | 5 | 98 | Wed | 98217 | 20 | HUMB | 116 | 3 |
| 7 | 5 | 99 | Mon | 99186 | 16 | WPHX | 115 | 2 |
| 7 | 5 | 99 | Mon | 99186 | 15 | MARY | 112 | 2 |
| 8 | 28 | 98 | Fri | 98240 | 16 | MARY | 114 | 3 |
| 8 | 28 | 98 | Fri | 98240 | 17 | WPHX | 112 | 3 |
| 8 | 12 | 98 | Wed | 98224 | 15 | PINN | 114 | 3 |
| 7 | 23 | 99 | Fri | 99204 | 17 | FOUN | 113 | 4 |
| 7 | 27 | 98 | Mon | 98208 | 15 | NPHX | 113 | 3 |
| 7 | 27 | 98 | Mon | 98208 | 16 | PINN | 112 | 3 |
| 7 | 11 | 98 | Sat | 98192 | 14 | NPHX | 112 | 3 |
| 8 | 1 | 00 | Tue | 00214 | 18 | MORD | 111 | 2 |
| 7 | 24 | 99 | Sat | 99205 | 16 | EMGM | 110 | 3 |
| 7 | 24 | 99 | Sat | 99205 | 17 | MESA | 109 | 3 |
| 7 | 19 | 99 | Mon | 99200 | 17 | MESA | 110 | 3 |
| 7 | 19 | 99 | Mon | 99200 | 16 | EMGM | 108 | 3 |
| 10 | 12 | 99 | Tue | 99285 | 15 | WPHX | 109 | 2 |
| 8 | 9 | 00 | Wed | 00222 | 17 | MORD | 109 | 3 |
| 6 | 28 | 98 | Sun | 98179 | 13 | NPHX | 109 | 3 |
| 9 | 12 | 98 | Sat | 98255 | 16 | NPHX | 109 | 3 |
| 8 | 26 | 99 | Thu | 99238 | 17 | GLEN | 109 | 3 |
| 6 | 29 | 98 | Mon | 98180 | 15 | PINN | 108 | 2 |
| 8 | 22 | 99 | Sun | 99234 | 13 | NPHX | 108 | 3 |
| 7 | 15 | 98 | Wed | 98196 | 15 | SRPI | 108 | 3 |
| 5 | 26 | 99 | Wed | 99146 | 18 | BLUE | 108 | 3 |
| 8 | 10 | 00 | Thu | 00223 | 18 | NPHX | 108 | 3 |

| M | D | Yr | Day | Julian | Hr | Site | PPB | PWD* |
|---|---|---|---|---|---|---|---|---|
| Regime 2<br>PWD = Other | | | | | | | | |
| **8** | **24** | **99** | **Tue** | **99236** | **17** | **MESA** | **124** | **5** |
| **8** | **24** | **99** | **Tue** | **99236** | **17** | **NPHX** | **124** | **5** |
| 8 | 24 | 99 | Tue | 99236 | 16 | PINN | 120 | 5 |
| 8 | 24 | 99 | Tue | 99236 | 16 | EMGM | 118 | 5 |
| 8 | 24 | 99 | Tue | 99236 | 17 | SRPI | 116 | 5 |
| 8 | 24 | 99 | Tue | 99236 | 17 | FOUN | 115 | 5 |
| 8 | 23 | 99 | Mon | 99235 | 16 | PINN | 119 | 1 |
| 8 | 23 | 99 | Mon | 99235 | 17 | RIOV | 112 | 1 |
| 8 | 19 | 98 | Wed | 98231 | 17 | BLUE | 112 | 6 |
| 8 | 19 | 99 | Thu | 99231 | 17 | MESA | 112 | 1 |
| 8 | 17 | 99 | Tue | 99229 | 17 | EMGM | 110 | 1 |
| 8 | 17 | 99 | Tue | 99229 | 17 | CPHX | 110 | 1 |
| 8 | 17 | 99 | Tue | 99229 | 15 | WPHX | 110 | 1 |
| 8 | 17 | 99 | Tue | 99229 | 18 | MESA | 109 | 1 |
| 8 | 27 | 98 | Thu | 98239 | 17 | FOUN | 110 | 7 |
| 10 | 14 | 99 | Thu | 99287 | 16 | WPHX | 108 | 1 |

* The highest areawide daily maximum ozone values with predominant wind directions (PWD) that were in proximity to the climatological windrose PWD for all of the episode days for 1998-2000 were ranked the highest.

## MODELING EPISODES SELECTION

The candidate episode days within each regime were ranked according to the magnitude of the peak observed ozone concentrations, as presented in Table 6. Several considerations were given in selecting the modeling episode days, as listed below.

Only the top three ranked episode days from each meteorological regime were considered. That includes August 25, 1998, August 23, 1998, July 17, 1998, and August 5, 2000 in Regime 1, and August 24, 1999, August 23, 1999, and August 19, 1998 in Regime 2.

The intention is to select one episode day from each meteorological regime.

The availability and quality of meteorological and air quality databases. None of the top-ranked episode days coincides with any special field study for either meteorology or air quality. Measurements on all of the candidate days were taken from routine operations of the monitoring stations. Sources of the available air quality and meteorological data are listed in Tables 2 and 7, respectively, and graphically displayed in Figure 2. Therefore, this criteria did not differentiate any day among all the candidate days.

The availability of transportation data and emission estimates. Since transportation data and modeling results are normally available for weekdays, any high ozone days happened on weekend days were discarded. Therefore, August 23, 1998 and August 5, 2000 in Regime 1 were removed from consideration.

Pervasiveness of the high ozone readings. In Regime 1, August 25, 1998 recording high ozone at five monitoring stations has the greatest pervasiveness. In Regime 2, August 24, 1999 recording high ozone at six monitoring stations has the greatest pervasiveness.

Severity of the ozone readings. In Regime 1, August 25, 1998 recording the highest ozone of 124 ppb at FOUN monitoring station has the greatest severity. In Regime 2, August 24, 1999 recording the highest ozone of 124 ppb at both MESA and NPHX monitoring stations has the greatest severity.

Persistence of the high ozone days. In Regime 1, the persistence for the last two candidate days are the same, one day. In Regime 2, the persistence for August 24, 1999 is three days and is on top of any other candidate days. See Table 1.

Frequency of high ozone readings at the monitoring sites. See Table 4. In Regime 1, the total number of high ozone episodes for 1998-2000 at the sites with high ozone on August 25, 1998 is 23, and 20 times at the sites on July 17, 1998. However, since the high ozone readings on July 17, 1998 occurred at both NPHX and WPHX which are the first and second highest occurrences of high ozone readings, July 17, 1998 may be of better interest than the other day. In Regime 2, August 24, 1999 has a total of 33 times of high ozone episodes and is on top of all others for this criteria.

At this point, August 24, 1999 remains the strongest candidate for a modeling episode day in Regime 2. In Regime 1, however, July 17, 1998 and August 25, 1998 are still in candidacy. Examination on the spatial distribution of peak ozone readings as provided in Attachment II provides a favorable determination for July 17, 1998. Given the episode days of August 24, 1999 in Regime 1, July 17, 1998 exhibits a central/western oriented high ozone pattern distinct from those observed on both August 24, 1999 and August 25, 1998.

This review indicates that the recommended episodes for ozone modeling are Friday July 17, 1998 and Tuesday, August 24, 1999. The previous 24-hour time period may be used as the modeling start-up days.

**Table 7.** Meteorology Monitoring Sites

| Abbr. | Name | Site Operator | Location | UTM Zone 12 (m) Easting | Northing |
|---|---|---|---|---|---|
| AGUI | Aguila | AZMET | 0.96 km NW of Aguila City | 297716 | 3758206 |
| ALAM | Alameda | PRISM | Southern Ave & Dorsey Ln | 414518 | 3695417 |
| ARCA | Arcadia | PRISM | Bamelback Rd & 40th St. | 406863 | 3708085 |
| BNKO | Bank One | ADEQ | 201 N. Central | 400242 | 3701788 |
| BUCK | Buckeye | AZMET | 3.5 km south of exit 109 from I-10 | 343451 | 3696706 |
| CARE | Carefree Ranch | FCDMC | 3.5 mi NE of Skyranch Airport | 421380 | 3747596 |
| CHAN | Chandler | MCESD | 1475 E Pecos Rd. | 423957 | 3683327 |
| COLL | Collier | PRISM | 107th Ave & I-10 | 380172 | 3703143 |
| COOL | Coolidge | AZMET | 4.3 mi from Rt. 87 on Coolidge Rd. | 443495 | 3649041 |
| CORB | Corbell | PRISM | McQueen Rd. & Guadalupe Rd | 422957 | 3690973 |
| CPHX | Central Phoenix | MCESD | 1845 East Roosevelt | 403224 | 3702365 |
| CROS | Crossroads Park | FCDMC | 0.5 mi NW of Ray and Greenfield | 430480 | 3687682 |
| DURA | Durango Complex | FCDMC | 27th Ave and Durango St. | 395955 | 3699110 |
| ELOY | Eloy | AZMET | E of 11 mile corner road on Arica Rd | 447839 | 3626168 |
| ENCA | Phx. Encanto | AZMET | Encanto Golf Course | 398132 | 3704754 |
| ESTR | Estrella Fan | FCDMC | El Mirage and Germann Rd | 376983 | 3681775 |
| FACN | Falcon | PRISM | McDowell Rd & Greenfield Rd | 431961 | 3703348 |
| FCAD[1] | ACDC@67th Ave | FCDMC | 67th Ave. Bridge at Arizona Canal | 388433 | 3720910 |
| FCFT[1] | Fountain Hills Fire | FCDMC | Palisades Blvd Fire Station | 432767 | 3719080 |
| FCHA[1] | Hassy R. @I-10 | FCDMC | I-10 Bridge over Hassayampa River | 336173 | 3703389 |
| FCLA | Lake Pleasant - FCDMC | FCDMC | On New Waddell Dam | 381783 | 3745757 |
| FCTA[1] | Thunderbird Academy | FCDMC | Thunderbird Rd. & Scottsdale Rd. | 414393 | 3719165 |
| FCTP[1] | Thompson Peak | FCDMC | Thompson Peak | 423984 | 3722842 |
| FONT | Fountain | PRISM | Coyote Dr & El Lago Blvd. | 434202 | 3717838 |
| GILA | Gila Bend Mountains | FCDMC | 16 mi NW of Painted Rock Dam | 294659 | 3679991 |
| GILB | Gilbert | MCESD | Guadalupe & Linsey Rd. | 428468 | 3691346 |
| GLEN | Glendale | MCESD | 6000 West Olive | 389475 | 3714845 |
| GREE | Greenwood | MCESD | 27th Ave & I-10 | 396213 | 3702738 |
| HARQ | Harquahala | AZMET | 1.8 Km No or Courhouse Rd | 303333 | 3706683 |
| IBWI | IBW@Indian School | FCDMC | Indian School & Hayden Rd | 415875 | 3705908 |
| JOMA | Pima@ Jomax | FCDMC | 1/8 mi NW of Pima and Jomax Rd | 417263 | 3732168 |
| LAVE | Laveen | AZMET | 3921 W. Baseline Rd. | 393025 | 3693413 |
| LITC | Litchfield | AZMET | 1.6 km N of McDowell Rd | 370084 | 3703767 |
| MESA | Mesa | MCESD | 370 South Brooks | 419633 | 3696938 |
| MORD | Mt. Ord | ADEQ | Mazatzal Mountains | 462223 | 3751473 |

**Table 7.** Meteorology Monitoring Sites (Continued)

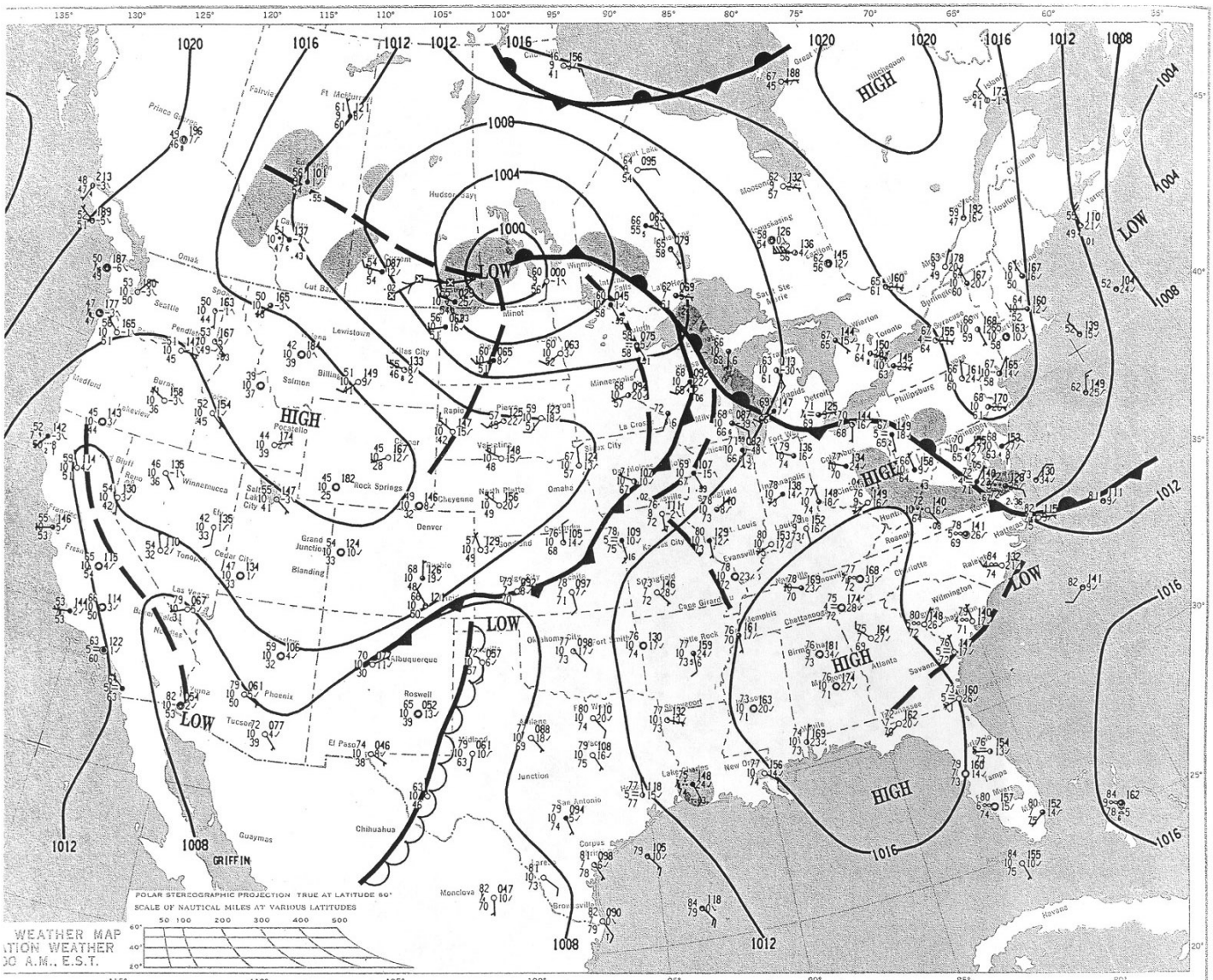
| | | | | | |
|---|---|---|---|---|---|
| NPHX | North Phoenix | MCESD | 601 East Butler | 401095 | 3713719 |
| PERA | Pera | PRISM | McDowell Rd & Cross Cut Canal | 412777 | 3702948 |
| PGRN | Phx. Greenway | AZMET | Cave Creek Golf Course | 397191 | 3720535 |
| PINN | Pinnacle Peak | MCESD | 25000 Windy Walk Way | 421092 | 3730363 |
| PRIN | Pringle | PRISM | 23rd Ave & Dunlap Rd | 397208 | 3714898 |
| QUEE | Queen Creek | AZMET | Queen Creek Rd & Ellsworth Rd. | 440232 | 3679918 |
| RITT | Rittenhouse | PRISM | Ellsworth Rd & Queen Creek Rd | 440647 | 3680162 |
| SHEE | Sheely | PRISM | 71st Ave & Osborn Rd | 386991 | 3705648 |
| SKYH | Sky Harbor Intl Airport | NWS | Sky Harbor Intl Airport | 407040 | 3699582 |
| SMTF | South Mountain Fan | FCDMC | Ray Rd & 35th Ave in S. Mtn. Park | 393856 | 3686689 |
| SMTP | South Mountain Park | FCDMC | Elliot Rd & 24th St. | 403868 | 3689634 |
| SPHX | South Phoenix | MCESD | Central Ave & Broadway | 400209 | 3696337 |
| SPUR | Spurlock | PRISM | US 60 & Kings Ranch Rd. | 457642 | 3690913 |
| SSCT | South Scottsdale | MCESD | 2857 North Miller Road | 414851 | 3704625 |
| STAP | Stapley | PRISM | Stapley Dr & Consolidated Canal | 425245 | 3699424 |
| STEW | Stewart Mountain | PRISM | Near Stewart Mountain Dam | 450493 | 3713121 |
| SUNL | Sun Lakes | PRISM | Dobson Rd & Riggs Rd | 418543 | 3676318 |
| SUPR | Superstition | PRISM | Cactus Rd & Junction St. | 450104 | 3697632 |
| TIGR | Tiger Wash Fan | FCDMC | Eagle Eye Rd & Salome Highway | 285360 | 3727594 |
| USRY | Usery Park WS | FCDMC | Crismon Rd. & Thomas Rd | 442761 | 3705064 |
| WADD | Waddell | AZMET | Cotton Ln and Greenway Rd. | 364589 | 3720570 |
| WICK | Wickenburg Airport | FCDMC | 4.5 mi W of US 60/US 93 Junction | 333310 | 3759732 |
| WIND | West Indian School | MCESD | 33rd Ave. & W. Indian Sch. Rd. | 395007 | 3706551 |
| WPHX | West Phoenix | MCESD | 3847 West Earll Road | 393893 | 3705301 |

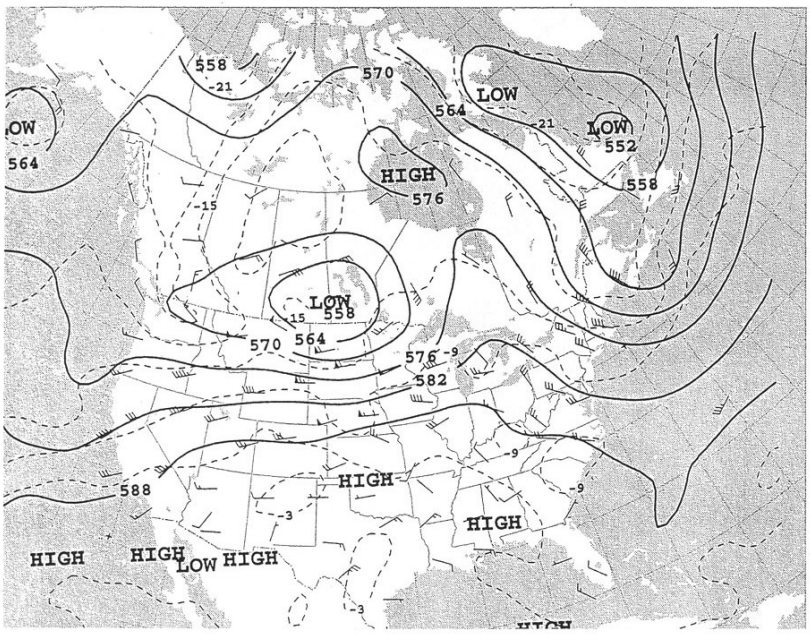
[1] Only temperature data are available from the sites.

ATTACHMENT I

Surface Maps for High Ozone Days in 1998 to 2000
(Source: Daily Weather Maps, Weekly Series, Dept. of Commerce)

JUNE 28, 1998


HIGH
LOW
1020
1016
1012
1008
1004
1000
Minot
Denver
Cheyenne
Omaha
Chicago
Detroit
Toronto
Philadelphia
Washington
Atlanta
Memphis
Chattanooga
Wilmington
Raleigh
Tampa
Havana
Phoenix
Tucson
Albuquerque
Roswell
El Paso
Chihuahua
Guaymas
Monclova
Brownsville
Corpus Christi
San Antonio
Junction
Abilene
Shreveport
Little Rock
Fort Smith
Oklahoma City
Kansas City
St. Louis
Evansville
Cape Girardeau
Lake Charles
New Orleans
Salt Lake City
Winnemucca
Rock Springs
Grand Junction
Blanding
Cedar City
Las Vegas
Fresno
Reno
Seattle
Spokane
Pendleton
Lewistown
Billings
Miles City
Salmon
Pocatello
Medford
Burns
Eureka
Prince George
Fort McMurray
Fairview
Hudson Bay
Moosonee
Great Whale
Kitchenogan
Sault Ste Marie
Toronto
Kingston
Ottawa
Montreal
Quebec
Halifax
Hatteras
Charlotte
Savannah
Jacksonville
Key West
Havana
GRIFFIN
POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE 60°
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
50 100 200 300 400 500
WEATHER MAP
ATION WEATHER
00 A.M., E.S.T.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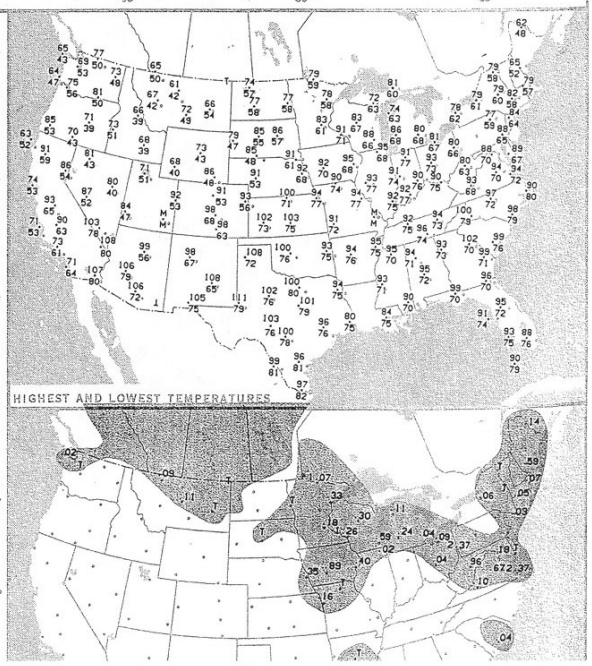
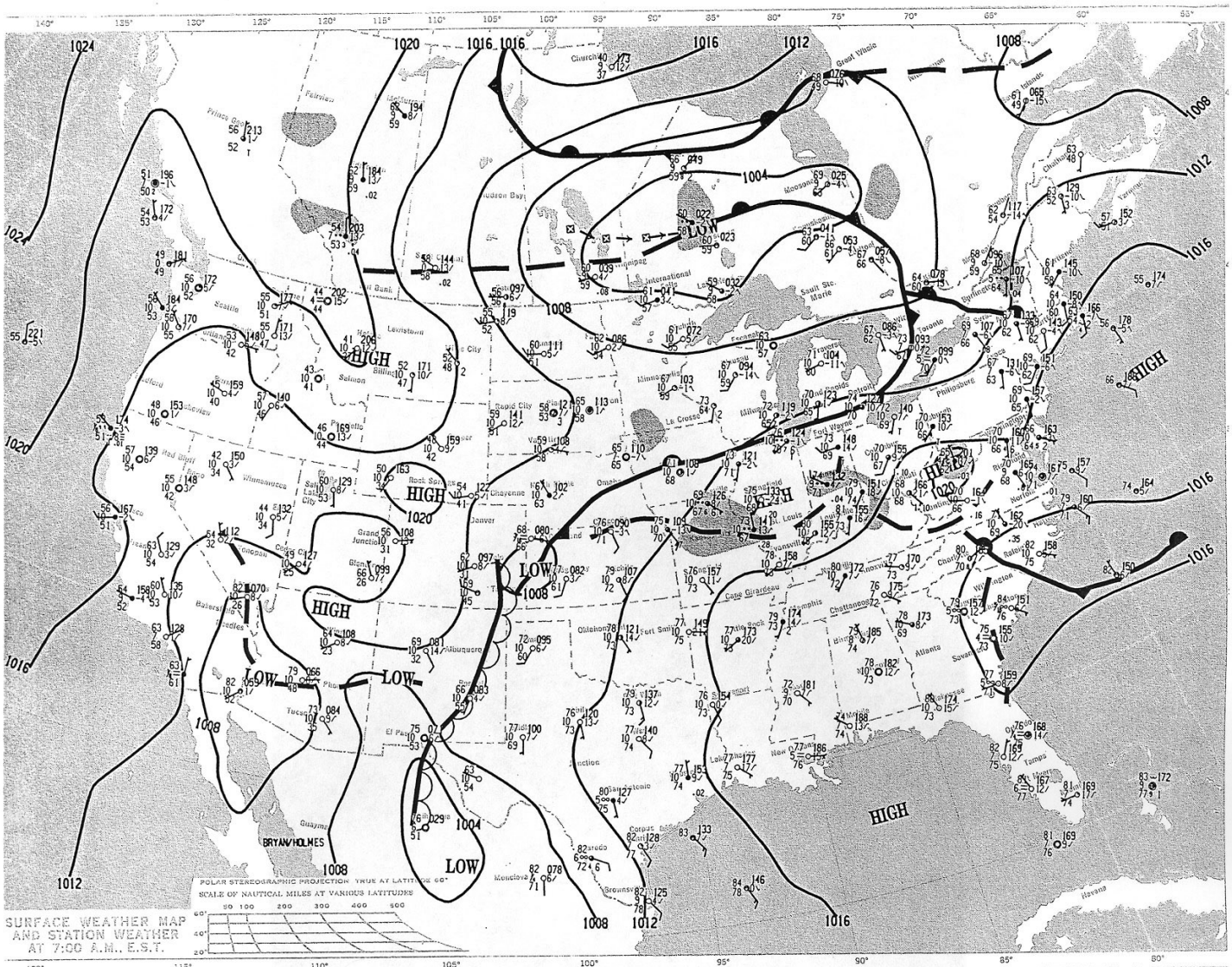
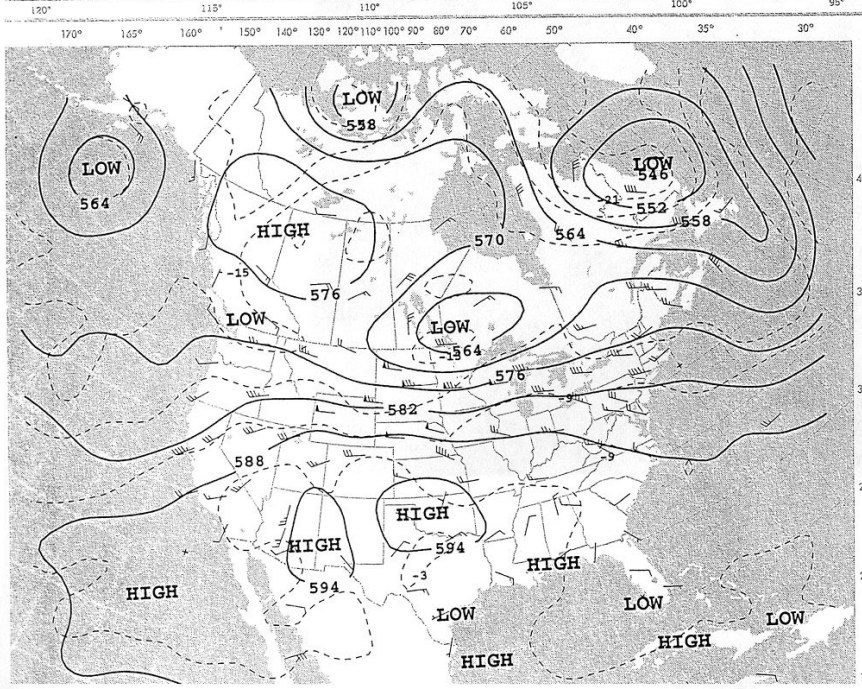
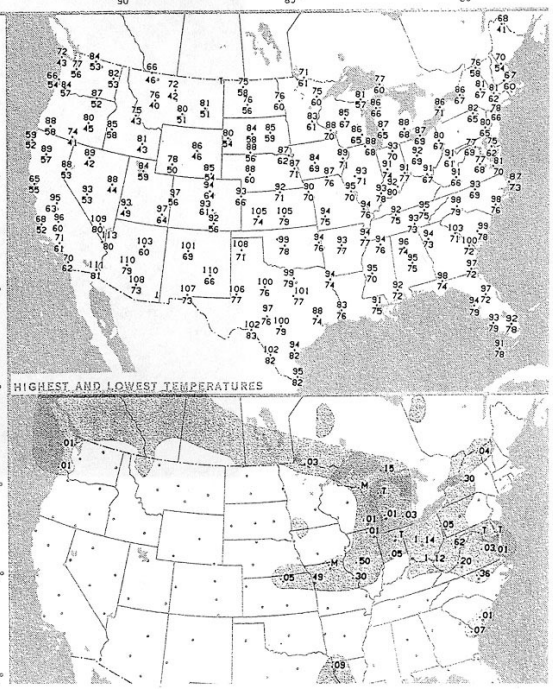
570
564
LOW
552
HIGH
576
582
588
HIGH
LOW
HIGH


HIGHEST AND LOWEST TEMPERATURES

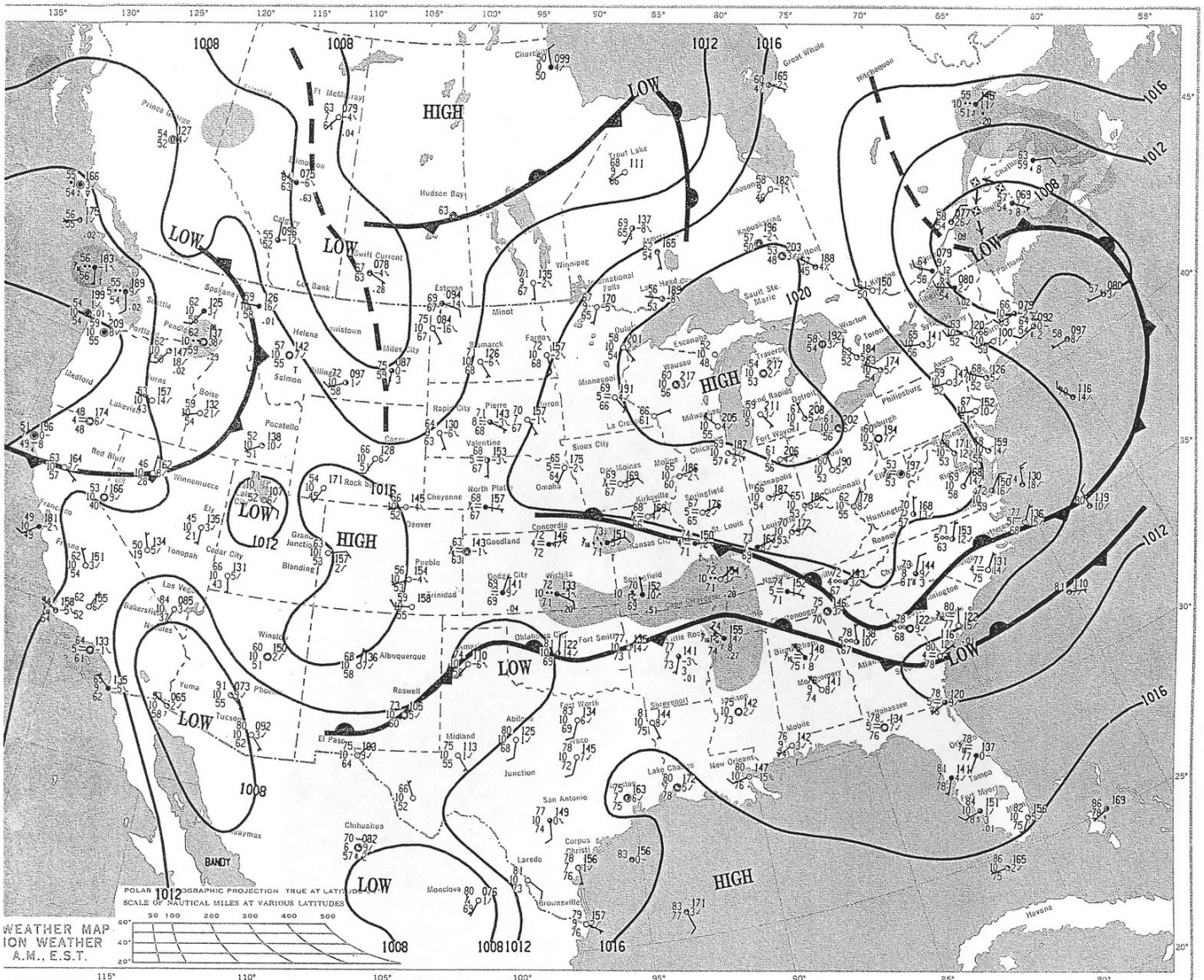
JUNE 29, 1998

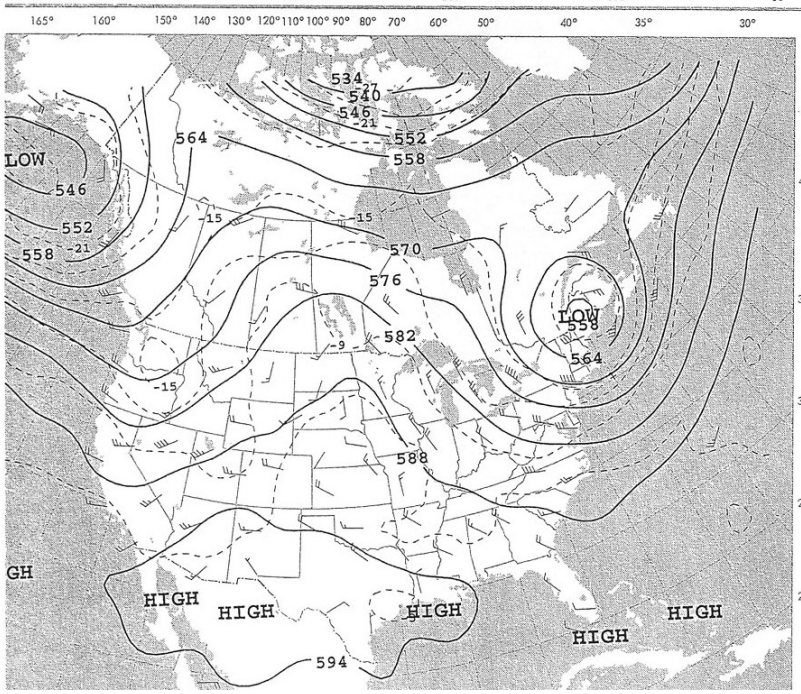

SURFACE WEATHER MAP
AND STATION WEATHER
AT 7:00 A.M., E.S.T.
POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE 60°
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
BRYAN HOLMES
HIGH
LOW


LOW
HIGH


HIGHEST AND LOWEST TEMPERATURES

JULY 11, 1998


HIGH
LOW
1008
1012
1016
1020
POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
WEATHER MAP
ION WEATHER
A.M., E.S.T.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HIGH
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552
558
564
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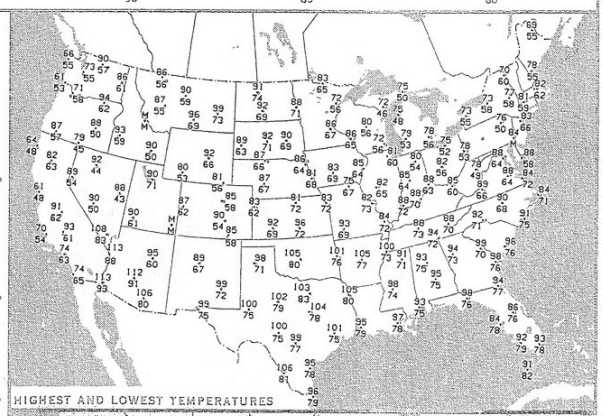
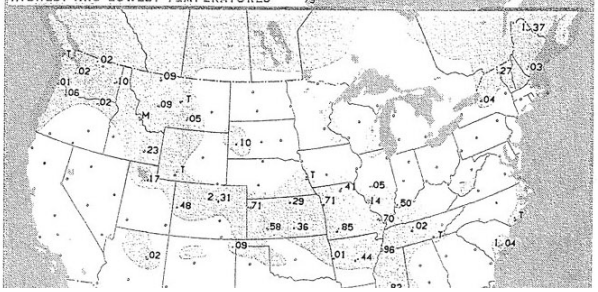
576
582
588
594


HIGHEST AND LOWEST TEMPERATURES



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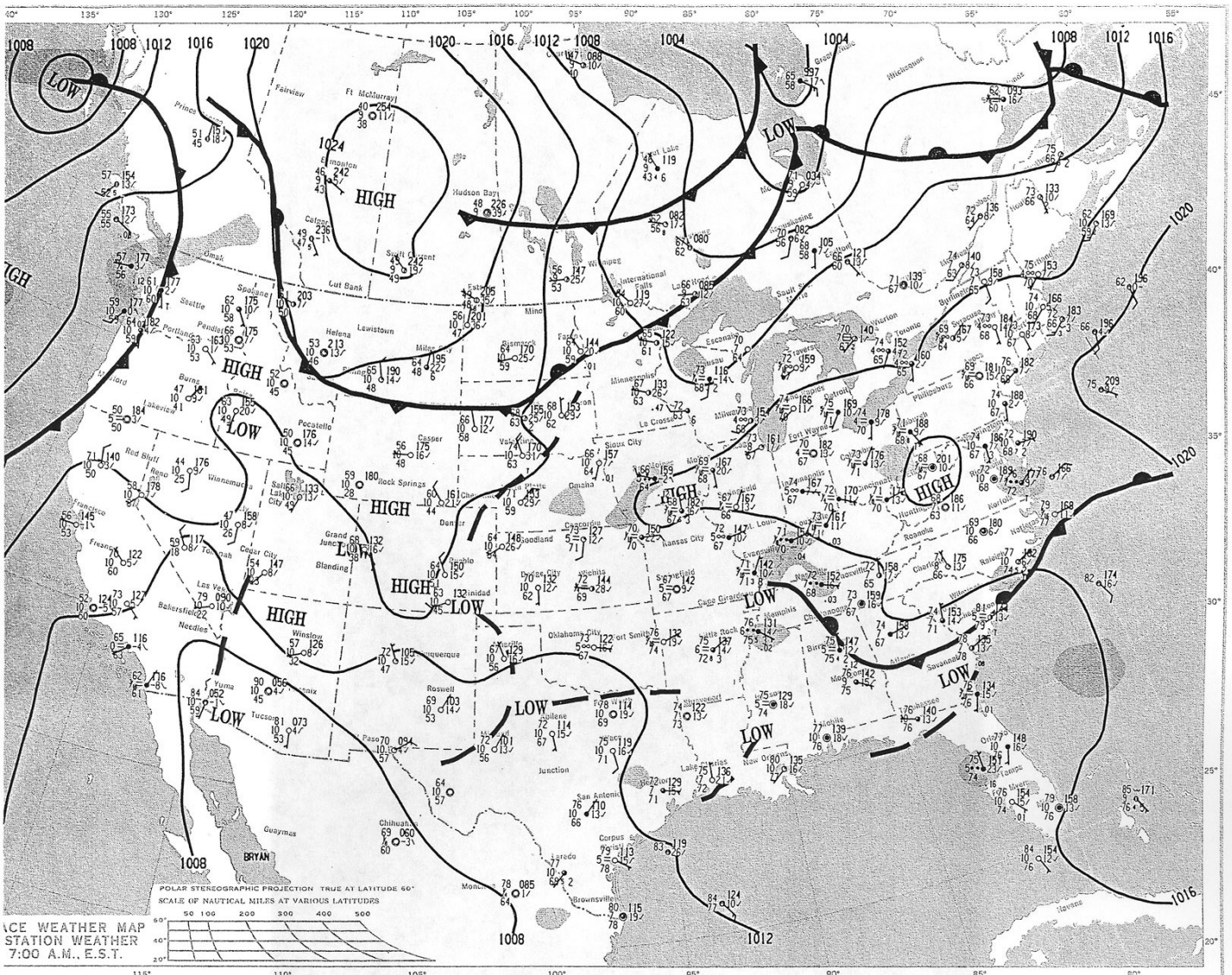
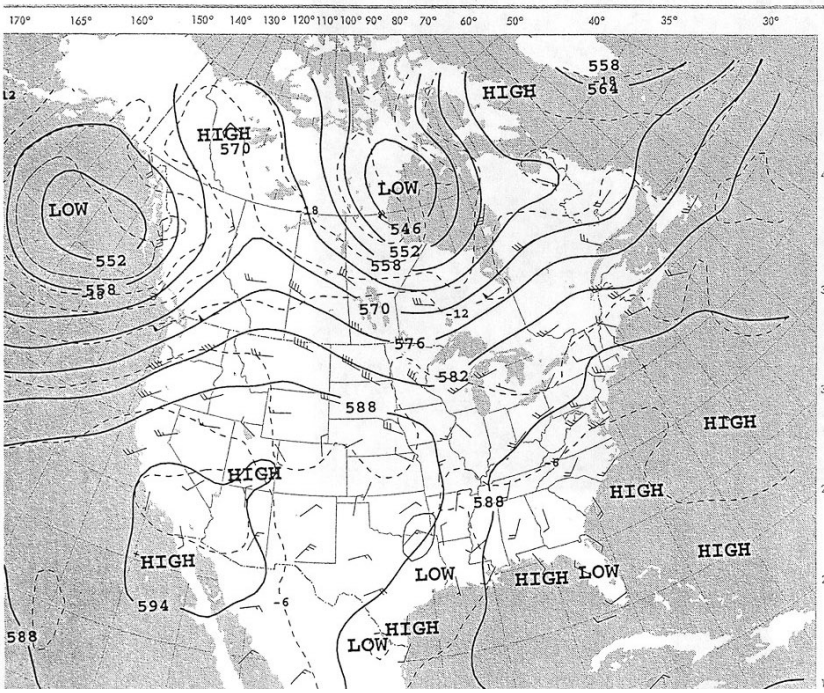
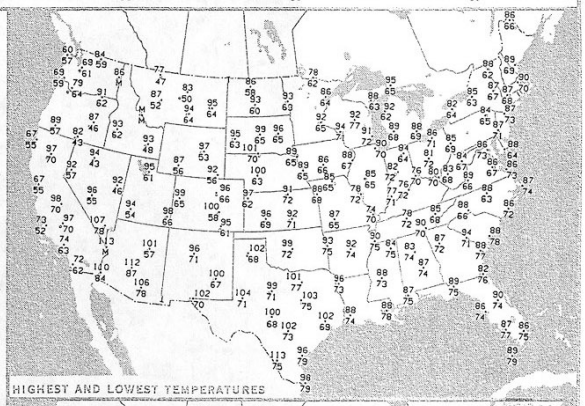
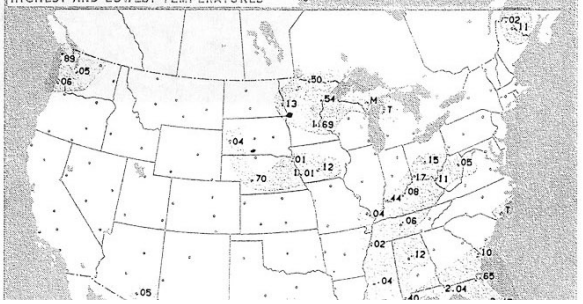

POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE 60°
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
ACE WEATHER MAP
STATION WEATHER
7:00 A.M., E.S.T.




HIGHEST AND LOWEST TEMPERATURES



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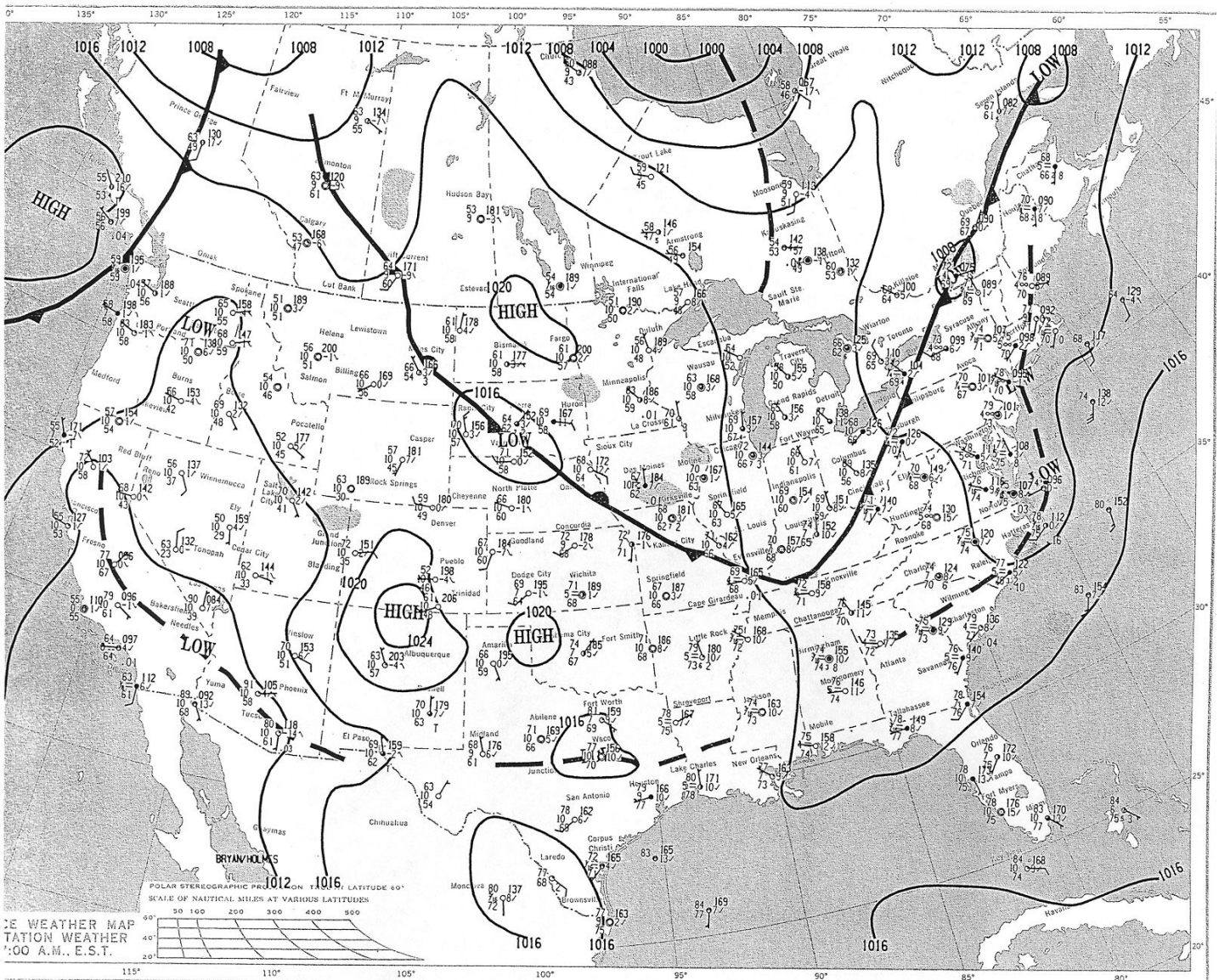
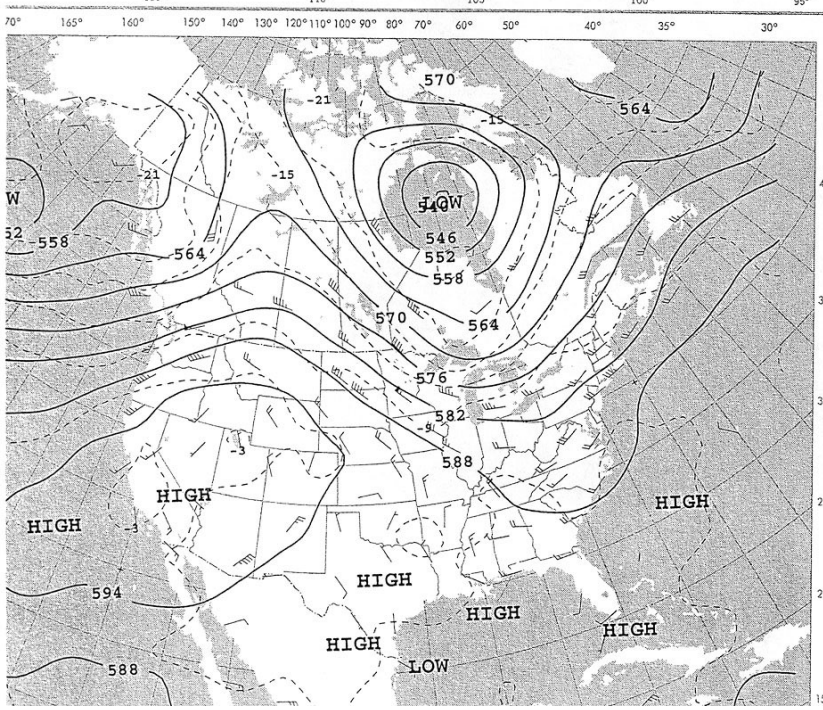
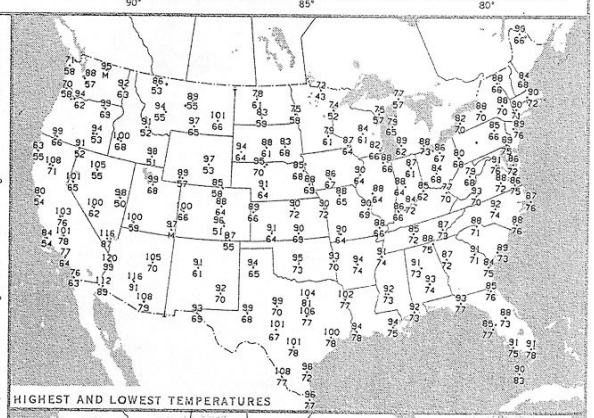
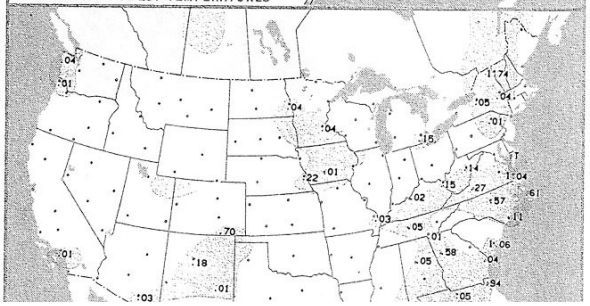

HIGH
LOW
BRYAN/HOLMES
POLAR STEREOGRAPHIC PROJECTION TANGENT LATITUDE 60°
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
CE WEATHER MAP
TATION WEATHER
:00 A.M., E.S.T.


HIGH
LOW


HIGHEST AND LOWEST TEMPERATURES



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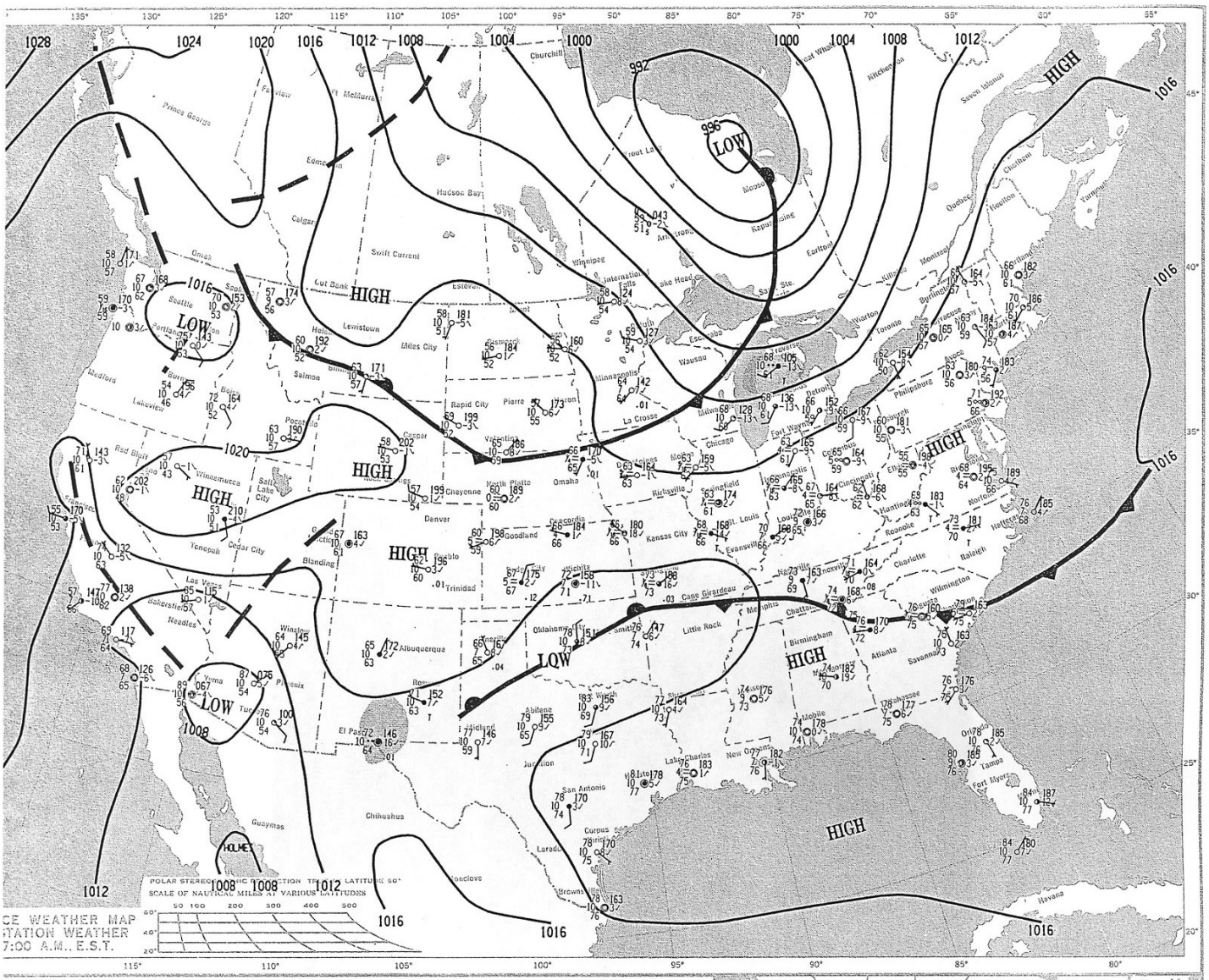
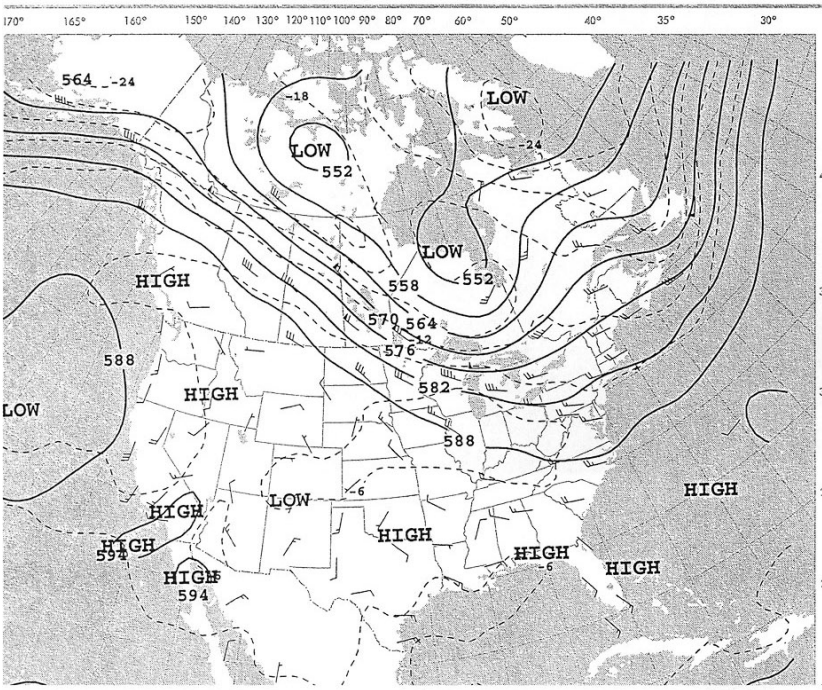

HIGH
LOW
1028
1024
1020
1016
1012
1008
1004
1000
992
996
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES
CE WEATHER MAP
TATION WEATHER
7:00 A.M., E.S.T.


LOW
HIGH
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552
558
570
576
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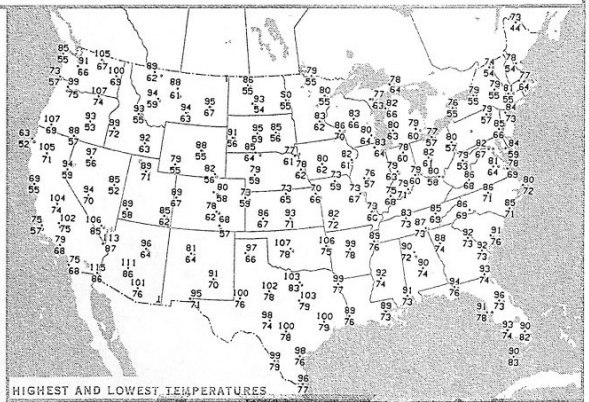
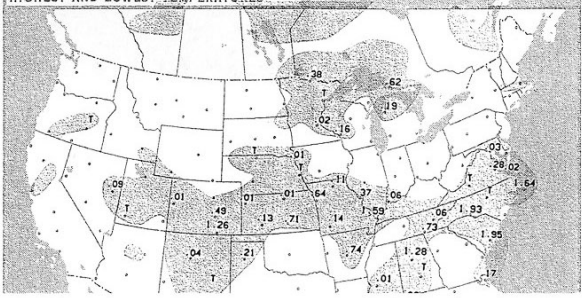
588
594




HIGHEST AND LOWEST TEMPERATURES

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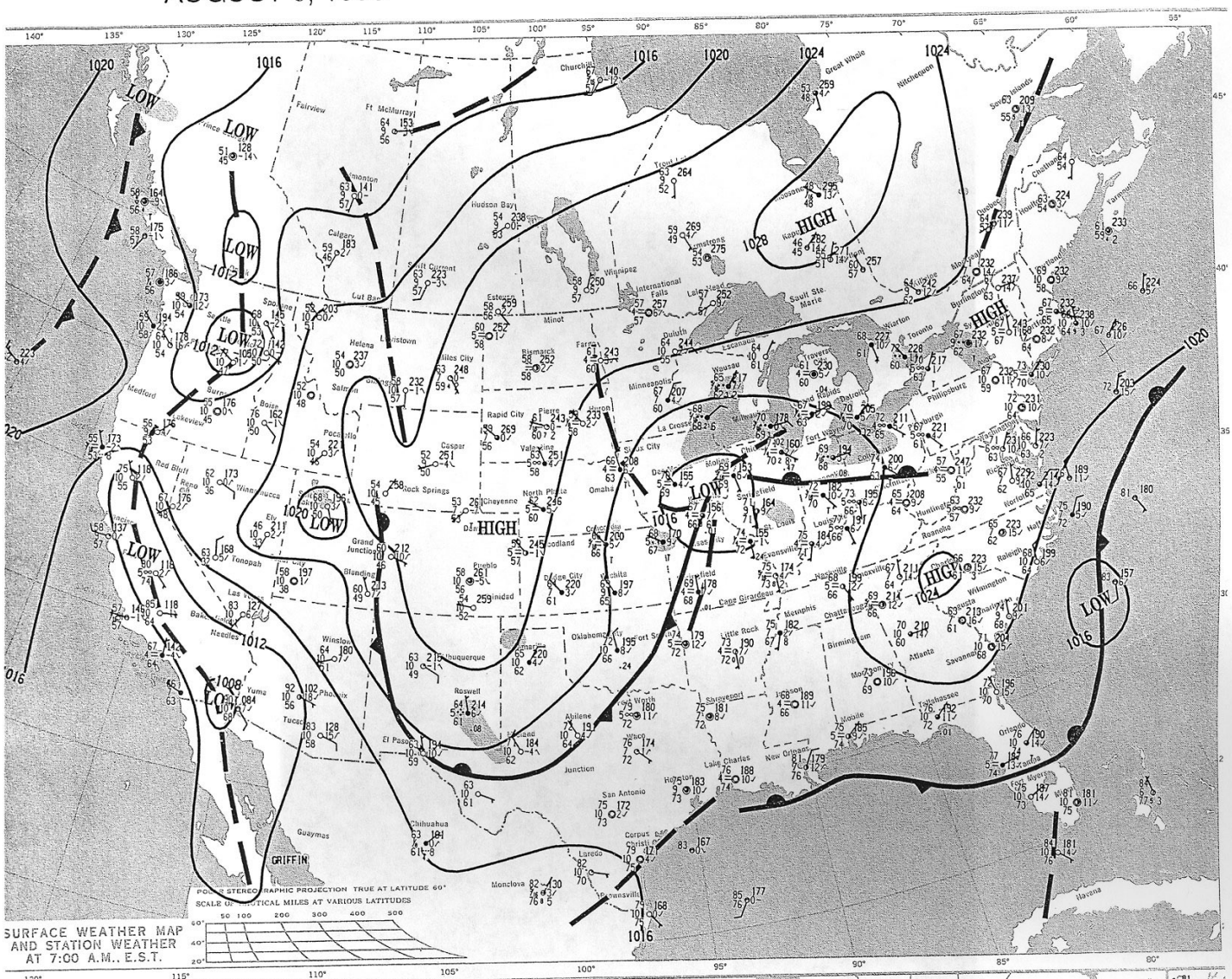


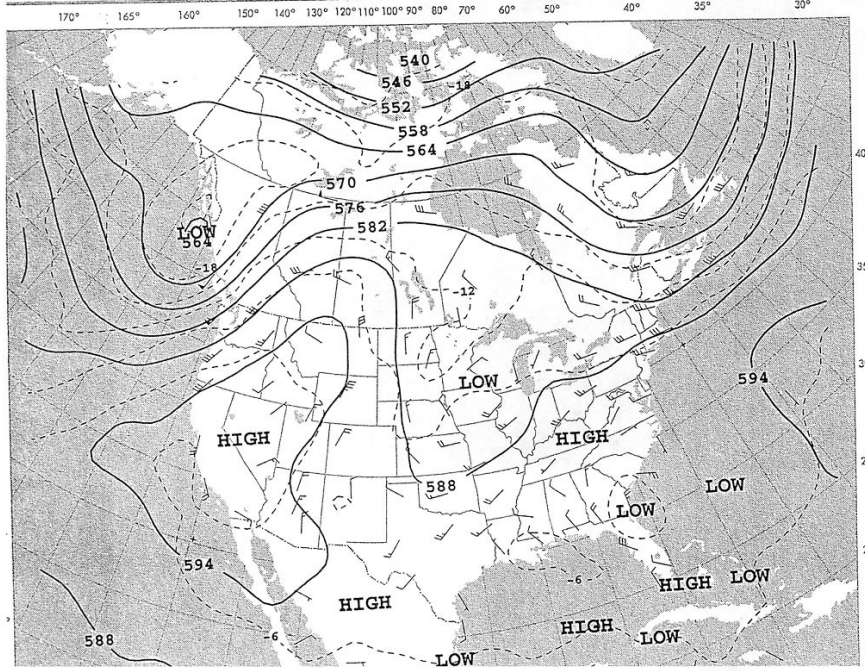


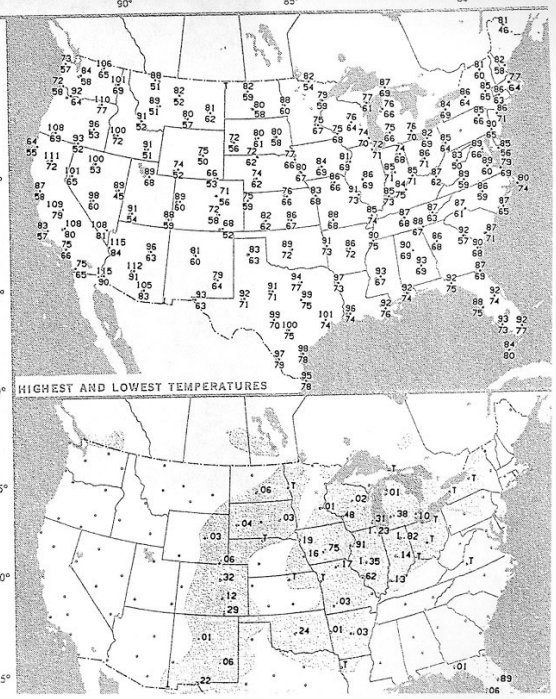

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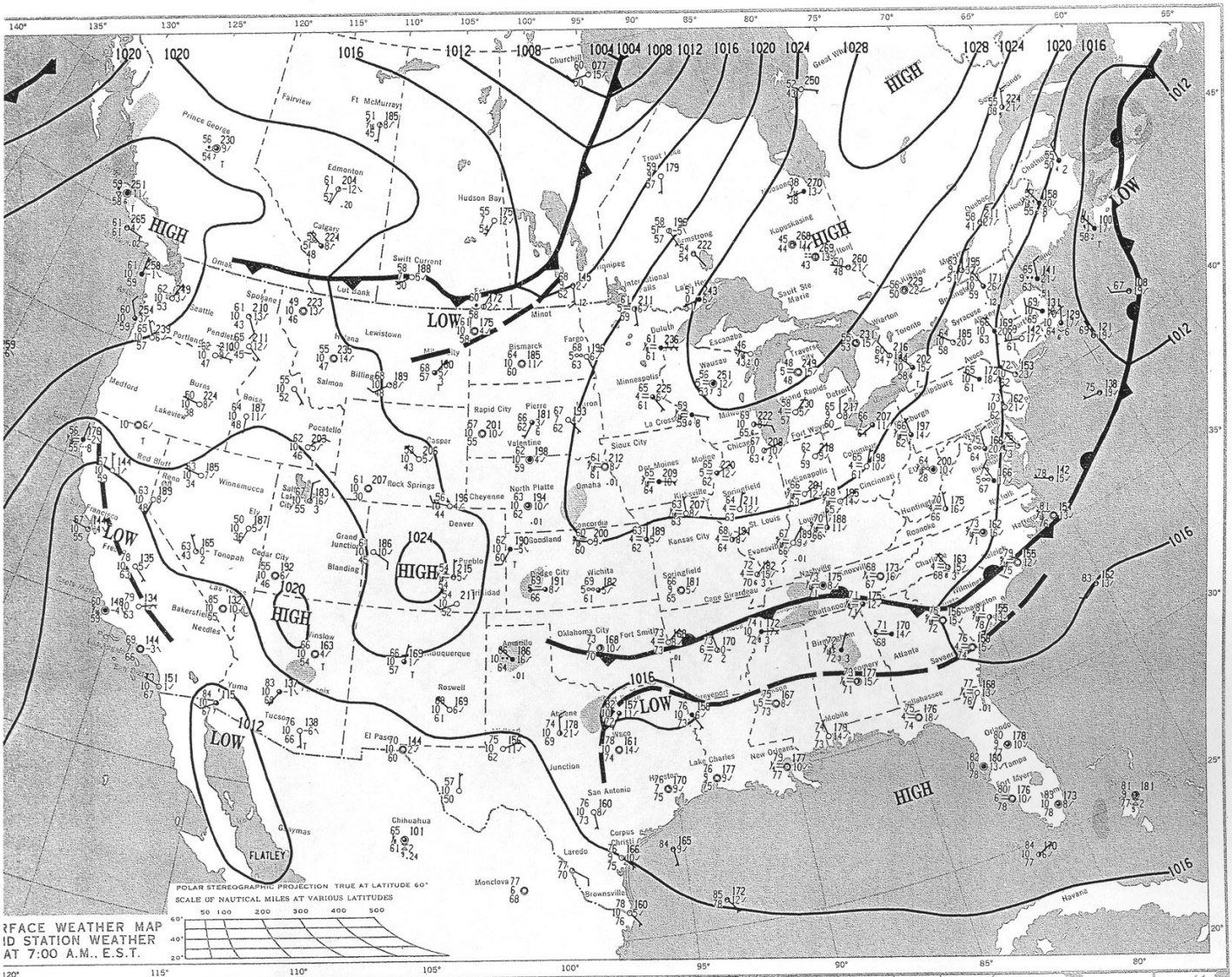


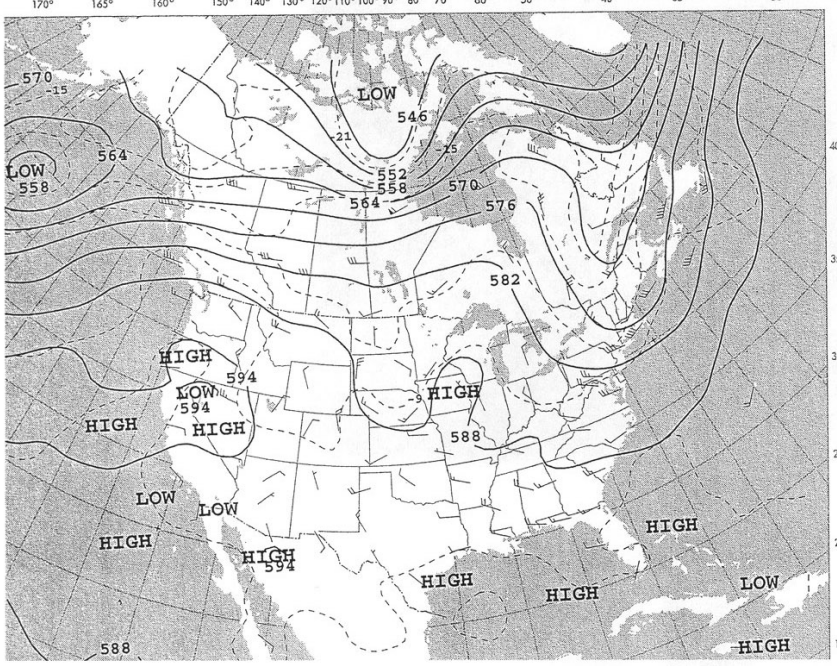


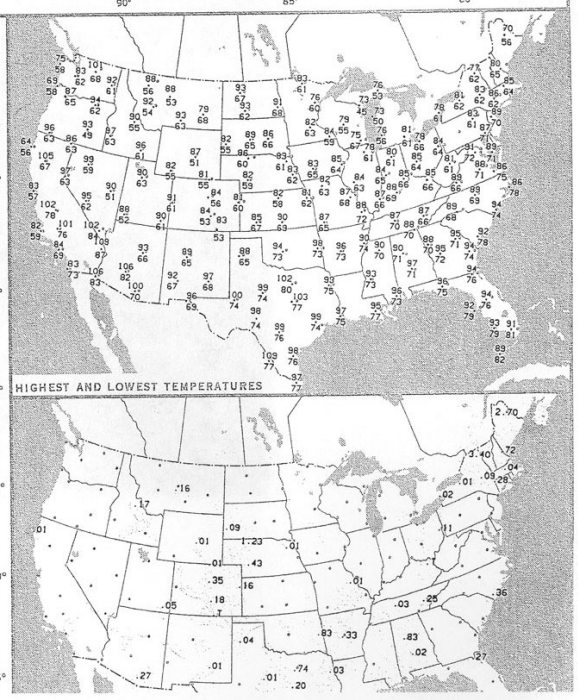

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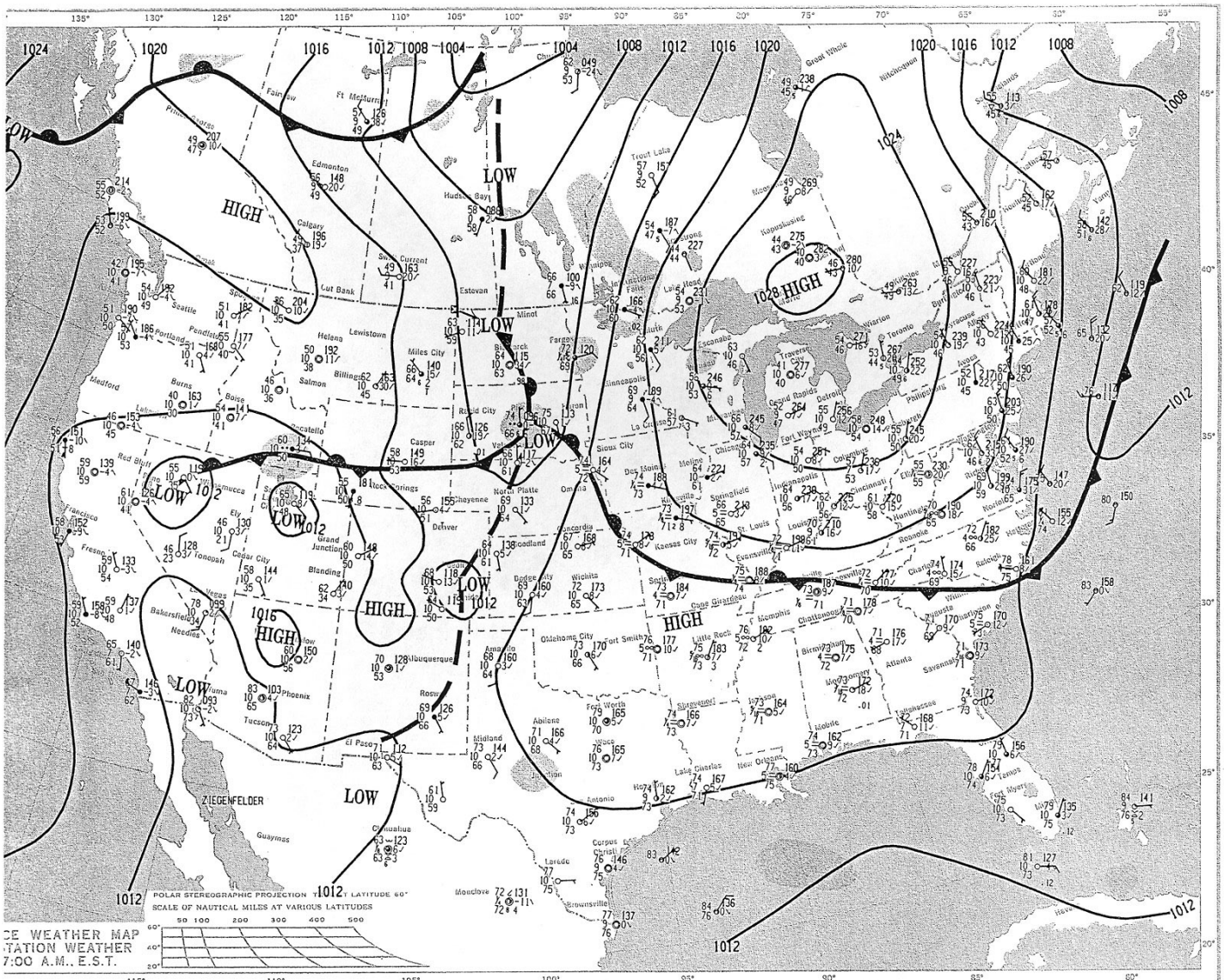


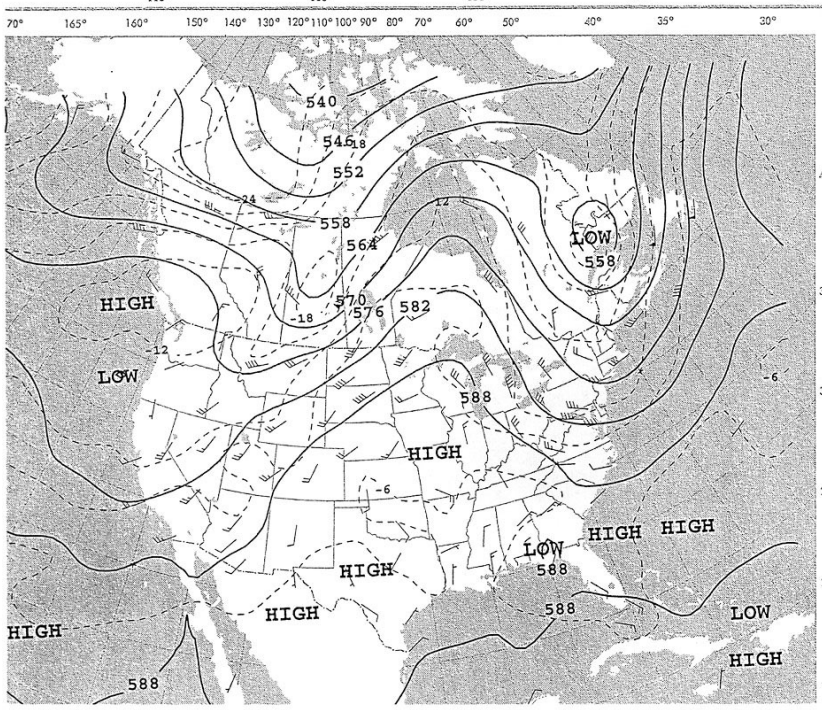


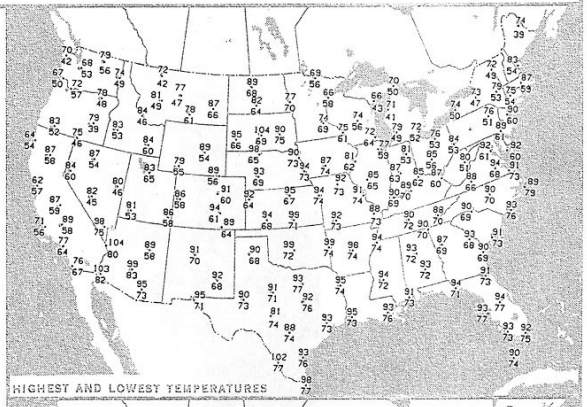

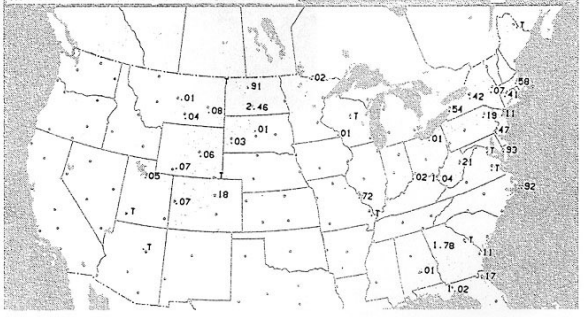

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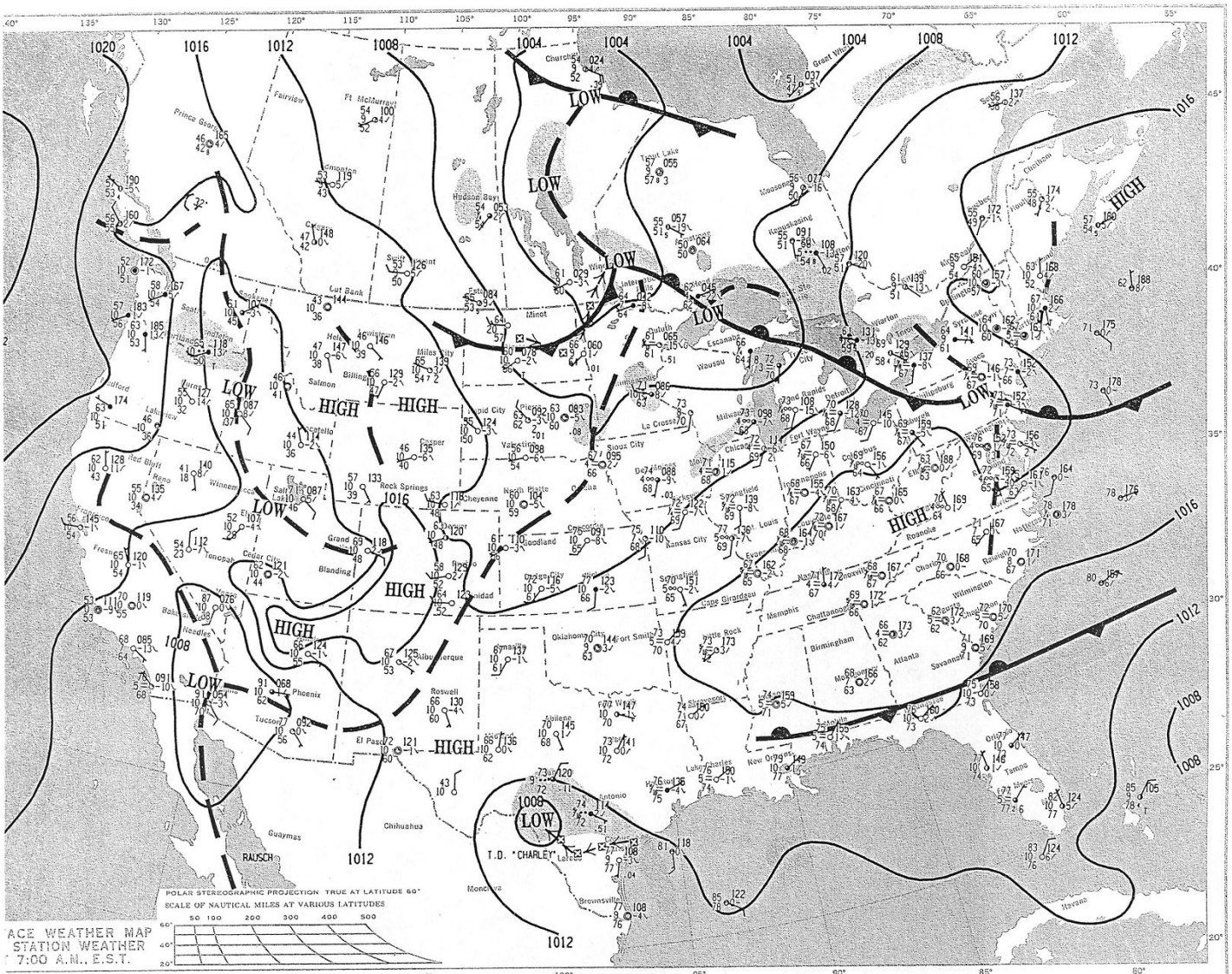


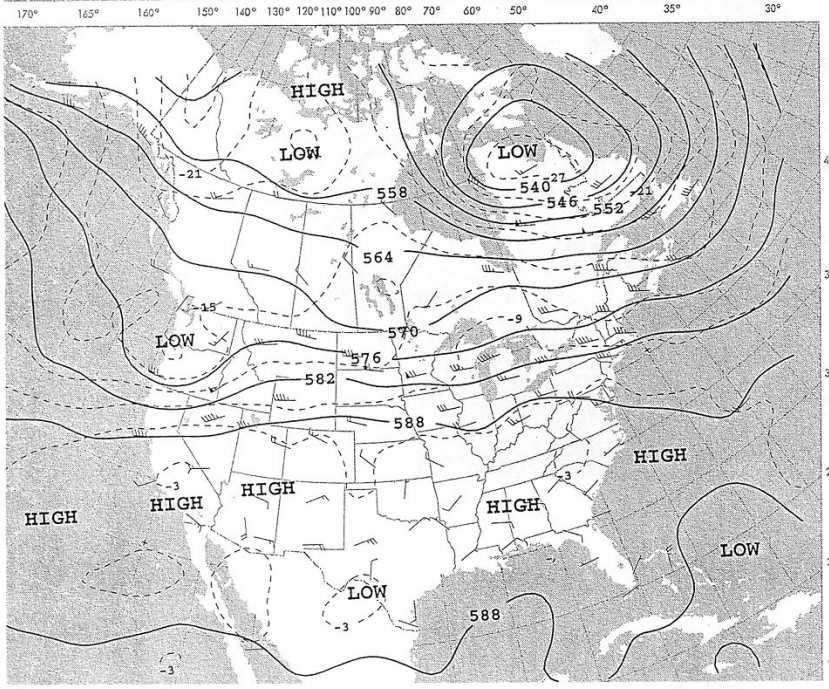


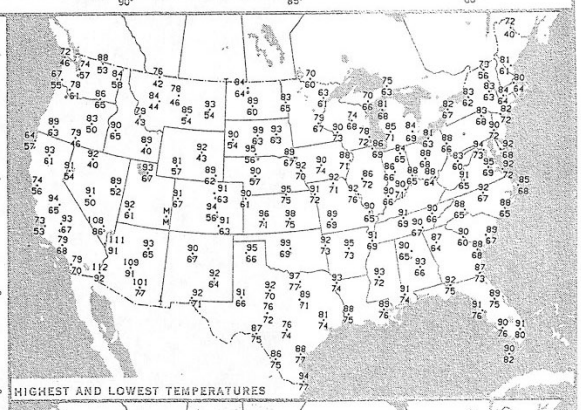

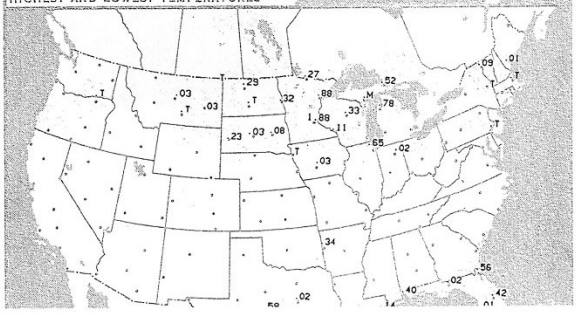

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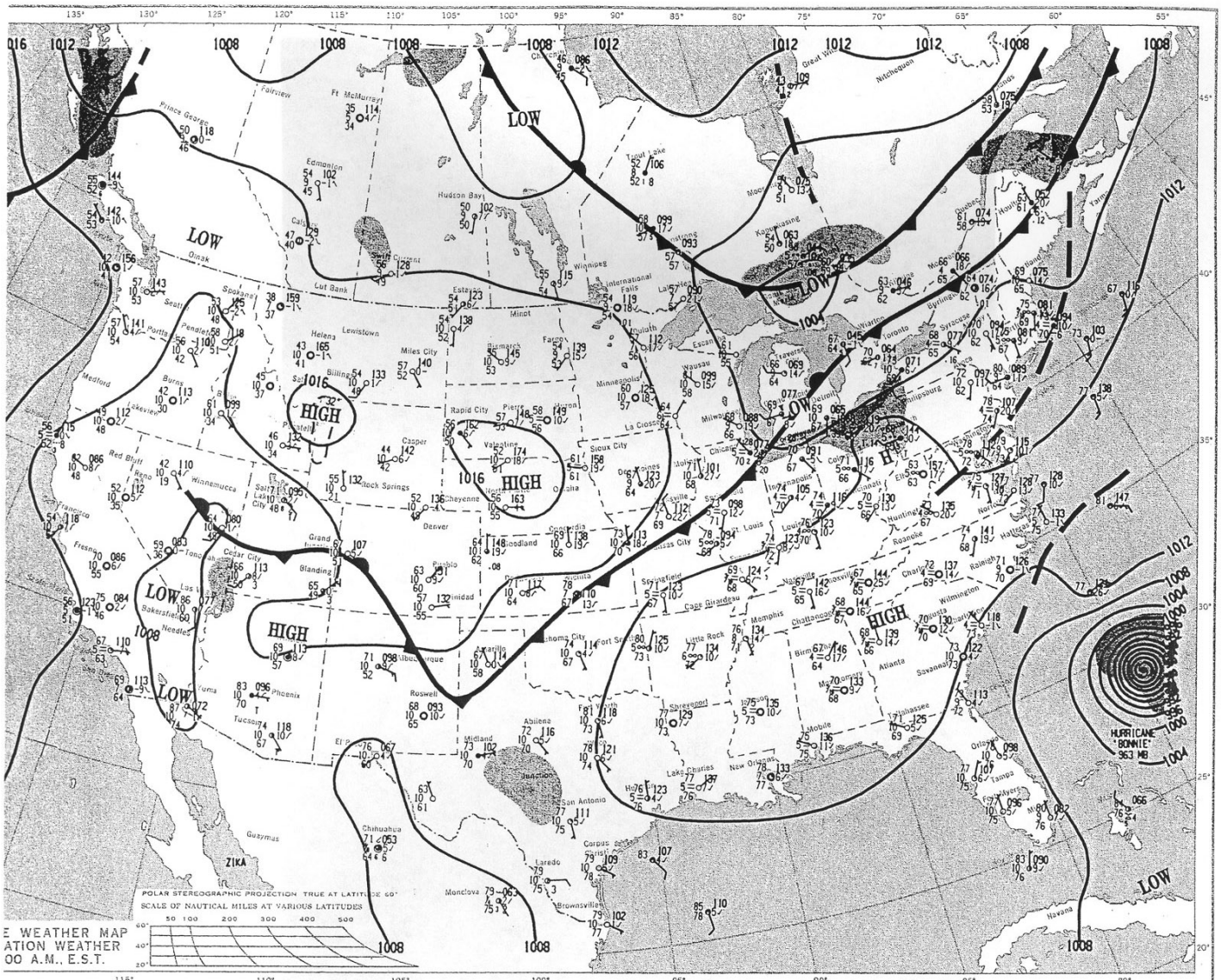


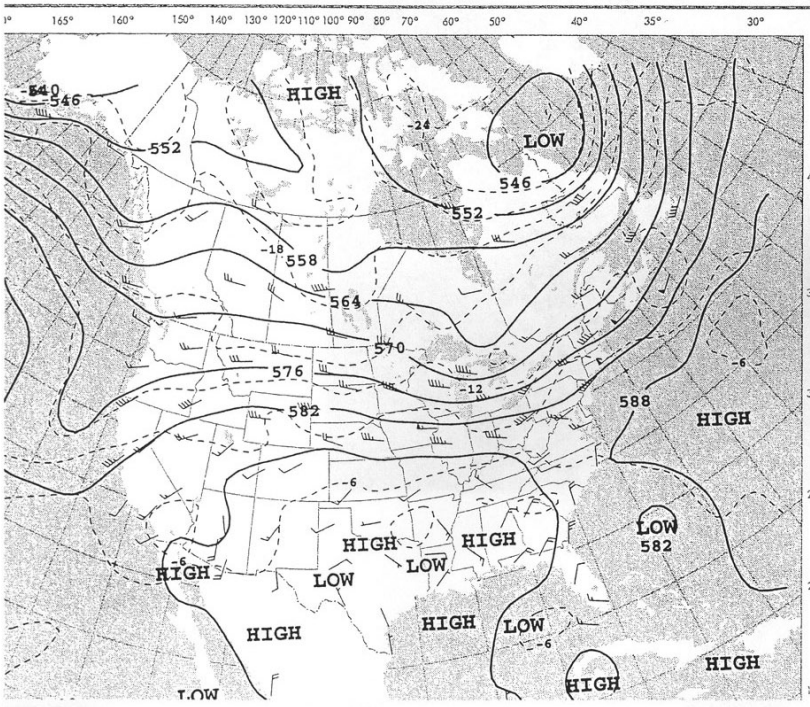


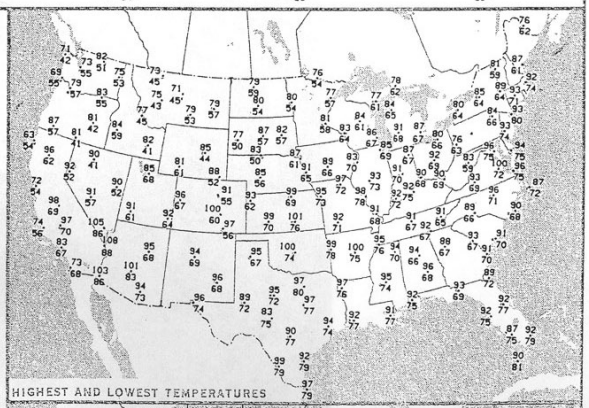


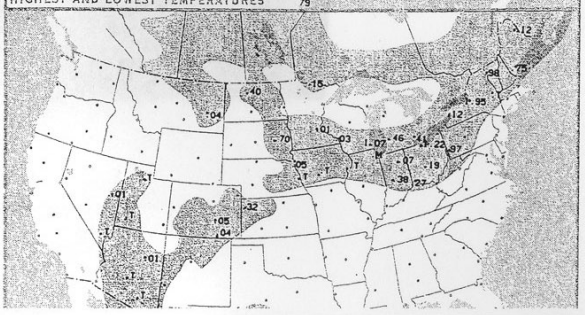

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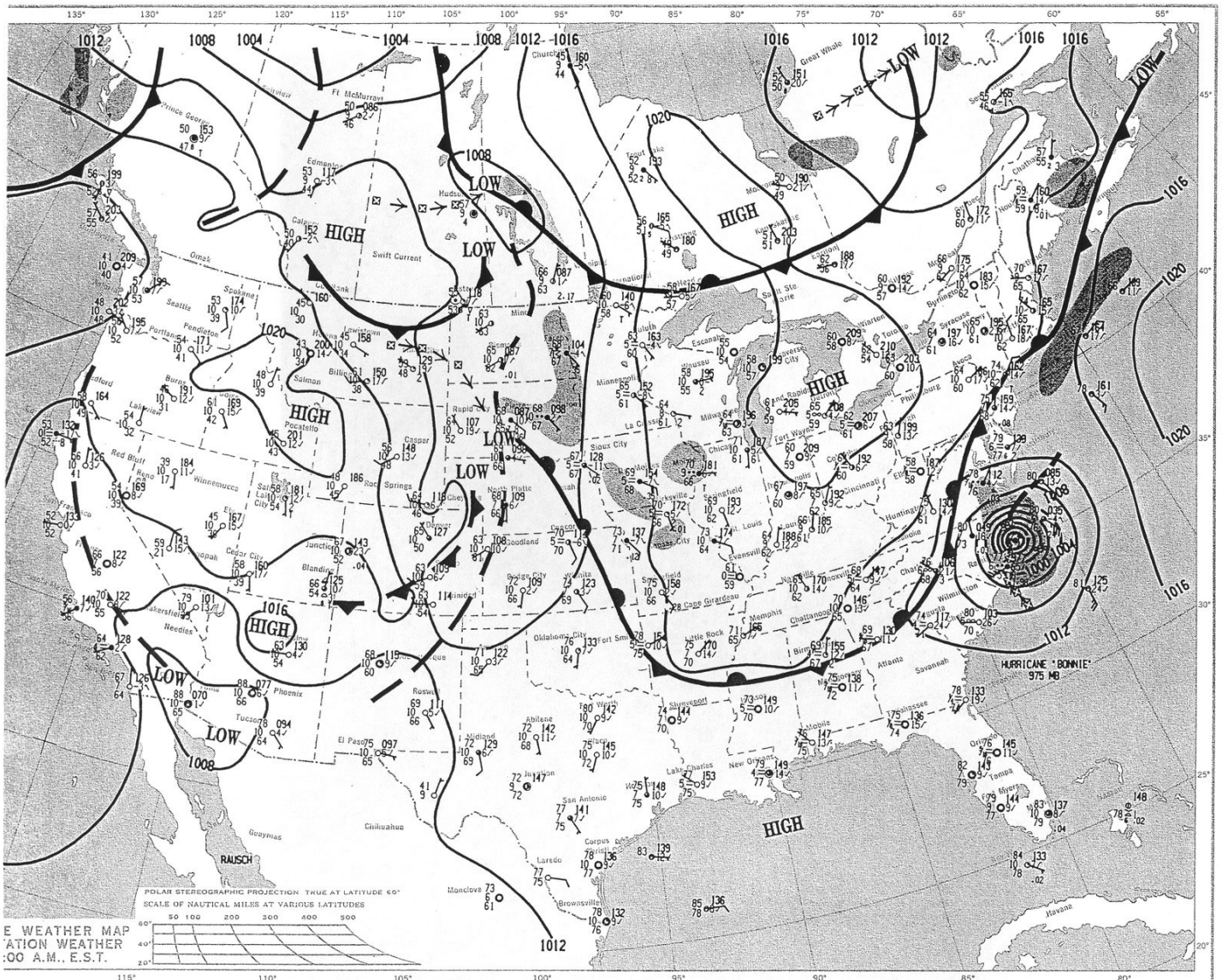
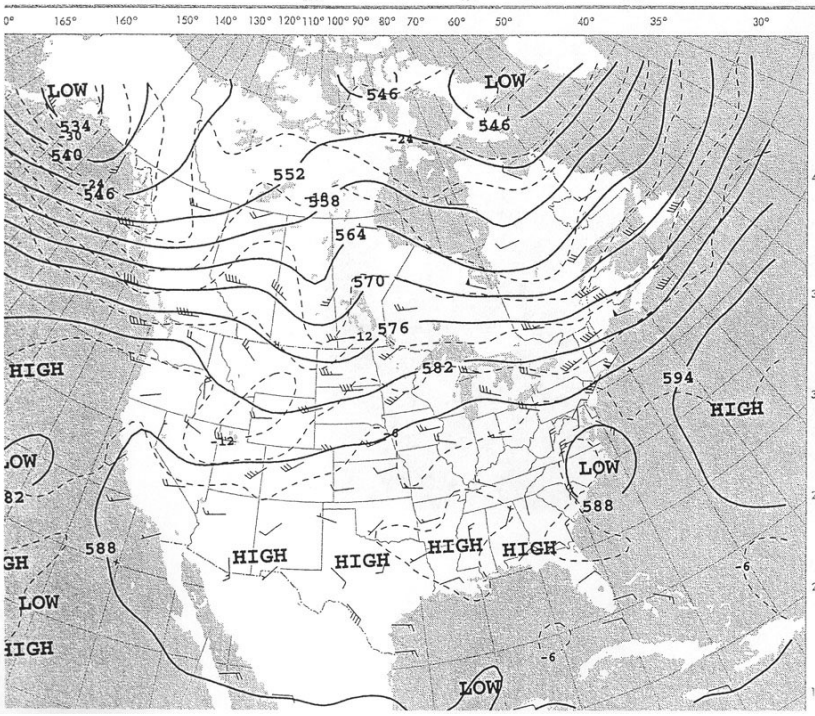
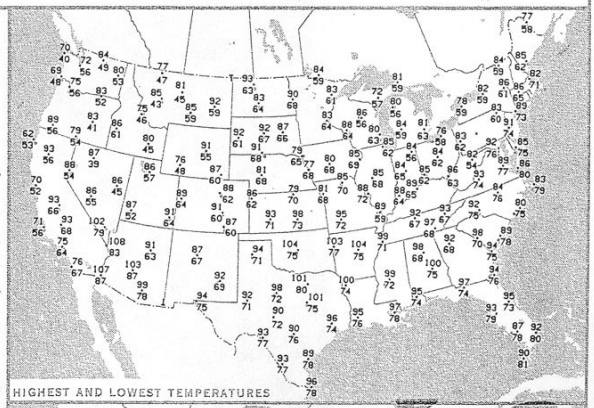
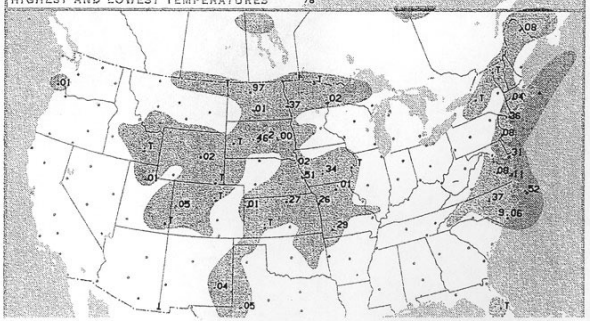
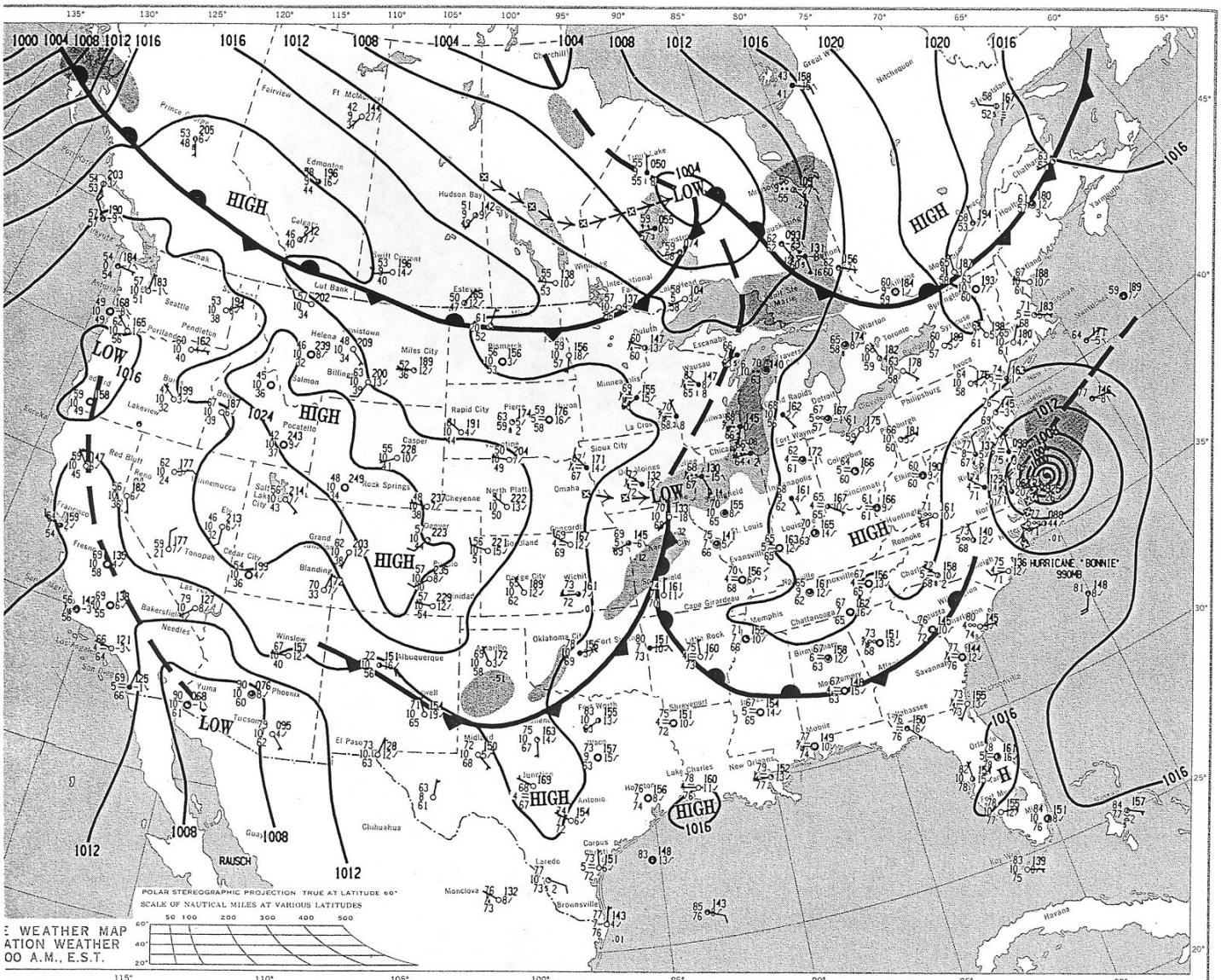


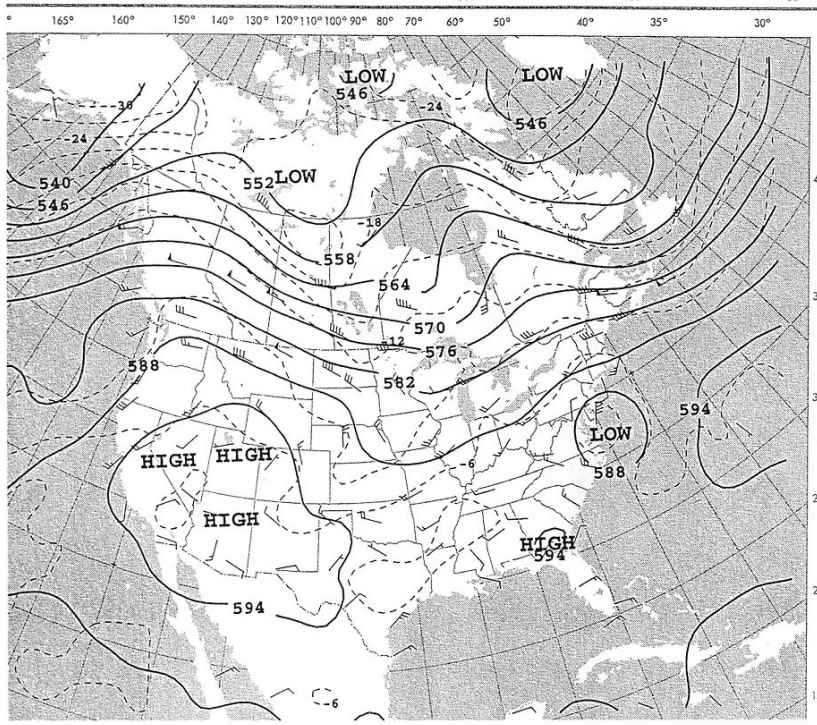



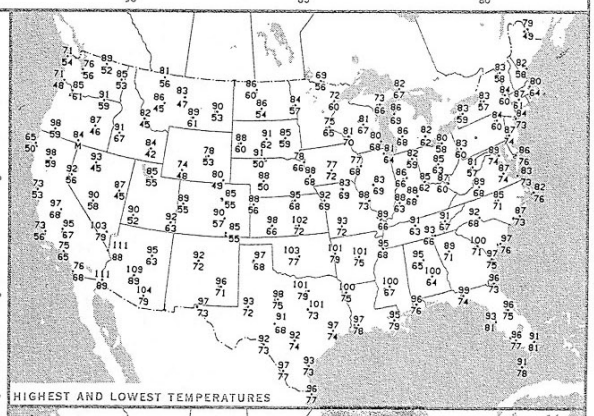


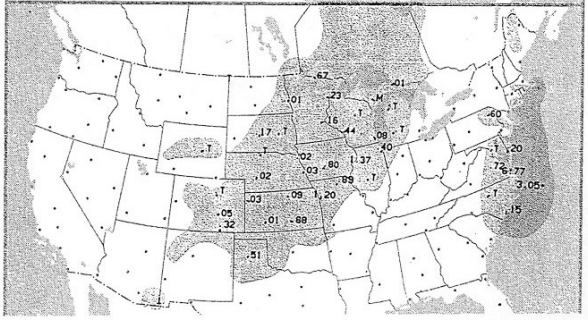


AUGUST 28, 1998

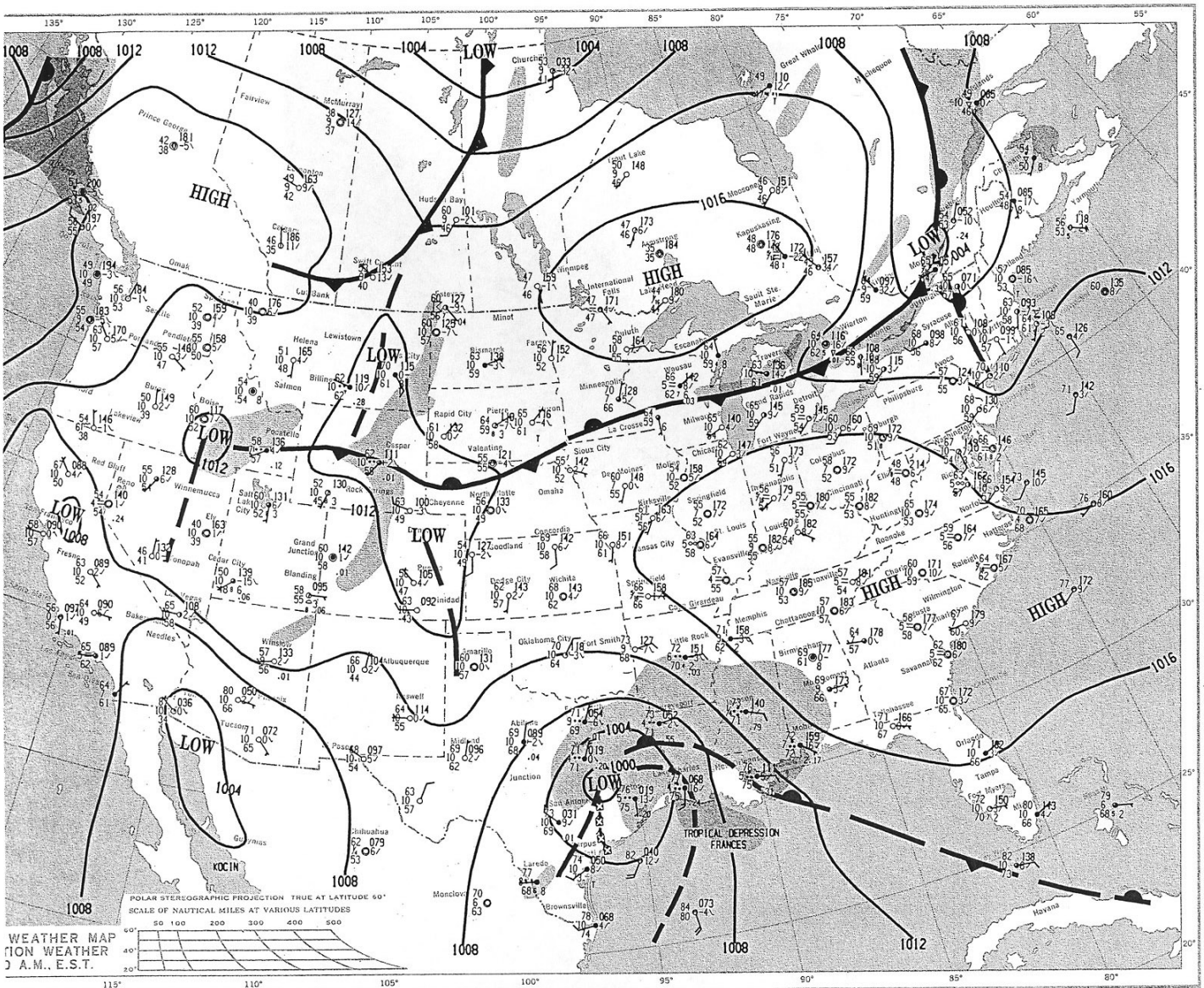


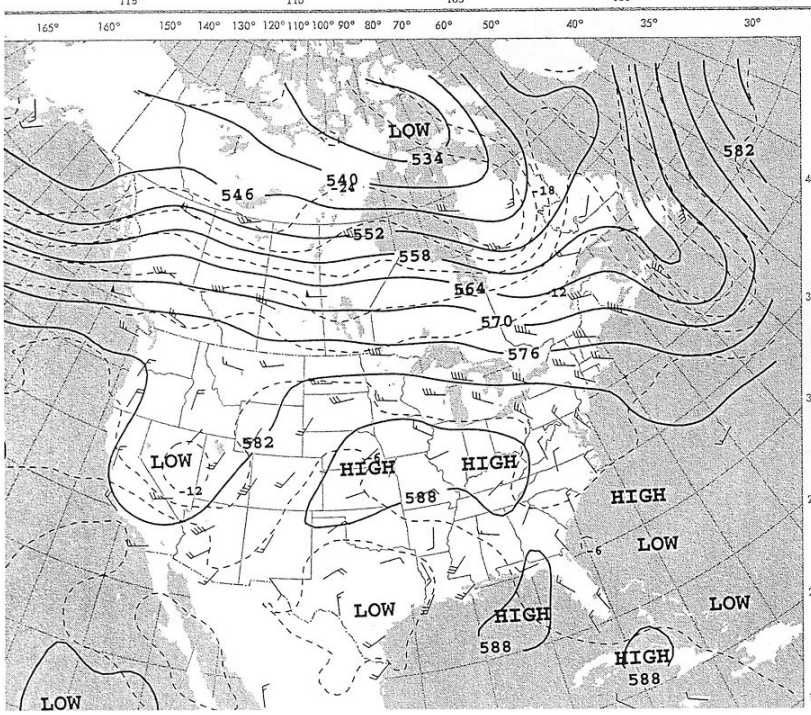



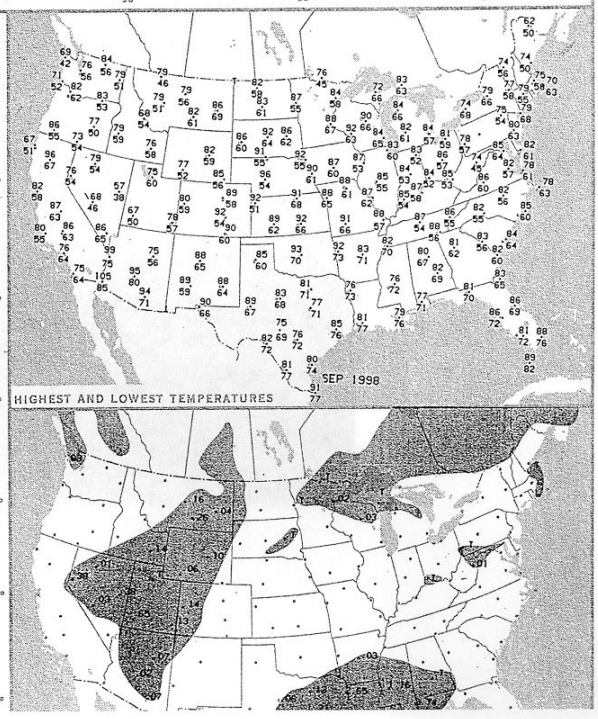



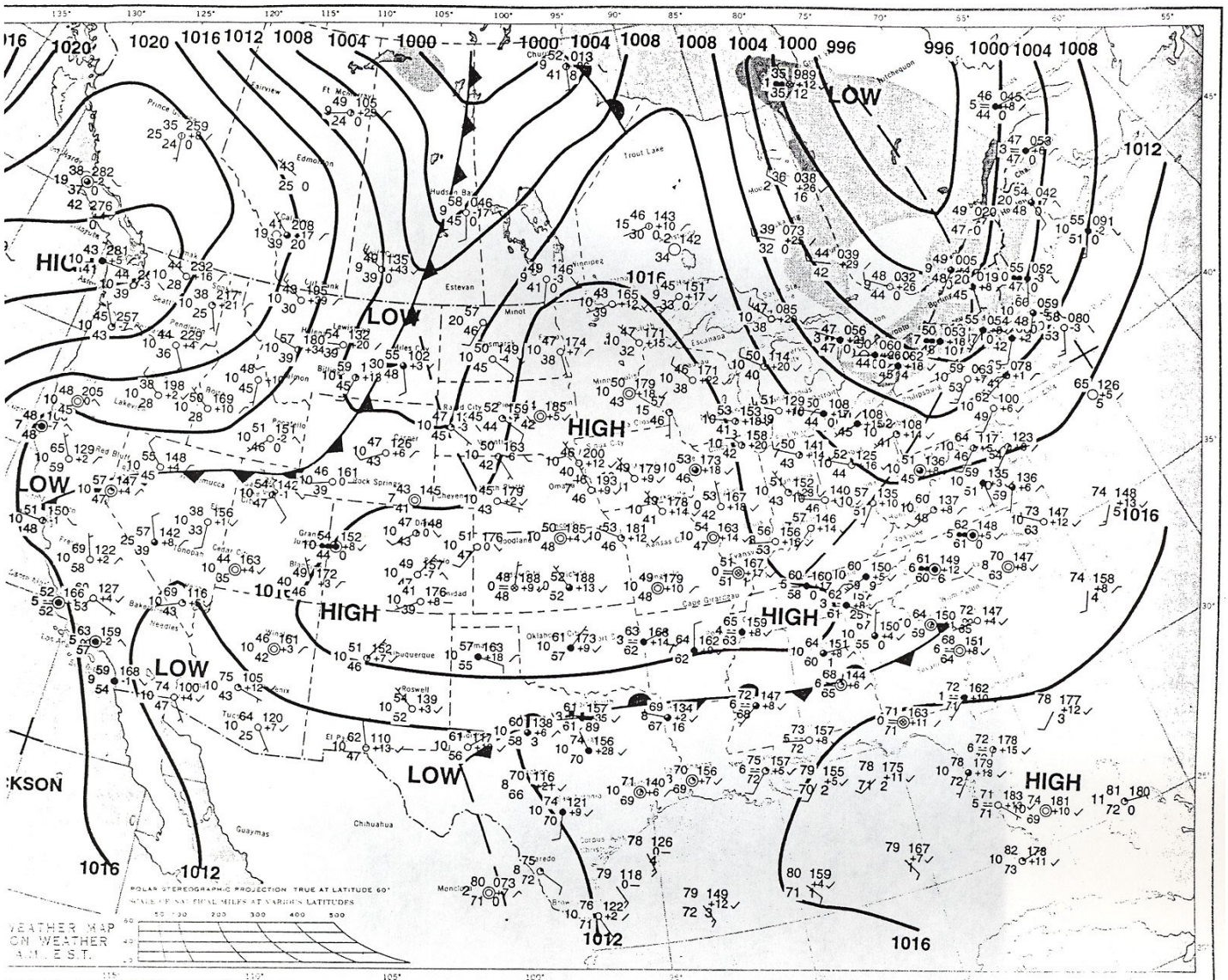
SEPTEMBER 12, 1998



MAY 26, 1999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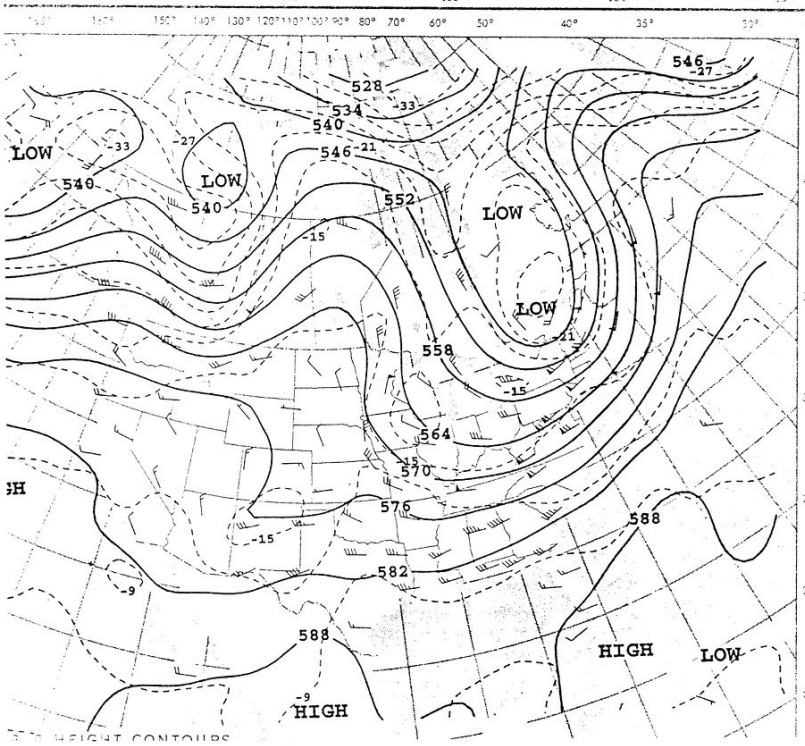
POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE 60°
SCALE IN NAUTICAL MILES AT VARIOUS LATITUDES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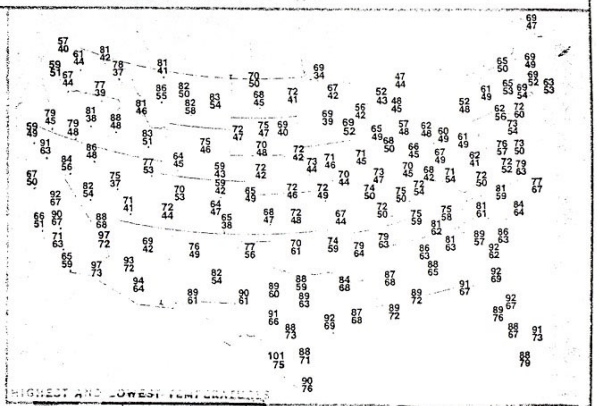
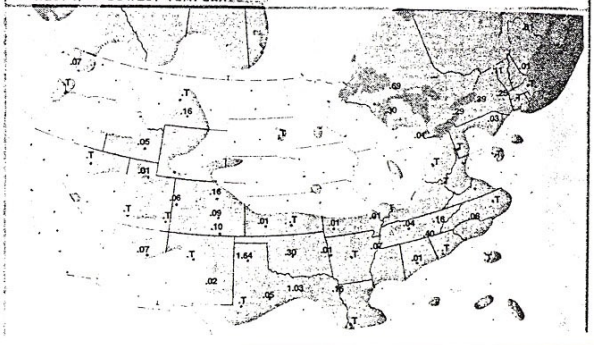
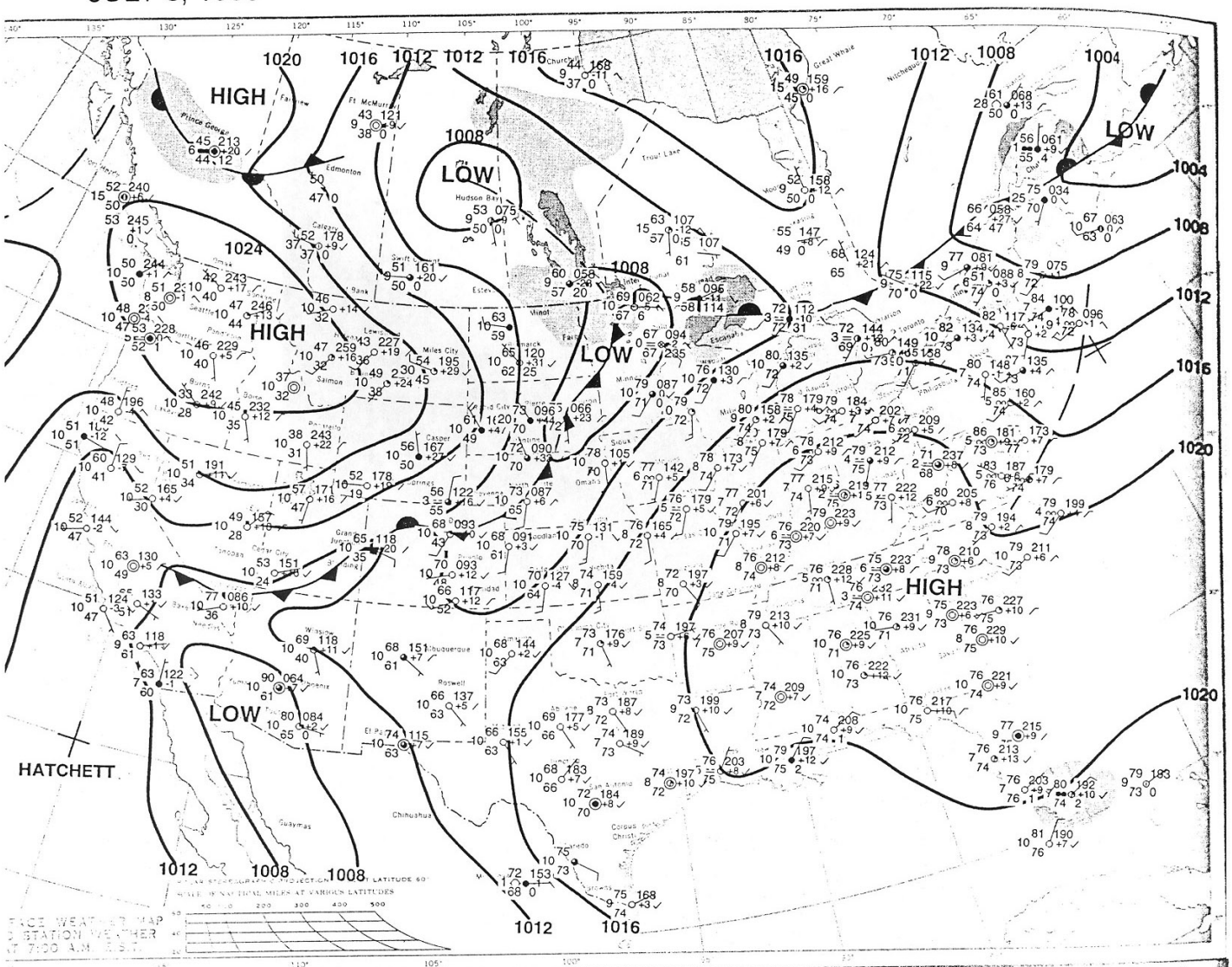

HIGHEST AND LOWEST TEMPERATURES



JULY 5, 1999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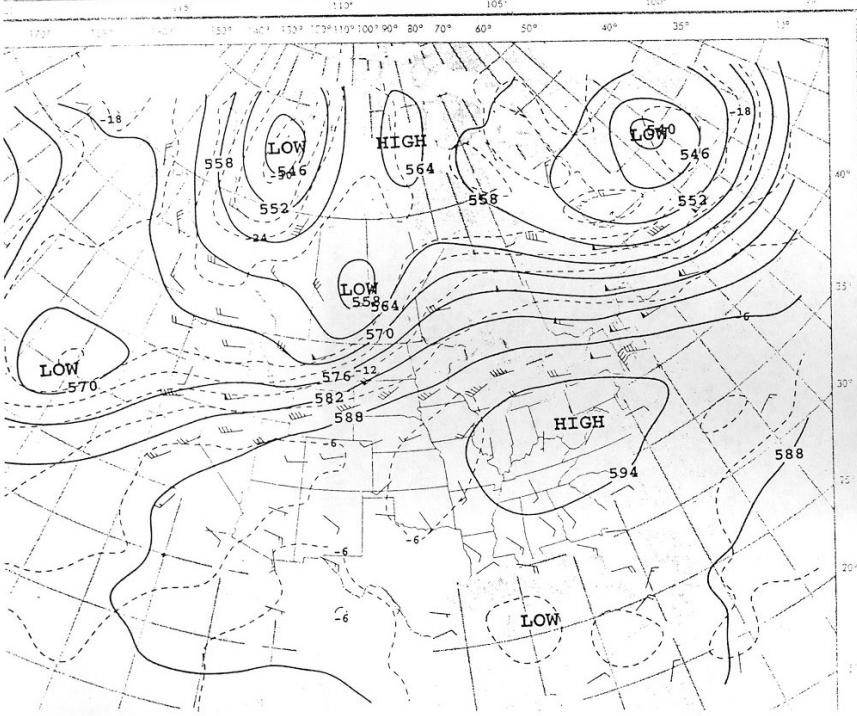
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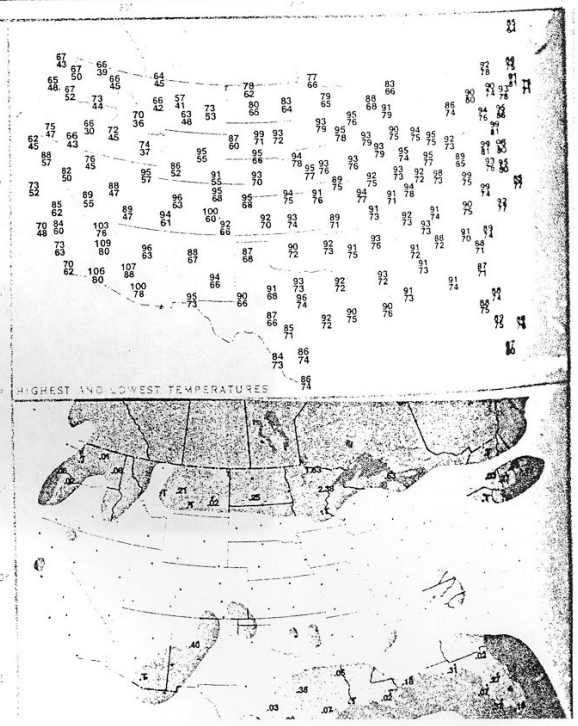
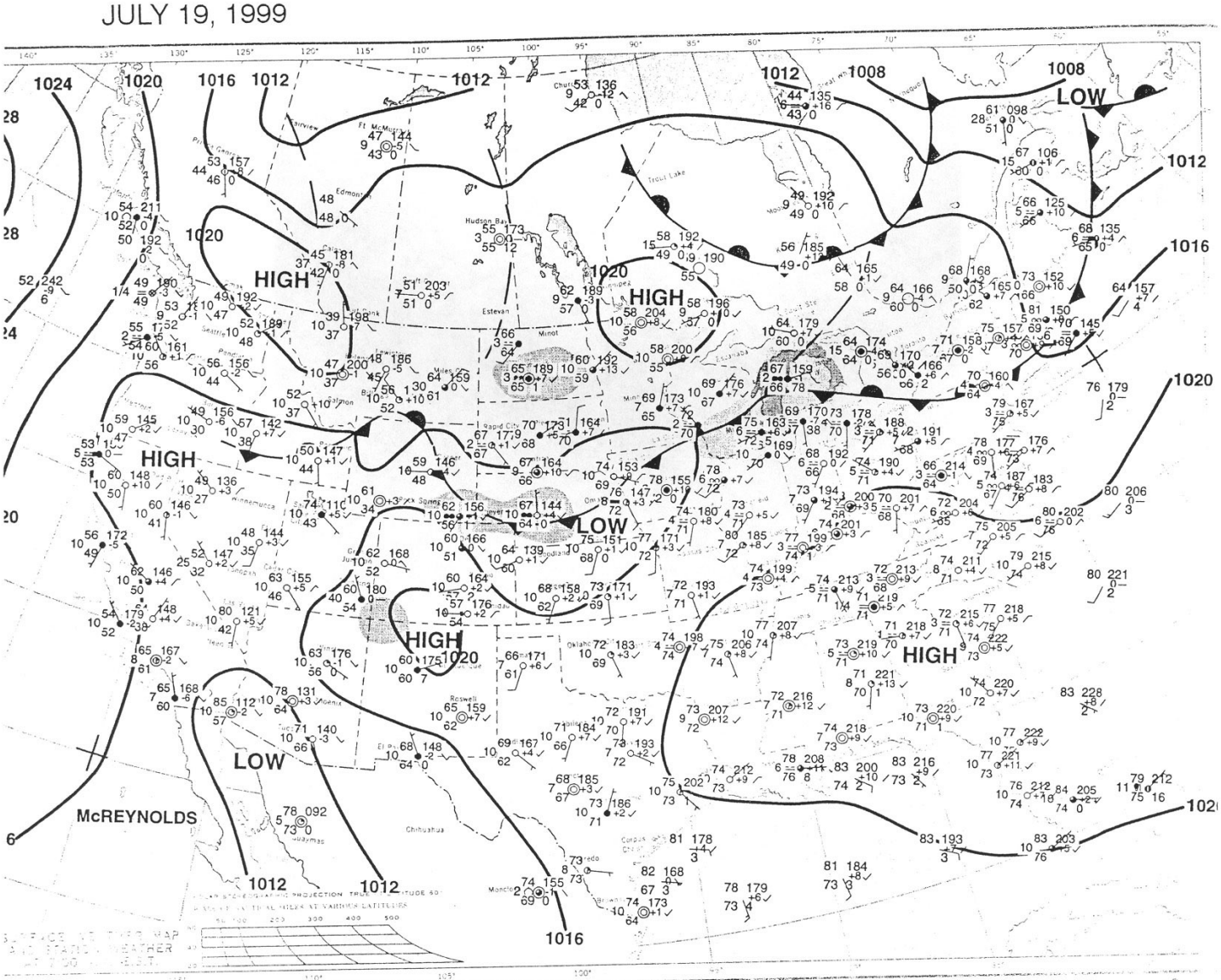

HIGHEST AND LOWEST TEMPERATURES

JULY 19, 1999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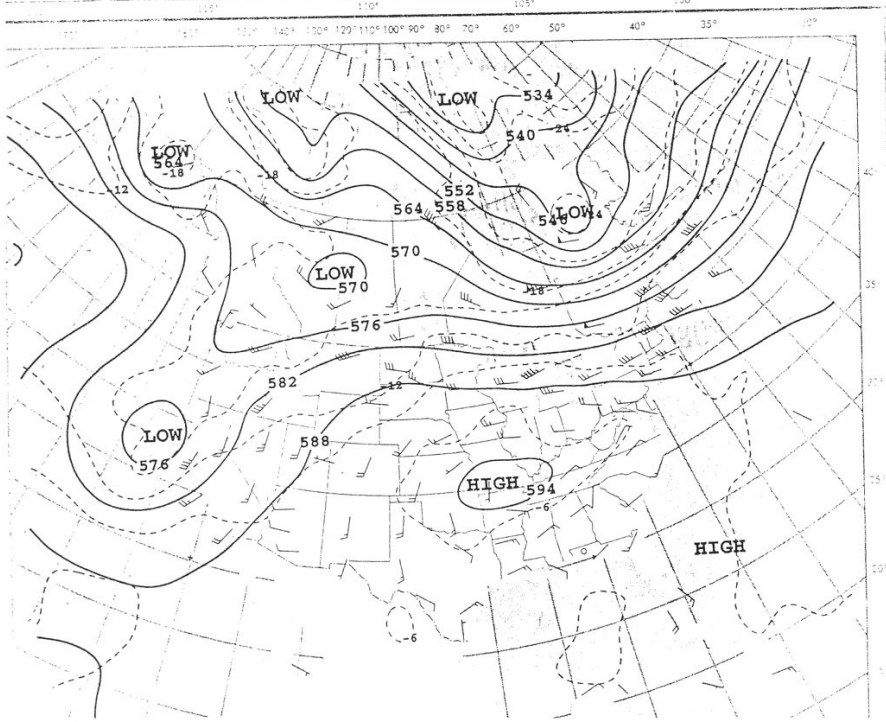
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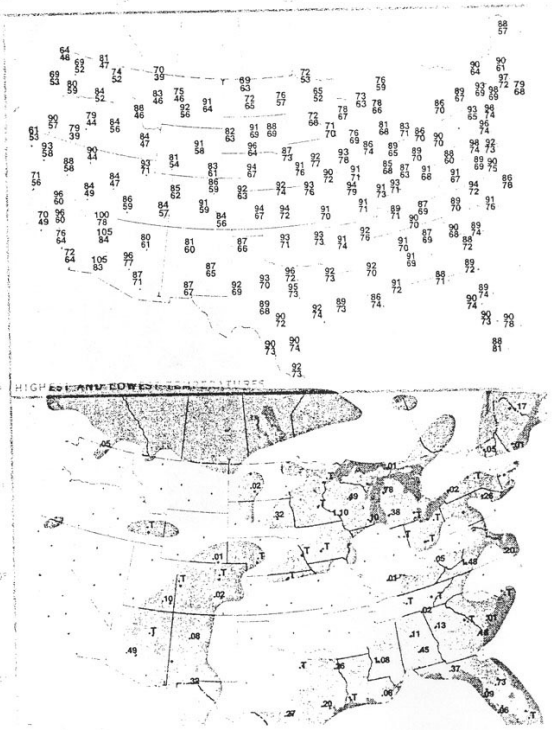

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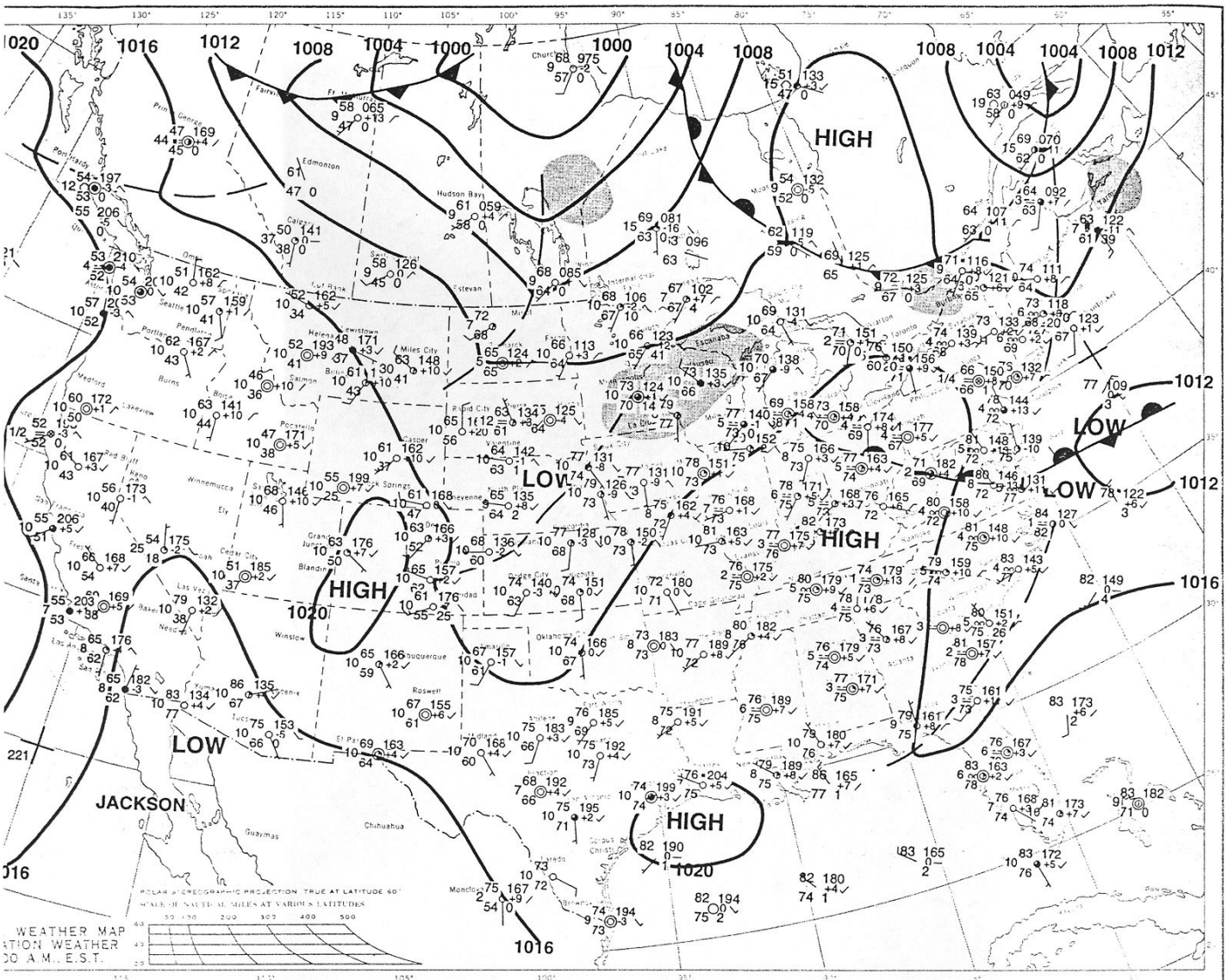
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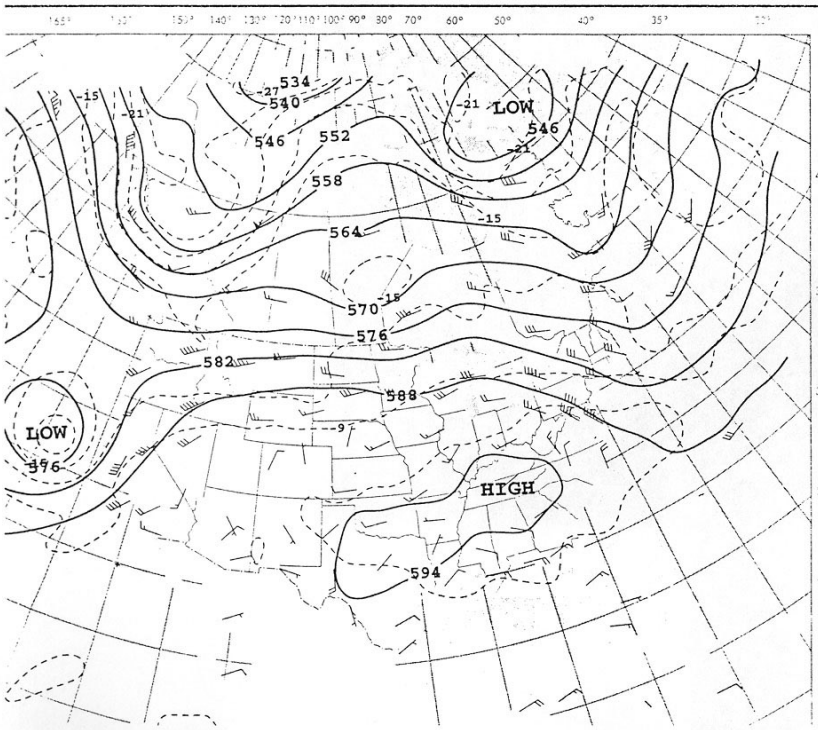
POLAR STEREOGRAPHIC PROJECTION TRUE AT LATITUDE 60°
SCALE OF NAUTICAL MILES AT VARIOUS LATITUDES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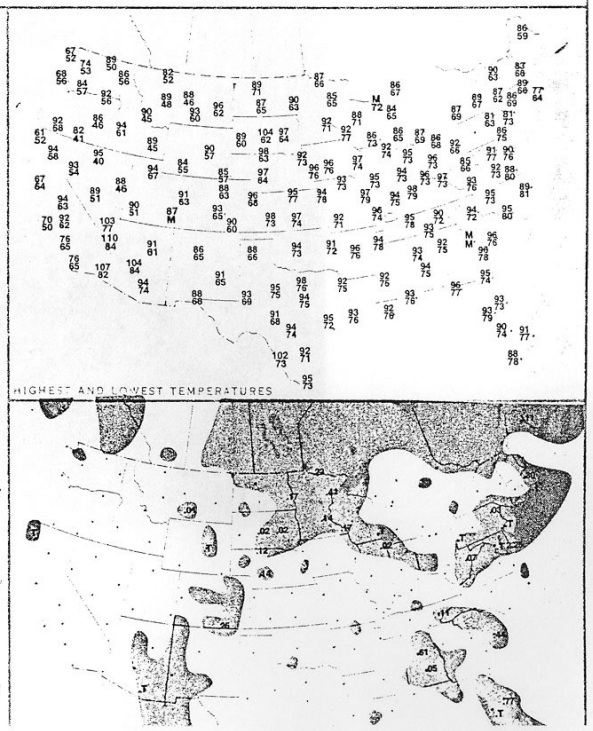
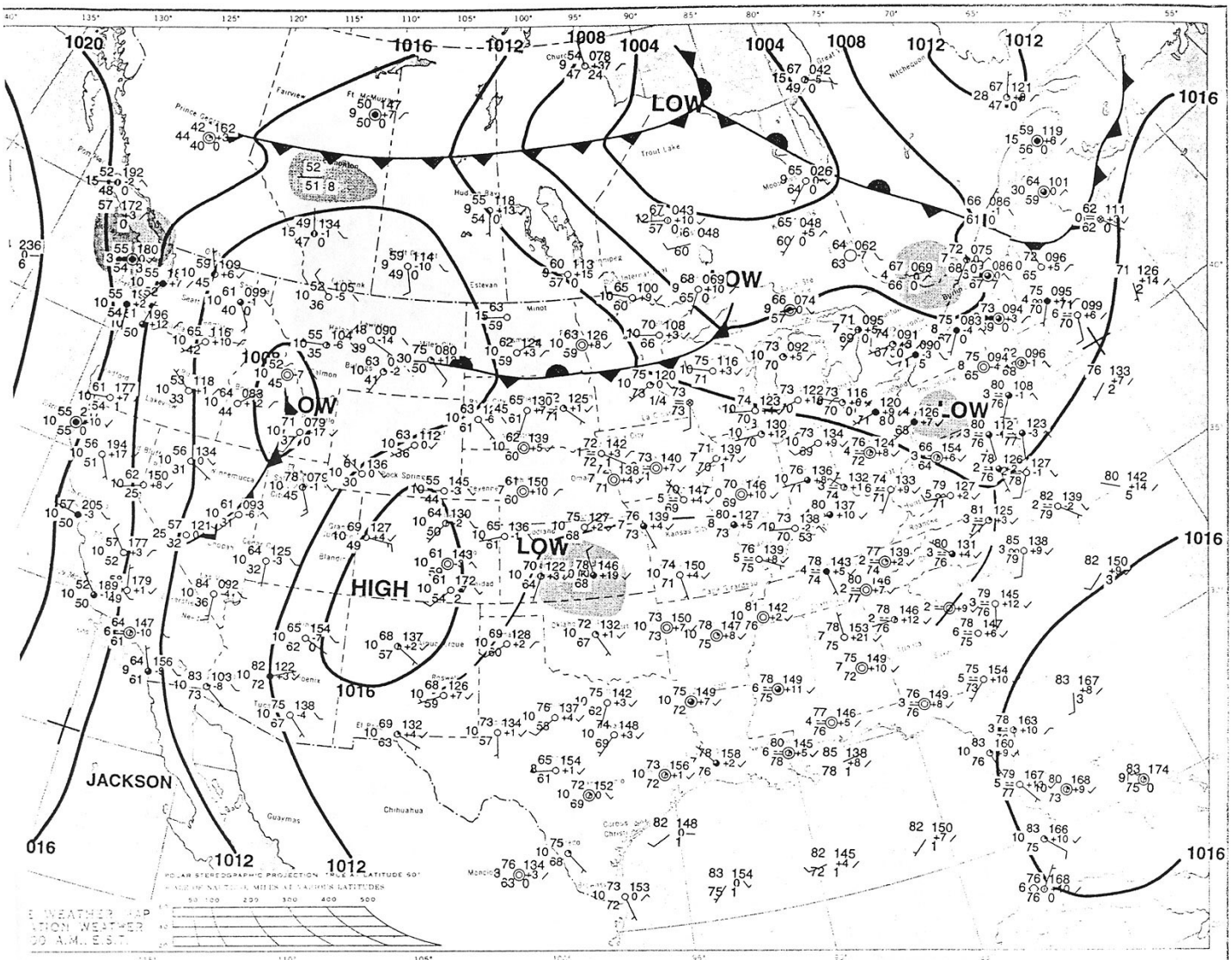

HIGHEST AND LOWEST TEMPERATURES

JULY 24, 1999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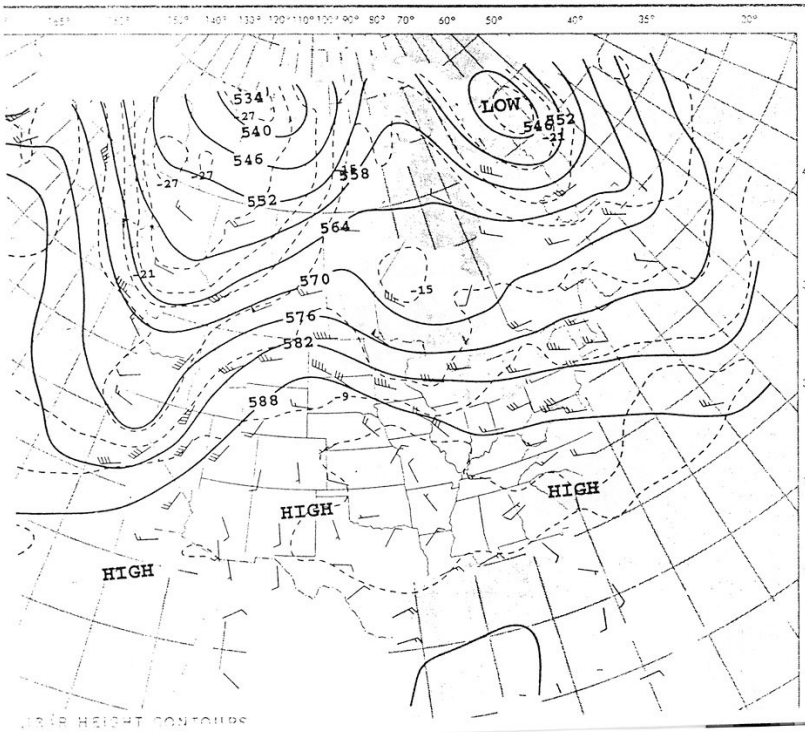
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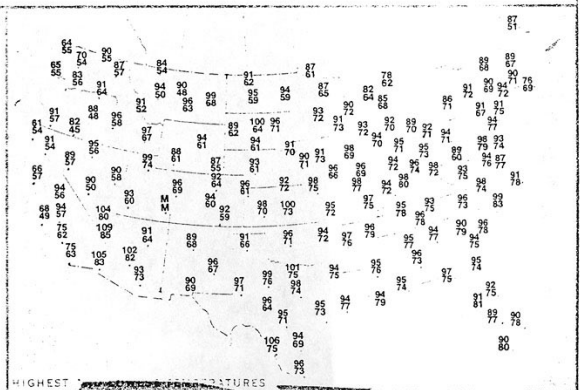
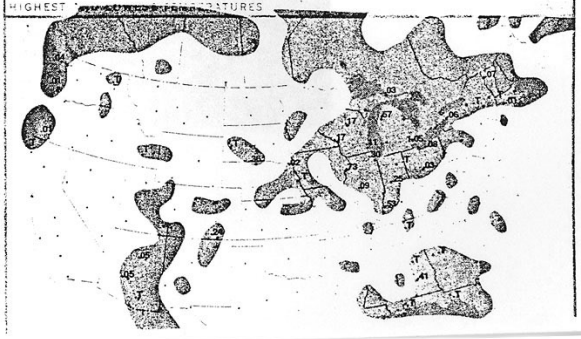
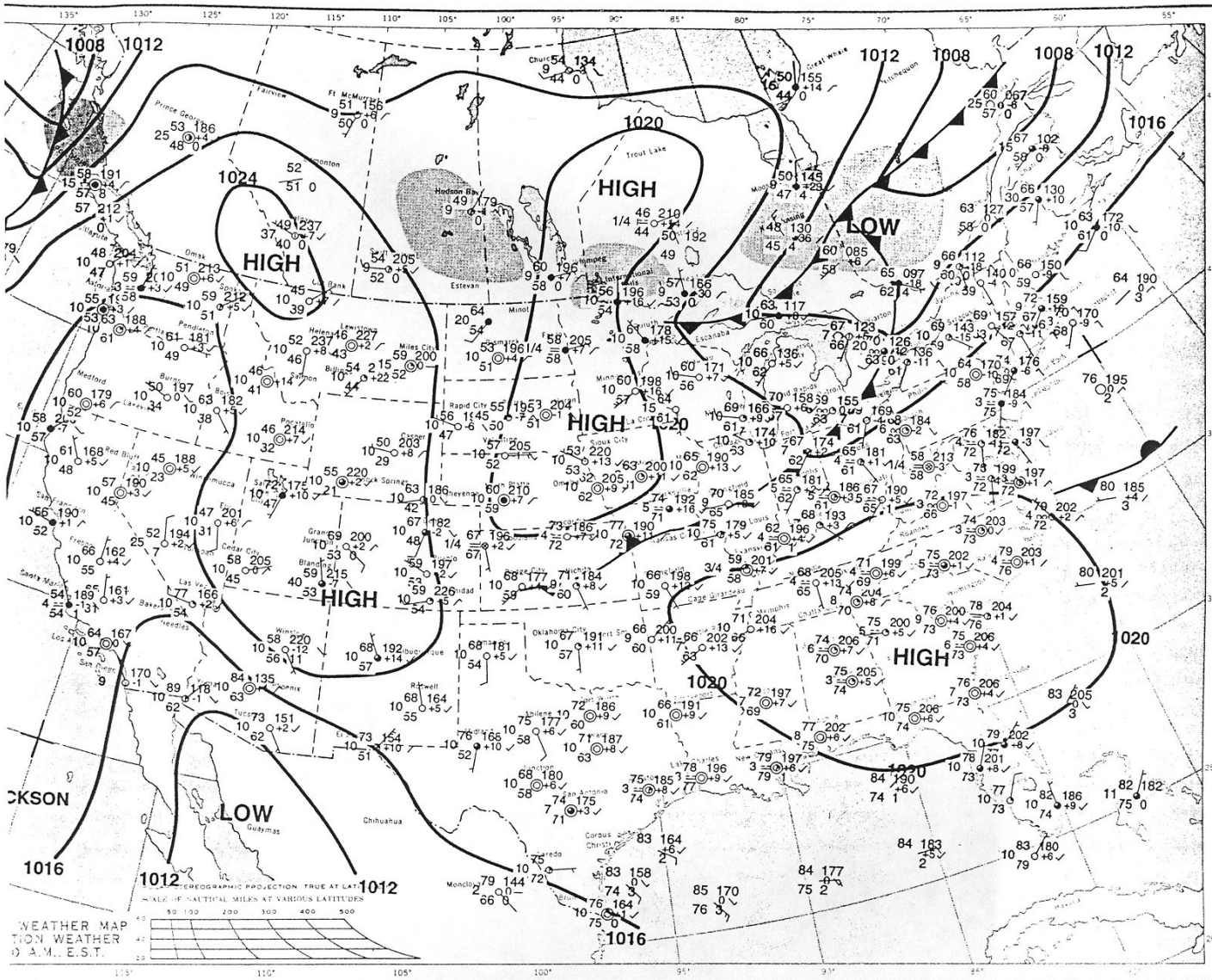
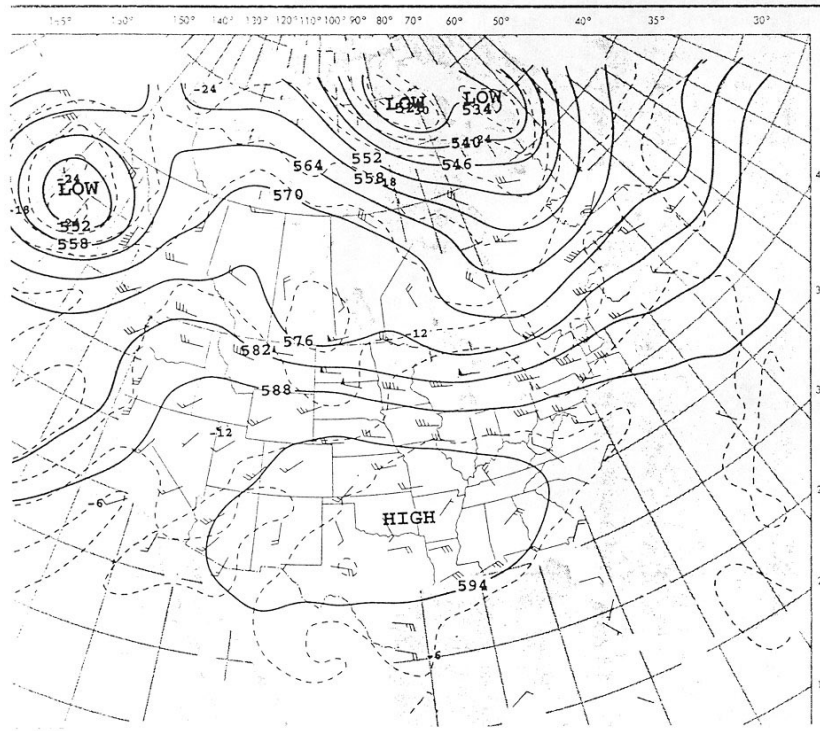
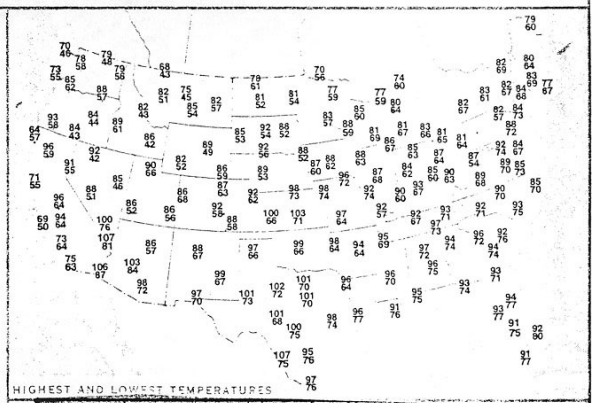


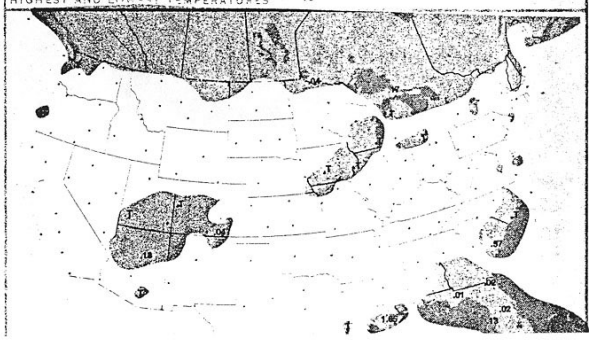


AUGUST 17, 1999



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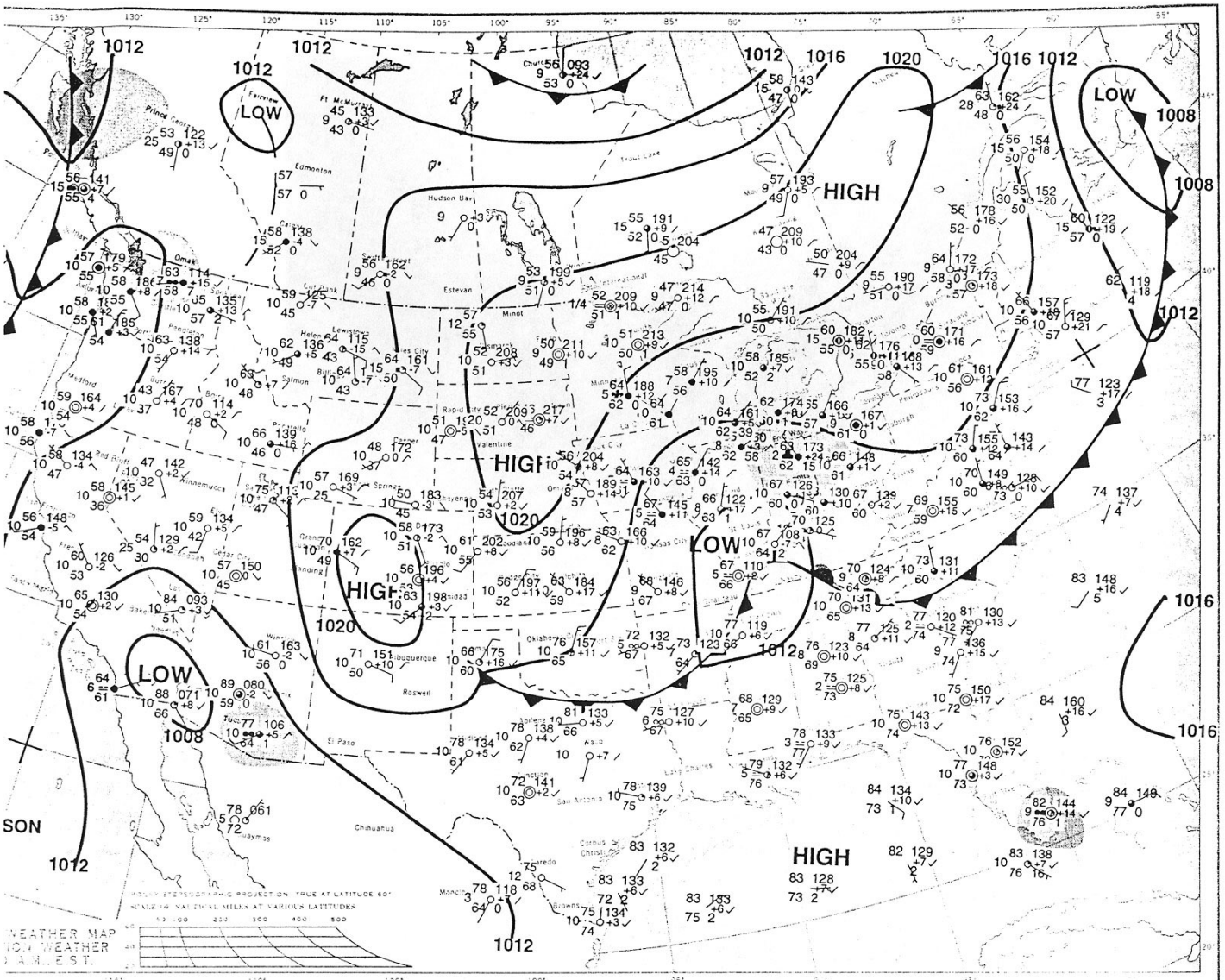
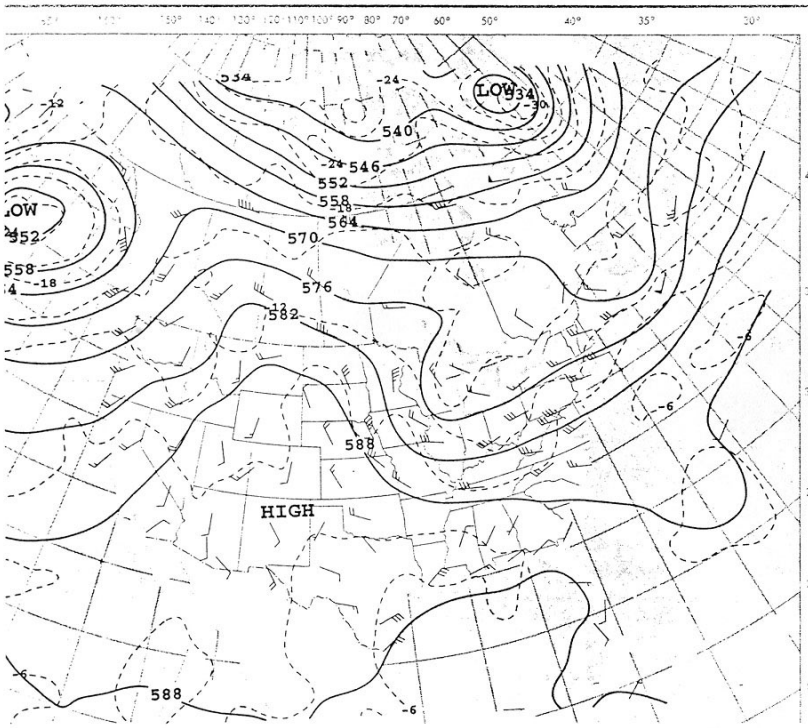
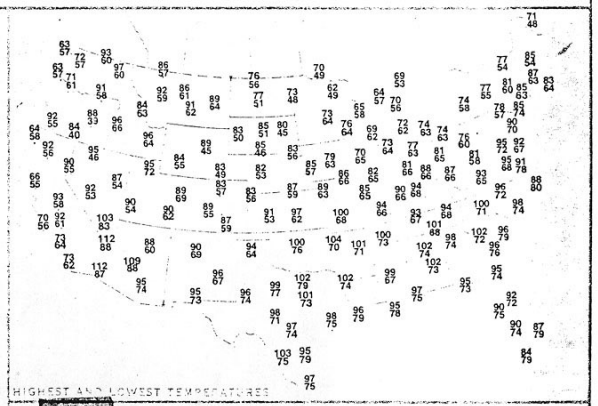
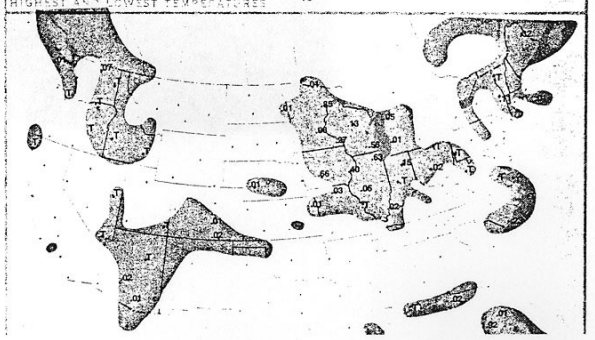
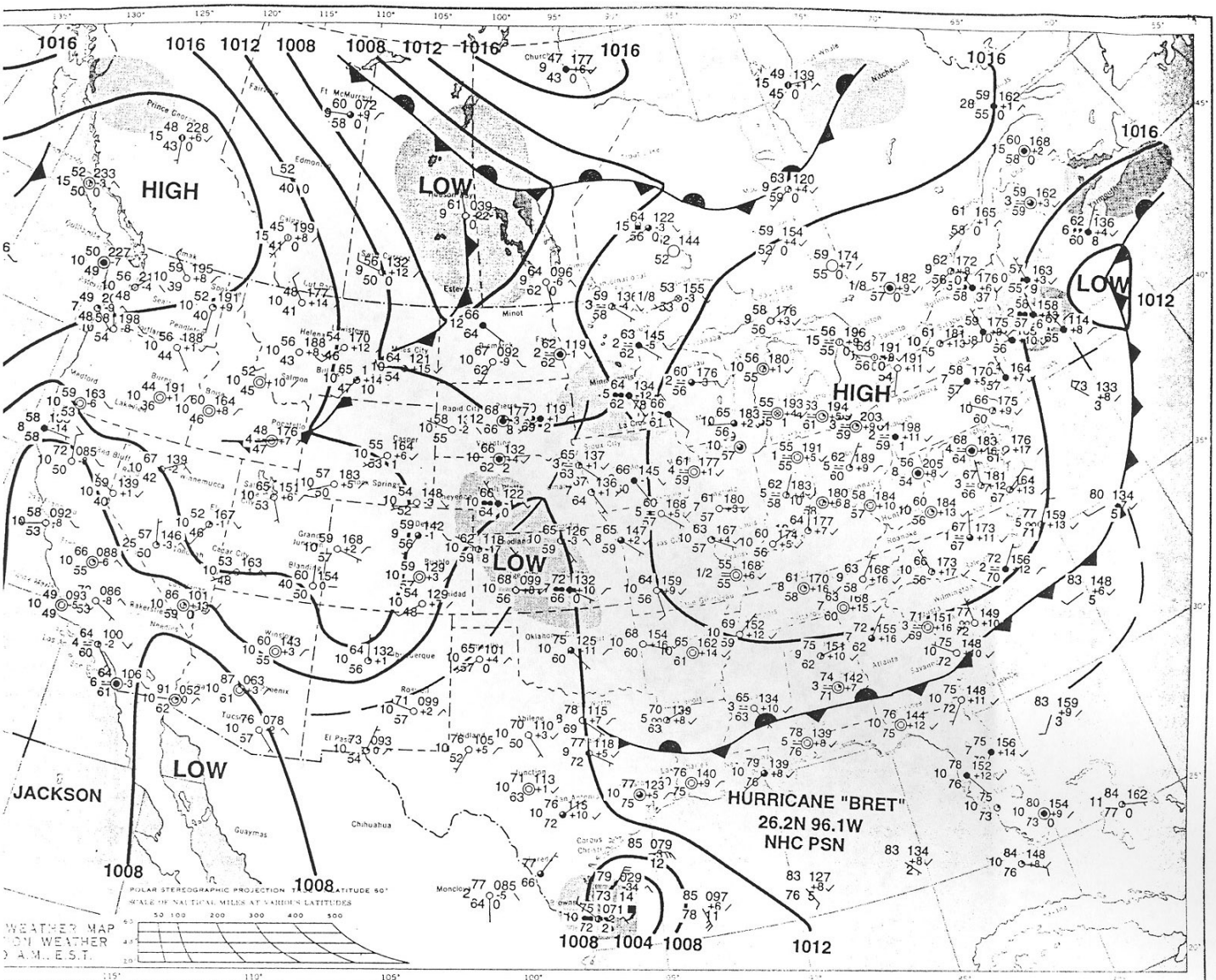


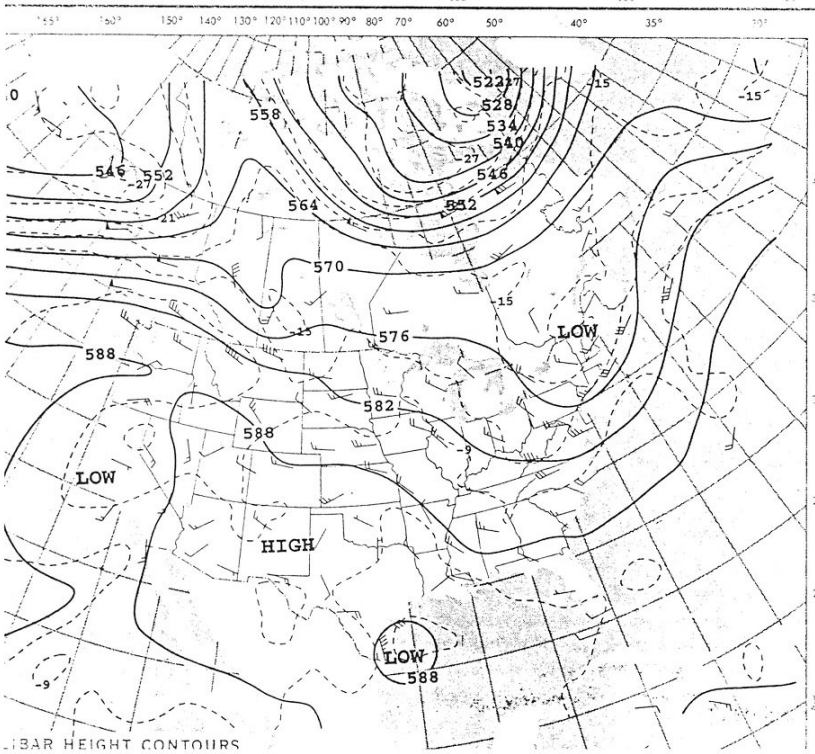



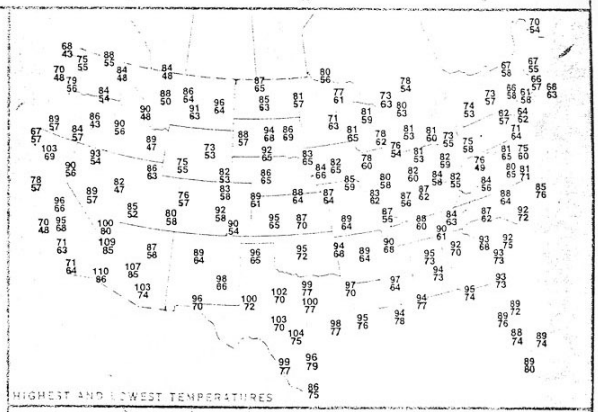



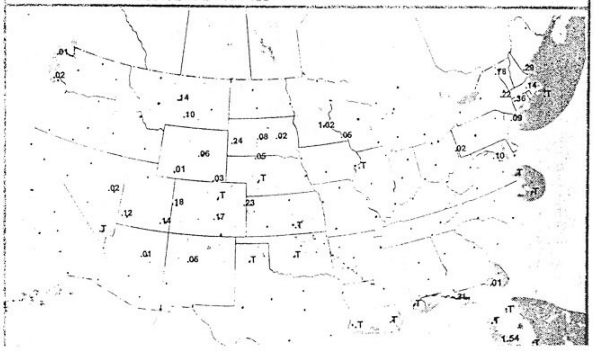



AUGUST 22, 1999



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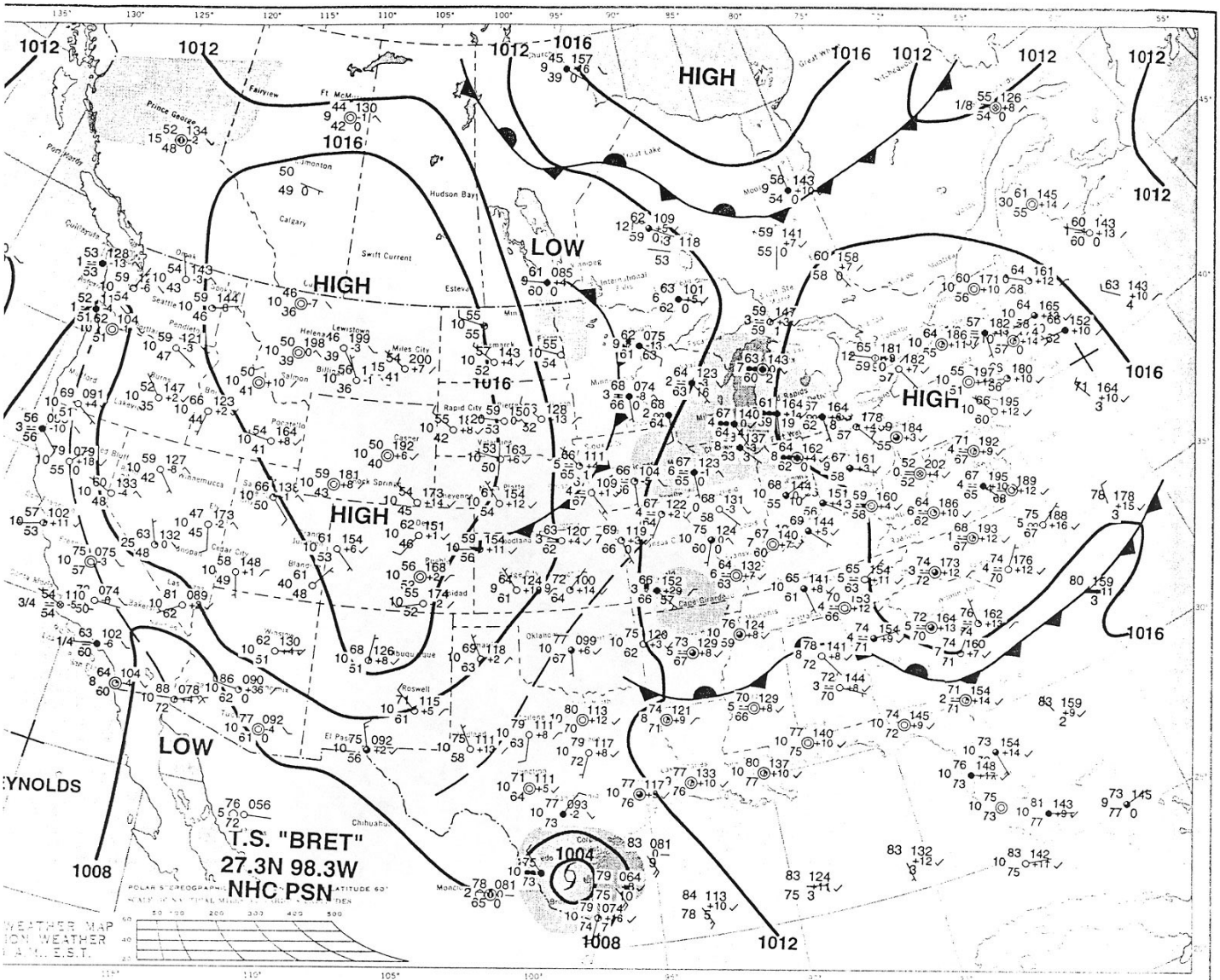


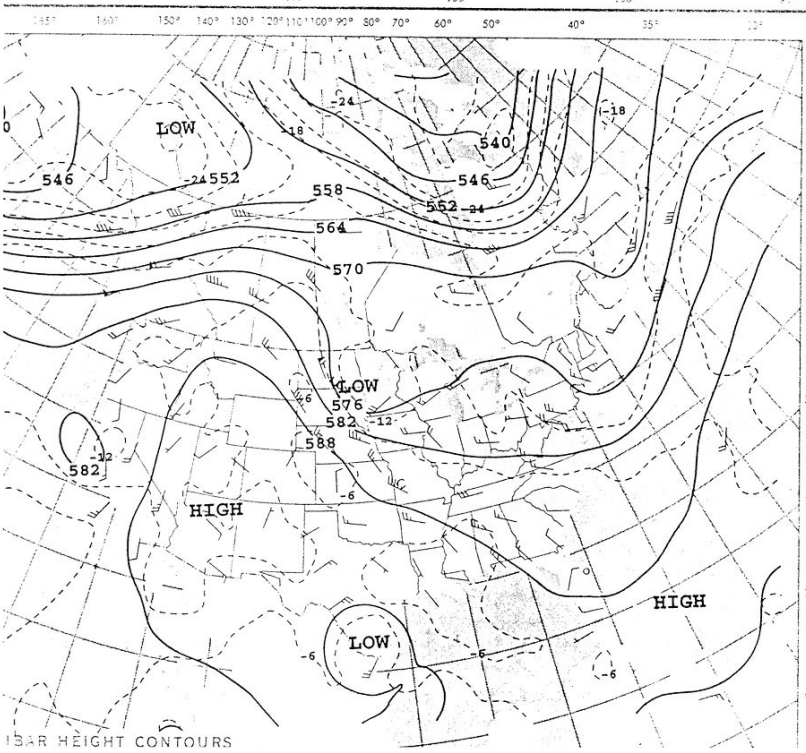


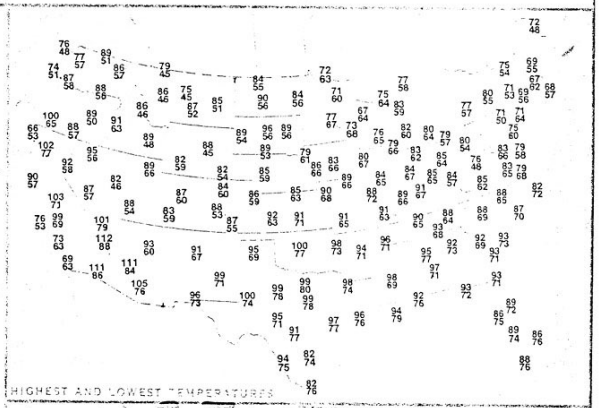


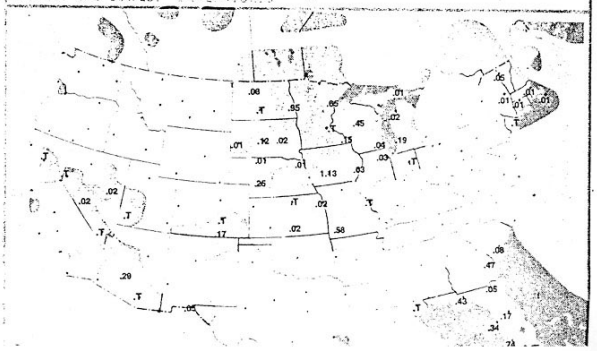

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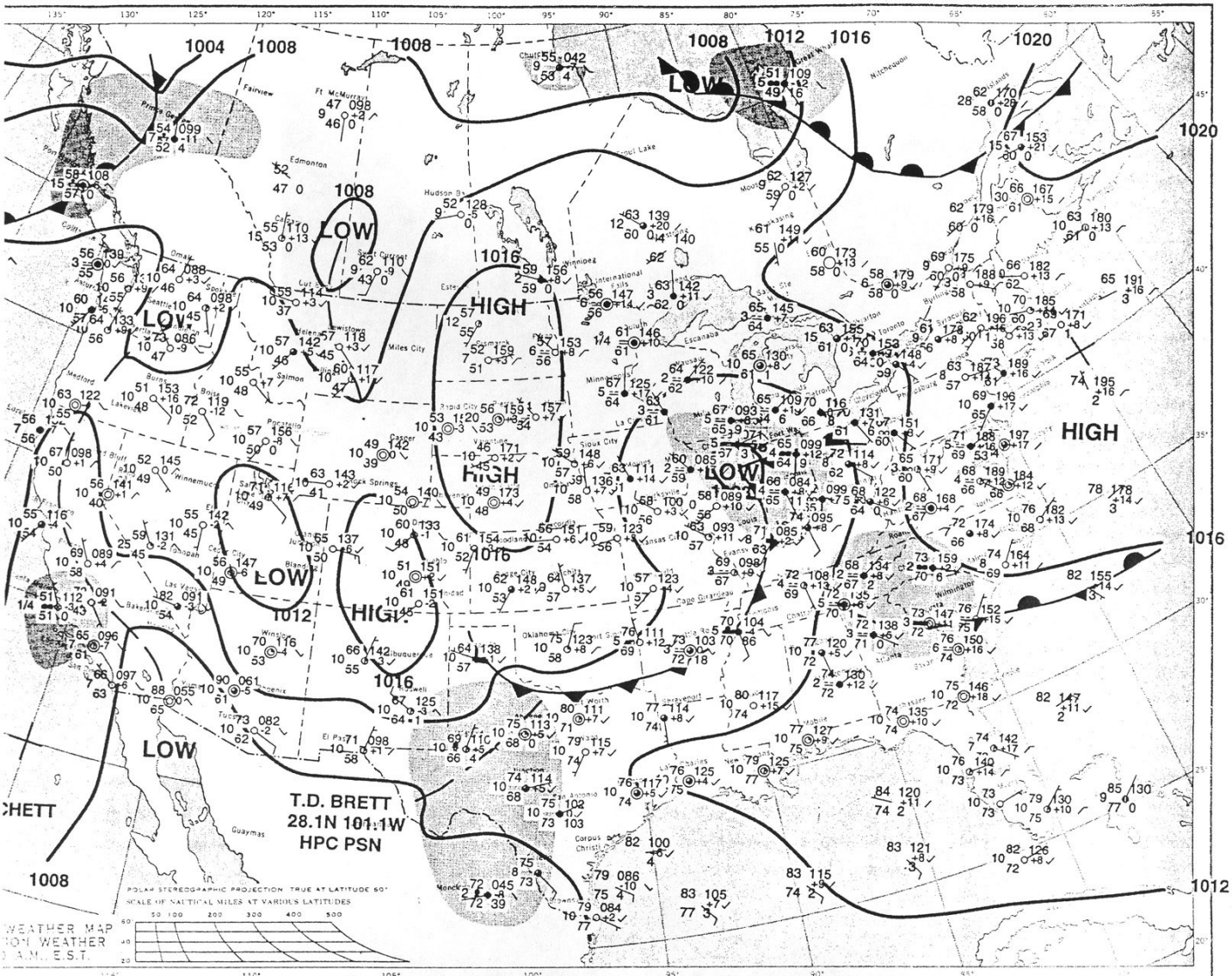
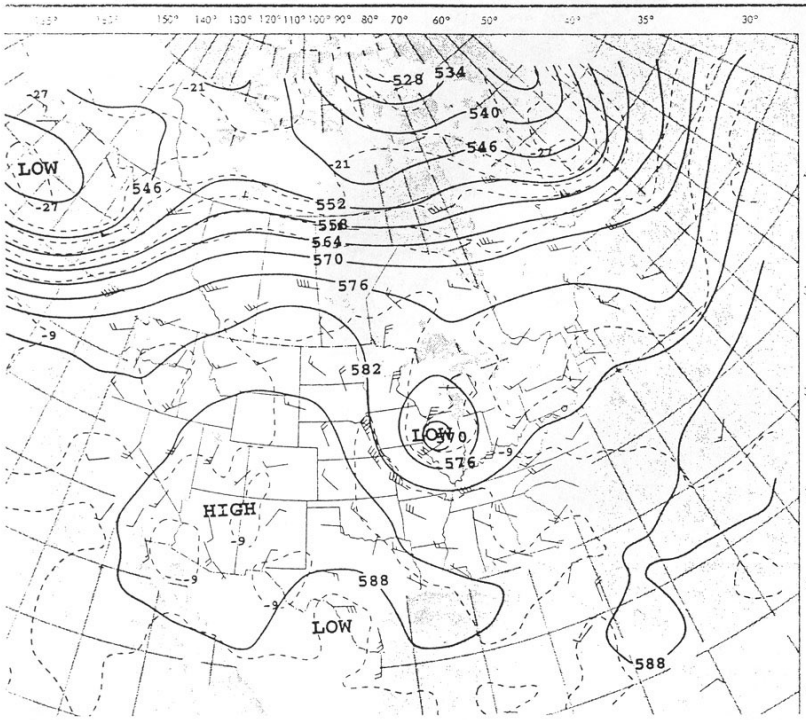
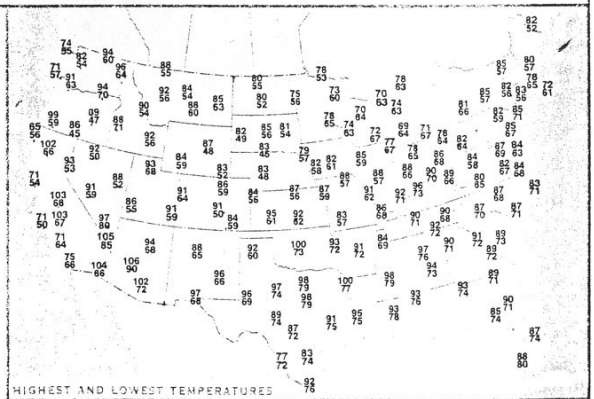
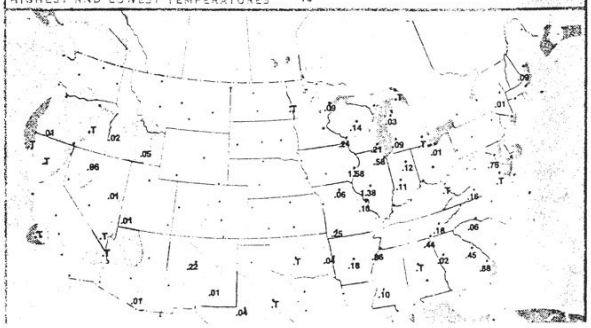
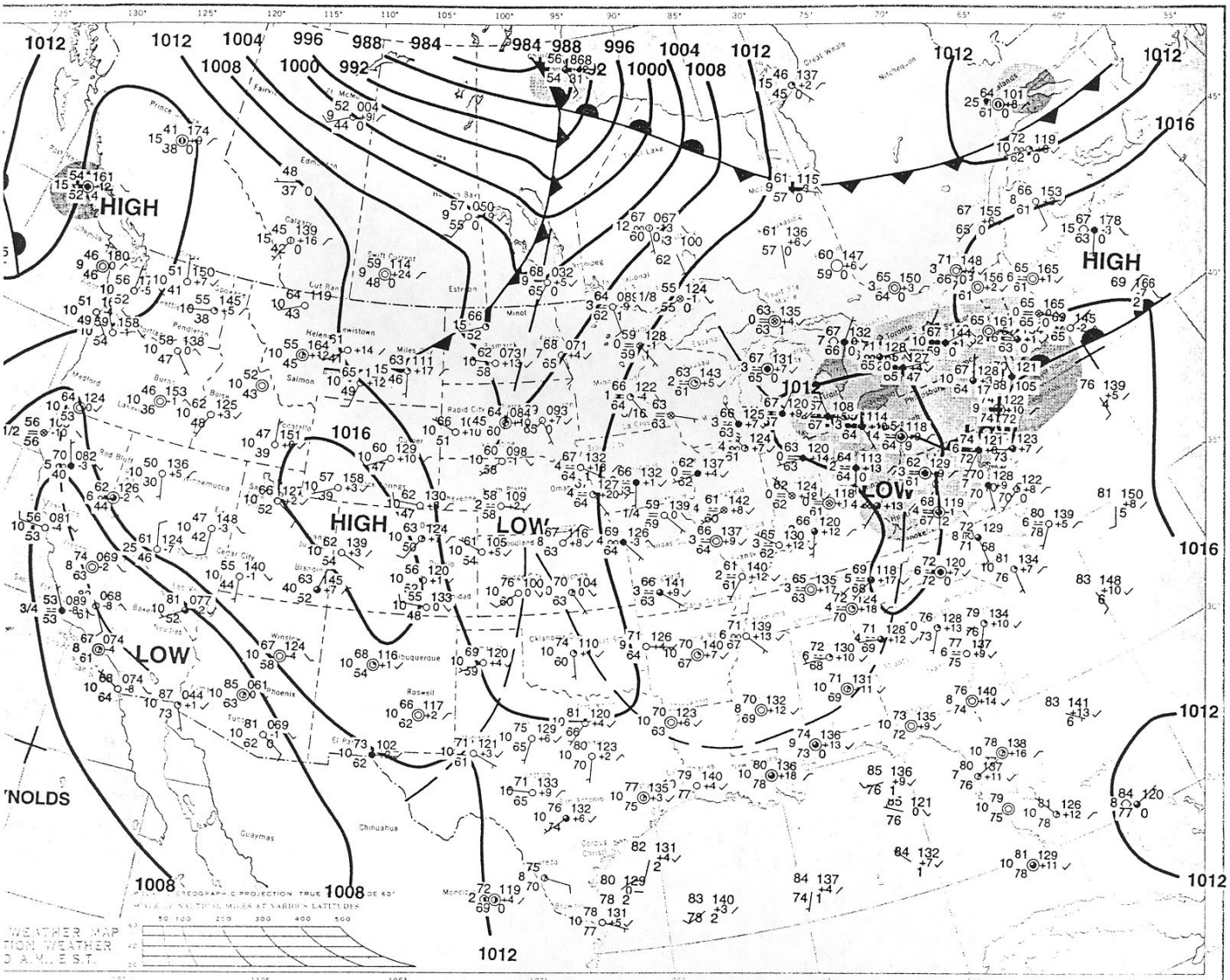


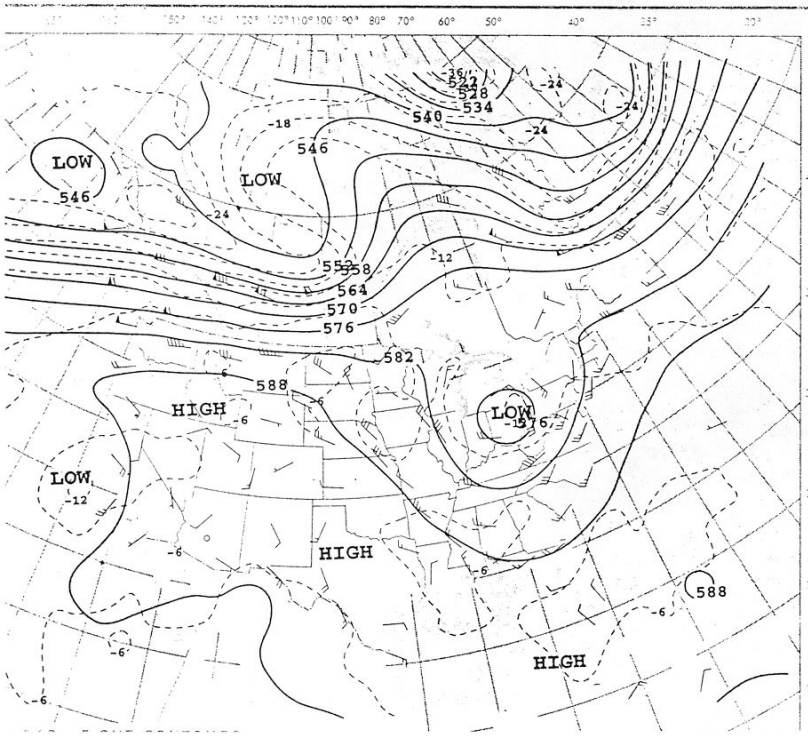



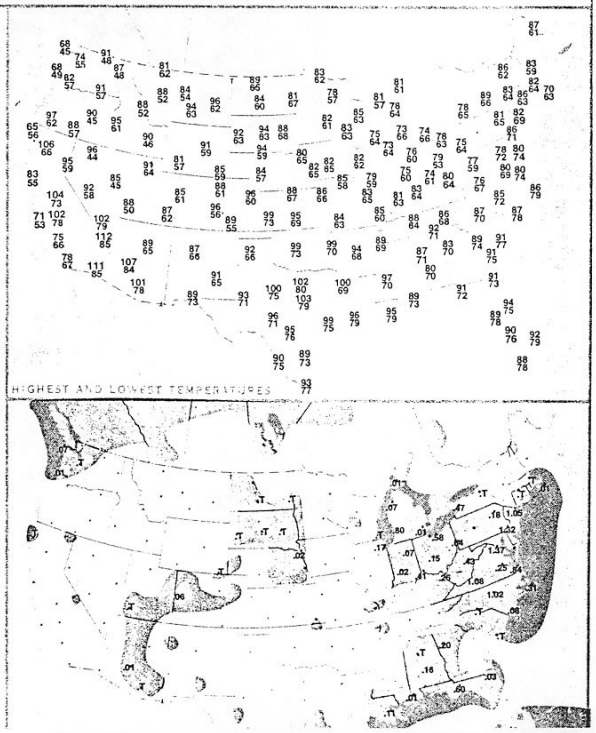


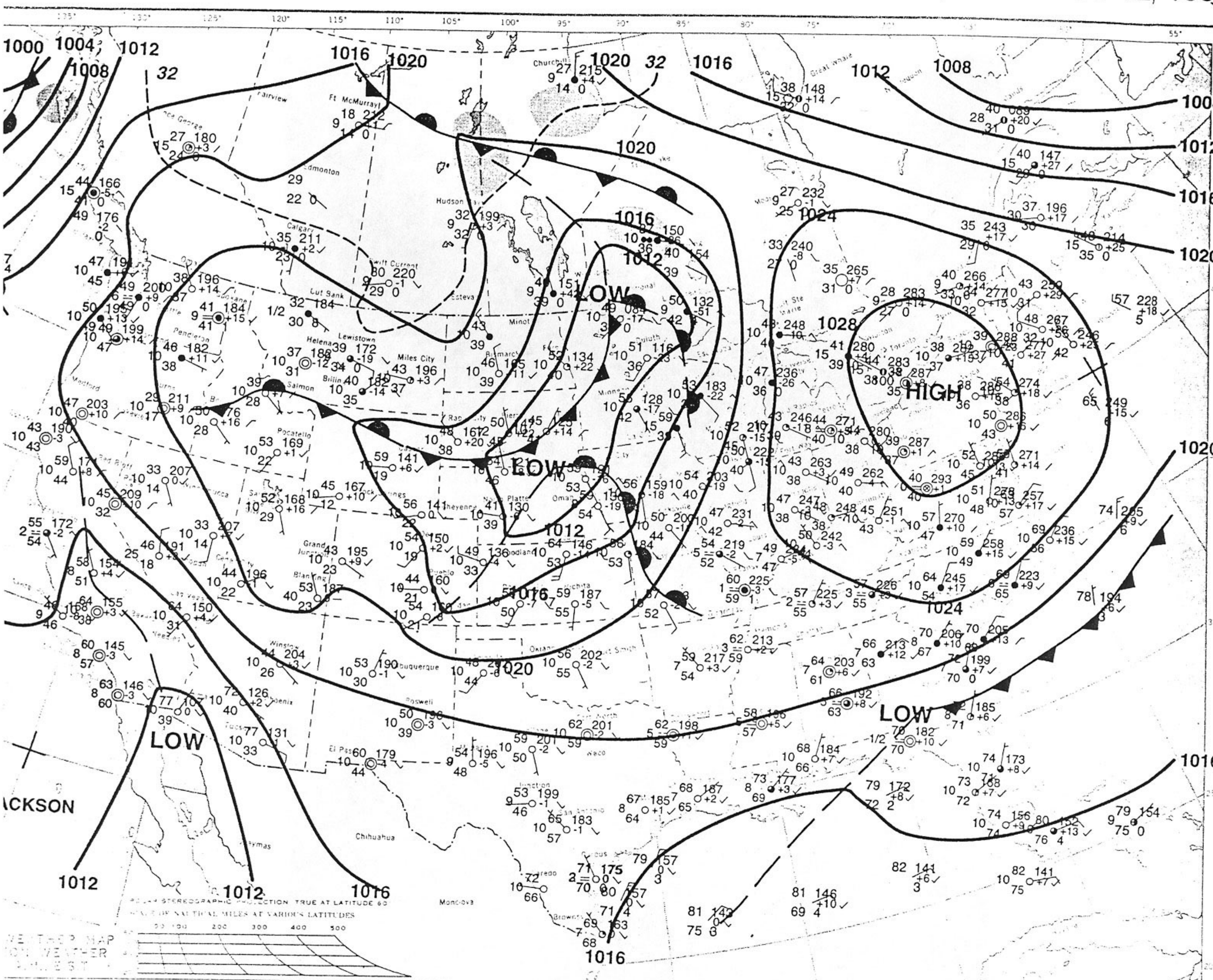



AUGUST 26, 1999

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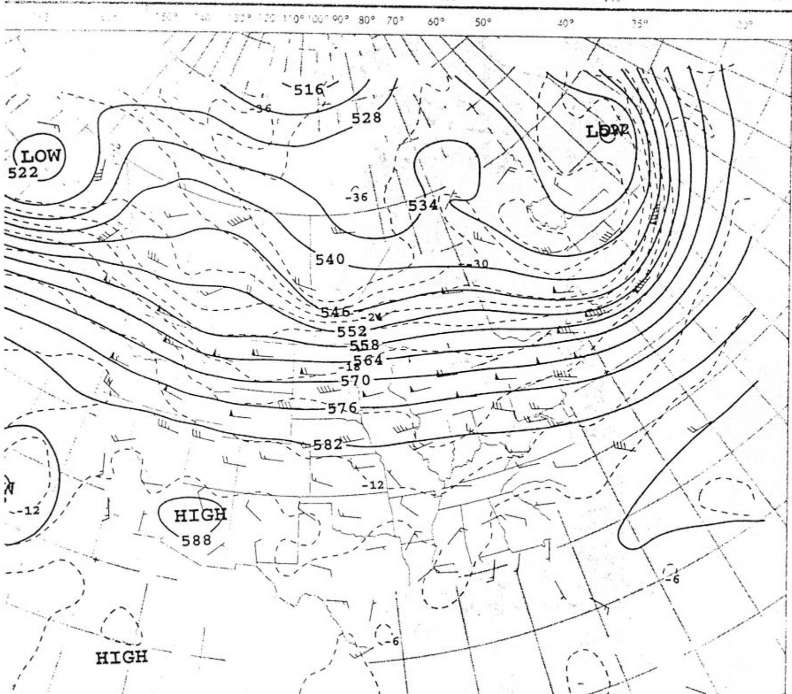
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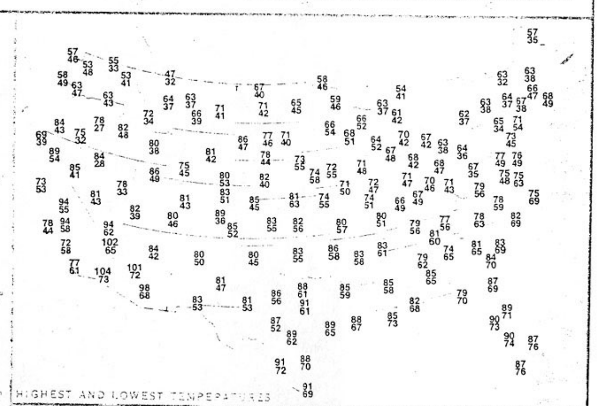
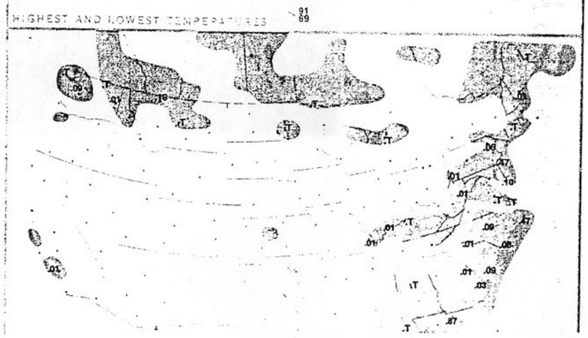
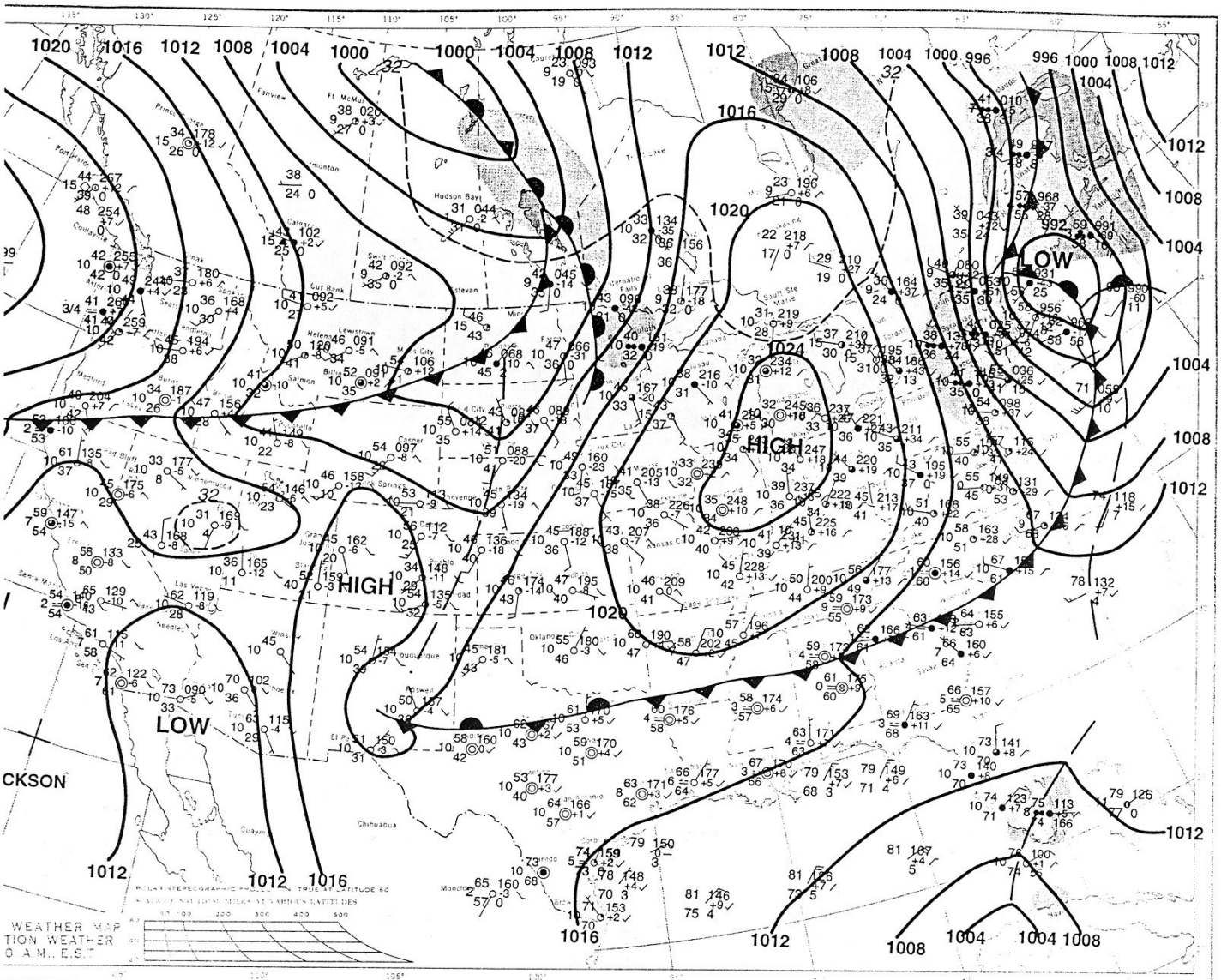
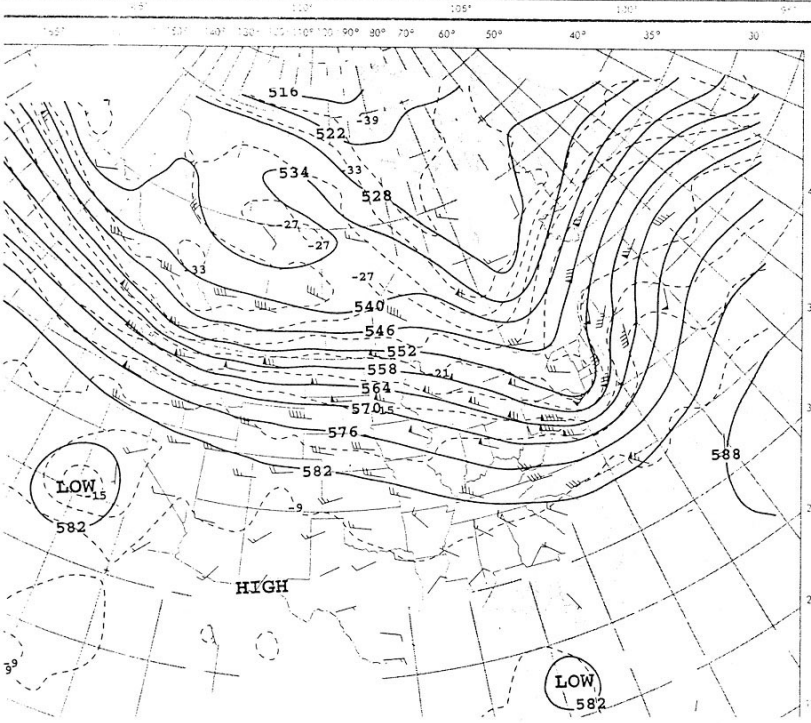
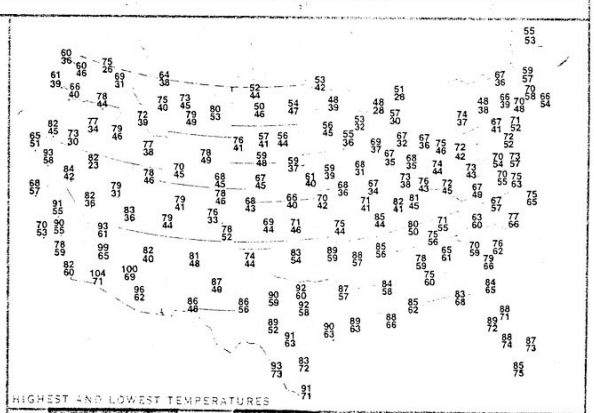

HIGHEST AND LOWEST TEMPERATURES



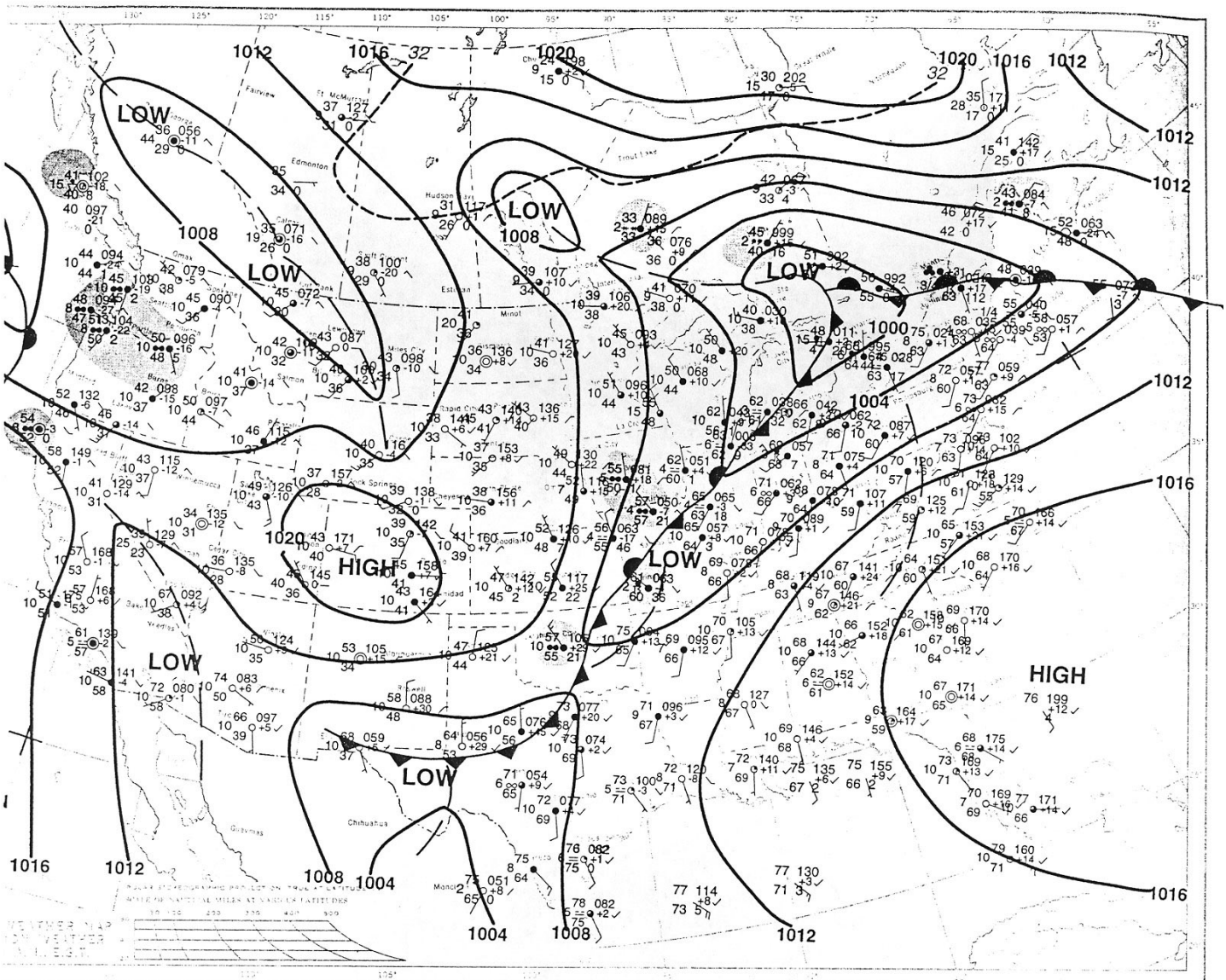
OCTOBER 14, 1999



MAY 9, 2000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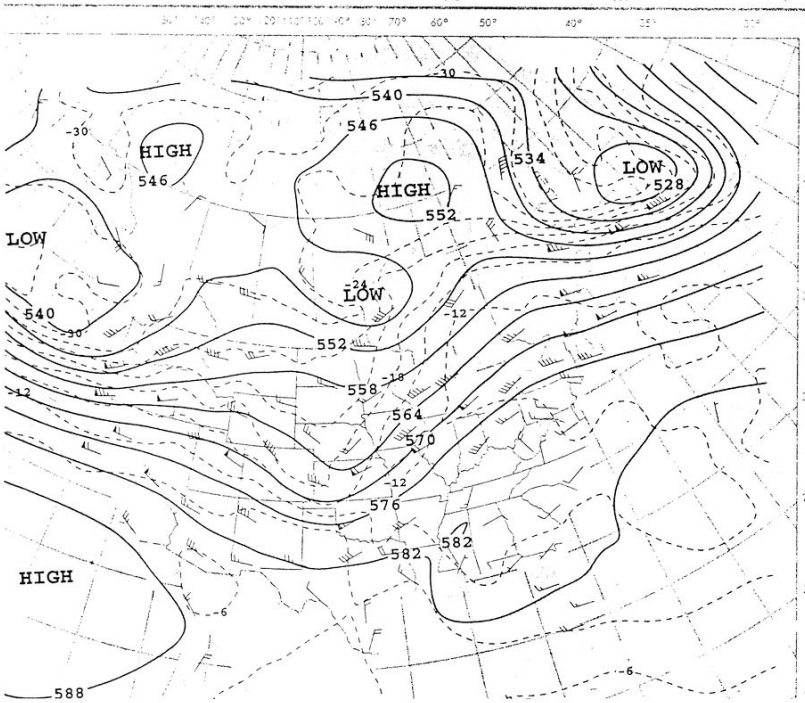
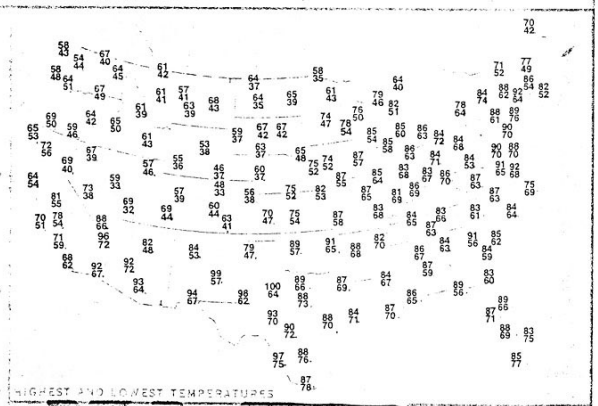
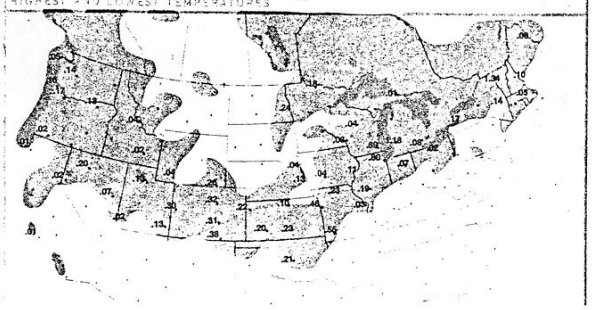
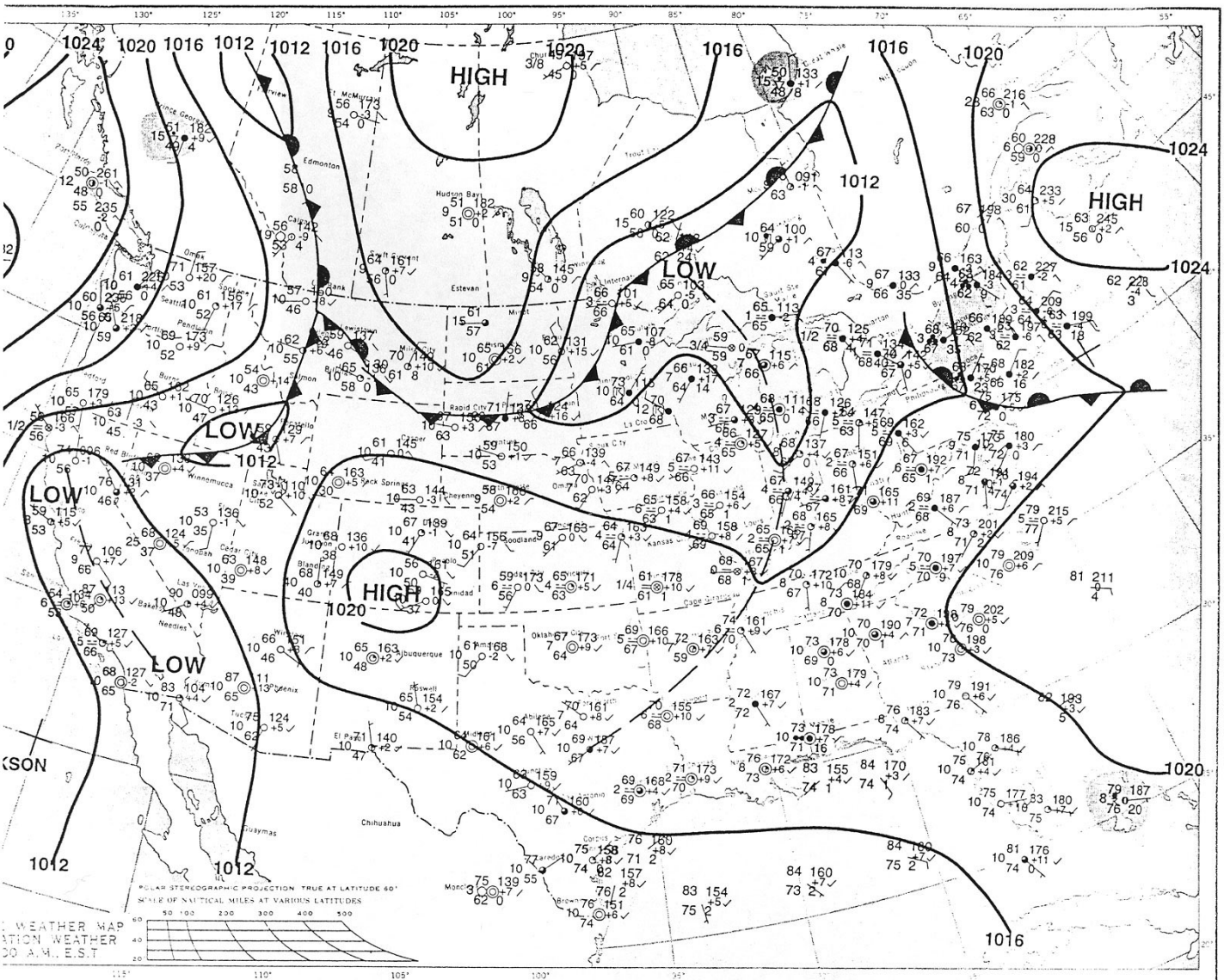
Edmonton
Chihuahua

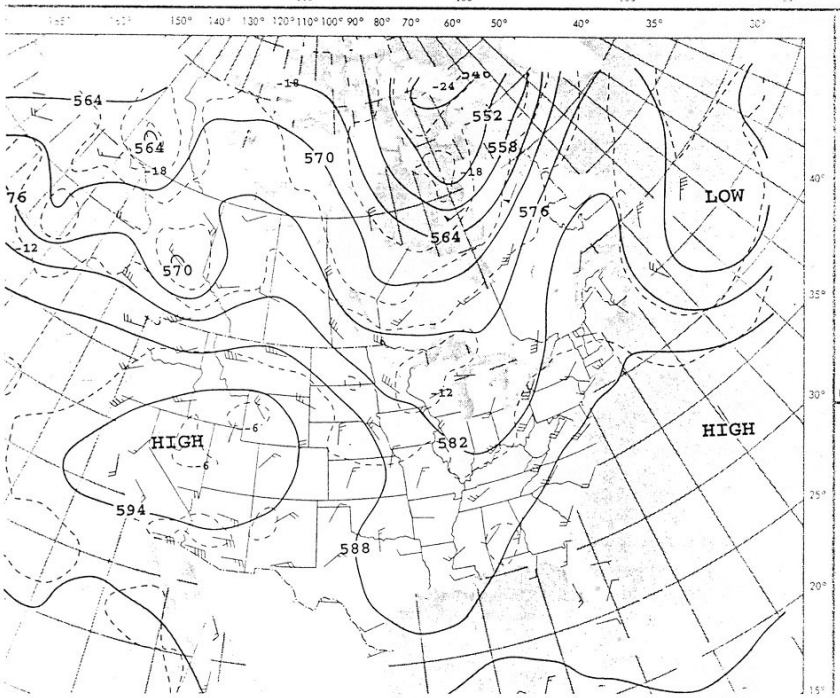

HIGH
LOW
540
546
534
528
552
558
564
570
576
582
588

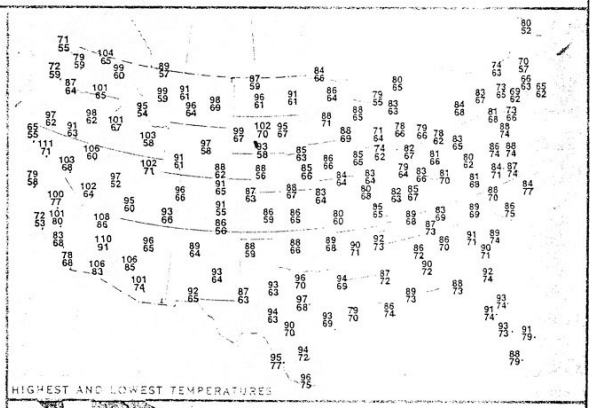


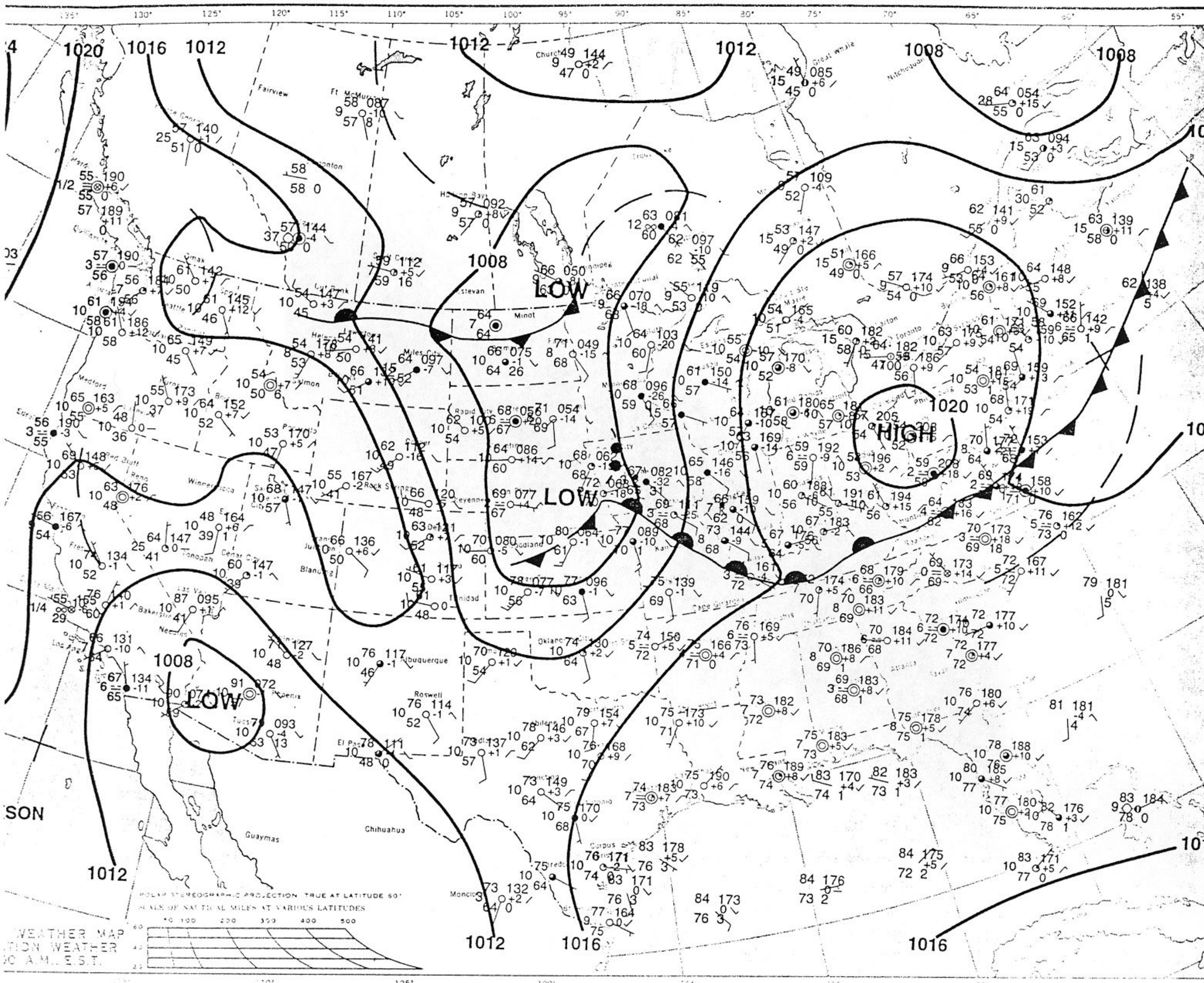

HIGHEST AND LOWEST TEMPERATURES

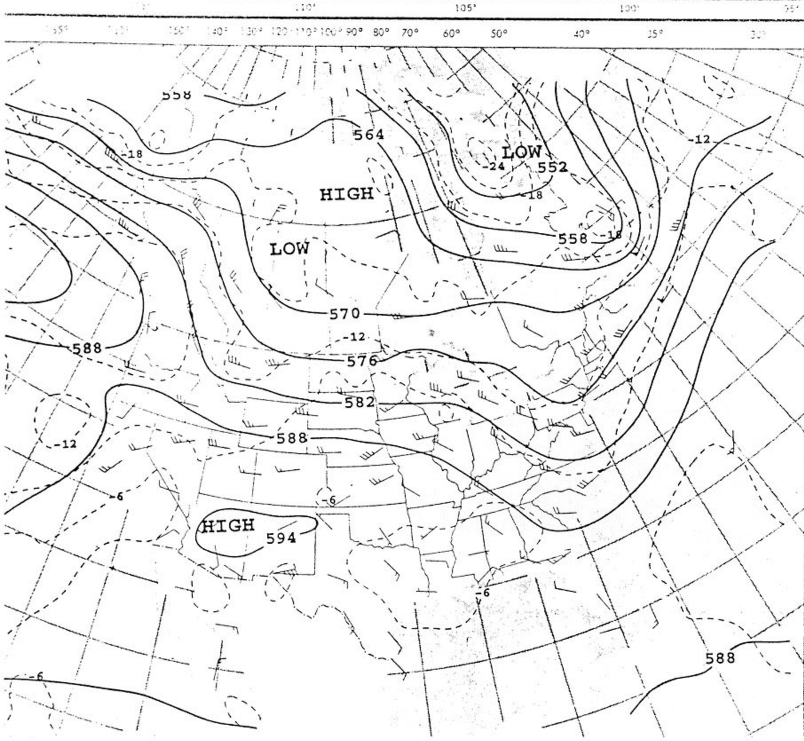
AUGUST 1, 2000

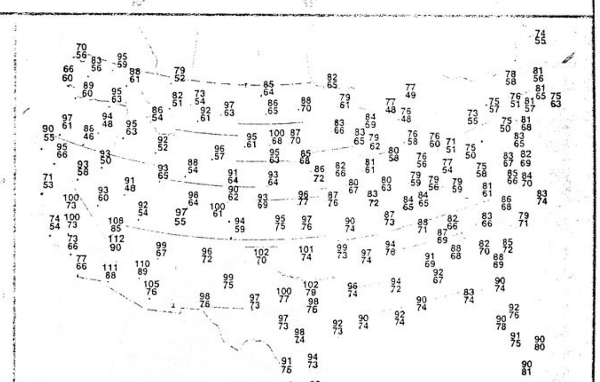


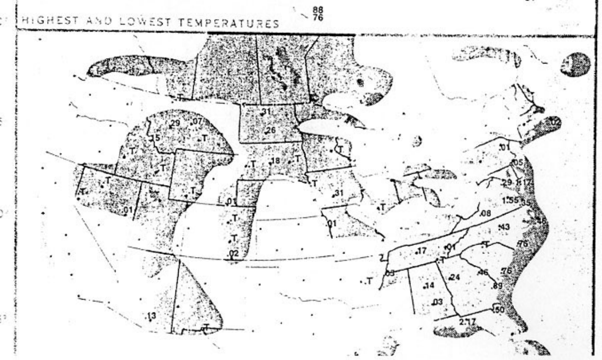





HIGHEST AND LOWEST TEMPERATURES



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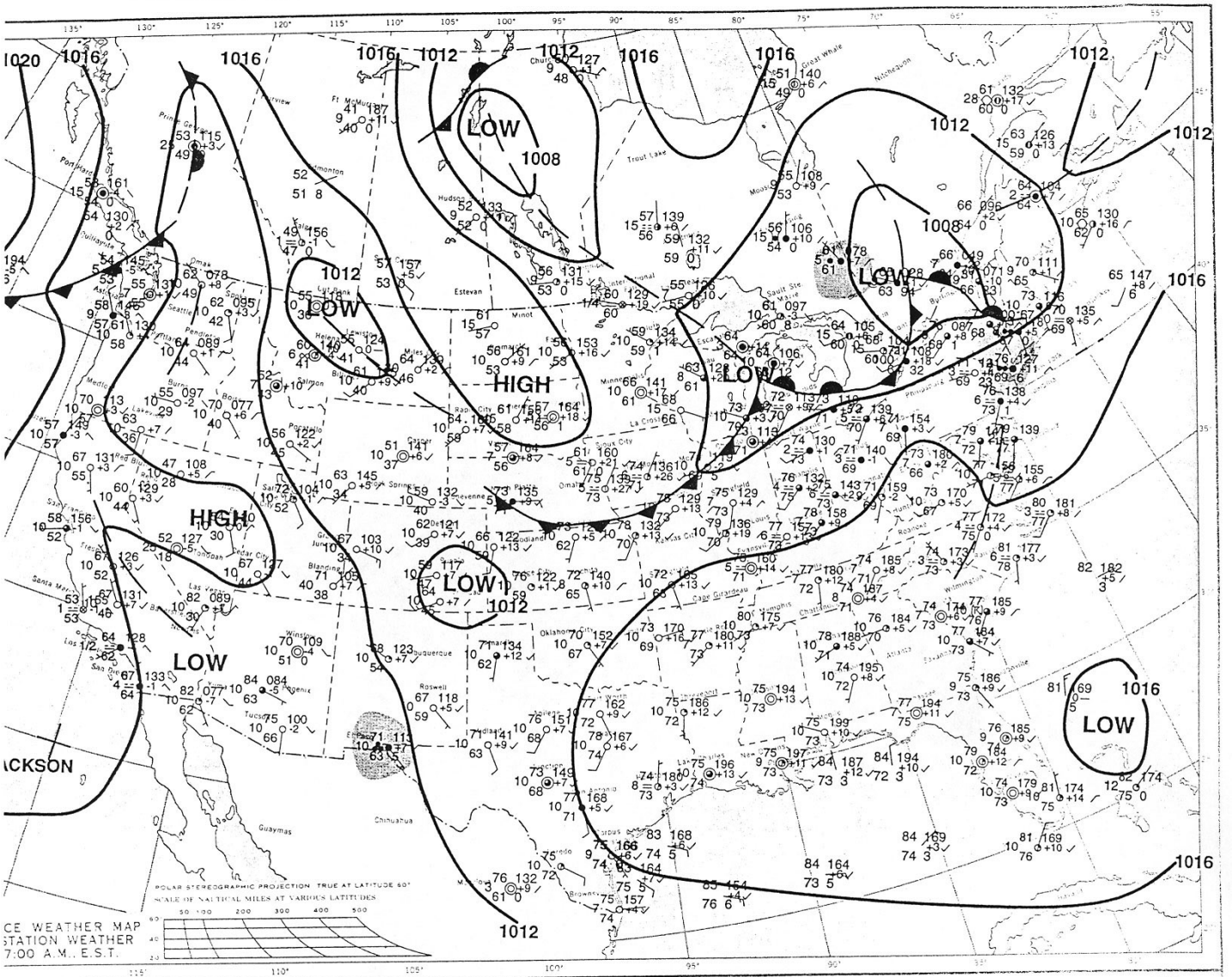
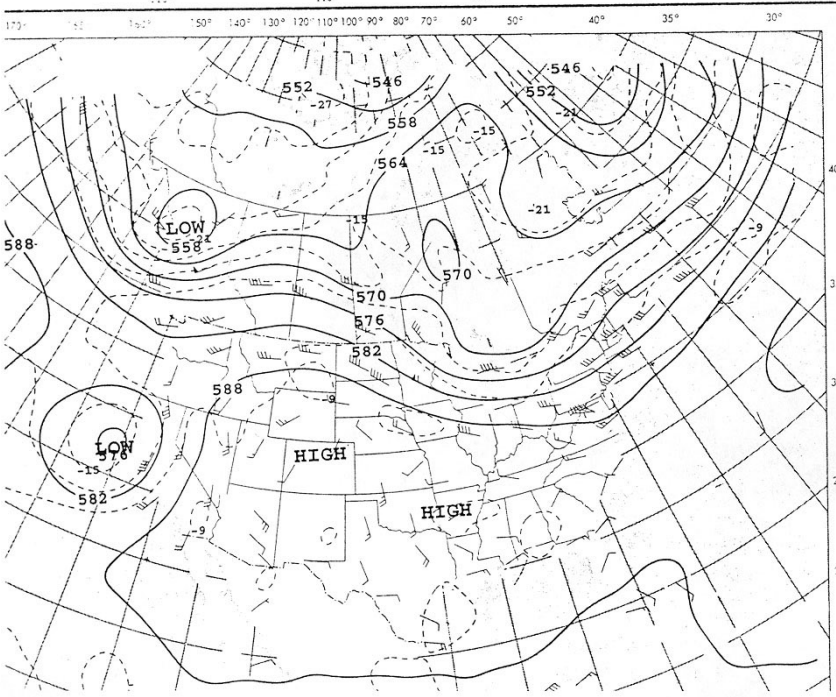
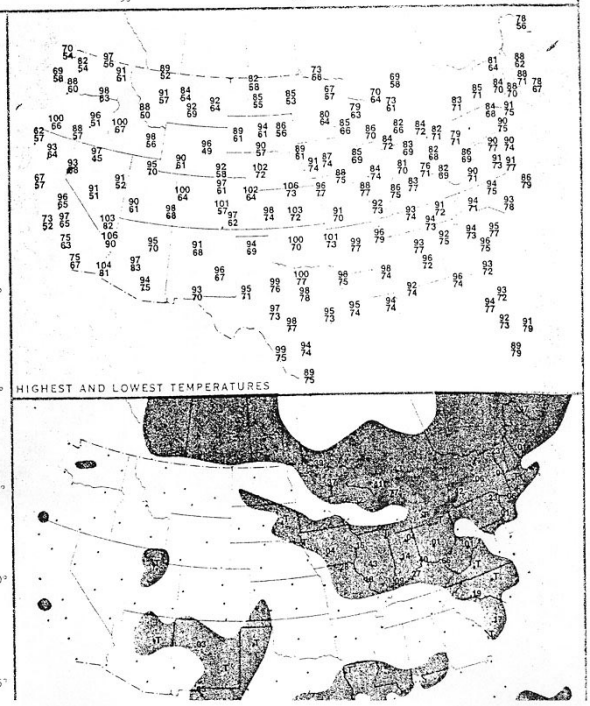
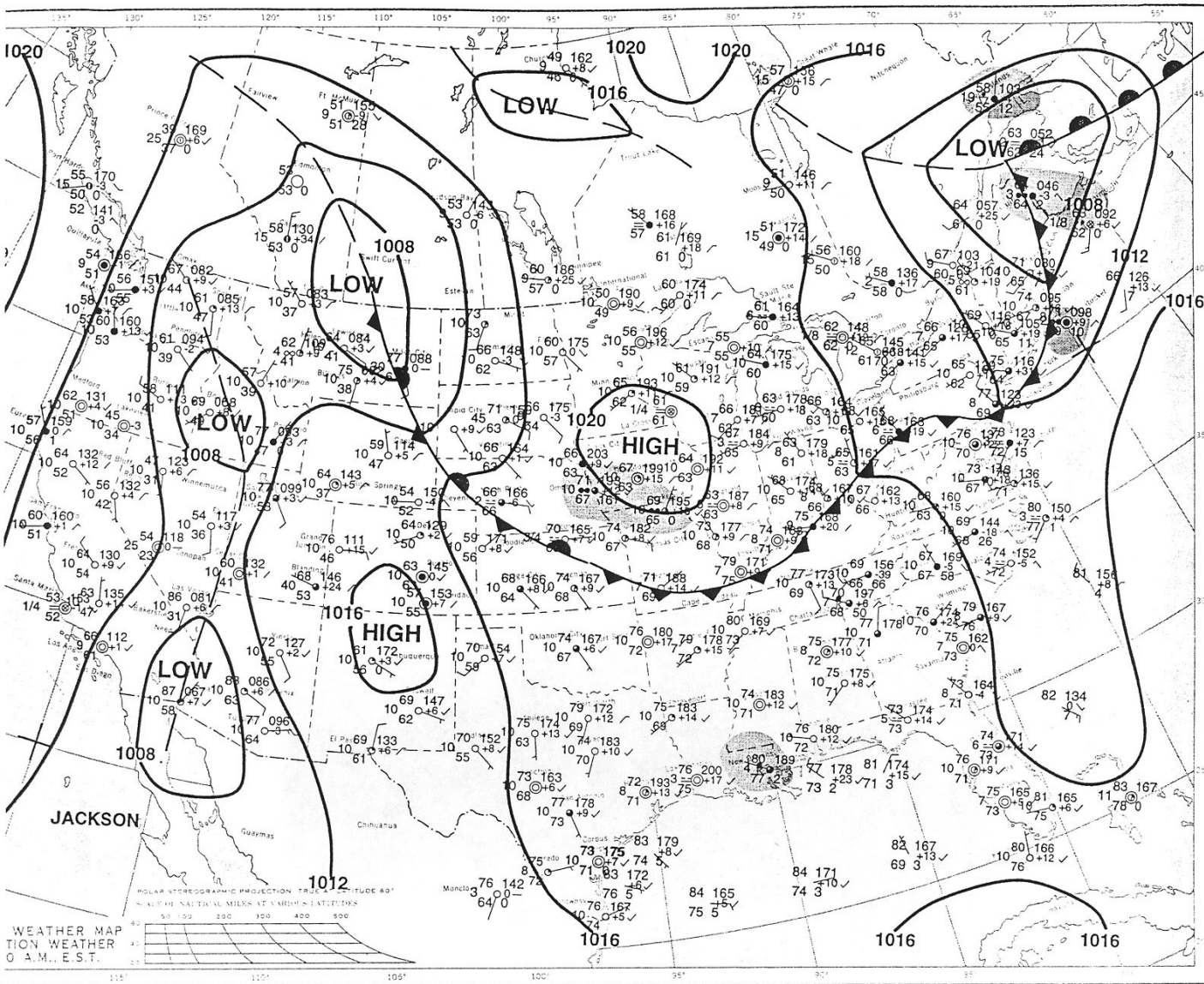
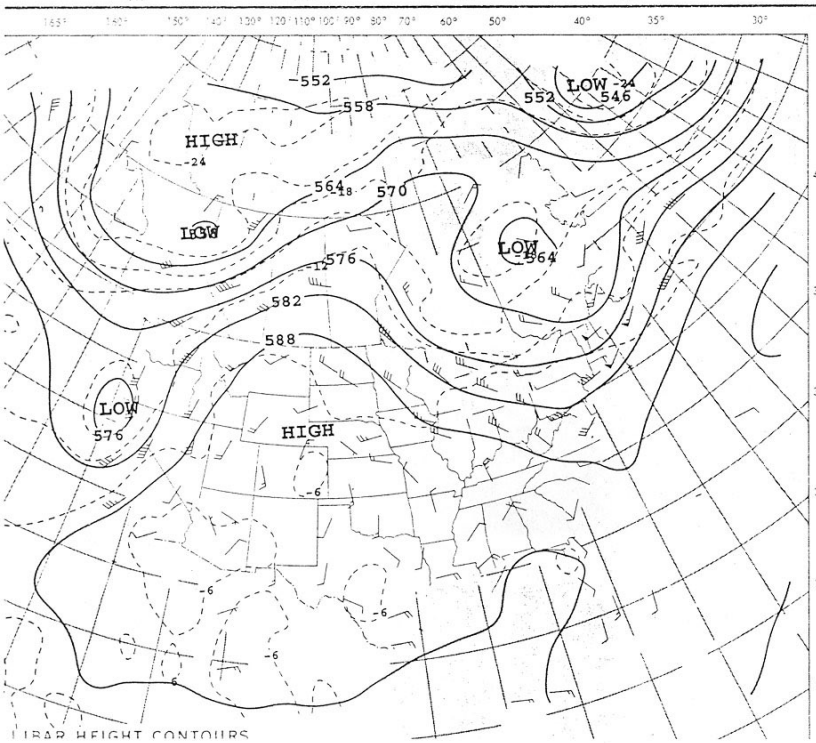


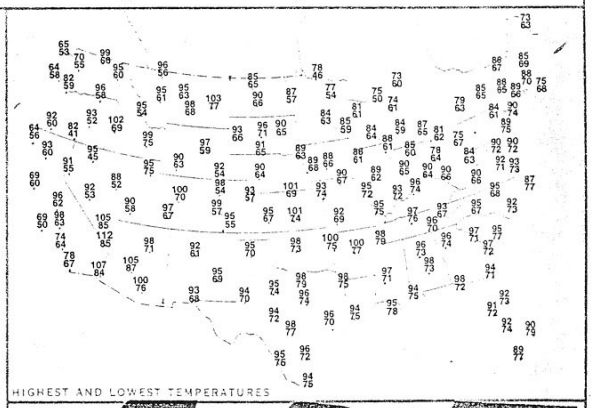



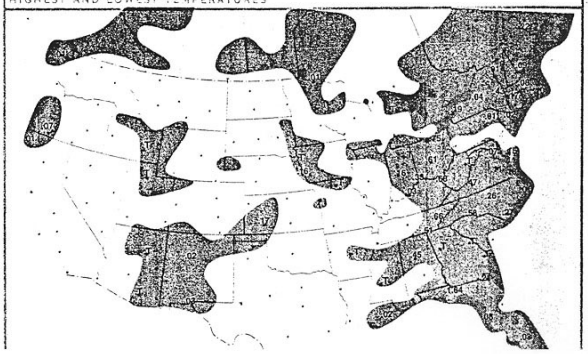



AUGUST 10, 2000



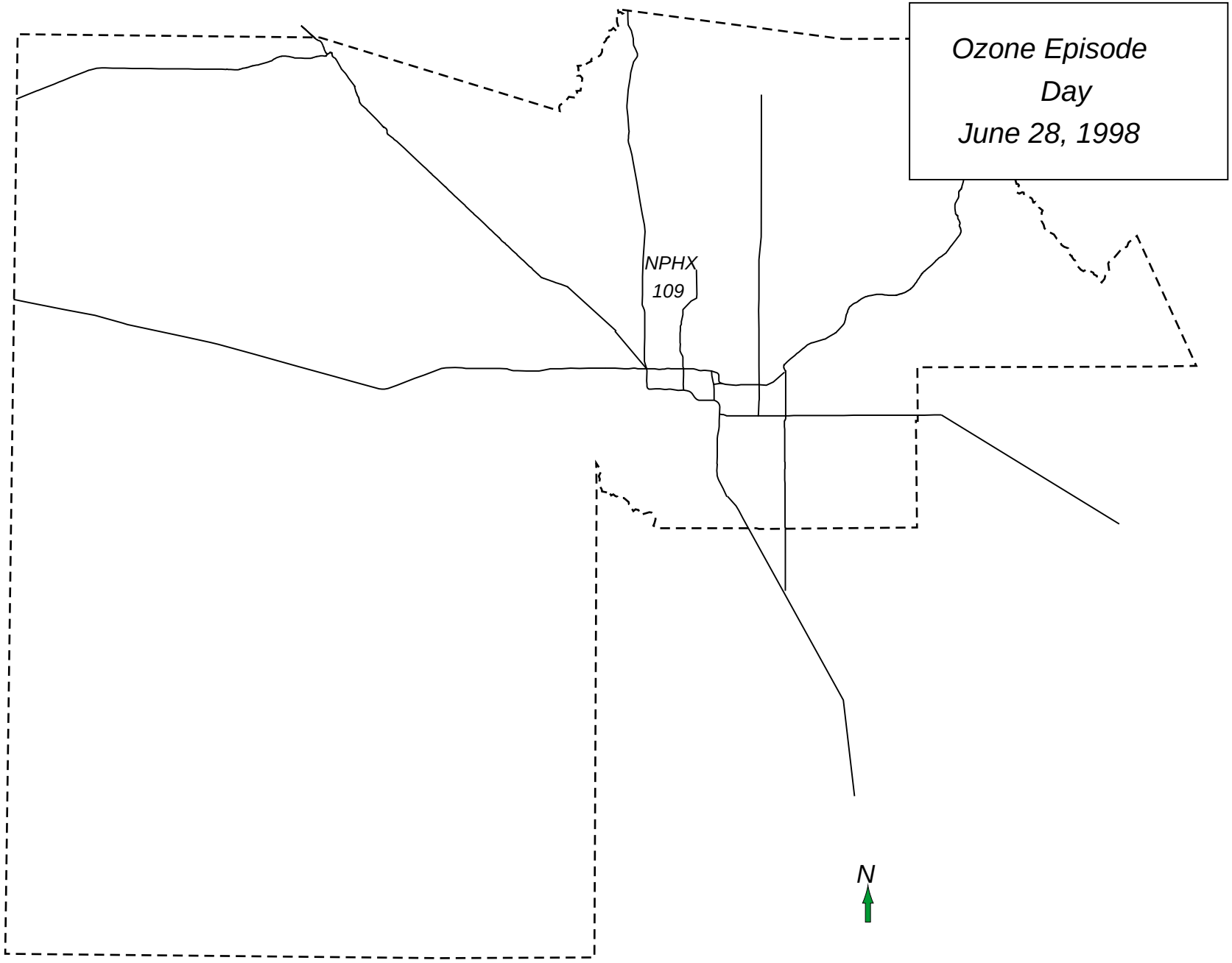



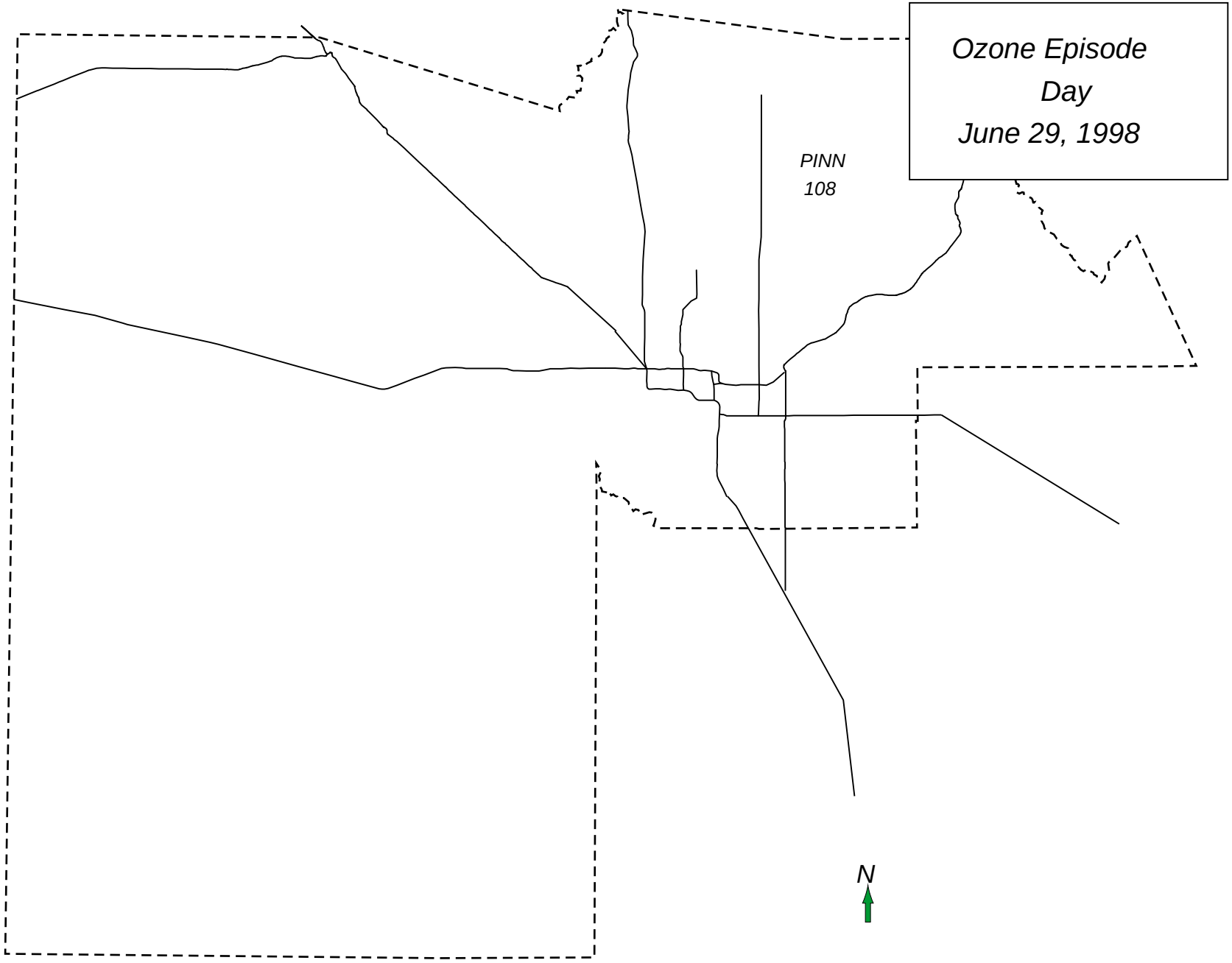



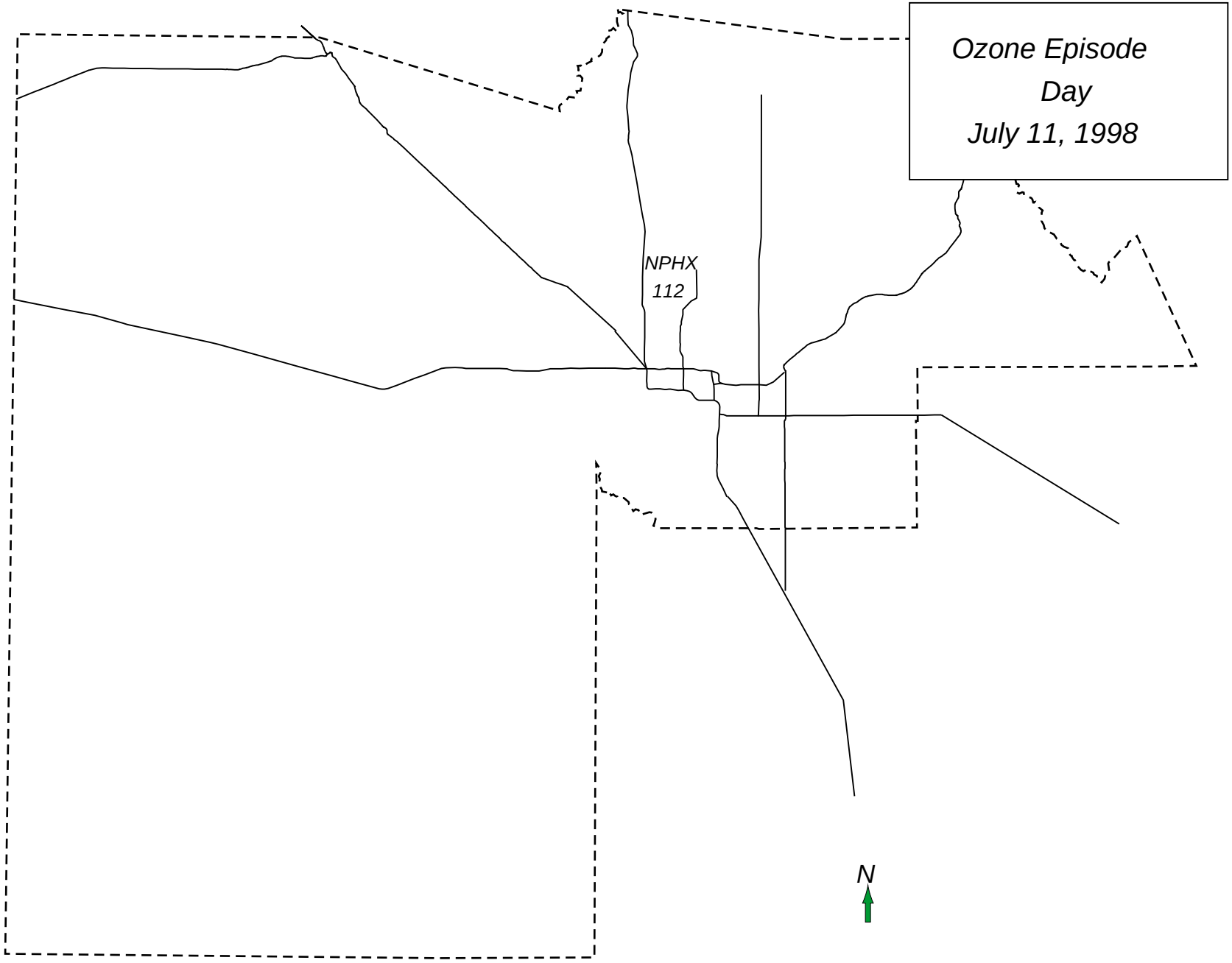



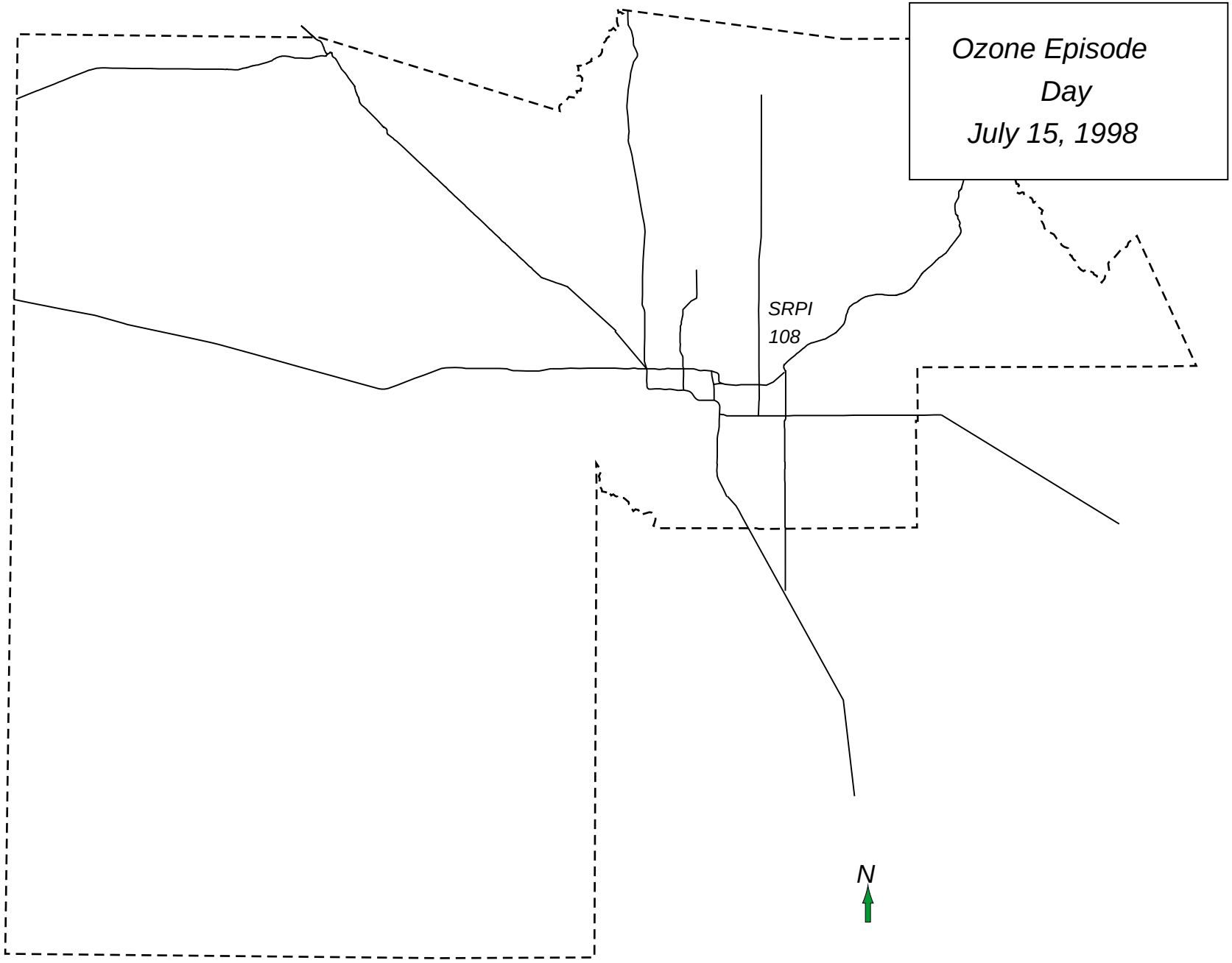
ATTACHMENT II

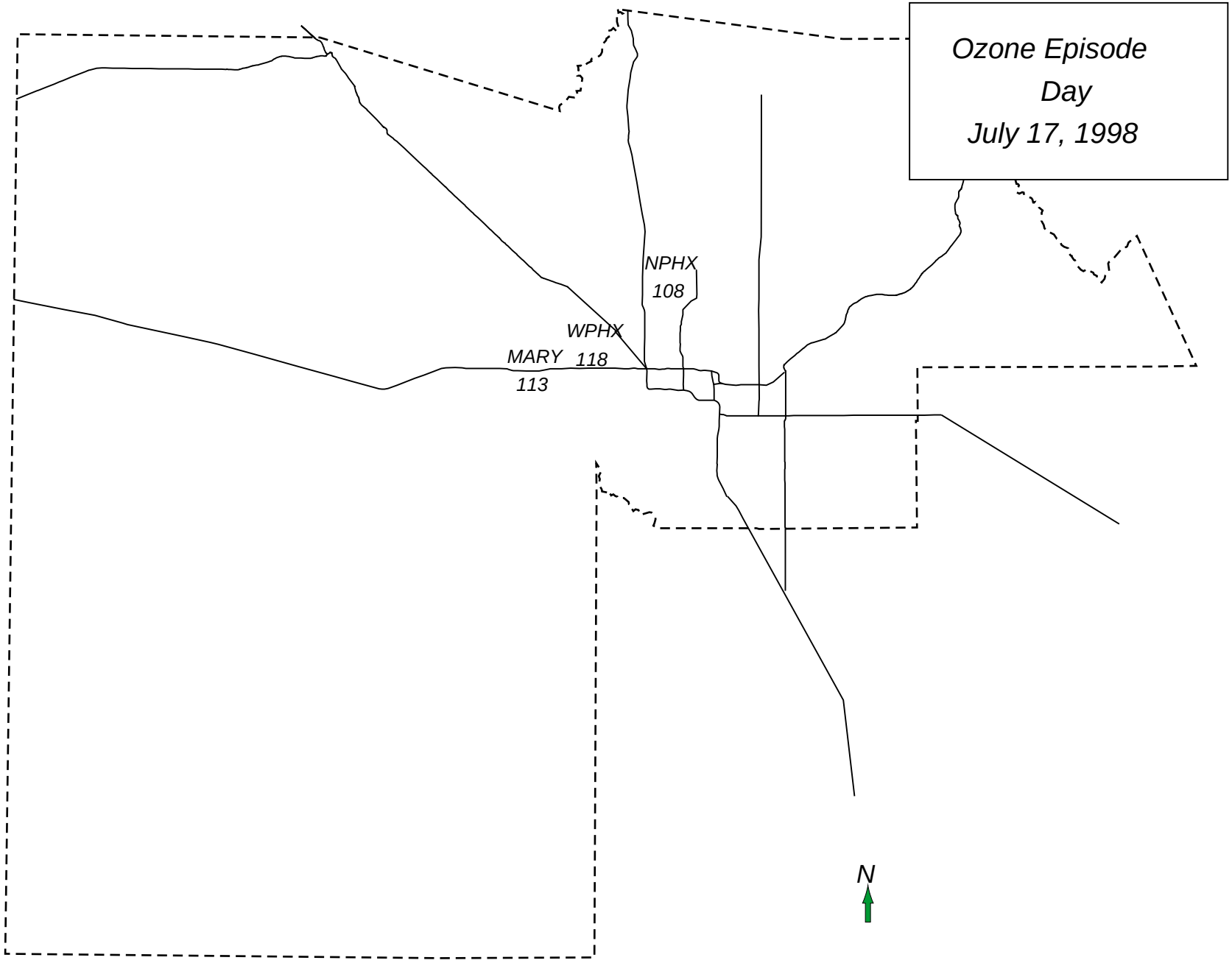
Spatial Distribution of Maximum Ozone Readings on High Ozone Days in 1998-2000

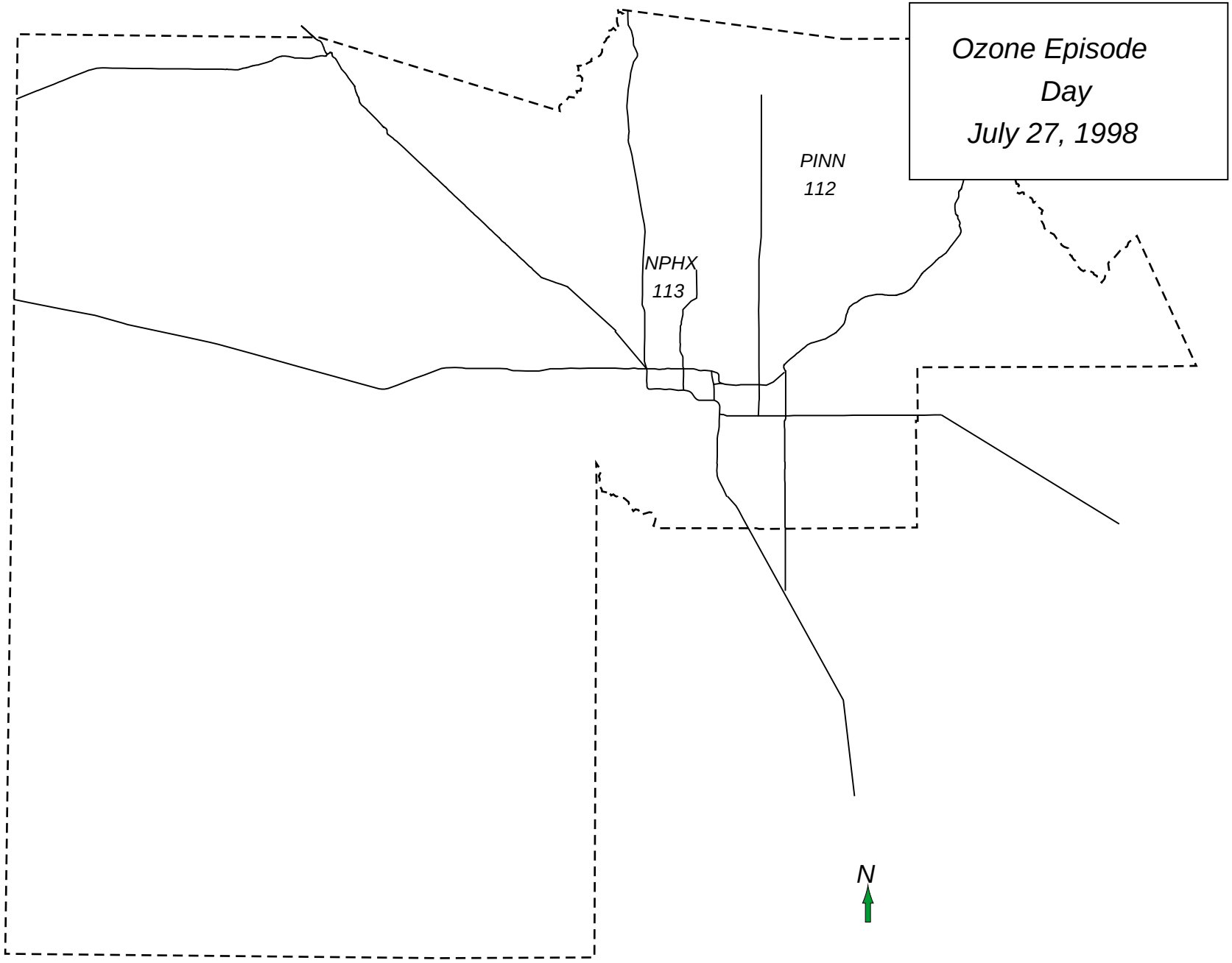

Ozone Episode
Day
June 28, 1998
NPHX
109
N

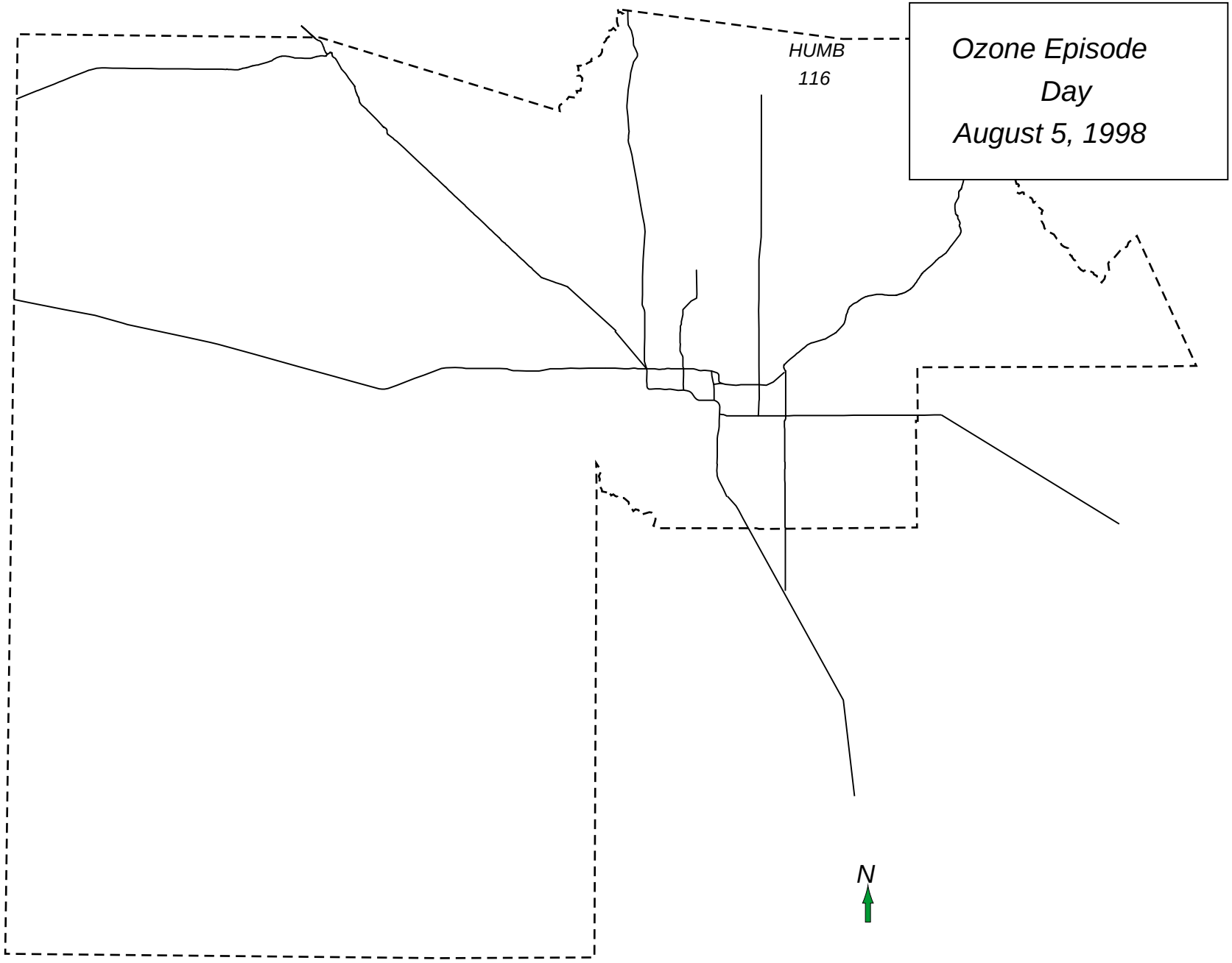

Ozone Episode
Day
June 29, 1998
PINN
108
N

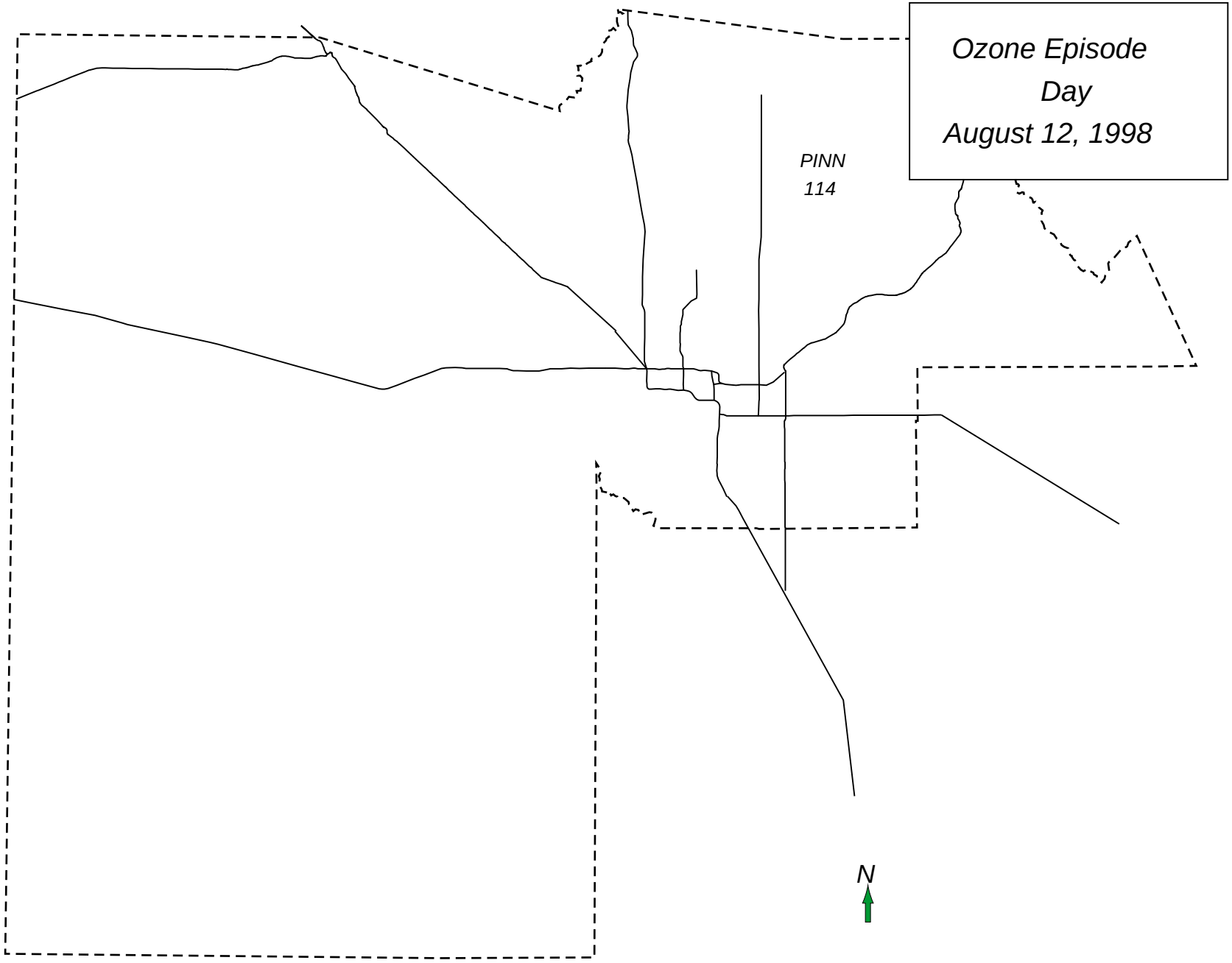

Ozone Episode
Day
July 11, 1998
NPHX
112
N

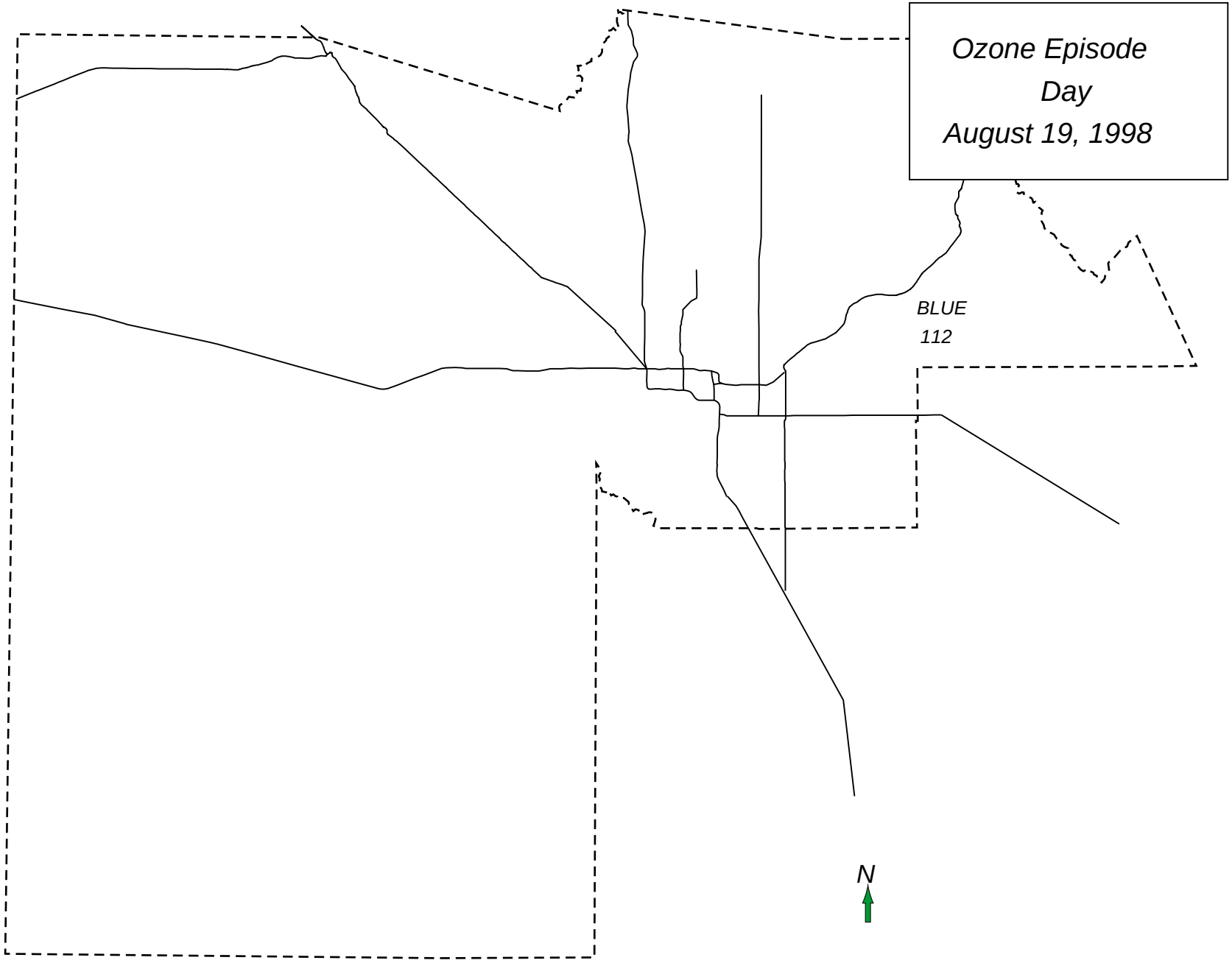

Ozone Episode
Day
July 15, 1998
SRPI
108
N

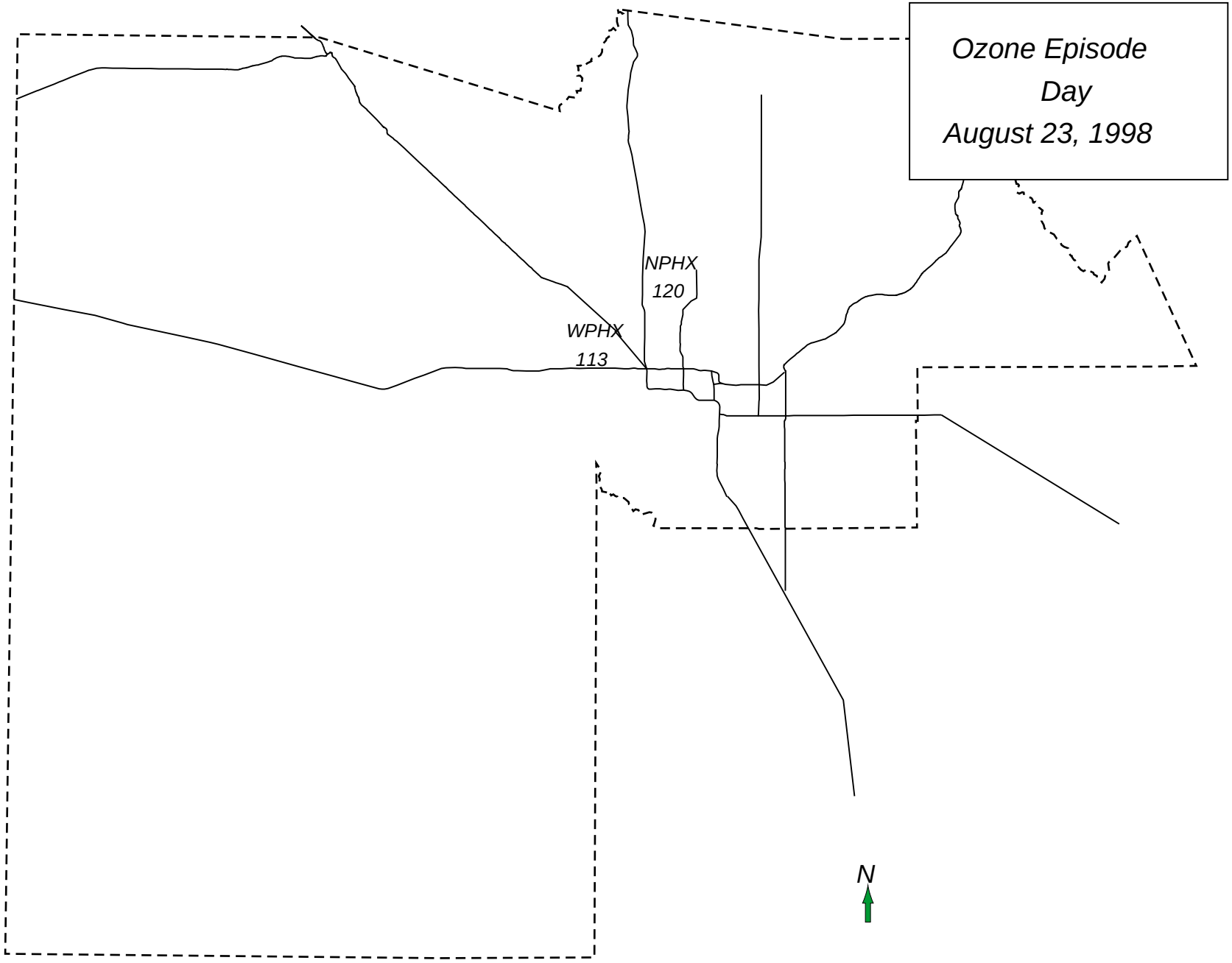

Ozone Episode
Day
July 17, 1998
NPHX
108
WPHX
118
MARY
113
N

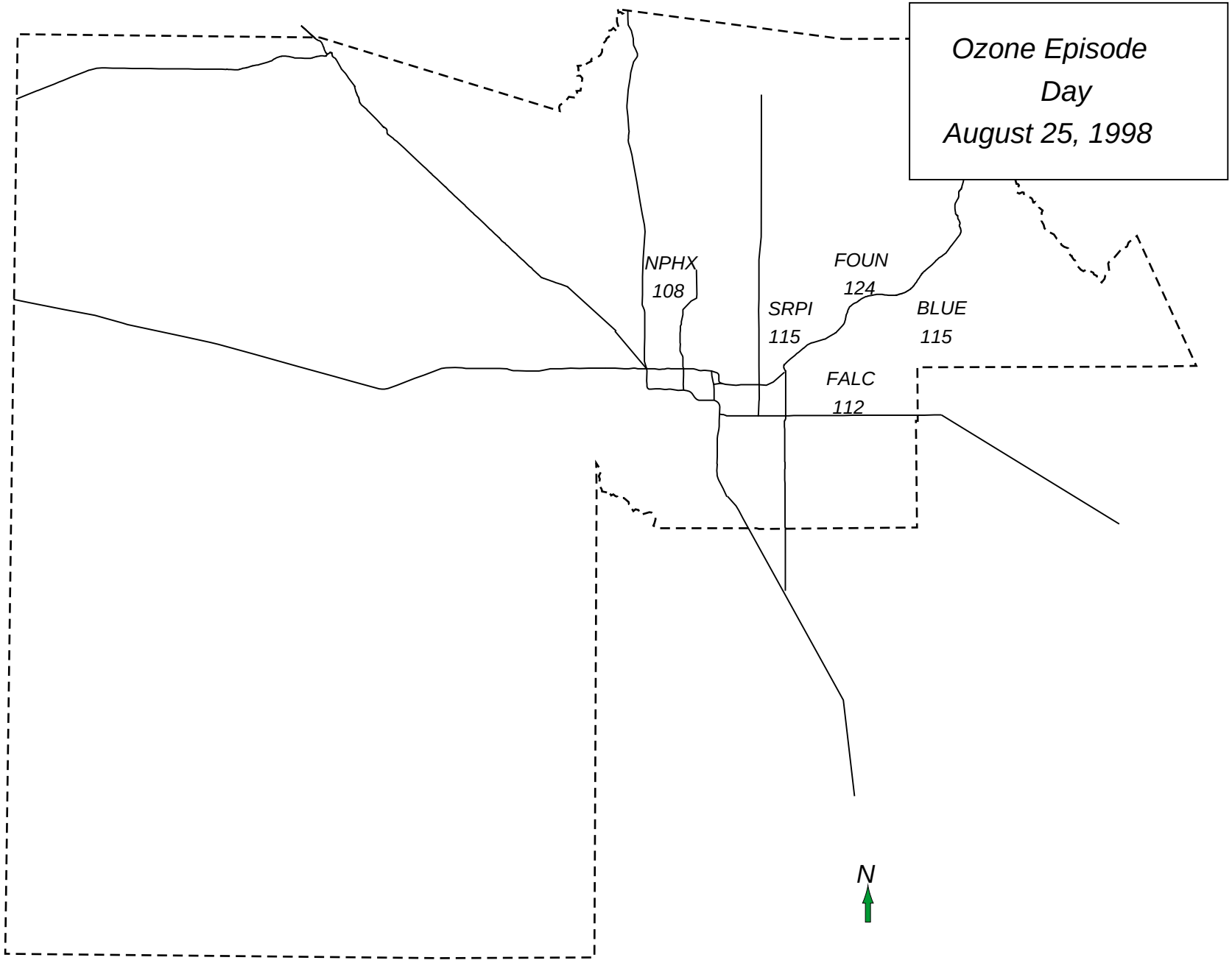

Ozone Episode
Day
July 27, 1998
PINN
112
NPHX
113
N

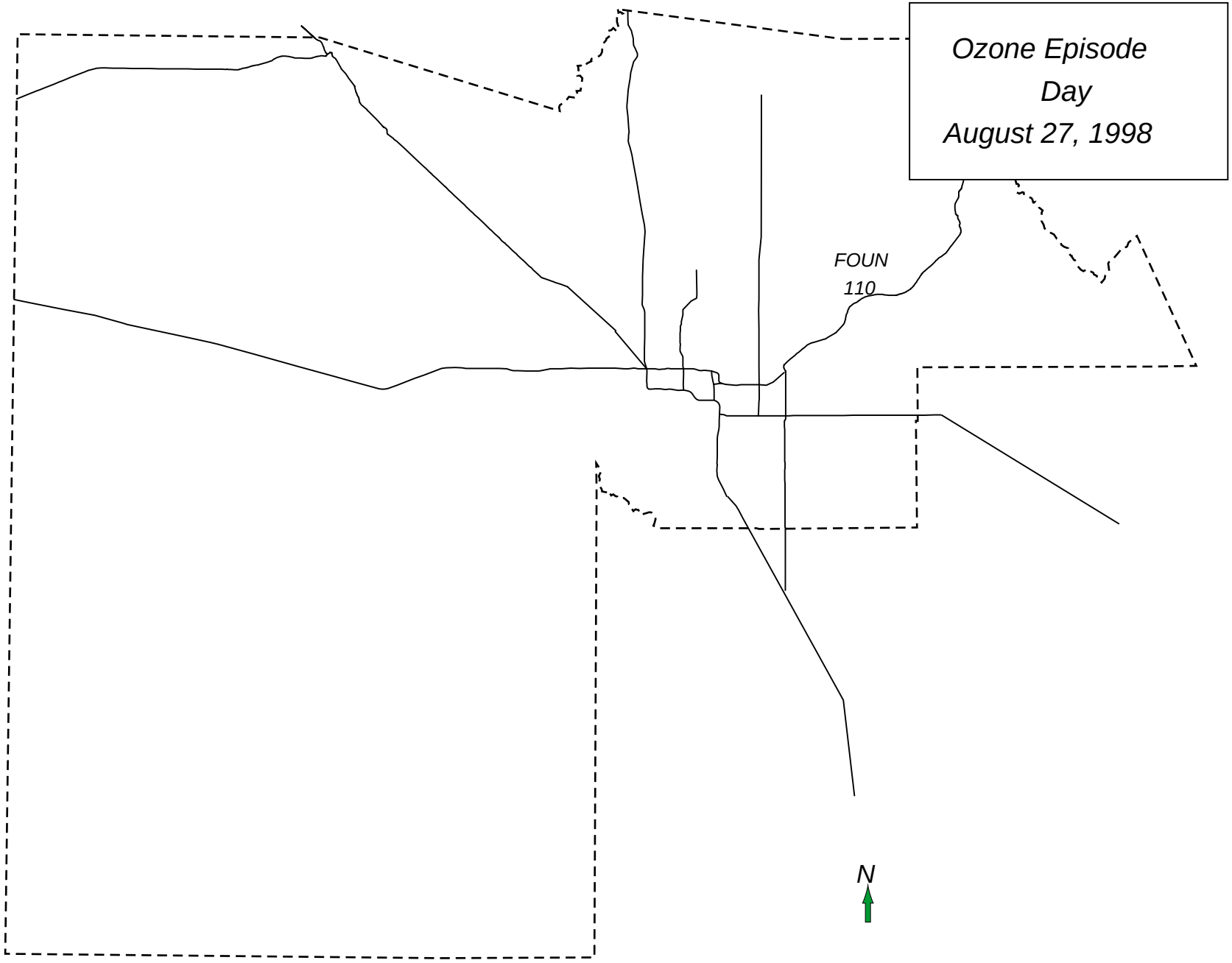

Ozone Episode
Day
August 5, 1998
HUMB
116
N

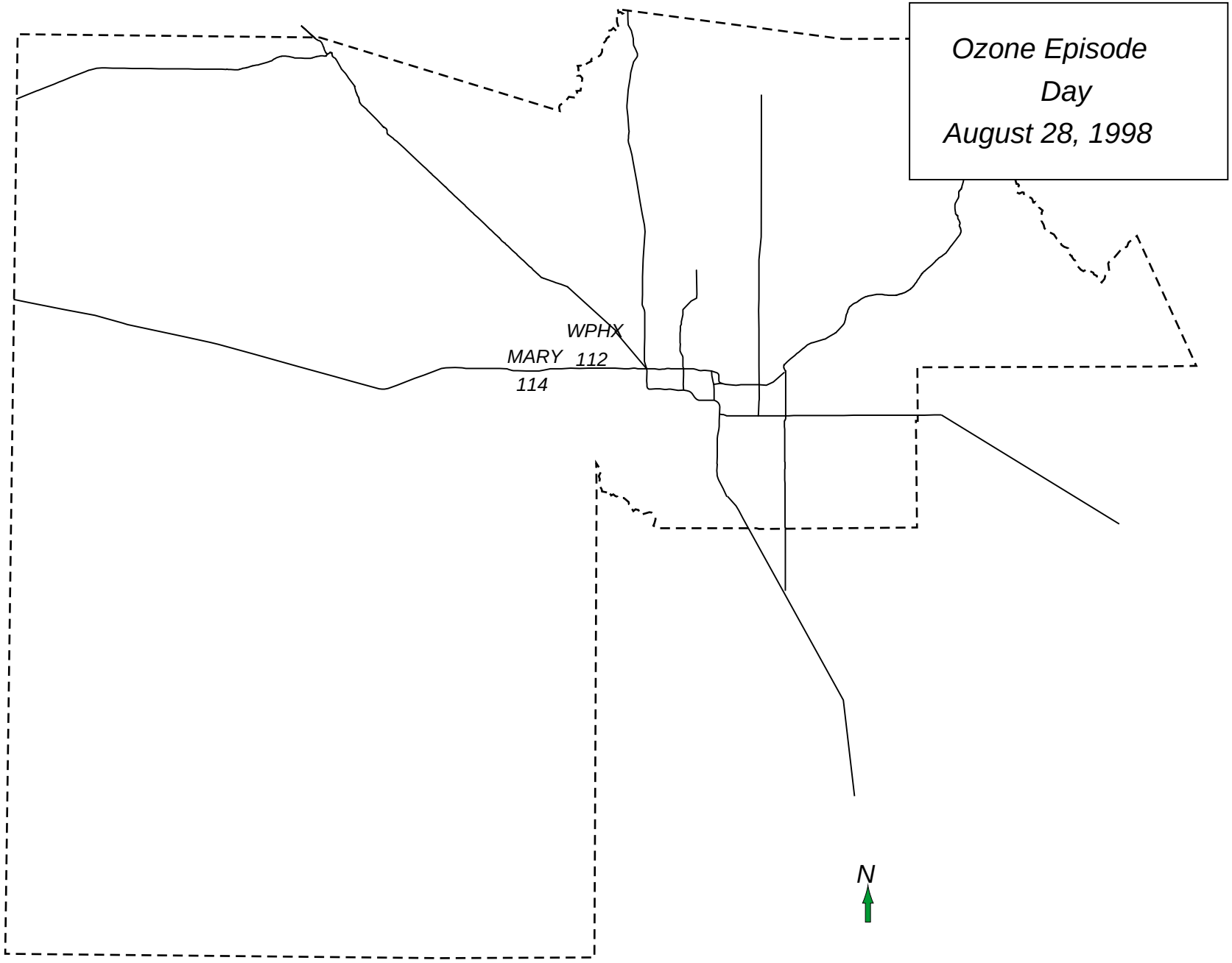

Ozone Episode
Day
August 12, 1998
PINN
114
N

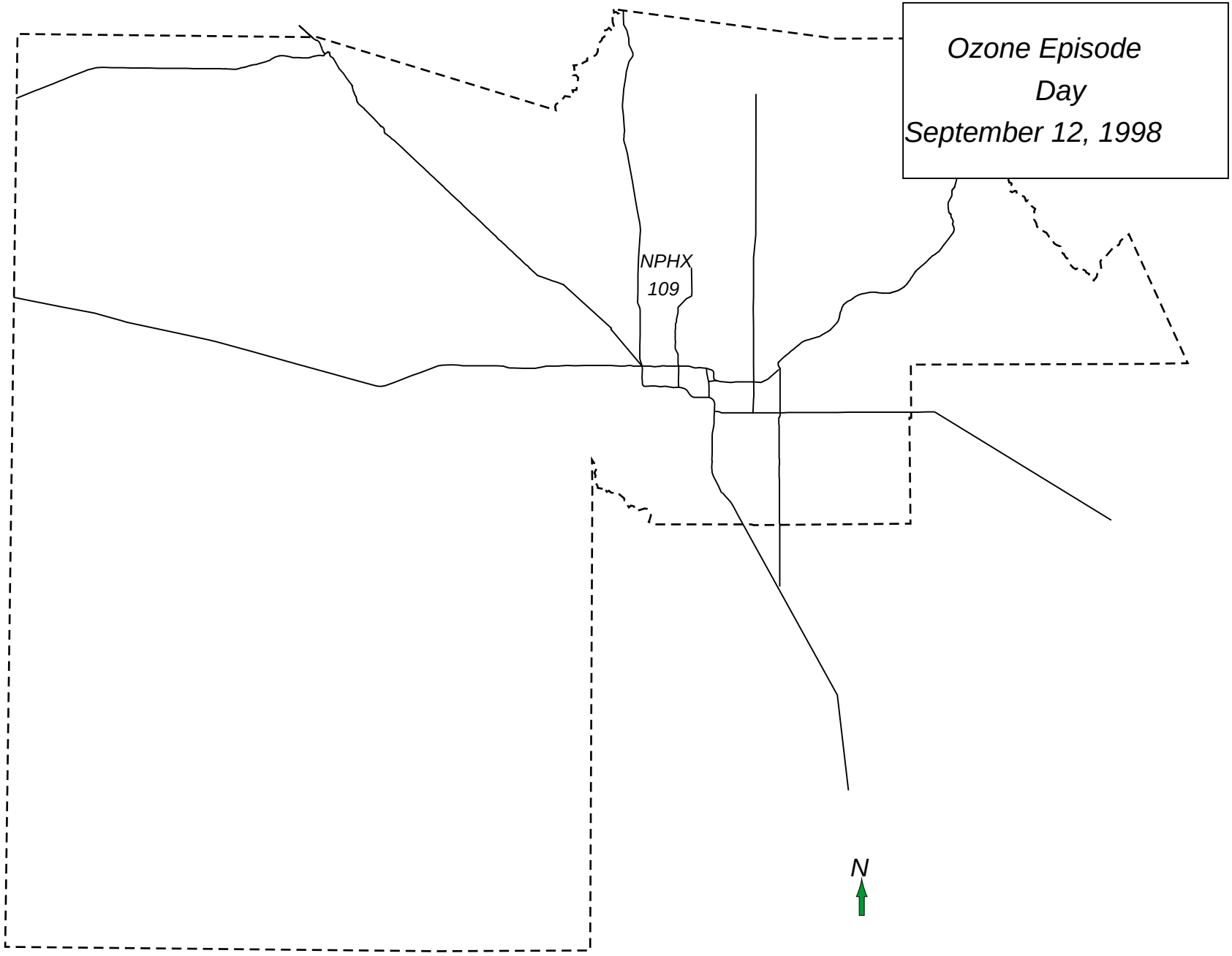

Ozone Episode
Day
August 19, 1998
BLUE
112
N

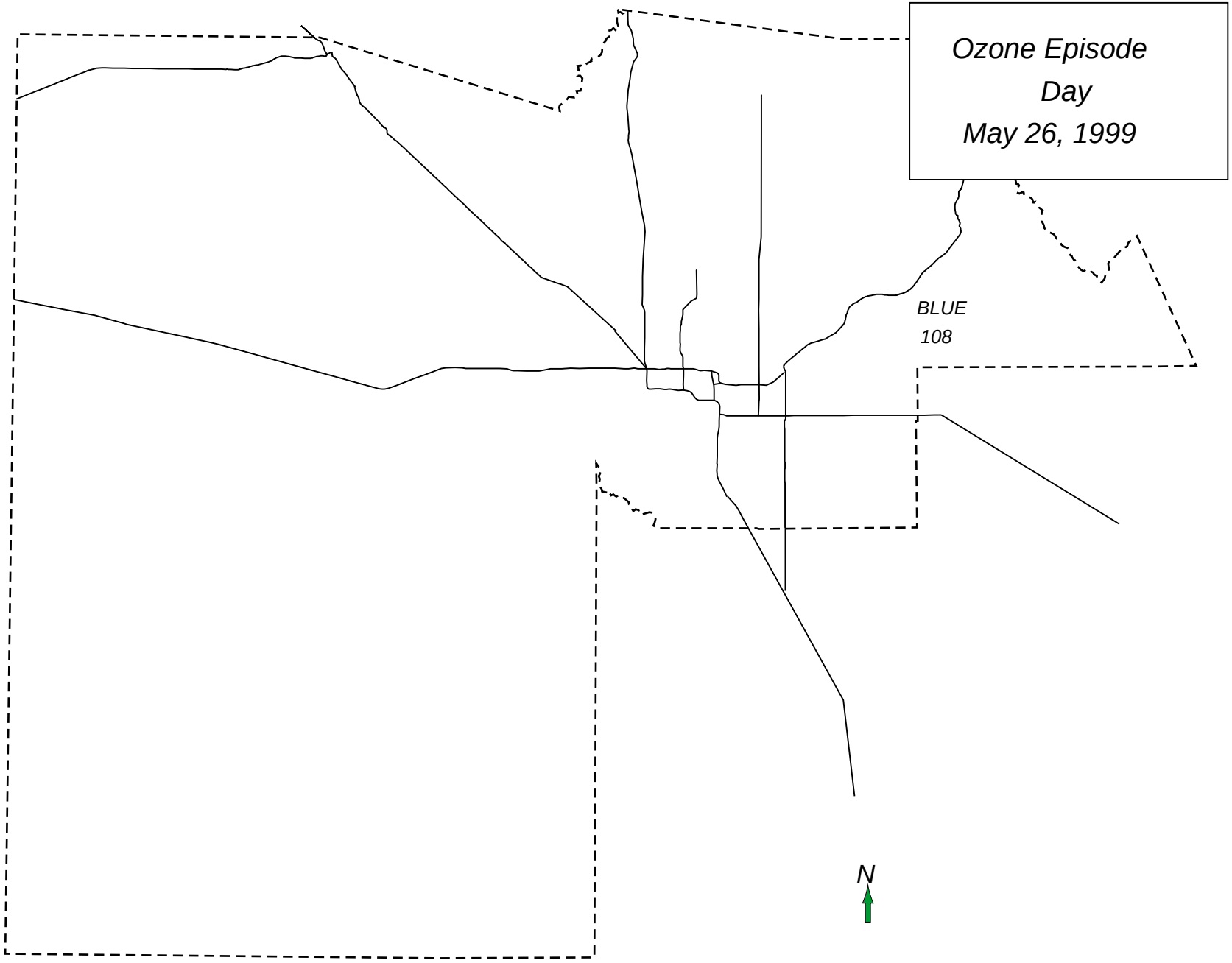

Ozone Episode
Day
August 23, 1998
NPHX
120
WPHX
113
N

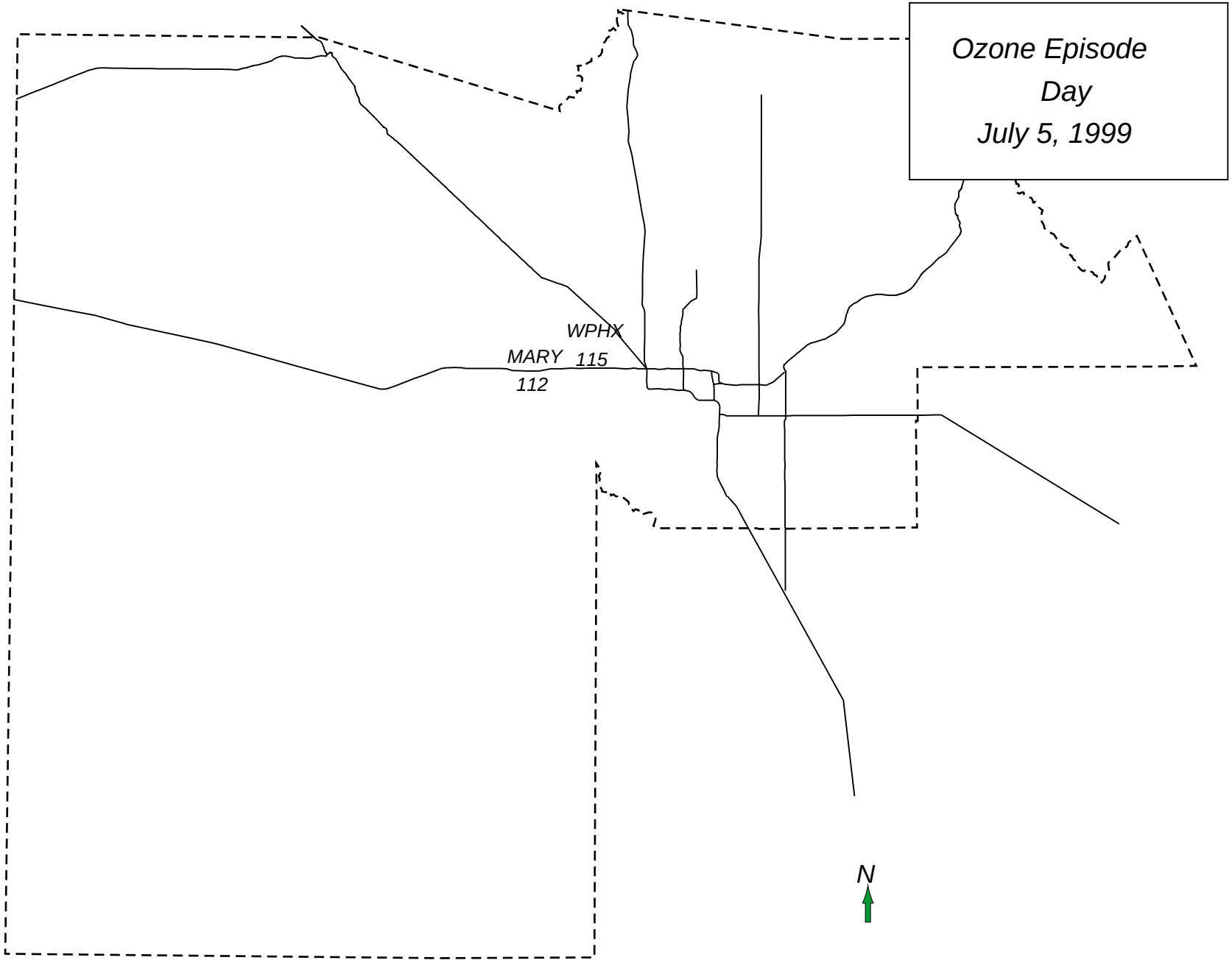

Ozone Episode
Day
August 25, 1998
NPHX
108
SRPI
115
FOUN
124
BLUE
115
FALC
112
N

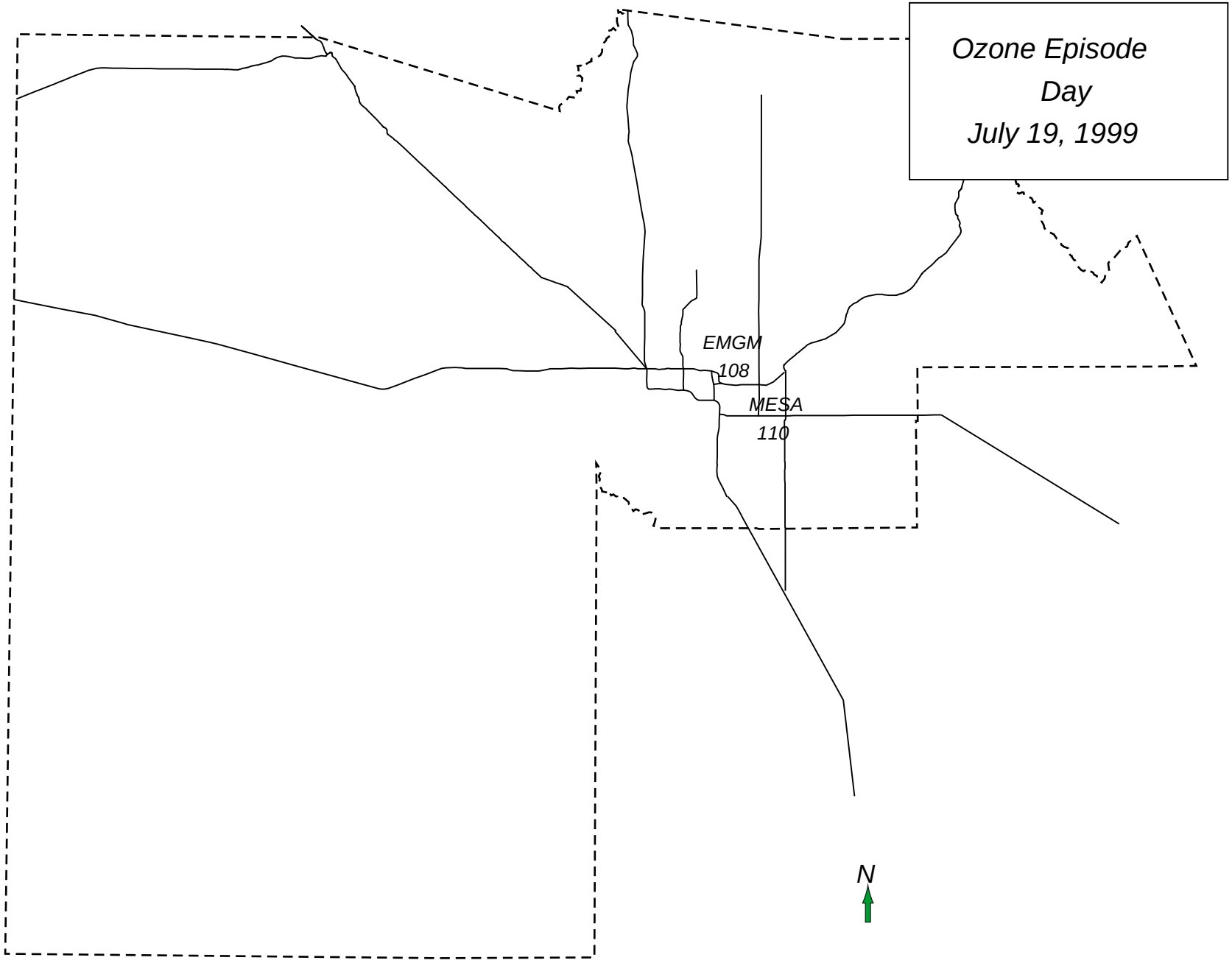

Ozone Episode
Day
August 27, 1998
FOUN
110
N

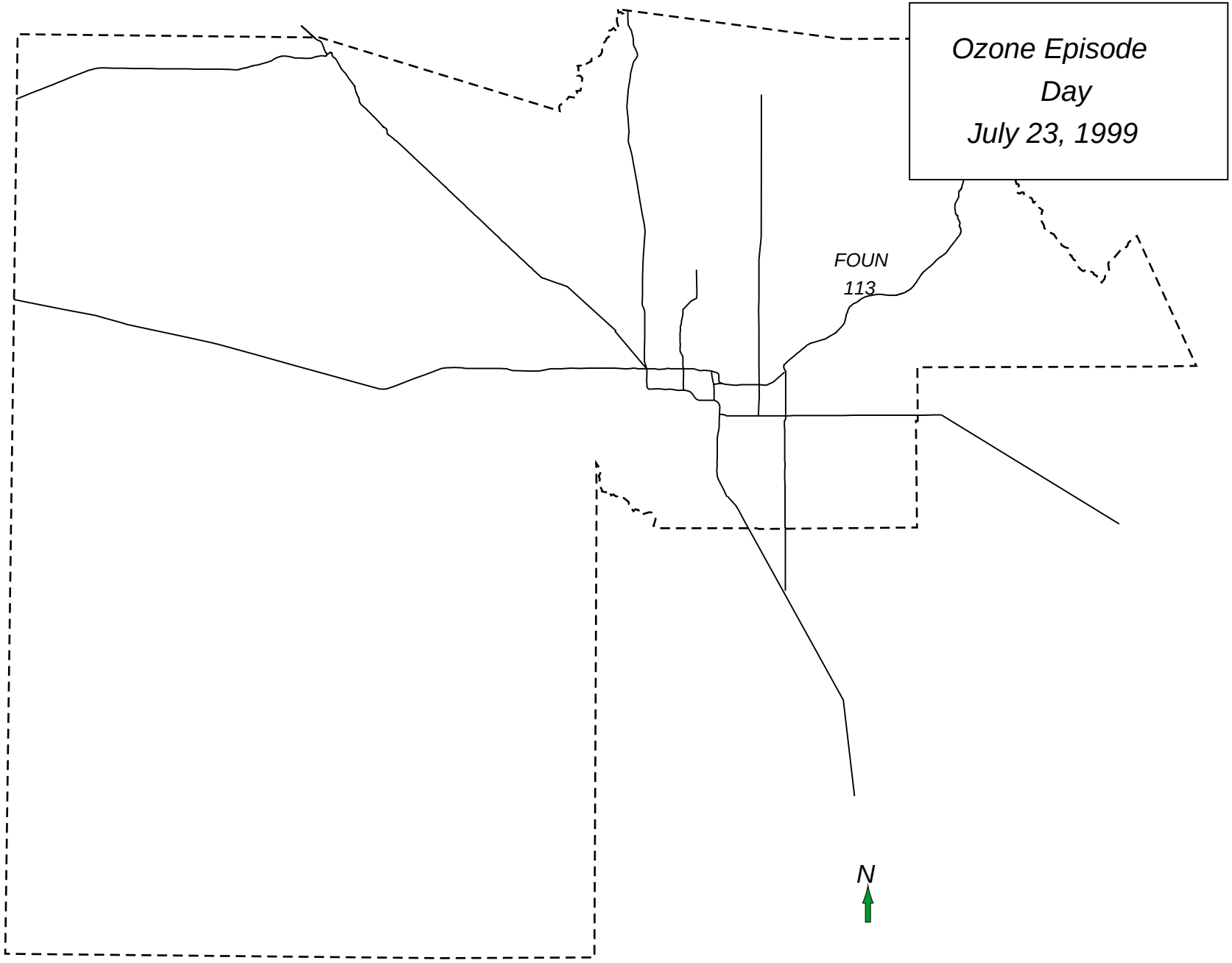

Ozone Episode
Day
August 28, 1998
WPHX
MARY
112
114
N

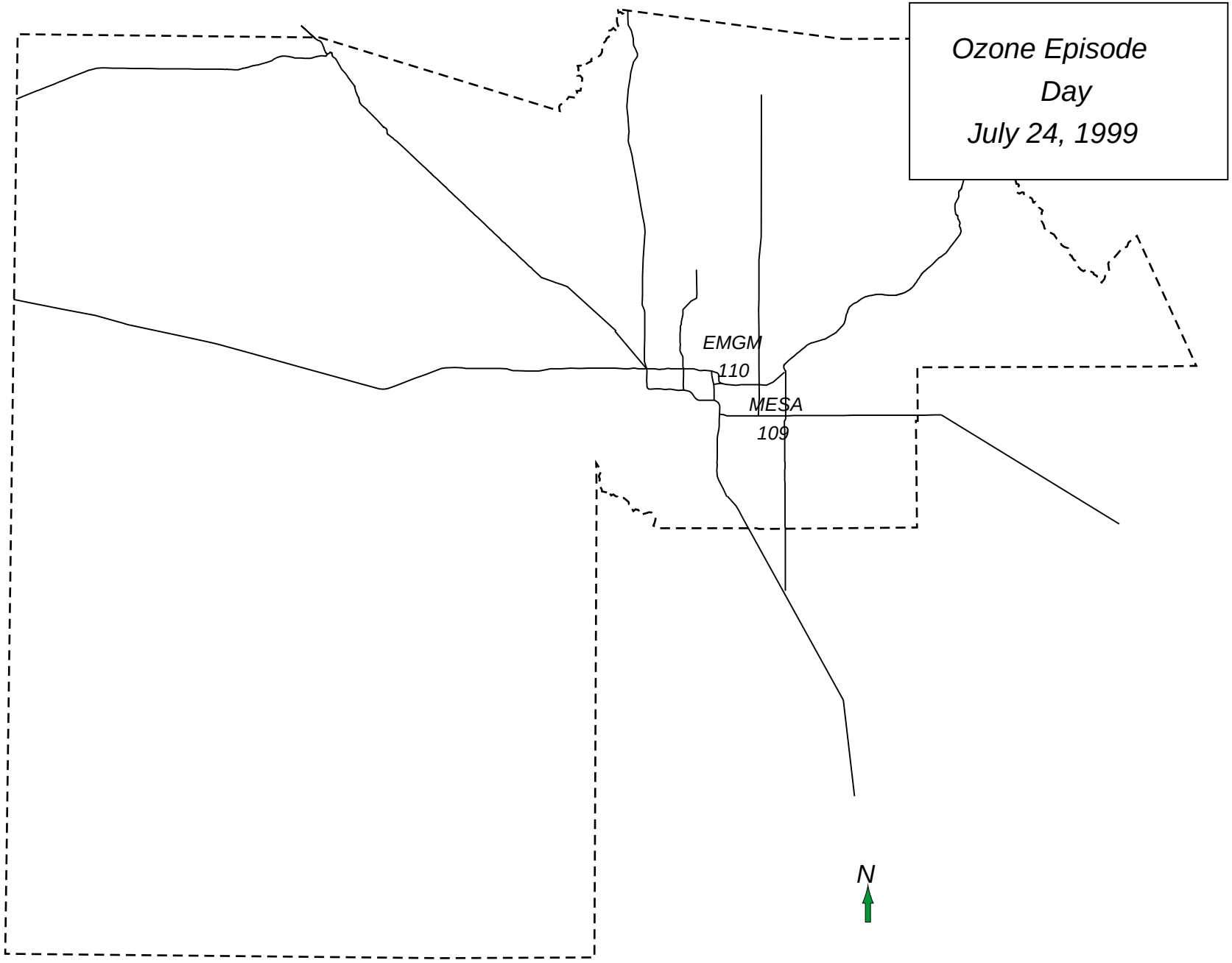

Ozone Episode
Day
September 12, 1998
NPHX
109
N

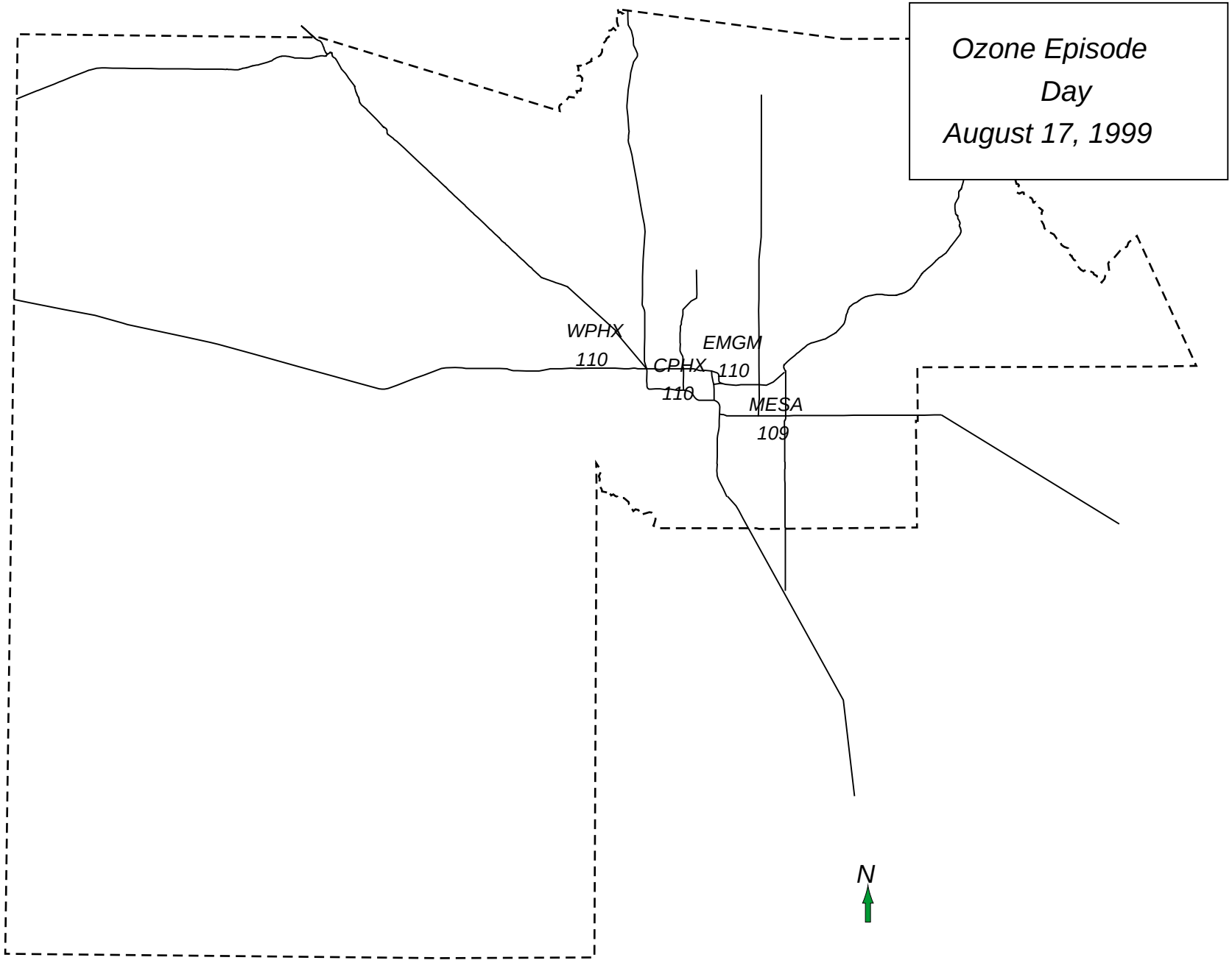

Ozone Episode
Day
May 26, 1999
BLUE
108
N

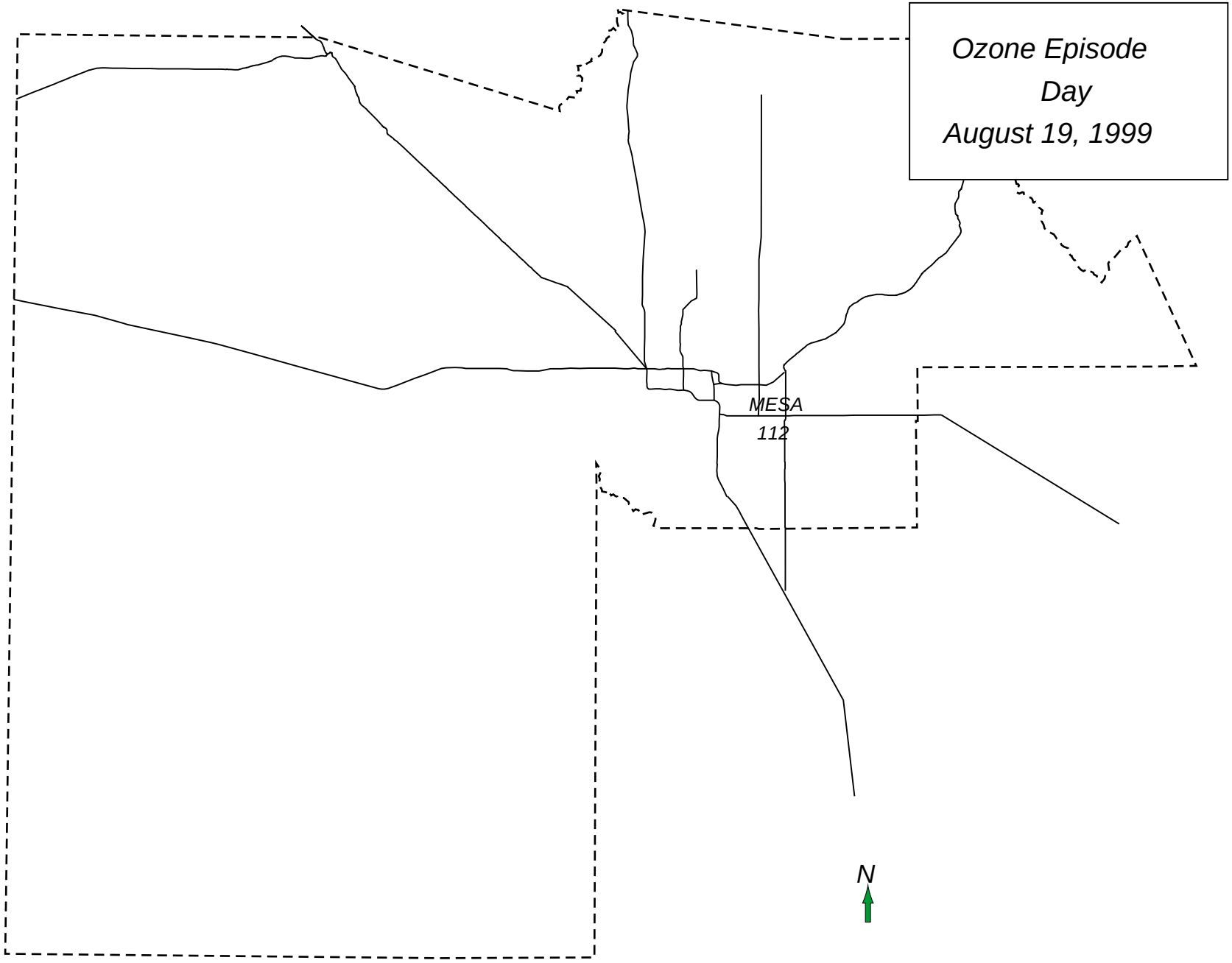

Ozone Episode
Day
July 5, 1999
WPHX
MARY
115
112
N

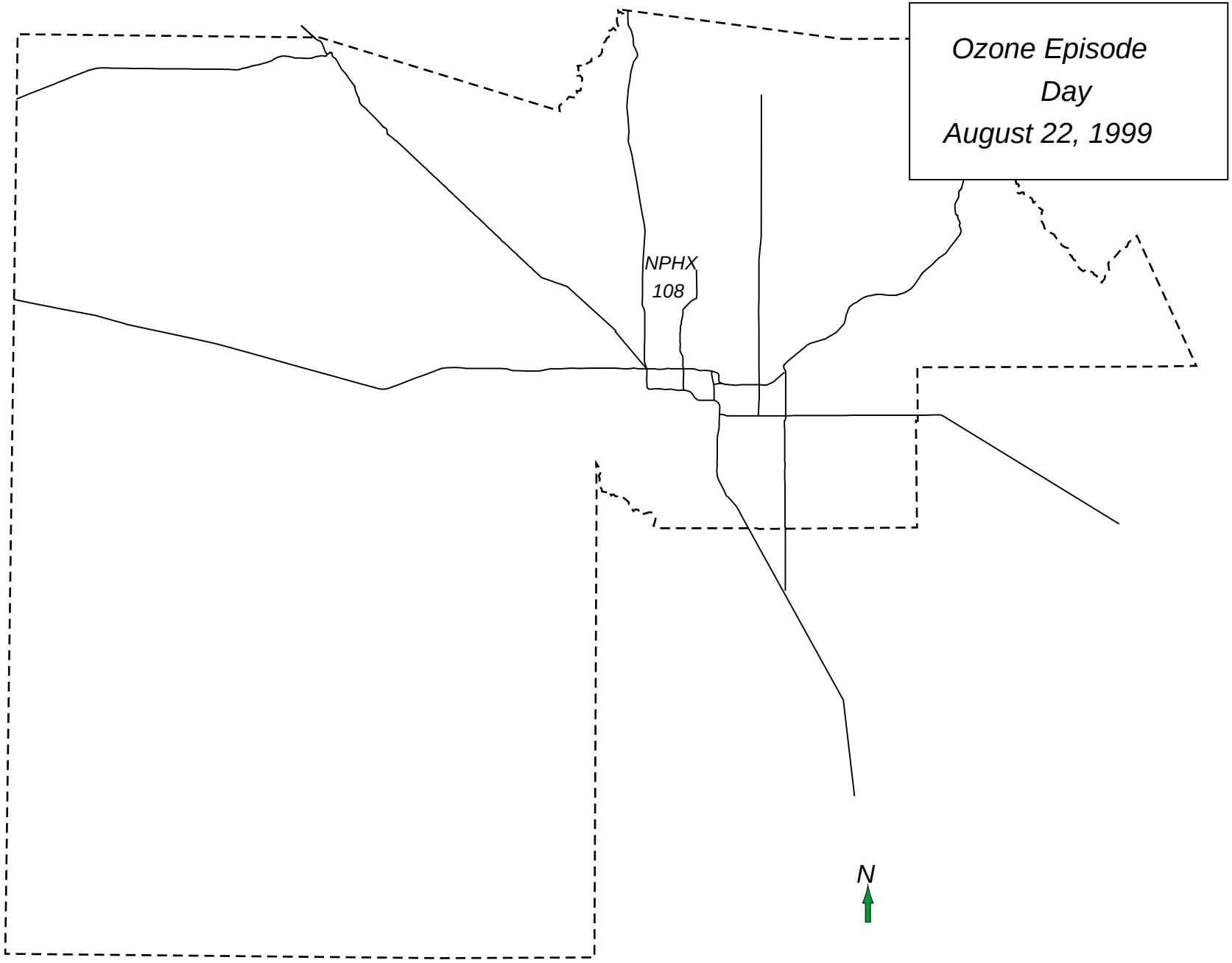

Ozone Episode
Day
July 19, 1999
EMGM
108
MESA
110
N


Ozone Episode
Day
July 23, 1999
FOUN
113
N

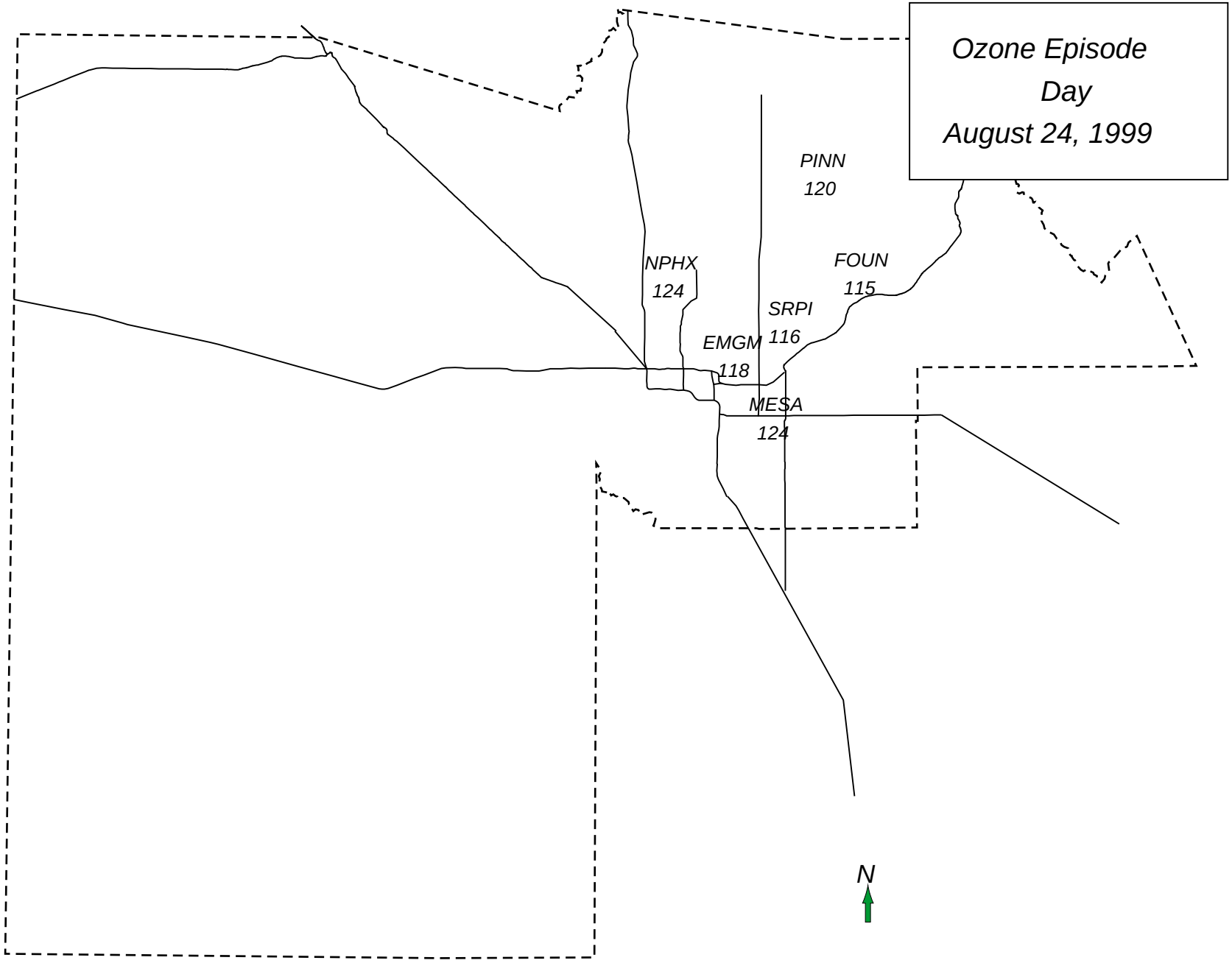

Ozone Episode
Day
July 24, 1999
EMGM
110
MESA
109
N

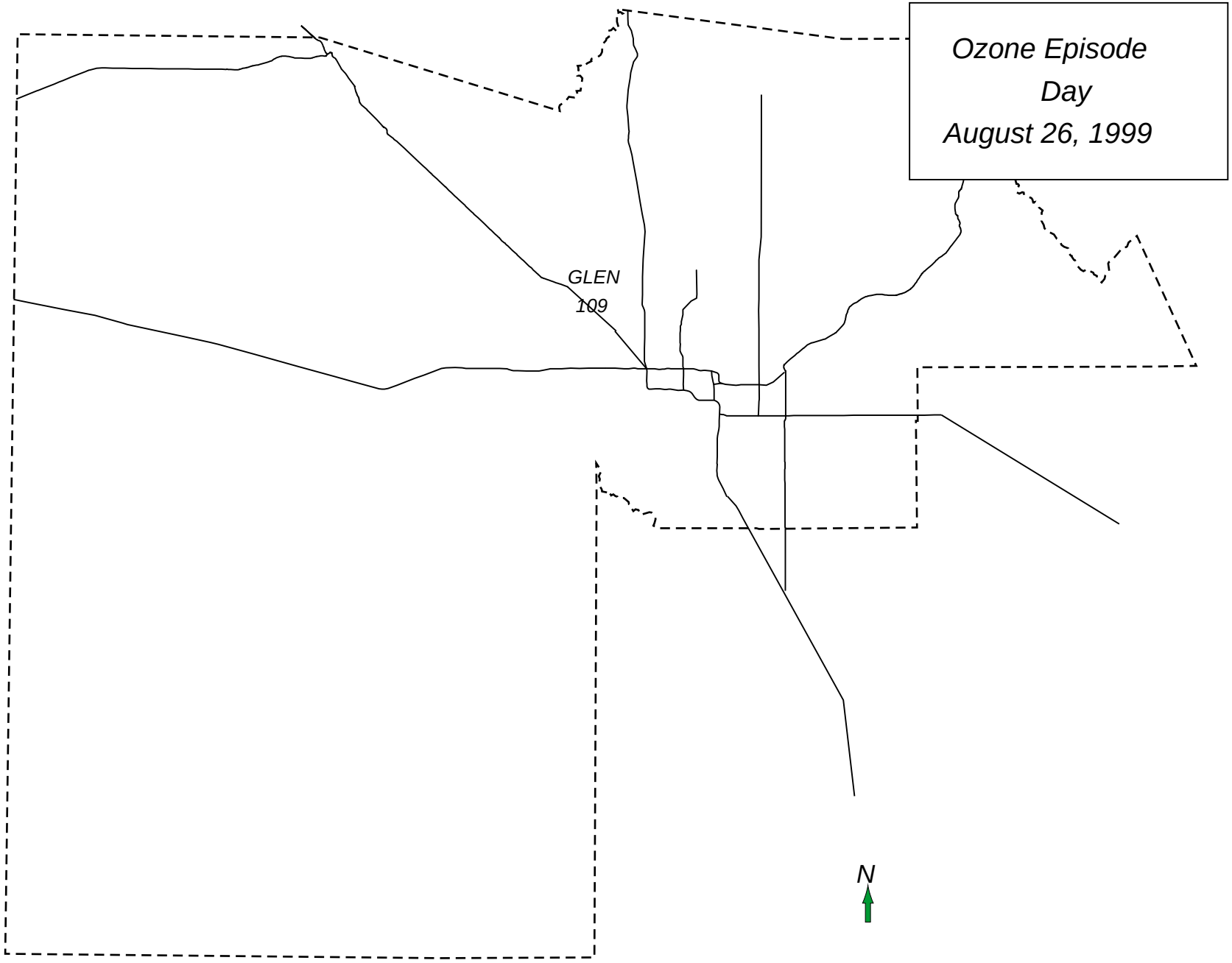

Ozone Episode
Day
August 17, 1999
WPHX
110
CPHX
110
EMGM
110
MESA
109
N

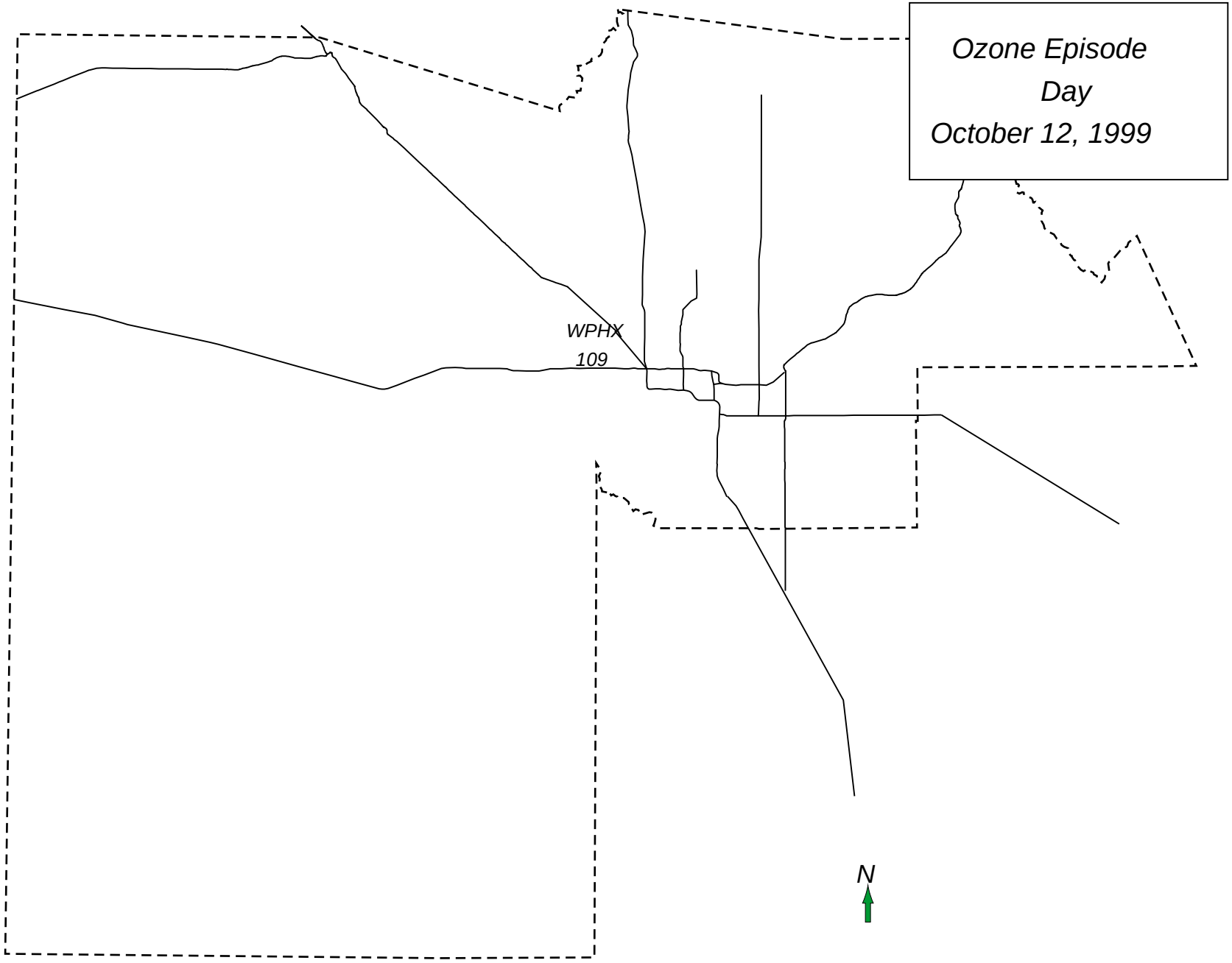

Ozone Episode
Day
August 19, 1999
MESA
112
N

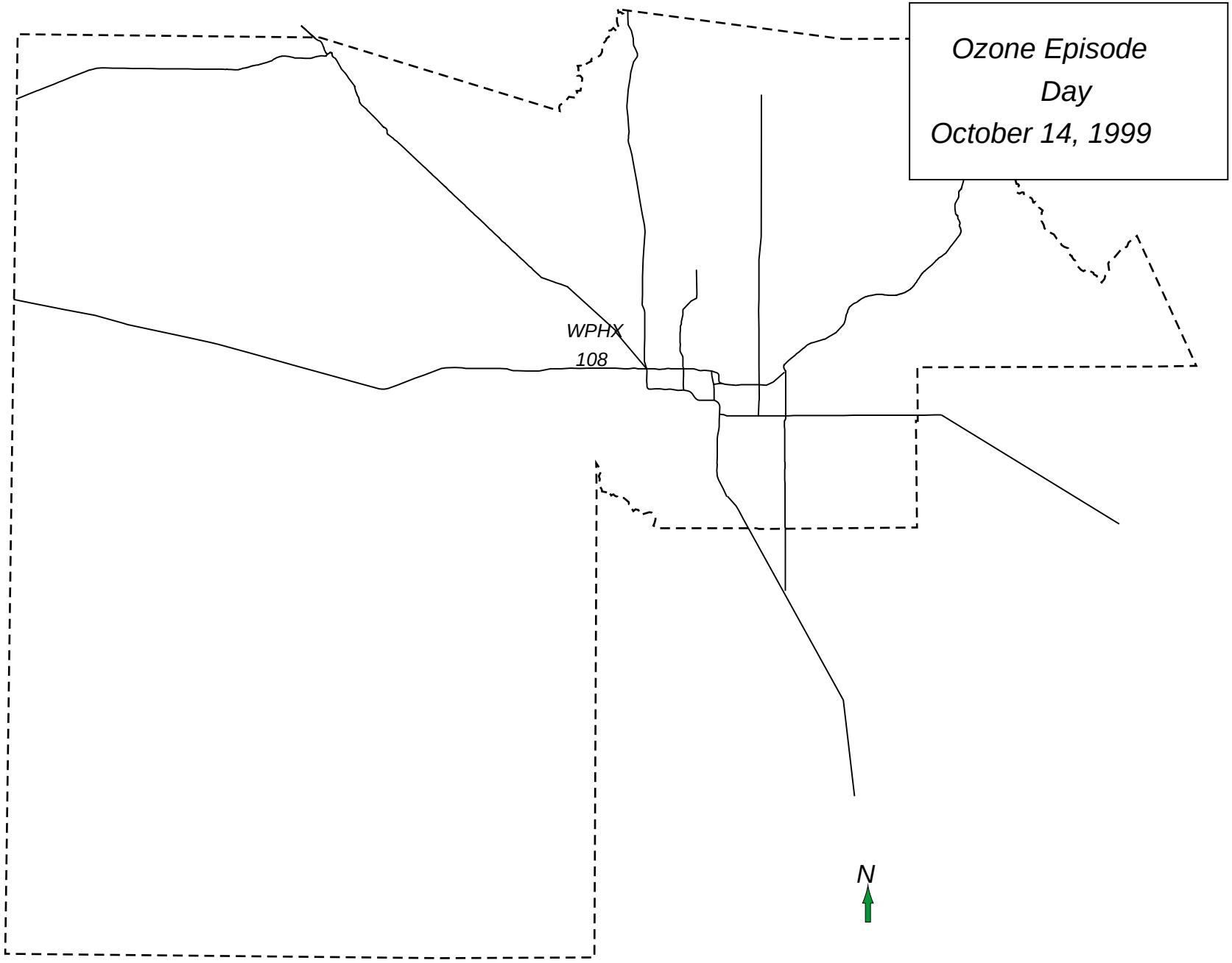

Ozone Episode
Day
August 22, 1999
NPHX
108
N

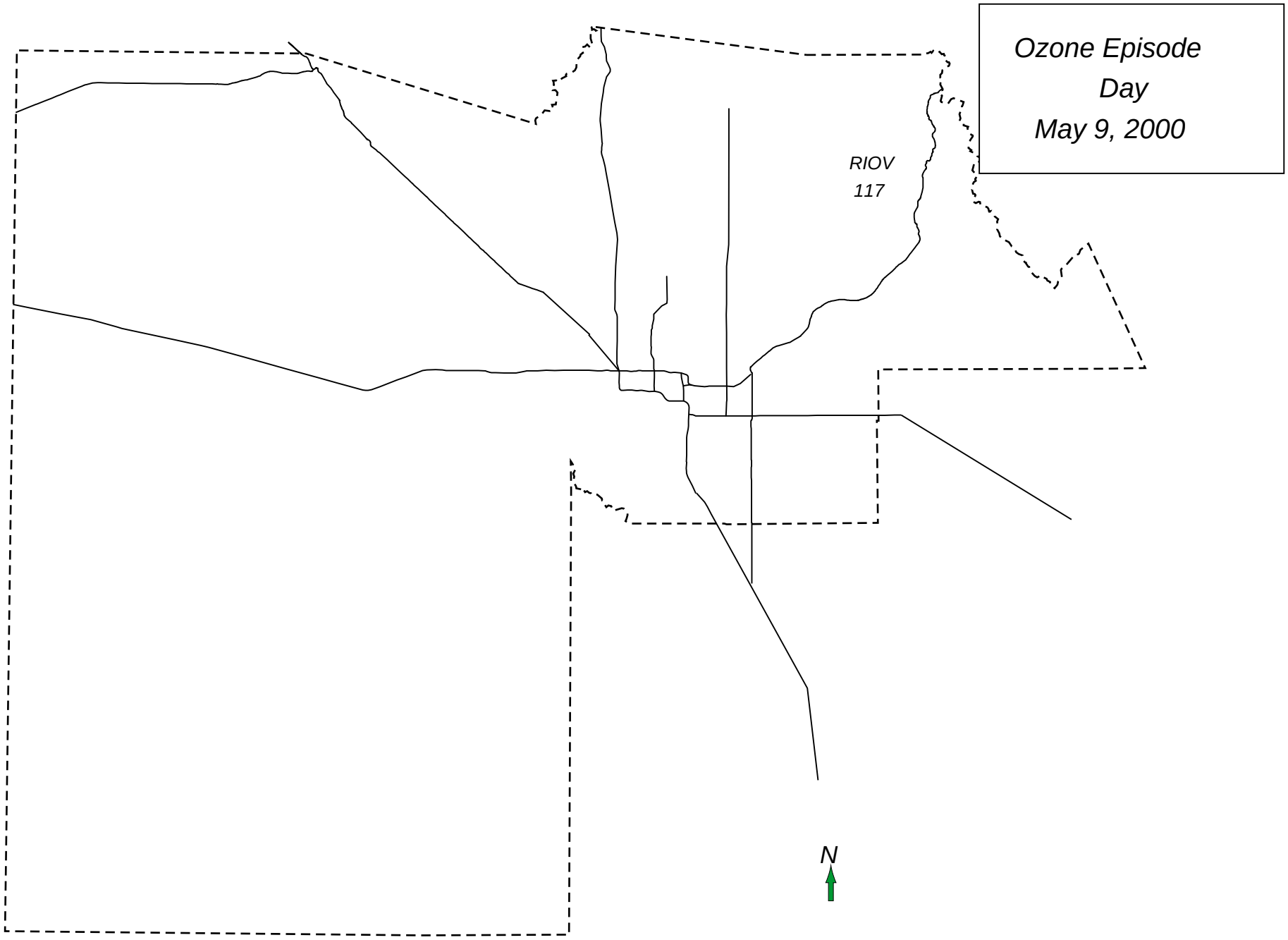
Ozone Episode
Day
August 23, 1999
PINN
119
RIOV
112
N


Ozone Episode
Day
August 24, 1999
PINN
120
NPHX
124
FOUN
115
SRPI
116
EMGM
118
MESA
124
N

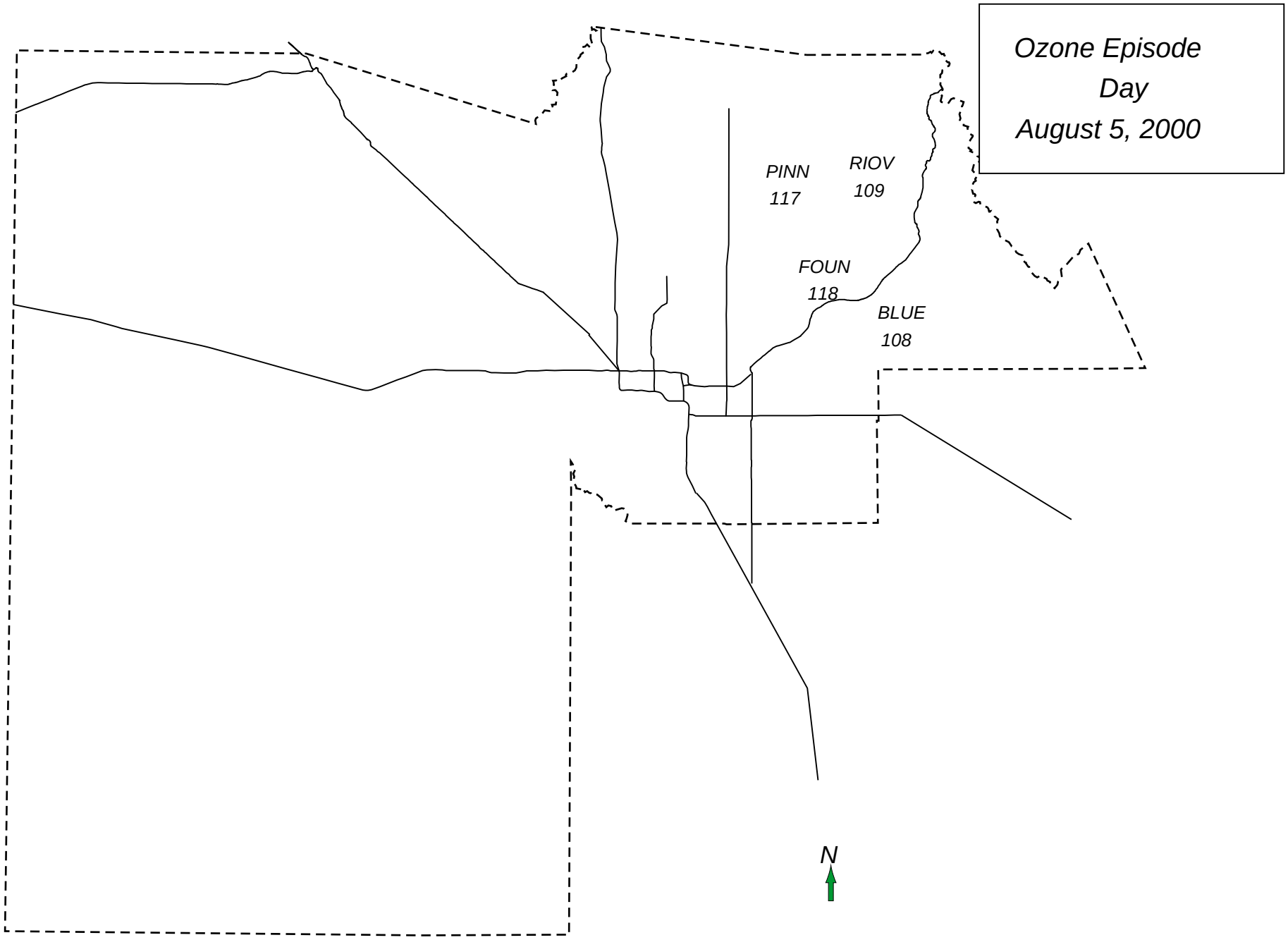

Ozone Episode
Day
August 26, 1999
GLEN
109
N

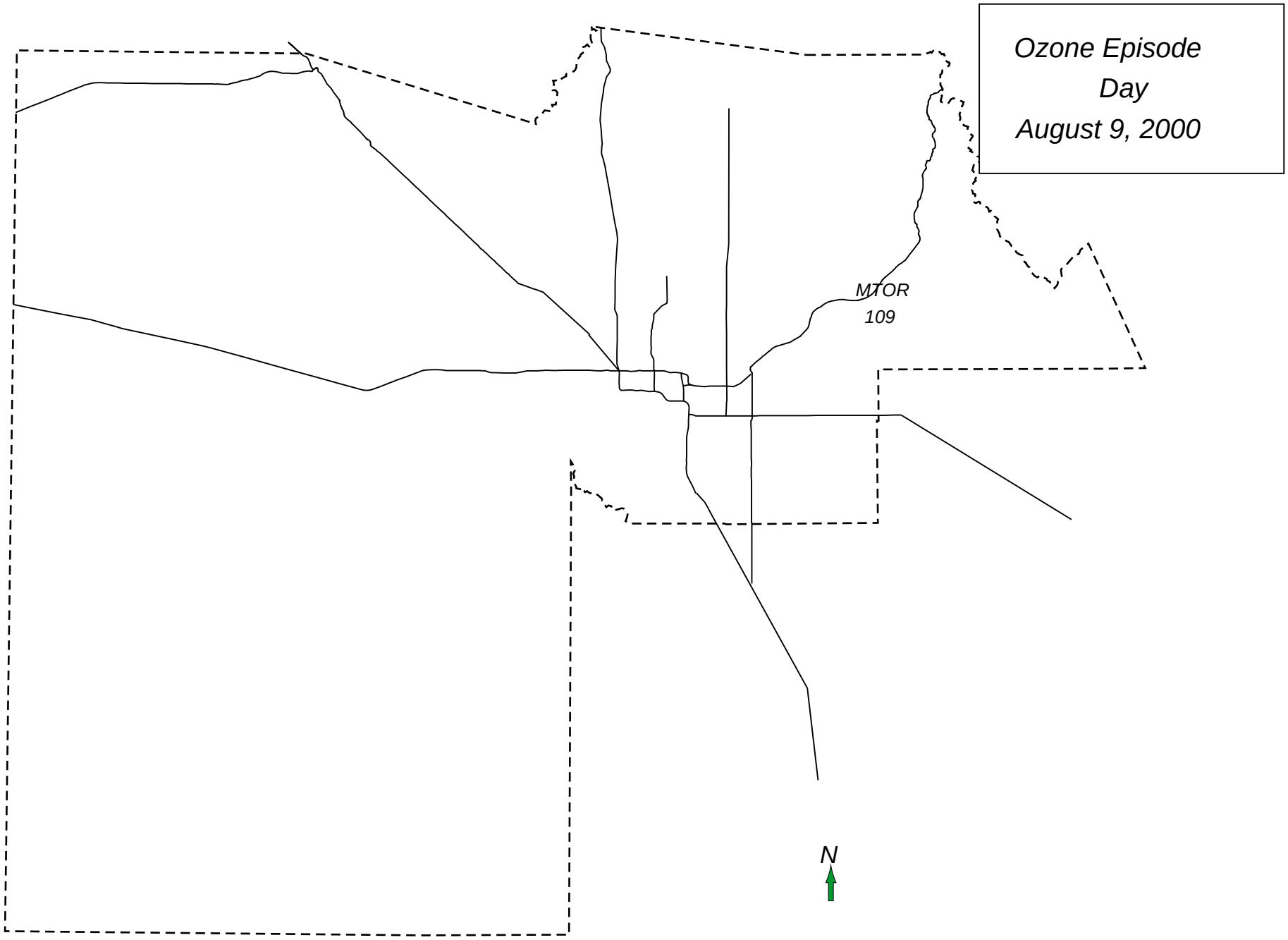

Ozone Episode
Day
October 12, 1999
WPHX
109
N

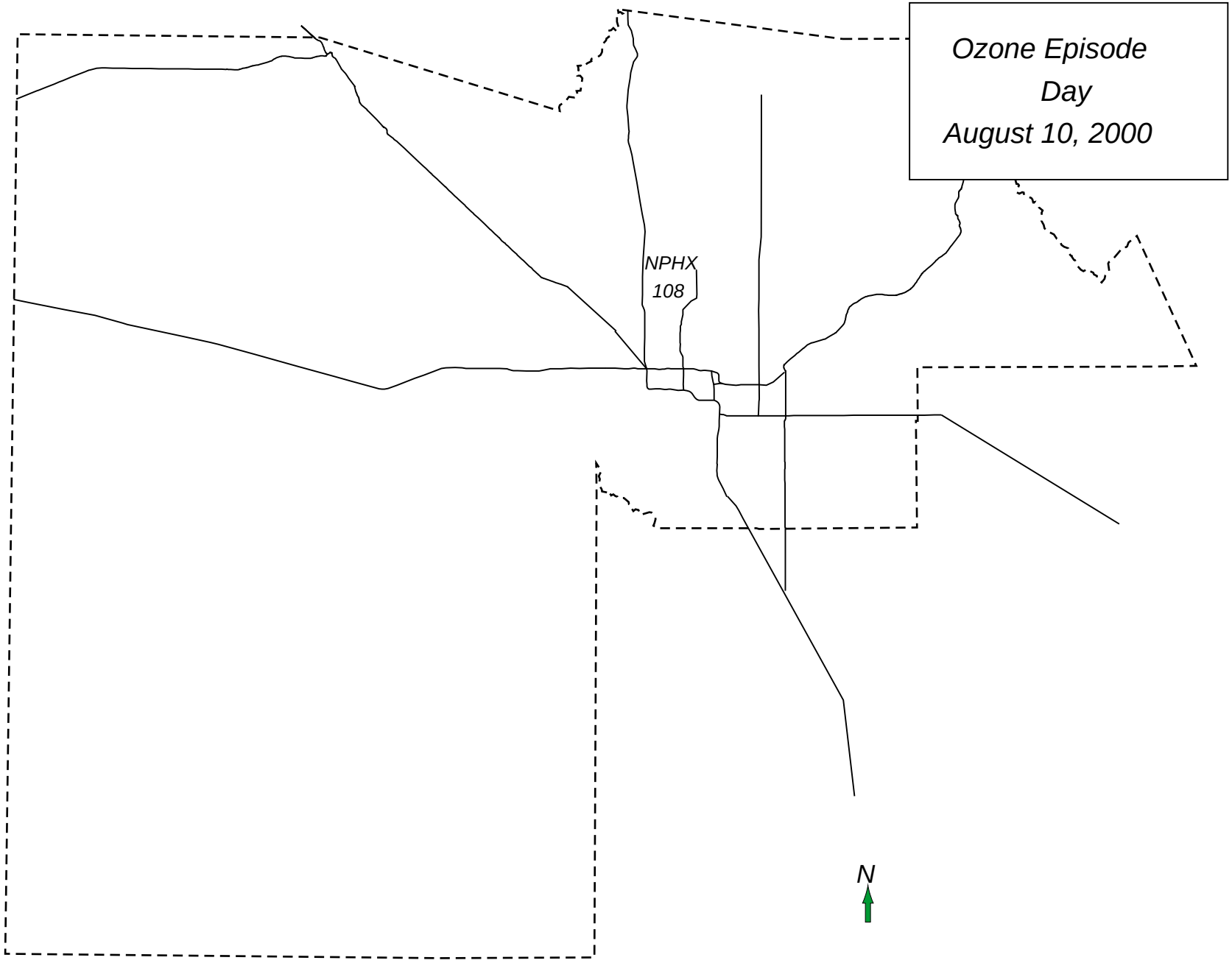

Ozone Episode
Day
October 14, 1999
WPHX
108
N


Ozone Episode
Day
May 9, 2000
RIOV
117
N

Ozone Episode
Day
August 1, 2000
MTOR
111
N


Ozone Episode
Day
August 5, 2000
PINN
117
RIOV
109
FOUN
118
BLUE
108
N


Ozone Episode
Day
August 9, 2000
MTOR
109
N


Ozone Episode
Day
August 10, 2000
NPHX
108
N

ATTACHMENT III

Emission Density Plots

Source: “Revision to the Modeling Attainment Demonstration for the MAG 1993 Ozone Plan for the Maricopa County Area and Addendum”, March 1995.

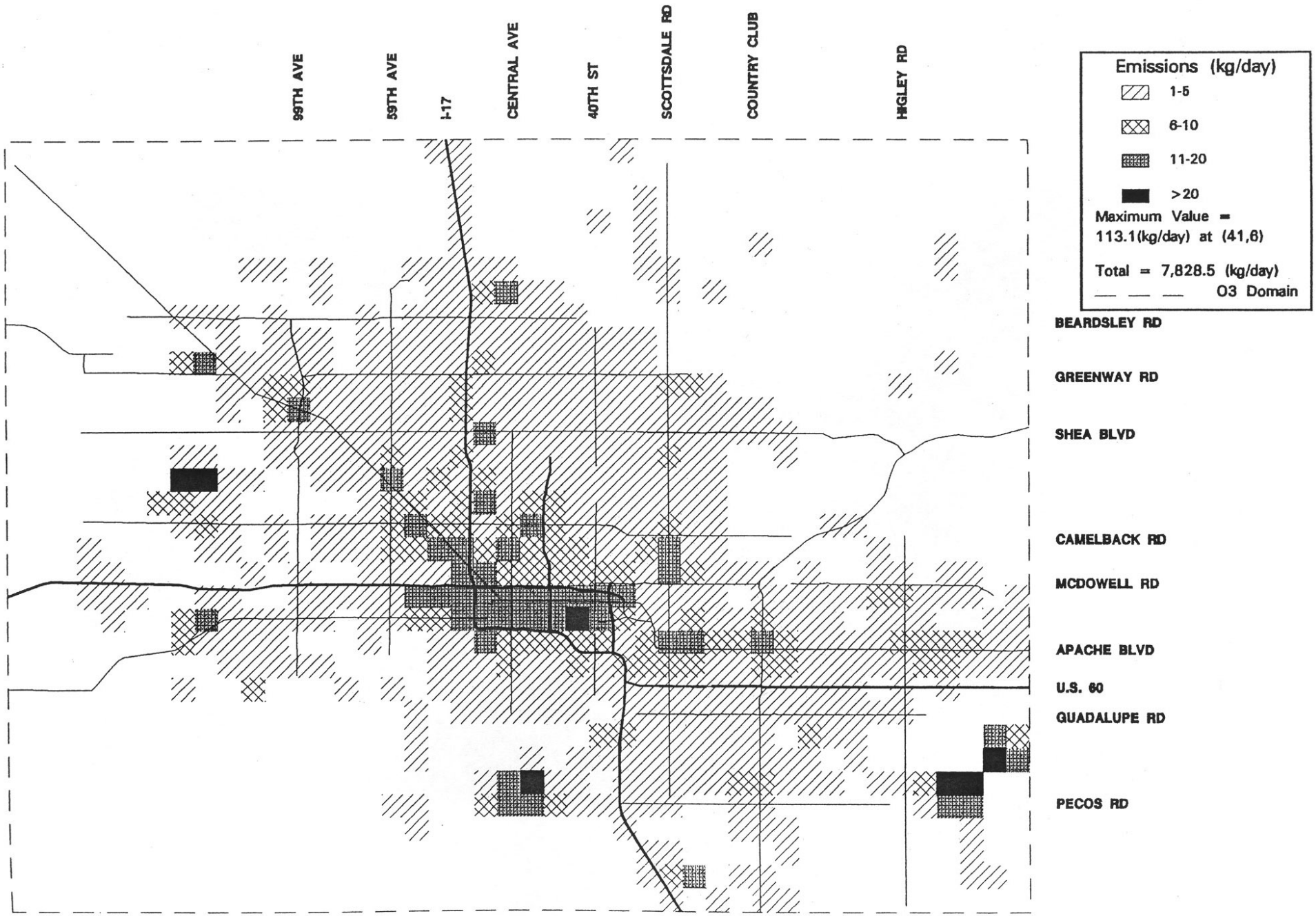



FIGURE 3-3a. NOx Area Source Emissions for August 10, 1992.

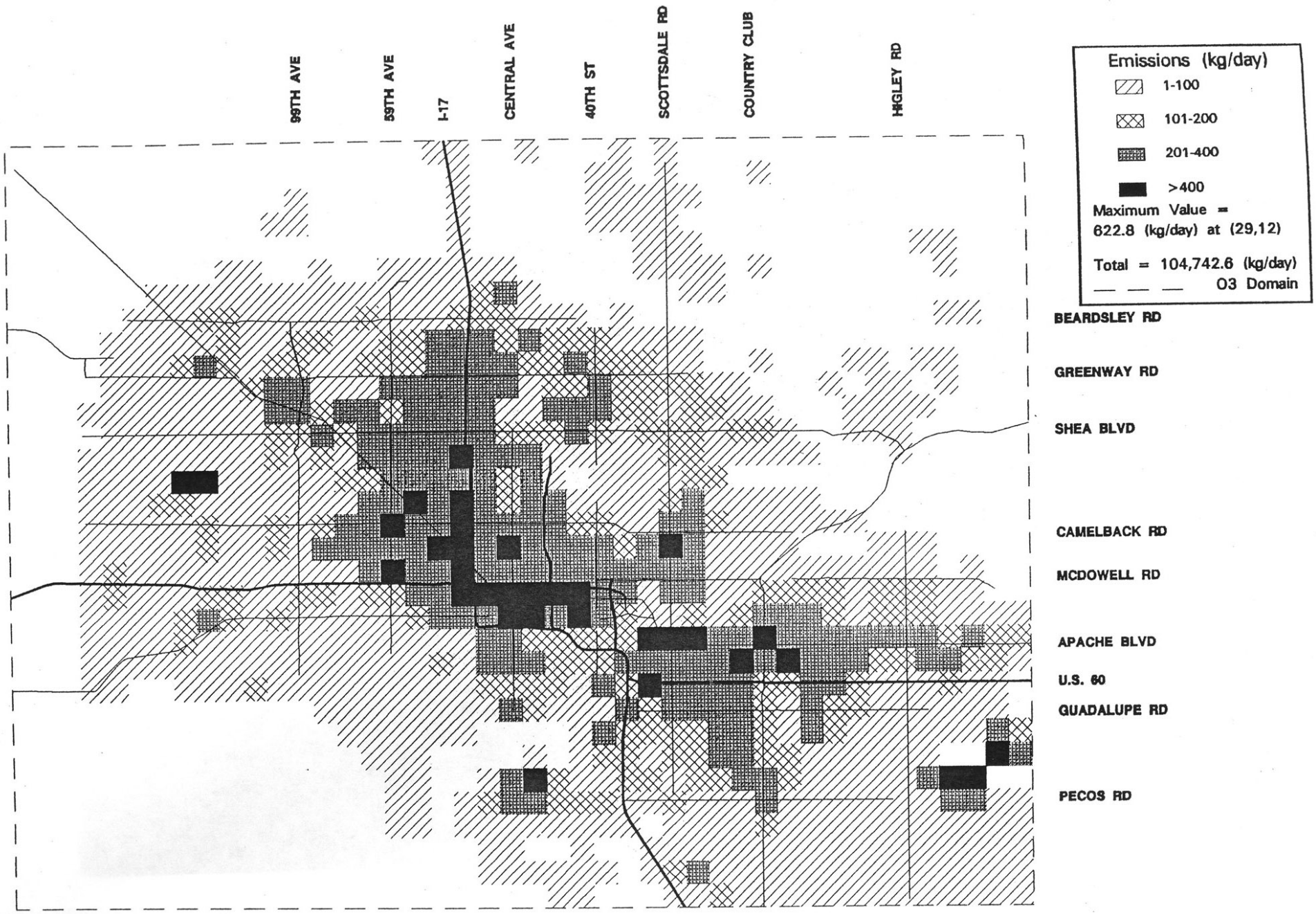



FIGURE 3-3b. RHC Area Source Emissions for August 10, 1992.

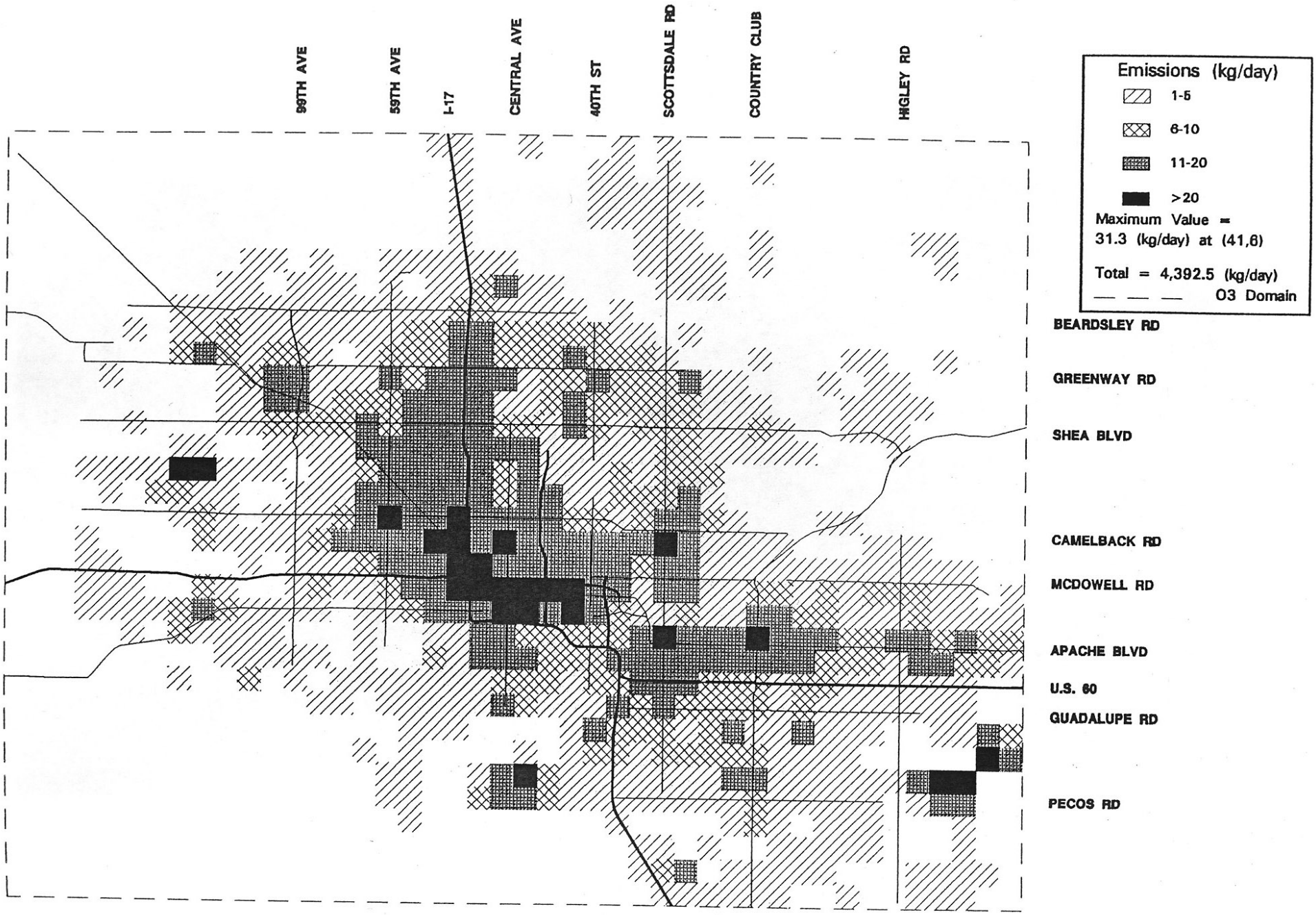



FIGURE 3-3c. CO Area Source Emissions for August 10, 1992.

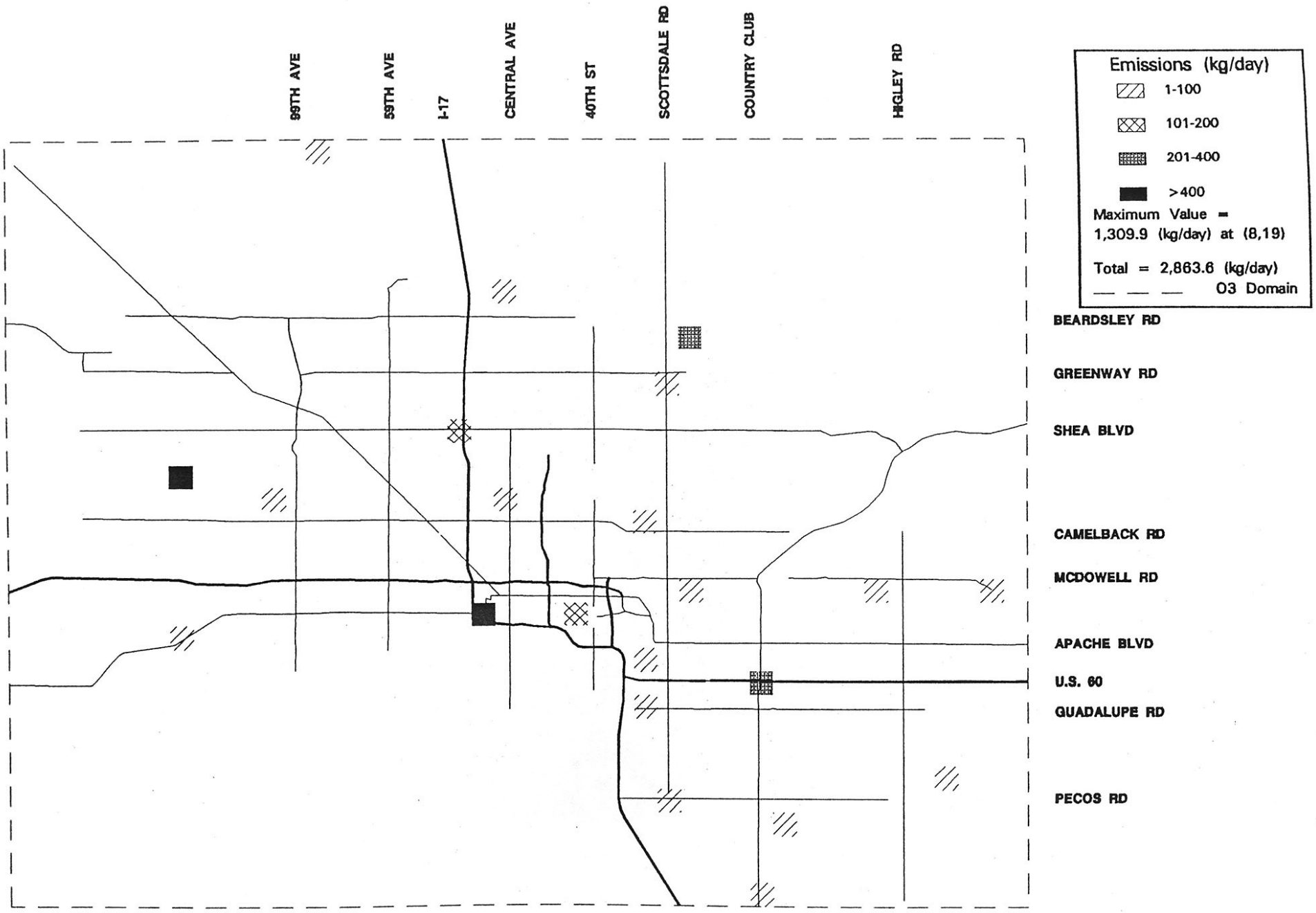



FIGURE 3-4a. NOx Low-Level Point Source Emissions for August 10, 1992.

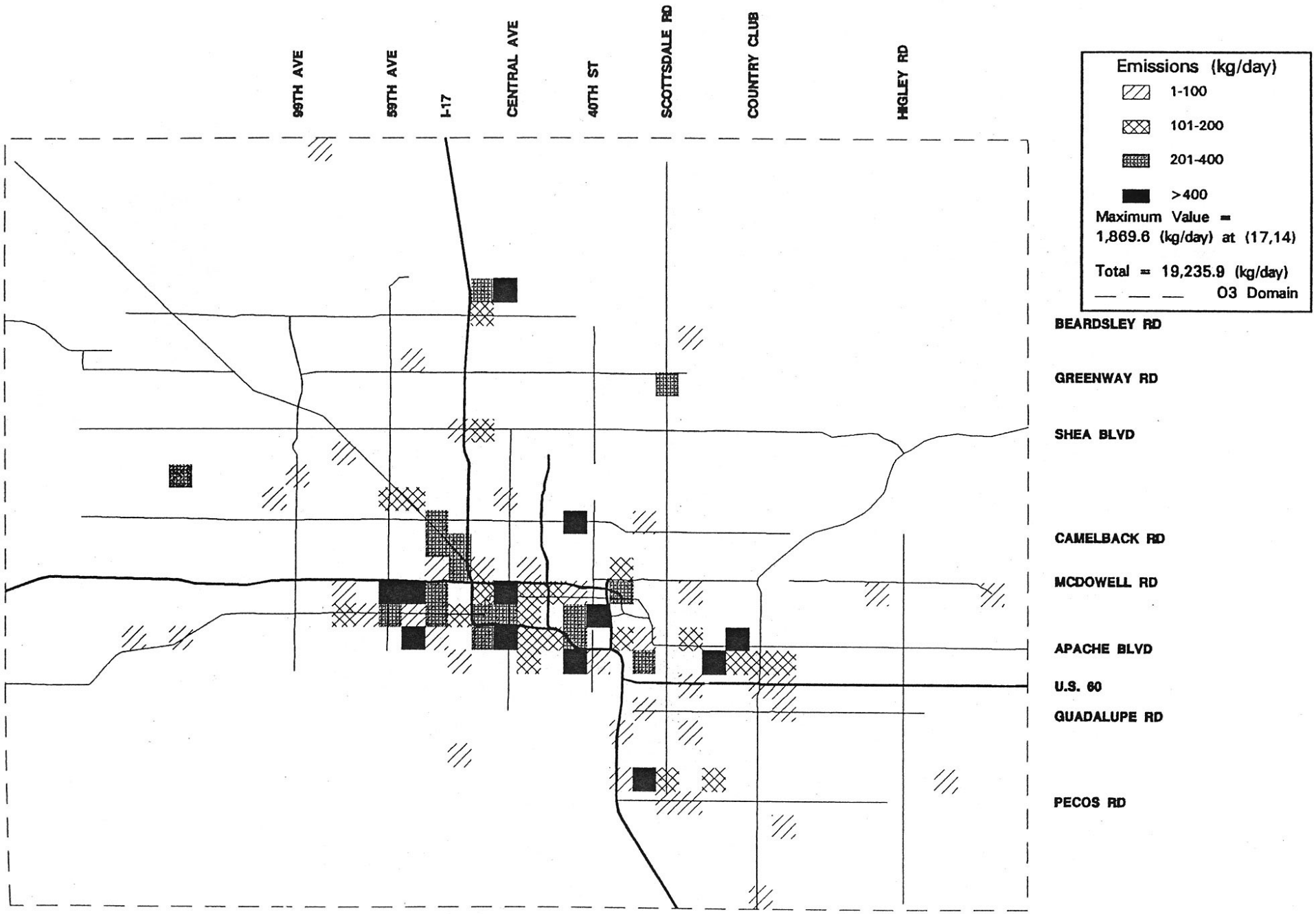



FIGURE 3-4b. RHC Low-Level Point Source Emissions for August 10, 1992.

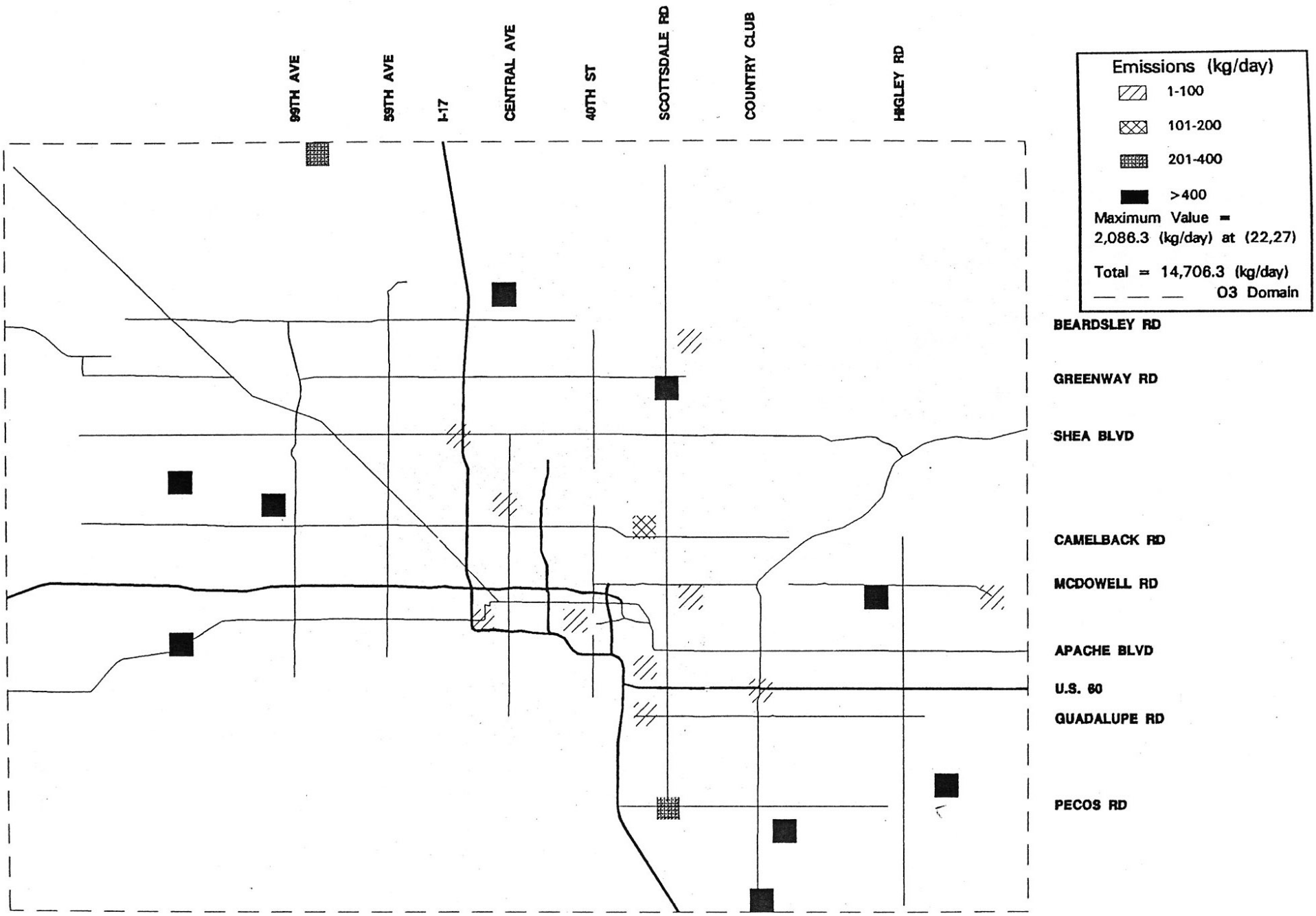



FIGURE 3-4c. CO Low-Level Point Source Emissions for August 10, 1992.

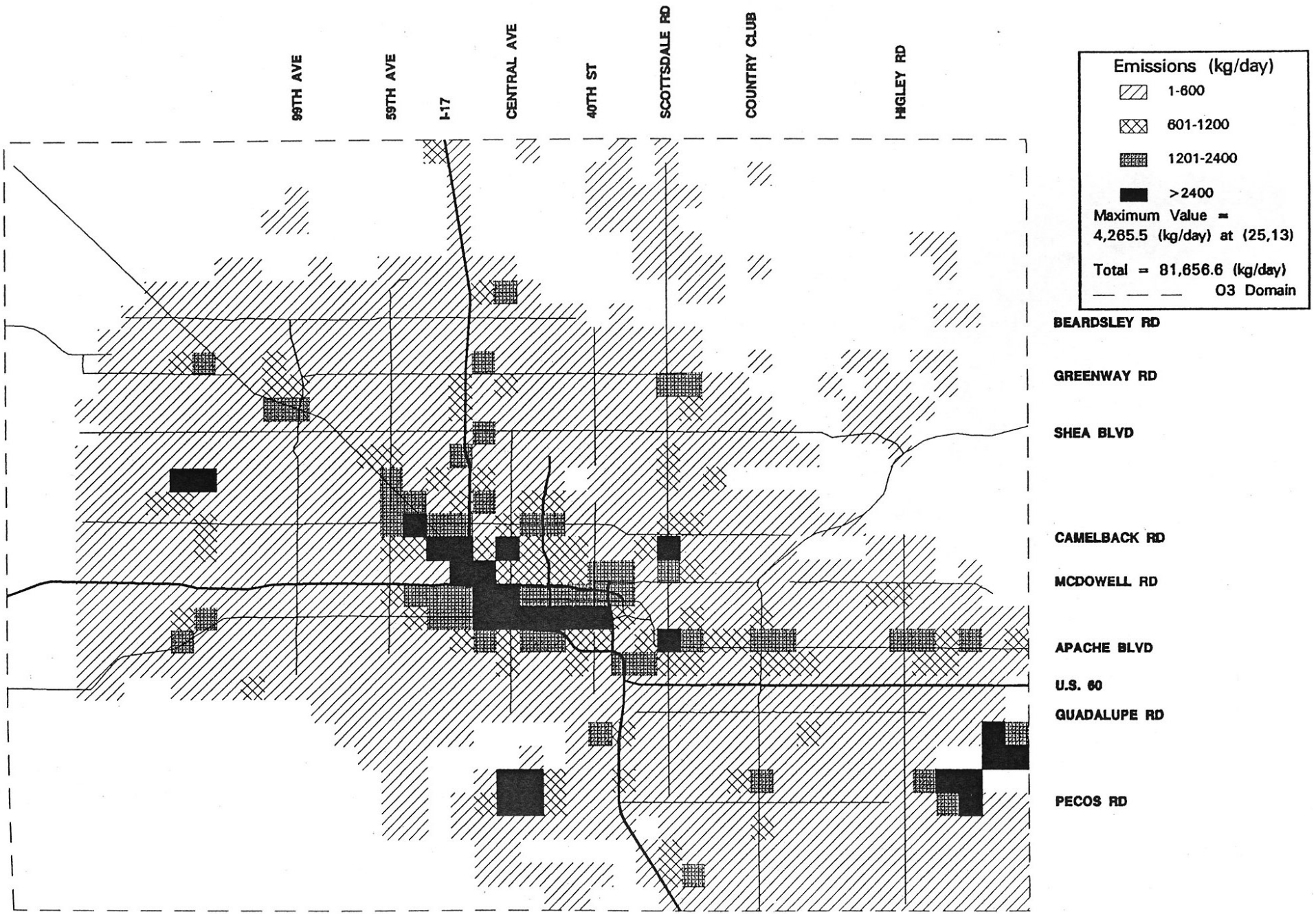



FIGURE 3-5a. NOx Nonroad Mobile Source Emissions for August 10, 1992.

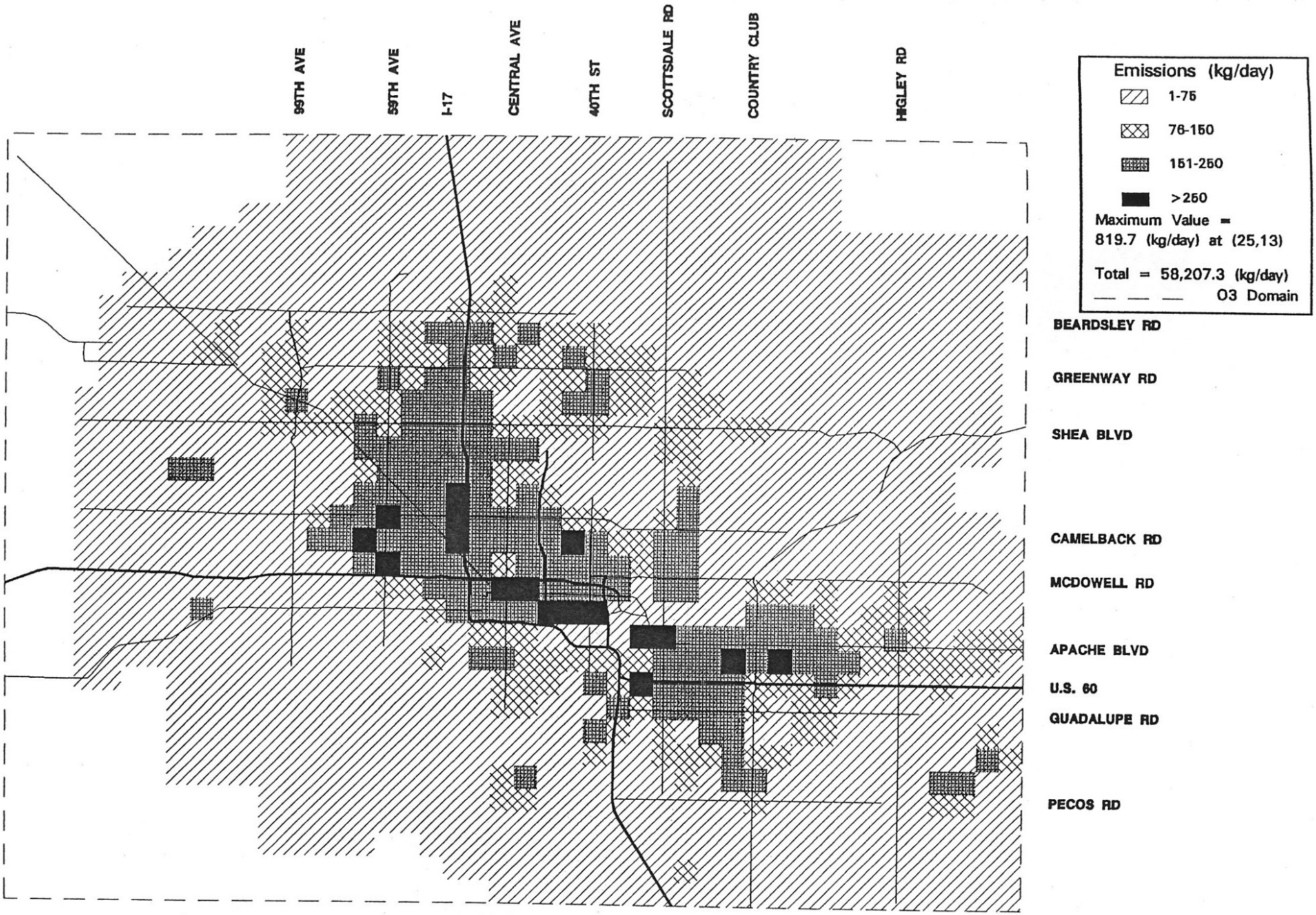



FIGURE 3-5b. RHC Nonroad Mobile Source Emissions for August 10, 1992.

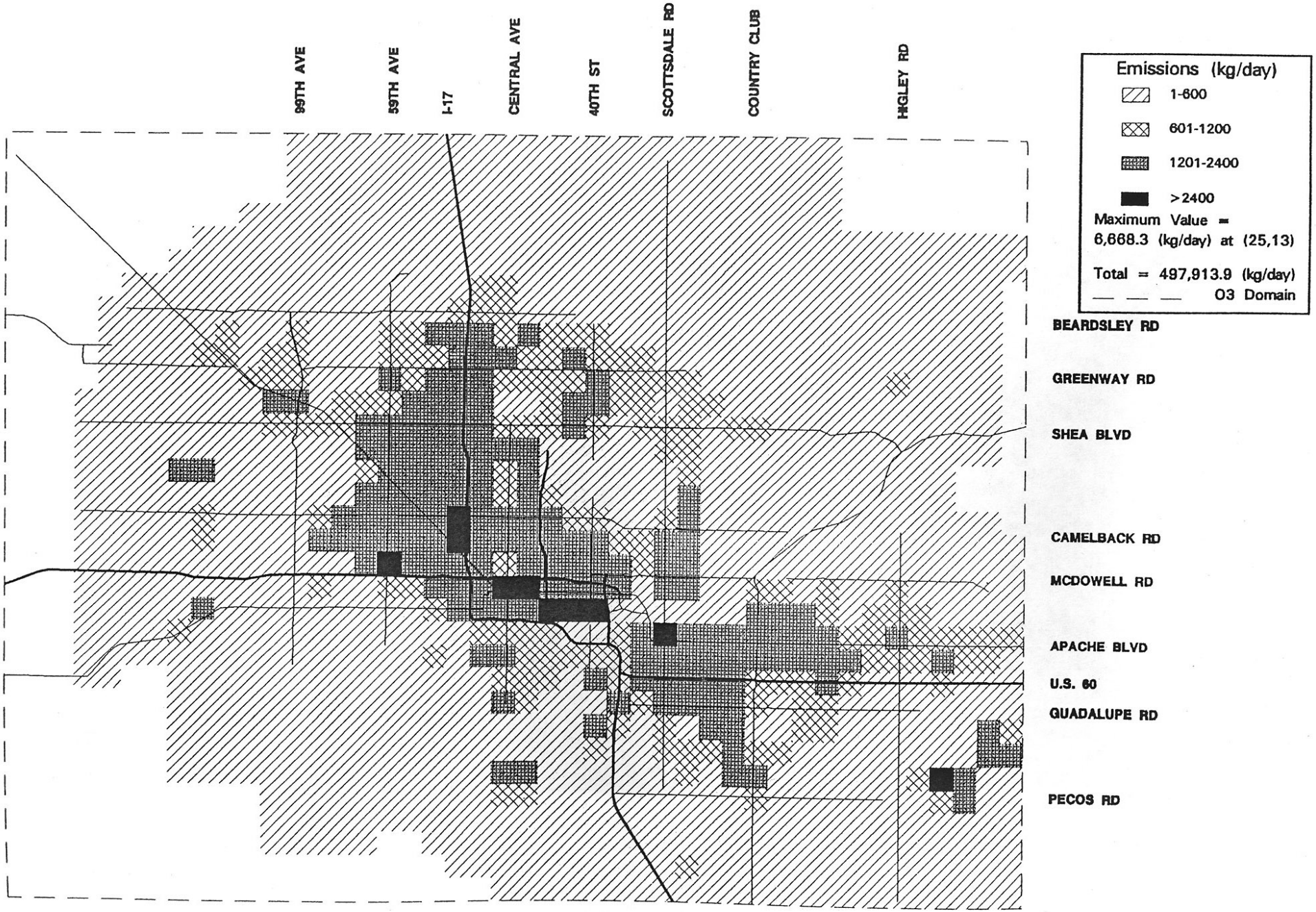



FIGURE 3-5c. CO Nonroad Mobile Source Emissions for August 10, 1992.

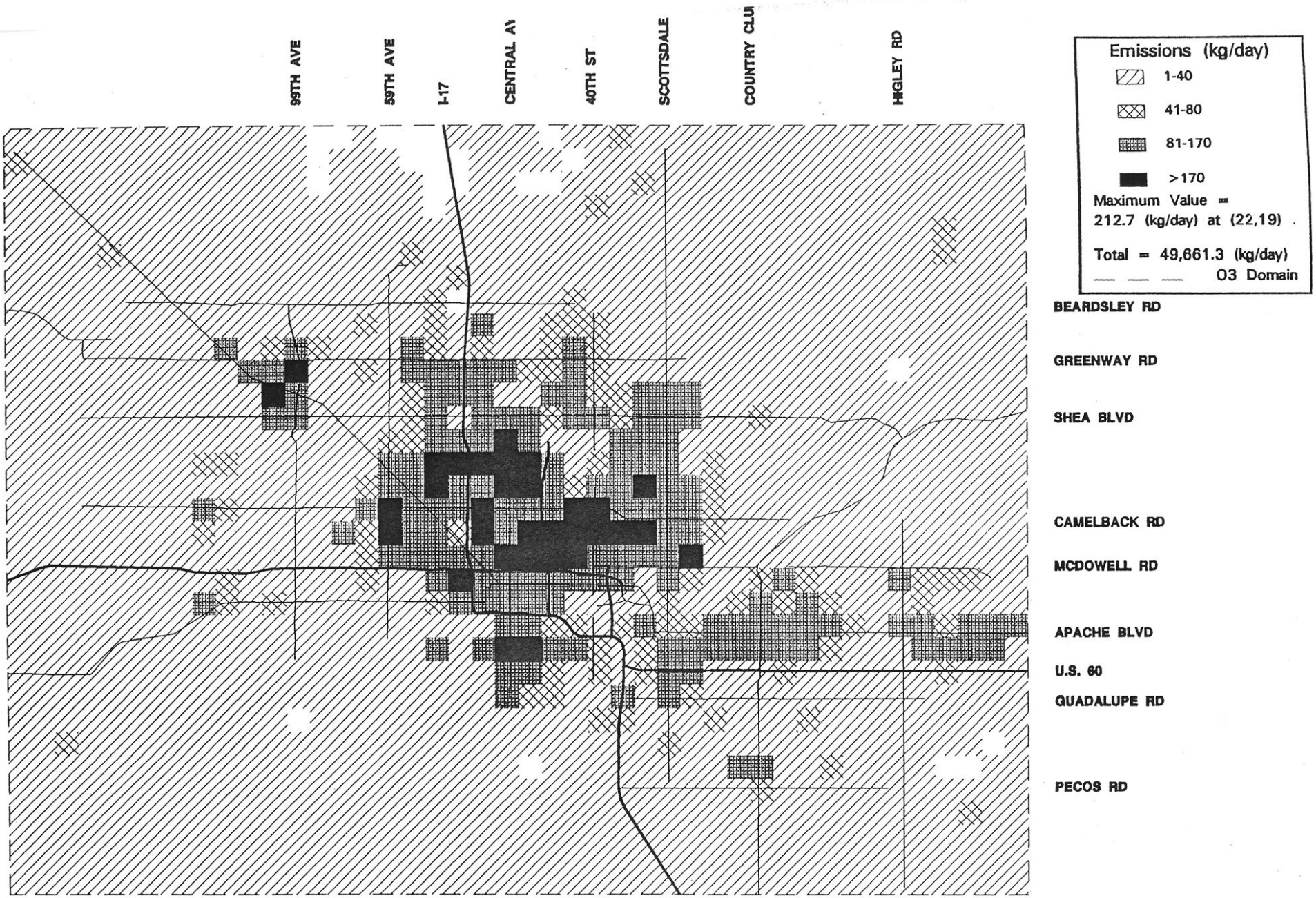



FIGURE 3-6a. RHC Biogenic Source Emissions for August 10, 1992.

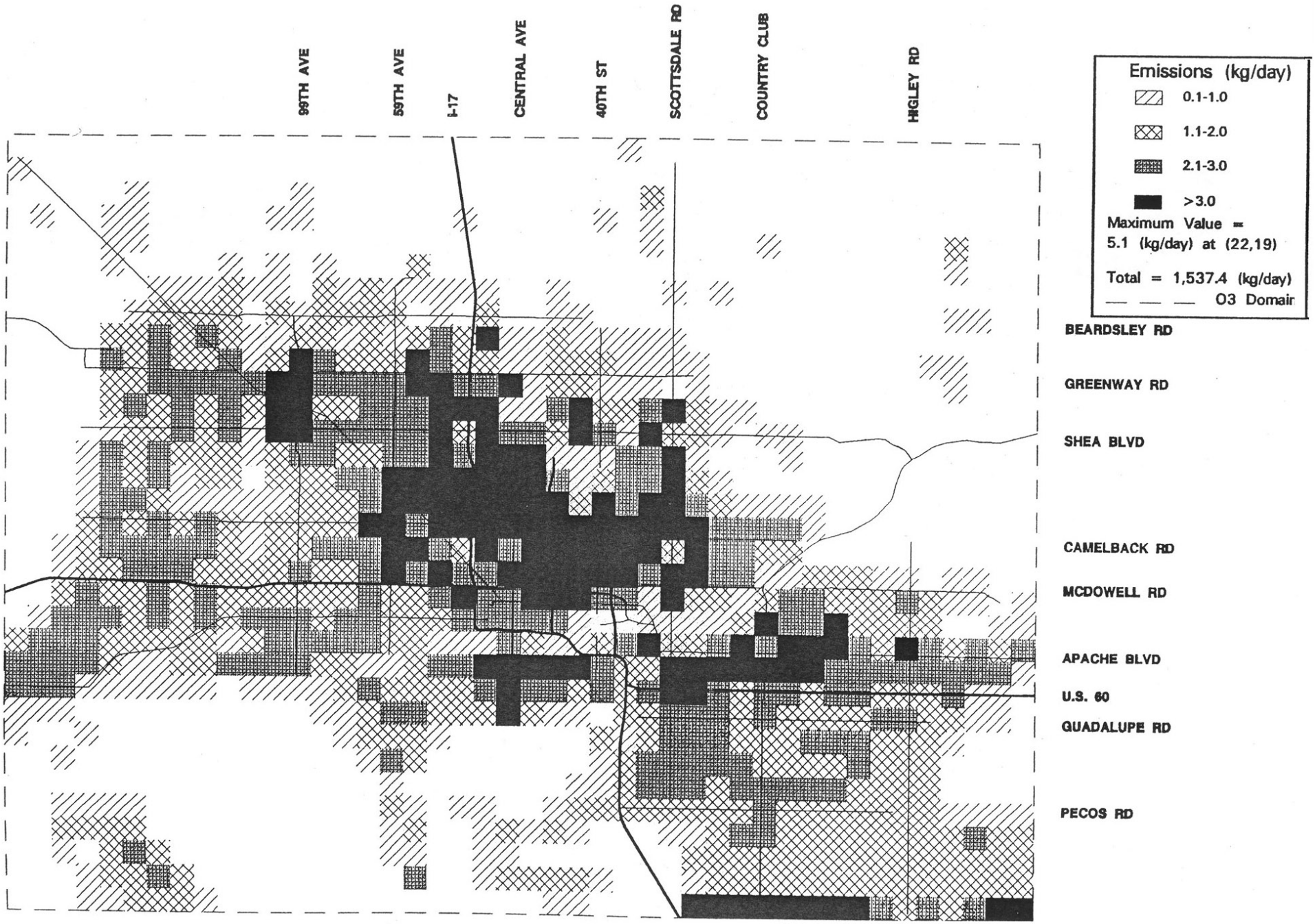



FIGURE 3-6b. NOx Biogenic Source Emissions for August 10, 1992.

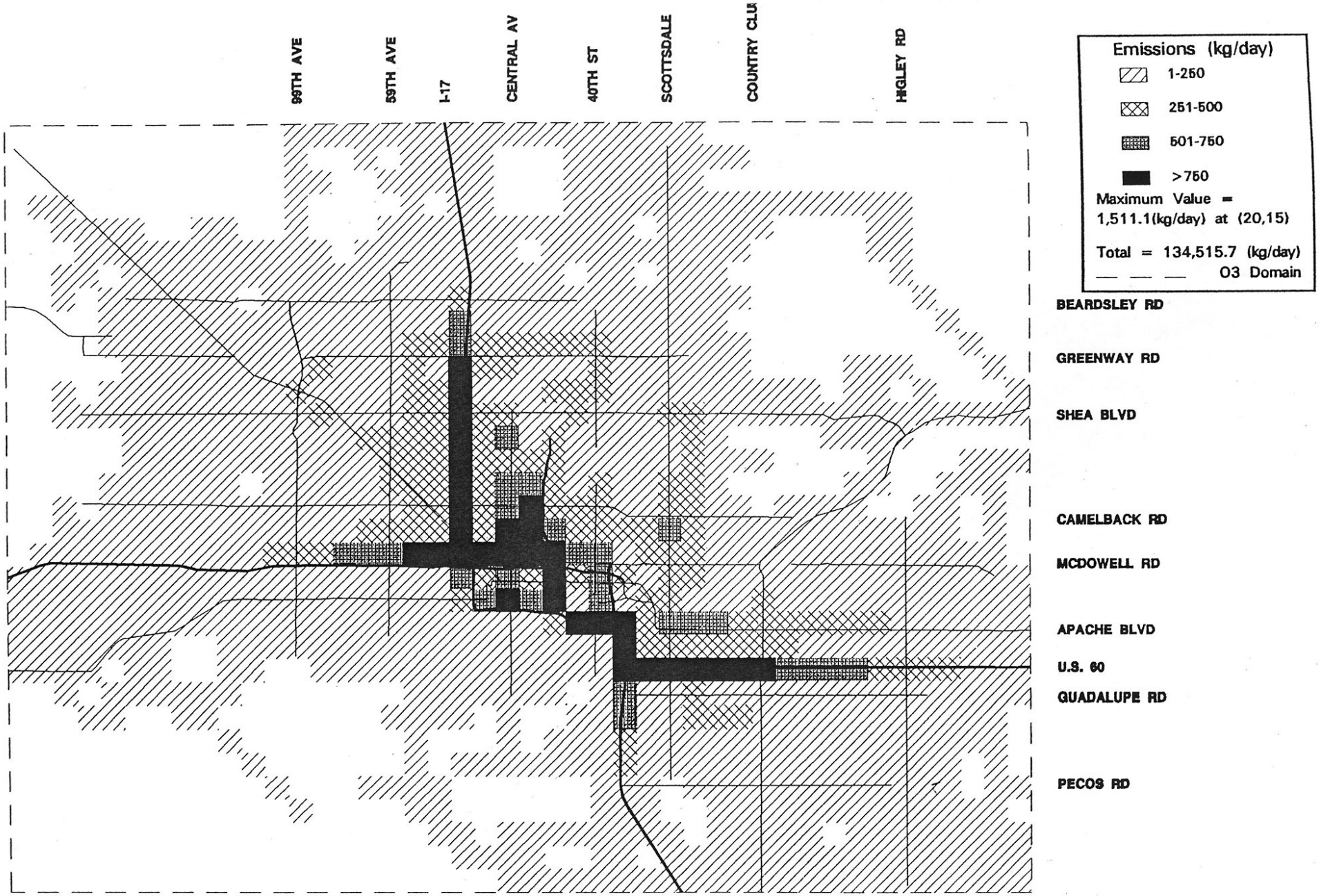



FIGURE 3-7a. NOx Onroad Mobile Source Emissions for August 10, 1992.

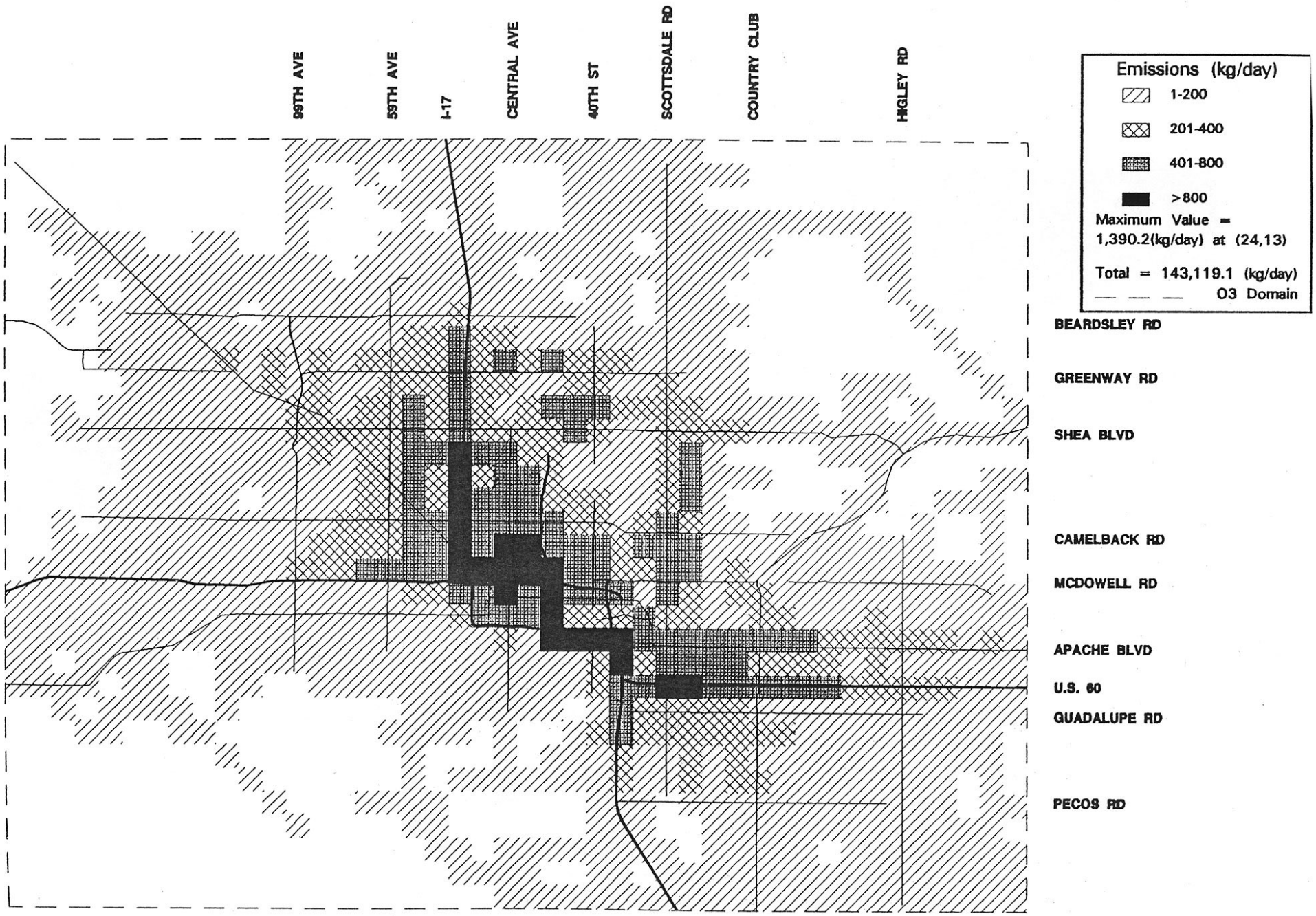



FIGURE 3-7b. RHC Onroad Mobile Source Emissions for August 10, 1992.

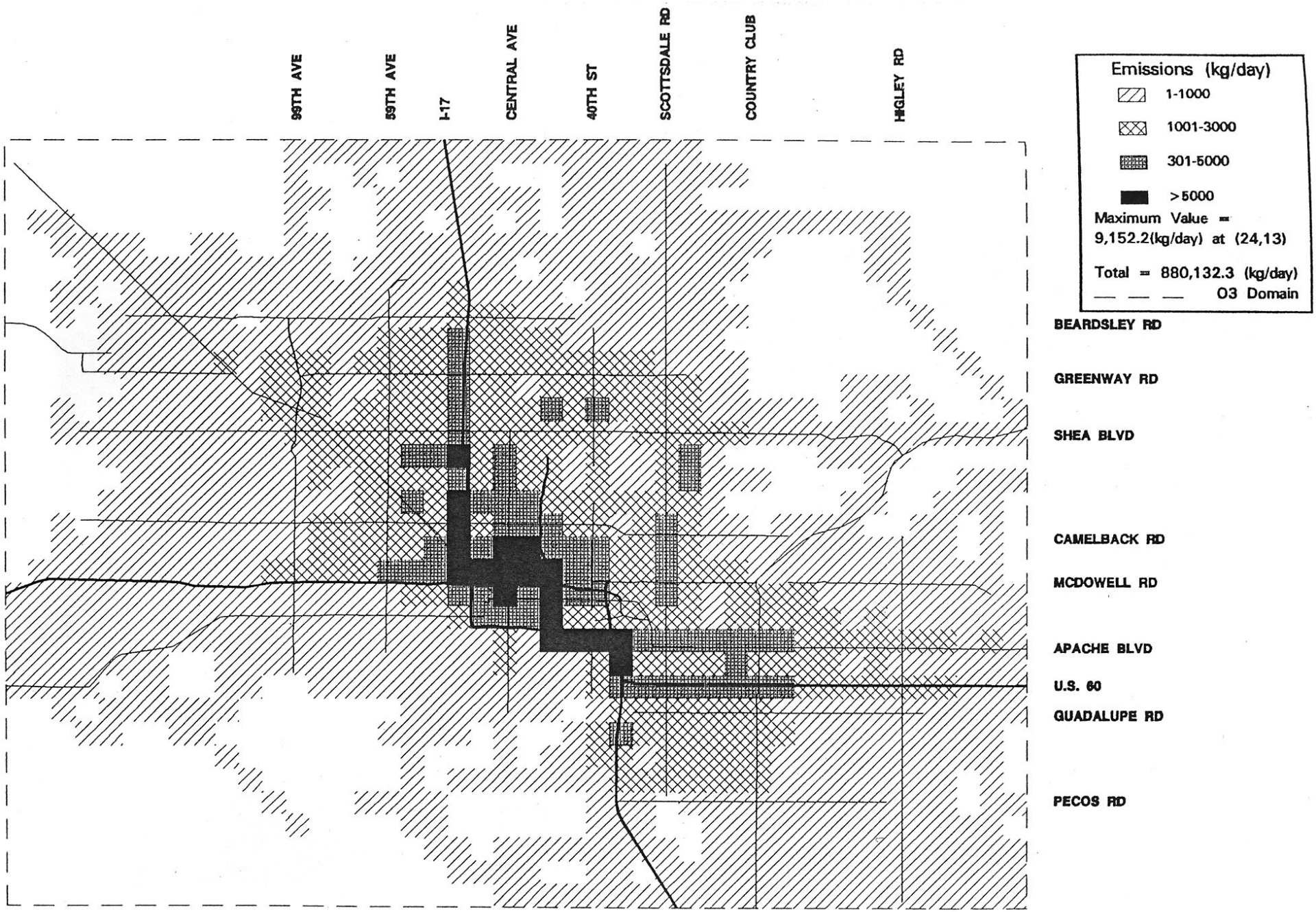



FIGURE 3-7c. CO Onroad Mobile Source Emissions for August 10, 1992.

# MODELING DATA FILE LIST

The air quality modeling conducted in support of the MAG Ozone Maintenance Plan was performed by the Maricopa Association of Governments (MAG). The MAG modeling runs were mostly performed on personal computers using the RedHat Linux operating system. The exception is MOBILE6 and the first portion of M6Link, which was run on a PC using the Microsoft Windows XP operating system. The input, output, and job files utilized in the modeling effort were subsequently compiled and stored on a single data tape. The files were transferred from the MAG computers to 8mm magnetic tape using the UNIX tar (Tape file ARchiver) command. Input, output, and job files from the modeling runs are available in this principal format. To receive copies of any data files on 8mm tape, please contact Ruey-in Chiou, Air Quality Modeling Program Manager, at (602) 254-6300.

The description of where specific data files are located is noted in each section below. Some directories are further split into subdirectories pertaining whether the file is appropriate for a particular model year (1998, 1999, 2006, or 2015), control measure package (CMP), an individual measure analysis, or the no measures package analysis. A detailed list that notes the full contents of each modeling subdirectory follows the job summary.

**MOBILE6**

Data tape subdirectory: ./MOBILE6

MOBILE6 was used to generate emission rate factors for onroad mobile vehicles as a function of temperature, vehicle speed, vehicle age, vehicle type, etc. These emission rate factors were derived incorporating local vehicle registration distribution data, fuel data, and other local factors. The fleet average emission rates were subsequently input to the M6Link program or the CAL3QHC model for further processing.

Files which were used to estimate emission rates for use in M6Link are in the data tape subdirectory ./mobile6 /forM6Link. MOBILE6 files used to estimate the benefit from the intelligent transportation systems and traffic signal synchronization measures are in the data tape subdirectory ./mobile6 /forPostProc.

**M6Link**

Data tape subdirectory: ./M6Link

The M6Link program was used to prepare input UAM emission files for onroad mobile sources. The M6Link program is made up of two modules. The M6Link1 module extracts data such as roadway link speeds, locations, and vehicle miles of travel (VMT) and assigns link VMT to the correct hour and air quality grid cell accordingly. M6Link1 also factors link VMT to be consistent with Highway Performance Monitoring System VMT by functional system. The M6Link2 module combines the output from M6Link1 and the output of MOBILE6 to produce hourly gridded emissions, suitable for input to the Urban Airshed Model (UAM). These results incorporate locally-derived hourly VMT splits, vehicle speed data, VMT by four vehicle classes by area and roadway type, fuel characteristics, and temperatures to ensure results appropriate to local conditions.

The M6Link directory is divided into “ControlFiles”, “JobFiles”, “Part1Inputs”,“Part2Inputs”, “out”, and “sourcecode” subdirectories for control files, job files, input files, output files, and the FORTRAN source code for M6Link programs.

Job Control Files: FinO3.job.allyears and FinO3.job.IndMeasures

**MEDEXPLORA**
Data tape subdirectory: ./Medexplora

The MEDEXPLORA module converts the output from M6Link into a UAM-ready emissions input file.

Job Control Files: medexp.Fin.AllYears, medexp.Fin.base2015.

**EMSCOR**
Data tape subdirectory: ./Emscor

The EMSCOR program applies across-the-board adjustment factors to UAM-ready emission files, such as those created by MEDEXPLORA. This program was used to apply socioeconomic adjustments as well as postprocess for certain control measures.

Job Control Files: emscor.2015base.job, emscor.Fin.job, emscor.Fin.job.2006upp.

**MAGBEIS**

Data tape subdirectory: ./magbeis

MAGBEIS was used to estimate biogenic emissions of VOCs and NOx. This directory is further subdivided into 11 subdirectories, “magland", “Jul_16_98_B11" , “Jul_17_98_B11", “Aug_23_99_B11", “Aug_24_99_B11", “Aug_23_06_B13", “Aug_24_06_B13", “Jul_16_15_B14", “Jul_17_15_B14", “Aug_23_15_B14", and “Aug_24_15_B14"

Job Control Files: Magbeis.steve.job (separate version in each subdirectory)

**Emissions Preprocessor System (EPS 2.0)**

Data tape subdirectory: ./eps2

The UAM Emission Preprocessor System was used to prepare UAM-ready emission estimate files for point, area, and nonroad mobile sources. Onroad mobile emission files were prepared using the M6Link system and are described in a previous section.

The data tape directory for all EPS 2.0 files is ./eps2. The ./eps2 directory is further subdivided into “inp”, “job”, “msg”, and “out” for input files, job files, message files, and output files respectively from the EPS runs. These directories are further subdivided into six subdirectories, “1998", “1999, “2006", “2015", “2015_ind_measures”, and “2015_no_measures” for 1998, 1999 base case, 2006, 2015 with control measures, 2015 individual measures, and 2015 no measures.

**PREPNT Module**

The PREPNT module was used to prepare the annual or seasonal point source inventory for further processing and identifies which sources are to be treated as elevated by UAM.

Job Control Files: prp.o3.98.197.1000m.job, prp.o3.98.198.1000m.job, prp.o3.99.235.1000m.job, prp.o3.99.236.1000m.job, prp.o3.06.235.1000m.finalpt.pp.job, prp.o3.06.236.1000m.finalpt.pp.job, prp.o3.15.197.1000m.popsCR.final.pp.job, prp.o3.15.198.1000m.popsCR.final.pp.job, prp.o3.15.235.1000m.popsCR.final.pp.job, prp.o3.15.236.1000m.popsCR.final.pp.job, prp.o3.15.236.1000m.baspp-rule348.job

**PREAM Module**

The PREAM module prepared county-level area and nonroad mobile source emission estimates from the periodic inventory for further processing.

Job Control Files: pra.o3.98.197.R2.job, pra.o3.98.198.R2.job, pra.o3.99.235.R2.job, pra.o3.99.236.R2.job

**LBASE Module**

The LBASE module prepared aviation-related source emission estimates from the MAG Airport Emissions Model for further processing.

Job Control files: lbs.avi.o3.98.197.job, lbs.avi.o3.98.198.job, lbs.avi.o3.99.235.job, lbs.avi.o3.99.236.job, lbs.avi.o3.06.235.job, lbs.avi.o3.06.236.job, lbs.avi.o3.15.197.job, lbs.avi.o3.15.198.job, lbs.avi.o3.15.235.job, lbs.avi.o3.15.236.job

**CNTLEM Module**

The CNTLEM module was used to project the 1998 and 1999 inventories to the maintenance year, and to account for measures enacted since the base year inventory. Since the CNTLEM module cannot apply stack-specific growth factors to point sources, factors for each year were applied before the PREPNT module.

Job Control files: ctl.area.o3.98.197.attainarea.R2.job, ctl.area.o3.98.197.nonattfire.R2.job, ctl.area.o3.98.198.attainarea.R2.job, ctl.area.o3.98.198.nonattfire.R2.job, ctl.mvoff.o3.98.197.attainarea.job, ctl.mvoff.o3.98.197.attainarea.nolog.job, ctl.mvoff.o3.98.197.RFG.job, ctl.mvoff.o3.98.197.RFG.nolog.job, ctl.mvoff.o3.98.198.attainarea.job, ctl.mvoff.o3.98.198.attainarea.nolog.job, ctl.mvoff.o3.98.198.RFG.job, ctl.mvoff.o3.98.198.RFG.nolog.job, ctl.area.o3.99.235.attainarea.R2.job, ctl.area.o3.99.235.nonattfire.R2.job, ctl.area.o3.99.236.attainarea.R2.job, ctl.area.o3.99.236.nonattfire.R2.job, ctl.mvoff.o3.99.235.attainarea.job, ctl.mvoff.o3.99.235.attainarea.nolog.job, ctl.mvoff.o3.99.235.nonatt.nolog.job, ctl.mvoff.o3.99.235.RFG.job, ctl.mvoff.o3.99.236.attainarea.job, ctl.mvoff.o3.99.236.attainarea.nolog.job, ctl.mvoff.o3.99.236.nonatt.nolog.job, ctl.mvoff.o3.99.236.RFG.job, ctl.area.o3.06.235.99to06GF.job, ctl.area.o3.06.235.attainarea.job, ctl.area.o3.06.235.nonattfire.job, ctl.area.o3.06.236.99to06GF.job, ctl.area.o3.06.236.attainarea.job, ctl.area.o3.06.236.nonattfire.job, ctl.avi.o3.06.235.nrmeas.job, ctl.avi.o3.06.236.nrmeas.job, ctl.mvoff.o3.06.235.99to06GF.job, ctl.mvoff.o3.06.235.attainarea.cmp.job, ctl.mvoff.o3.06.235.nonatt.nolog.cmp.job, ctl.mvoff.o3.06.235.Nonrd.job, ctl.mvoff.o3.06.236.99to06GF.job, ctl.mvoff.o3.06.236.attainarea.cmp.job, ctl.mvoff.o3.06.236.nonatt.nolog.cmp.job, ctl.mvoff.o3.06.236.Nonrd.job,

ctl.area.o3.15.197.98to15GF.E1.job, ctl.area.o3.15.197.attainarea.E1.job, ctl.area.o3.15.197.nonattfire.E1.job, ctl.area.o3.15.198.98to15.E1.job, ctl.area.o3.15.198.attainarea.E1.job, ctl.area.o3.15.198.nonattfire.E1.job, ctl.area.o3.15.235.99to15GF.E1.job, ctl.area.o3.15.235.attainarea.E1.job, ctl.area.o3.15.235.nonattfire.E1.job, ctl.area.o3.15.236.99to15GF.E1.job, ctl.area.o3.15.236.attainarea.E1.job, ctl.area.o3.15.236.nonattfire.E1.job, ctl.avi.o3.15.197.nrmeas.job, ctl.avi.o3.15.198.nrmeas.job, ctl.avi.o3.15.235.nrmeas.job, ctl.avi.o3.15.236.nrmeas.job, ctl.mvoff.o3.15.197.98to15GF.E1.job, ctl.mvoff.o3.15.197.attainarea.cmp.E1.job, ctl.mvoff.o3.15.197.nonatt.constr-18.E1.job, ctl.mvoff.o3.15.197.nonatt.nolog.E1.job, ctl.mvoff.o3.15.197.Nonrd.E1.job, ctl.mvoff.o3.15.198.98to15GF.E1.job, ctl.mvoff.o3.15.198.attainarea.cmp.E1.job, ctl.mvoff.o3.15.198.nonatt.constr-18.E1.job, ctl.mvoff.o3.15.198.nonatt.nolog.E1.job, ctl.mvoff.o3.15.198.Nonrd.E1.job, ctl.mvoff.o3.15.235.99to15GF.E1.job, ctl.mvoff.o3.15.235.attainarea.cmp.E1.job, ctl.mvoff.o3.15.235.nonatt.constr-18.E1.job, ctl.mvoff.o3.15.235.nonatt.nolog.E1.job, ctl.mvoff.o3.15.235.Nonrd.E1.job, ctl.mvoff.o3.15.236.99to15GF.E1.job, ctl.mvoff.o3.15.236.attainarea.cmp.E1.job, ctl.mvoff.o3.15.236.nonatt.constr-18.E1.job, ctl.mvoff.o3.15.236.nonatt.nolog.E1.job, ctl.mvoff.o3.15.236.Nonrd.E1.job, ctl.mvoff.o3.15.236.nonatt.bas+cons-18.job, ctl.mvoff.o3.15.236.nonatt.bas.nolog.job

**CHMSPL Module**

The CHMSPL module was used to assign input hydrocarbon emissions to chemical species expected by the chemical mechanism.

Job Files: chm.area.o3.98.197.atarea.E2.job, chm.area.o3.98.197.nonatt.R2.job, chm.area.o3.98.198.atarea.R2.job, chm.area.o3.98.198.nonatt.R2.job, chm.avi.o3.98.197.job, chm.avi.o3.98.198.job, chm.mvoff.o3.98.197.atarea.nolog.job, chm.mvoff.o3.98.197.nolog.job, chm.point.o3.98.197.1000m.job, chm.point.o3.98.198.1000m.job, chm.area.o3.99.235.atarea.R2.job, chm.area.o3.99.235.nonatt.R2.job, chm.avi.o3.99.235.job, chm.avi.o3.99.236.job, chm.mvoff.o3.99.235.atarea.nolog.job, chm.mvoff.o3.99.235.nonnolog.job, chm.mvoff.o3.99.236.atarea.nolog.job, chm.mvoff.o3.99.236.nonnolog.job, chm.point.o3.99.235.1000m.job, chm.point.o3.99.236.1000m.job, chm.area.o3.06.235.atarea.job, chm.area.o3.06.235.nonatt.job, chm.area.o3.06.236.atarea.job, chm.area.o3.06.236.nonatt.job, chm.avi.o3.06.235.job, chm.avi.o3.06.235.nrmeas.job, chm.avi.o3.06.236.job, chm.avi.o3.06.236.nrmeas.job, chm.mvoff.o3.06.235.atarea.cmp.job, chm.mvoff.o3.06.235.nonatt.cmp.job, chm.mvoff.o3.06.236.atarea.cmp.job, chm.mvoff.o3.06.236.nonatt.cmp.job, chm.point.o3.06.235.final.pp.job, chm.point.o3.06.236.final.pp.job, chm.area.o3.15.197.atarea.E1.job, chm.area.o3.15.197.nonatt.E1.job, chm.area.o3.15.198.atarea.E1.job, chm.area.o3.15.198.nonatt.E1.job, chm.area.o3.15.235.atarea.E1.job, chm.area.o3.15.235.nonatt.E1.job, chm.area.o3.15.236.atarea.E1.job, chm.area.o3.15.236.nonatt.E1.job, chm.avi.o3.15.197.nrmeas.job, chm.avi.o3.15.198.nrmeas.job, chm.avi.o3.15.235.nrmeas.job, chm.avi.o3.15.236.nrmeas.job, chm.mvoff.o3.15.197.atarea.cmp.E1.job, chm.mvoff.o3.15.197.nonatt.cmp.E1.job, chm.mvoff.o3.15.198.atarea.cmp.E1.job, chm.mvoff.o3.15.198.nonatt.cmp.E1.job, chm.mvoff.o3.15.235.atarea.cmp.E1.job, chm.mvoff.o3.15.235.nonatt.cmp.E1.job,

chm.mvoff.o3.15.236.atarea.cmp.E1.job, chm.mvoff.o3.15.236.nonatt.cmp.E1.job, chm.point.o3.15.197.popsCR.final.pp.job, chm.point.o3.15.198.popsCR.final.pp.job, chm.point.o3.15.235.popsCR.final.pp.job, chm.point.o3.15.236.popsCR.final.pp.job, chm.avi.o3.15.236.bas.job, chm.mvoff.o3.15.236.nonatt.bas.E1.job, chm.point.o3.15.236.baspp-rule348.job

**PSTPNT Module**

The PSTPNT module was used to process the elevated point sources.

Job Files: pst.point.o3.98.197.1000m.job, pst.point.o3.98.198.1000m.job, pst.point.o3.99.235.1000m.job, pst.point.o3.99.236.1000m.job, pst.point.o3.06.235.final.pp.job, pst.point.o3.06.236.final.pp.job, pst.point.o3.15.197.popsCR.final.pp.job, pst.point.o3.15.198.popsCR.final.pp.job, pst.point.o3.15.235.popsCR.final.pp.job, pst.point.o3.15.236.popsCR.final.pp.job, pst.point.o3.15.236.baspp-rule348.job

**TMPRL Module**

The TMPRL module was used to temporarily allocate emissions from annual, or seasonal average day to reflect the modeled episode. Point source emission data from peaking power plants were temporally allocated based upon operating schedule information provided by MCESD. All point sources which did not have actual operating schedule data available, as well as all area, aviation, and nonroad mobile sources, resolved temporally using default profiles for monthly, day of the week, and diurnal activity patterns.

Job Control Files: tpl.area.o3.98.197.atarea.R2.job, tpl.area.o3.98.197.nonatt.R2.job, tpl.area.o3.98.198.atarea.R2.job, tpl.area.o3.98.198.nonatt.R2.job, tpl.avi.o3.98.197, tpl.avi.o3.98.198, tpl.mvoff.o3.98.197.atarea.nolog.job, tpl.mvoff.o3.98.197.nolog.job, tpl.mvoff.o3.98.198.atarea.nolog.job, tpl.mvoff.o3.98.198.nolog.job, tpl.pnt.o3.98.197.1000m.job, tpl.pnt.o3.98.198.1000m.job, tpl.area.o3.99.235.atarea.R2.job, tpl.area.o3.99.235.nonatt.R2.job, tpl.avi.o3.99.235.job, tpl.avi.o3.99.236.job, tpl.mvoff.o3.99.235.atarea.nolog.job, tpl.mvoff.o3.99.235.nolog.job, tpl.mvoff.o3.99.236.atarea.nolog.job, tpl.mvoff.o3.99.236.nolog.job, tpl.pnt.o3.99.235.1000m.job, tpl.pnt.o3.99.236.1000m.job, tpl.area.o3.06.235.atarea2.job, tpl.area.o3.06.235.nonatt2.job, tpl.area.o3.06.236.atarea2.job, tpl.area.o3.06.236.nonatt2.job, tpl.avi.o3.06.nrmeas.235, tpl.avi.o3.06.nrmeas.236, tpl.mvoff.o3.06.235.atarea.cmp.job, tpl.mvoff.o3.06.235.nonatt.cmp.job, tpl.mvoff.o3.06.236.atarea.cmp.job, tpl.mvoff.o3.06.236.nonatt.cmp.job, tpl.pnt.o3.06.235.final.pp.job, tpl.pnt.o3.06.236.final.pp.job, tpl.area.o3.15.197.atarea.E2.job, tpl.area.o3.15.197.nonatt.E2.job, tpl.area.o3.15.198.atarea.E2.job, tpl.area.o3.15.198.nonatt.E2.job, tpl.area.o3.15.235.atarea.E2.job, tpl.area.o3.15.235.nonatt.E2.job, tpl.area.o3.15.236.atarea.E2.job, tpl.area.o3.15.236.nonatt.E2.job, tpl.avi.o3.15.nrmeas.197, tpl.avi.o3.15.nrmeas.198, tpl.avi.o3.15.nrmeas.235, tpl.avi.o3.15.nrmeas.236, tpl.mvoff.o3.15.197.atarea.cmp.E1.job, tpl.mvoff.o3.15.197.nonatt.cmp.E1.job, tpl.mvoff.o3.15.198.atarea.cmp.E1.job,

tpl.mvoff.o3.15.198.nonatt.cmp.E1.job, tpl.mvoff.o3.15.235.atarea.cmp.E1.job, tpl.mvoff.o3.15.235.nonatt.cmp.E1.job, tpl.mvoff.o3.15.236.atarea.cmp.E1.job, tpl.mvoff.o3.15.236.nonatt.cmp.E1.job, tpl.pnt.o3.15.197.popsCR.final.pp.job, tpl.pnt.o3.15.198.popsCR.final.pp.job, tpl.pnt.o3.15.235.popsCR.final.pp.job, tpl.pnt.o3.15.236.popsCR.final.pp.job, tpl.avi.03.15.236.bas.job, tpl.mvoff.o3.15.236.nonatt.bas.E1.job, tpl.pnt.o3.15.236.baspp-rule348.job

**GRDEM Module**

The GRDEM module was used to spatially allocate emissions. Point sources were located based on the geocoded location of the source provided by MCESD. Area and nonroad mobile source categories were each spatially allocated by surrogate factors which indicate activity by grid cell.

Job Control Files: grd.area.attain.o3.98.197.R2.job, grd.area.attain.o3.98.198.R2.job, grd.area.nonatt.o3.98.197.R2.job, grd.area.nonatt.o3.98.198.R2.job, grd.avi.nonatt.o3.98.197.job, grd.avi.nonatt.o3.98.198.job, grd.mvoff.attain.o3.98.197.nolog.job, grd.mvoff.attain.o3.98.198.nolog.job, grd.mvoff.nonatt.o3.98.197.nolog.job, grd.mvoff.nonatt.o3.98.198.nolog.job, grd.point.nonatt.o3.98.197.1000m.job, grd.point.nonatt.o3.98.198.1000m.job, grd.area.attain.o3.99.235.R2.job, grd.area.attain.o3.99.236.R2.job, grd.area.nonatt.o3.99.235.R2.job, grd.area.nonatt.o3.99.236.R2.job, grd.avi.nonatt.o3.99.235.job, grd.avi.nonatt.o3.99.236.job, grd.mvoff.attain.o3.99.235.nolog.job, grd.mvoff.attain.o3.99.236.nolog.job, grd.mvoff.nonatt.o3.99.235.nolog.job, grd.mvoff.nonatt.o3.99.236.nolog.job, grd.point.nonatt.o3.99.235.1000m.job, grd.point.nonatt.o3.99.236.1000m.job, grd.area.attain.o3.06.235.2.job, grd.area.attain.o3.06.236.2.job, grd.area.nonatt.o3.06.235.2.job, grd.area.nonatt.o3.06.236.2.job, grd.avi.o3.06.235.nrmeas.job, grd.avi.o3.06.236.nrmeas.job, grd.mvoff.attain.o3.06.235.cmp.job, grd.mvoff.attain.o3.06.236.cmp.job, grd.mvoff.nonatt.o3.06.235.cmp.job, grd.mvoff.nonatt.o3.06.235.cmp.job, grd.point.o3.06.235.final.pp.job, grd.point.o3.06.236.final.pp.job, grd.area.attain.o3.15.197.E2.job, grd.area.attain.o3.15.198.E2.job, grd.area.attain.o3.15.235.E2.job, grd.area.attain.o3.15.236.E2.job, grd.area.nonatt.o3.15.197.E2.job, grd.area.nonatt.o3.15.198.E2.job, grd.area.nonatt.o3.15.235.E2.job, grd.area.nonatt.o3.15.236.E2.job, grd.avi.o3.15.197.nrmeas.job, grd.avi.o3.15.198.nrmeas.job, grd.avi.o3.15.235.nrmeas.job, grd.avi.o3.15.236.nrmeas.job, grd.mvoff.attain.o3.15.197.cmp.E1.job, grd.mvoff.attain.o3.15.198.cmp.E1.job, grd.mvoff.attain.o3.15.235.cmp.E1.job, grd.mvoff.attain.o3.15.236.cmp.E1.job, grd.mvoff.nonatt.o3.15.197.cmp.E1.job, grd.mvoff.nonatt.o3.15.198.cmp.E1.job, grd.mvoff.nonatt.o3.15.235.cmp.E1.job, grd.mvoff.nonatt.o3.15.236.cmp.E1.job, grd.point.nonatt.o3.15.197.popsCR.final.pp.job, grd.point.nonatt.o3.15.198.popsCR.final.pp.job, grd.point.nonatt.o3.15.235.popsCR.final.pp.job, grd.point.nonatt.o3.15.236.popsCR.final.pp.job, grd.avi.o3.15.236.bas.job, grd.mvoff.nonatt.o3.15.236.bas.E1.job, grd.point.nonatt.o3.15.236.baspp-rule348.job

**MRGUAM Module**

The MRGUAM module was used to merge the UAM-ready emission files produced by GRDEM for area, nonroad mobile, aviation, and point sources with onroad mobile emissions produced by EXPLORA into a single UAM-ready emission file.

Job Control Files: mrg.o3.98.197.E5.job, mrg.o3.98.198.E5.job, mrg.o3.99.235.E5.job, mrg.o3.99.236.E5.job, mrg.o3.06.235.cmp.E20.job, mrg.o3.06.236.cmp.E20.job, mrg.o3.15.197.cmp.E9.job, mrg.o3.15.198.cmp.E9.job, mrg.o3.15.235.cmp.E12.job, mrg.o3.15.236.cmp.E12.job

**Urban Airshed Model (UAM)**

The UAM was used to estimate carbon monoxide concentrations. The ozone concentrations modeled are hourly and gridded into two square mile cells. The input and output files for the various UAM preprocessors share common directories. The data tape subdirectory for all UAM files is ./uam. The ./uam directory is further divided into three subdirectories. The ./uam/inputs subdirectory contains the output files from the preprocessors, which are inputs to the UAM core program. The ./uam/job subdirectory contains job files for running the UAM. The ./uam/outputs subdirectory contains the output files from the UAM core program.

Job Control Files: uam-ozmt-r41.job, uam-ozmt-zero-bnd.job, uam-ozmt-zero-aq.job, uam-ozmt-r66.job, uam-ozmt-zero.aq.job, uam-ozmt-zero-bnd.job, uam-ozmt-06r24-8.job, uam-ozmt-1508R26.job

**DIFFBREAK**
Data tape subdirectory for the job file: ./uam/job

The DIFFBREAK file was used to set the heights of mixing layers. The inputs for this preprocessor were calculated using the MIXEMUP package.

Job Control Files: dfsnbk-98R40.job, dfsnbk-r28.job

**METSCALARS**
Data tape subdirectory for the job file: ./uam/job

The METSCALARS file prepares hourly values for several meteorological scalars. The meteorological values reflect atmospheric water concentrations, pressure, $NO_2$, photolysis rate, exposure class, and temperature gradients.

Job Control Files: metscl.job

**TEMPERATUR**
Data tape subdirectory for the job file: ./uam/job

The TEMPERATURE file prepares time-varying matrices of temperatures at ground level. Temperature data are used to adjust chemical reaction rates in the UAM.

Job Control Files: tmprtr.job

**REGIONTOP**
Data tape subdirectory for the job file: ./uam/job

The REGIONTOP file sets the height of the modeling domain. The heightw of the modeling domain were set to 5400 meters for July UAM runs and 4800 meters for August UAM runs.

Job Control Files: regntp-r40.job, rt4800.job

**DIAGNOSTIC WIND MODEL**
Data tape subdirectory ./uam/job

The Diagnostic Wind Model (DWM) generates wind fields using available observations and terrain data. The output from DWM was input to the UAMWIND preprocessor to produce a UAM-ready wind file.

Job Control Files: dwm-r40.job, dwm-r49.job

**UAMWIND PREPROCESSOR**
Data tape subdirectory for the job file: /uam/job

The UAMWIND preprocessor converts the output from the DWM into wind fields which are used in the UAM.

Job Control Files: uamwnd-r40.job, uamwnd-r49.job

**AIRQUALITY**
Data tape subdirectory for job file: ./uam/job; Data Tape Subdirectory for Output: ./uam/inputs

The AIRQUALITY file provides pollutant concentrations to the UAM for the initial hour of the simulation. The initial CO concentrations are based upon available monitoring data.

Job Control Files: aq-r40.job, aq-zero.job, aq-r61.job, aq-zero.job

**BOUNDARY**
Data tape subdirectory for job file: ./uam/job; Data Tape Subdirectory for Output: ./uam/inputs

The BOUNDARY file provides pollutant concentrations to the UAM along the lateral boundaries.

Job Control Files: bndry-r40.job, bndry-r57.job, bndry-zero.job

**TOPCONC**
Data tape subdirectory for job file: ./uam/job; Data Tape Subdirectory for Output: ./uam/inputs

The TOPCONC file provides pollutant concentrations to the UAM along the upper boundary for the entire simulation period.

Job Control Files: topconc-r40.job, topconc-r56.job

**TERRAIN**
Data tape subdirectory: ./uam/job

The surface roughness lengths and deposition factors for the modeling domain are contained in the TERRAIN file for use in deposition calculations.

Job Control Files: creter.job

**PTSOURCE**
Data tape subdirectory for Input: ./uam/job; Data tape subdirectory for the UAM-ready file: ./uam/inputs

The PTSOURCE files contain emissions from elevated point sources.

Job Control Files: ptsrce-r40.job, ptsrce.job.

**EMISSIONS**
Data tape subdirectory for the UAM-ready file: ./uam/inputs

The EMISSIONS files contain merged emissions of all source categories except elevated point sources.

Job Control Files: see previous EPS2.0 section for details.

**CHEMPARAM**
Data tape subdirectory for job file: ./uam/job; Data tape subdirectory for Output: ./uam/inputs

The CHEMPARAM file defines the chemical species characteristics, reaction properties, and stoichiometric coefficients for the Carbon-Bond Mechamism IV.

Job Control Files: chemparam.job

Directory structure for the data files.

```
|-- EPS2
|   |-- inp
|   |   |-- 1998
|   |   |-- 1999
|   |   |-- 2006
|   |   |-- 2015
|   |   |-- 2015_ind_measures
|   |   `-- 2015_no_measures
|   |-- job
|   |   |-- 1998
|   |   |-- 1999
|   |   |-- 2006
|   |   |-- 2015
|   |   |-- 2015_ind_measures
|   |   `-- 2015_no_measures
|   |-- msg
|   |   |-- 1998
|   |   |-- 1999
|   |   |-- 2006
|   |   |-- 2015
|   |   |-- 2015_ind_measures
|   |   `-- 2015_no_measures
|   `-- out
|       |-- 1998
|       |-- 1999
|       |-- 2006
|       |-- 2015
|       |-- 2015_ind_measures
|       `-- 2015_no_measures
|-- Emscor
|   |-- JobFiles
|   |-- Outputs
|   `-- inputs
|-- M6Link
|   |-- ControlFiles
|   |-- JobFiles
|   |-- Part1Inputs
|   |-- Part2Inputs
|   |-- out
|   `-- sourcecode
|-- MAGBEIS
|   |-- Aug_23_2006_B13
|   |-- Aug_23_2015_B14
|   |-- Aug_23_99_B11
|   |-- Aug_24_2006_B13
|   |-- Aug_24_2015_B14
|   |-- Aug_24_99_B11
|   |-- Jul_16_2015_B14
|   |-- Jul_16_98_B11
|   |-- Jul_17_2015_B14
|   |-- Jul_17_98_B11
|   `-- MAGLAND
|       |-- 2000B5
|       |-- 2006B13
|       `-- 2015B14
|-- Medexplora
|   |-- JobFiles
|   |-- Outputs
|   `-- inputs
|-- Mobile6
|   |-- forM6Link
|   |   |-- 1998Inp
|   |   |-- 1999Inp
|   |   |-- 2006Inp
|   |   |-- 2015InpCMP
|   |   |-- 2015InpIndMeas
|   |   |   |-- BaseCase
|   |   |   |-- CBG
|   |   |   |-- OneTimeWaiver
|   |   |   `-- Phased-InCutpoints
|   |   |-- GenericInputs
|   |   `-- SampleOutput
|   `-- forPostProc
|       `-- ITSandTSS
`-- UAM
    |-- inputs
    |   |-- 06in
    |   |-- 15in
```

```
|   |-- 98in
|   `-- 99in
|-- job
|   |-- 1998
|   |-- 1999
|   |-- 2006
|   `-- 2015
|-- msg
|   |-- 06in
|   |-- 15in
|   |-- 98in
|   `-- 99in
`-- outputs
    |-- 1998
    |-- 1999
    |-- 2006
    |   |-- output7
    |   `-- output8
    `-- 2015
        |-- output7
        `-- output8
```

Complete File List:

Emscor
EPS2
M6Link
MAGBEIS
Medexplora
Mobile6
UAM

./Emscor:
inputs
JobFiles
Outputs

./Emscor/inputs:
Readme.txt

./Emscor/JobFiles:
emscor.2015base.job
emscor.Fin.job
emscor.Fin.job.2006upp

./Emscor/Outputs:
uam.Aug23_06.M6Link.A.Fin.adj
uam.Aug23_06.M6Link.A.Fin.adj.2p
uam.Aug23_06.M6Link.A.Fin.out
uam.Aug23_06.M6Link.A.Fin.out.2p
uam.Aug23_06.M6Link.N.Fin.adj
uam.Aug23_06.M6Link.N.Fin.adj.2p
uam.Aug23_06.M6Link.N.Fin.out
uam.Aug23_06.M6Link.N.Fin.out.2p
uam.Aug23_06.M6Link.O.Fin.adj
uam.Aug23_06.M6Link.O.Fin.adj.2p
uam.Aug23_06.M6Link.O.Fin.out
uam.Aug23_06.M6Link.O.Fin.out.2p
uam.Aug23_15.M6Link.A.Fin.adj
uam.Aug23_15.M6Link.A.Fin.out
uam.Aug23_15.M6Link.N.Fin.adj
uam.Aug23_15.M6Link.N.Fin.out
uam.Aug23_15.M6Link.O.Fin.adj
uam.Aug23_15.M6Link.O.Fin.out
uam.Aug23_99.M6Link.A.Fin.adj
uam.Aug23_99.M6Link.A.Fin.out
uam.Aug23_99.M6Link.N.Fin.adj
uam.Aug23_99.M6Link.N.Fin.out
uam.Aug23_99.M6Link.O.Fin.adj
uam.Aug24_06.M6Link.A.Fin.adj
uam.Aug24_06.M6Link.A.Fin.adj.2p
uam.Aug24_06.M6Link.A.Fin.out
uam.Aug24_06.M6Link.A.Fin.out.2p
uam.Aug24_06.M6Link.N.Fin.adj
uam.Aug24_06.M6Link.N.Fin.adj.2p
uam.Aug24_06.M6Link.N.Fin.out
uam.Aug24_06.M6Link.N.Fin.out.2p
uam.Aug24_06.M6Link.O.Fin.adj
uam.Aug24_06.M6Link.O.Fin.adj.2p
uam.Aug24_06.M6Link.O.Fin.out
uam.Aug24_06.M6Link.O.Fin.out.2p
uam.Aug24_15.M6Link.A.Fin.adj
uam.Aug24_15.M6Link.A.Fin.out
uam.Aug24_15.M6Link.N.Fin.adj
uam.Aug24_15.M6Link.N.Fin.out
uam.Aug24_15.M6Link.O.Fin.adj
uam.Aug24_15.M6Link.O.Fin.out
uam.Aug24_99.M6Link.A.Fin.adj
uam.Aug24_99.M6Link.A.Fin.out
uam.Aug24_99.M6Link.N.Fin.adj
uam.Aug24_99.M6Link.N.Fin.out
uam.Aug24_99.M6Link.O.Fin.adj
uam.Jul16_15.M6Link.A.Fin.adj
uam.Jul16_15.M6Link.A.Fin.out
uam.Jul16_15.M6Link.N.Fin.adj
uam.Jul16_15.M6Link.N.Fin.out
uam.Jul16_15.M6Link.O.Fin.adj
uam.Jul16_15.M6Link.O.Fin.out
uam.Jul16_98.M6Link.N.Fin.adj
uam.Jul16_98.M6Link.N.Fin.out
uam.Jul16_98.M6Link.O.Fin.adj
uam.Jul17_15.M6Link.A.Fin.adj
uam.Jul17_15.M6Link.A.Fin.out
uam.Jul17_15.M6Link.N.Fin.adj
uam.Jul17_15.M6Link.N.Fin.out
uam.Jul17_15.M6Link.O.Fin.adj
uam.Jul17_15.M6Link.O.Fin.out
uam.Jul17_98.M6Link.N.Fin.adj
uam.Jul17_98.M6Link.N.Fin.out
uam.Jul17_98.M6Link.O.Fin.adj

./EPS2:
inp
job
msg
out

./EPS2/inp:
1998
1999
2006
2015
2015_ind_measures
2015_no_measures

./EPS2/inp/1998:
afs.point.o3.98.bas.final
ams.o3.98.bas.final_01_09_03
chmprf.xref.98.o3.bas
chmspl.splits.98.bas
ctl.factor.ams.o3.ffire.nonatt
ctl.factors.ams.98.nologging
ctl.factors.ams.98.RFGnrd
ctl.factors.ams.o3.attarea.emiss
link.bas.O3.071698.linux
link.bas.O3.071798.linux
links.airp.o3.98.bas
madjin.98.bas
OUTEM_980716_B11
OUTEM_980717_B11
ozattsurg
oznoatsurg
sicasc.glsry.v0393
srgfac.xref.v0400.magozone
tpl.profile.o3.98.bas.linux.sd
tpl.xref.o3.98.bas.linux.sd
tpl.xref.o3.98.bas.linux.sd_01_09_03
uam.Jul16_98.M6Link.N.Fin.adj
uam.Jul16_98.M6Link.O.Fin.adj
uam.Jul17_98.M6Link.N.Fin.adj
uam.Jul17_98.M6Link.O.Fin.adj
userin.o3.98.197.bas
userin.o3.98.197.bas.1000m
userin.o3.98.197.bas.all
userin.o3.98.198.bas
userin.o3.98.198.bas.1000m
userin.o3.98.198.bas.all

./EPS2/inp/1999:
afs.point.o3.99.bas.final
ams.o3.99.bas.final_01_07_03
chmprf.xref.99.o3.bas

```
chmspl.splits.99.bas
ctl.factor.ams.o3.ffire.nonatt
ctl.factors.ams.99.nologging
ctl.factors.ams.99.RFGnrd
ctl.factors.ams.o3.attarea.emiss
link.bas.O3.082399.R2
link.bas.O3.082499.R2
links.airp.o3.99.bas
madjin.96.bas
madjin.99.bas
OUTEM_990823_B11
OUTEM_990824_B11
ozattsurg
oznoatsurg
sicasc.glsry.v0393
srgfac.xref.v0400.magozone
tpl.profile.o3.99.bas.linux.sd
tpl.xref.o3.99.bas.linux.sd
tpl.xref.o3.99.bas.linux.sd_01_08_03
uam.Aug23_99.M6Link.A.Fin.adj
uam.Aug23_99.M6Link.N.Fin.adj
uam.Aug23_99.M6Link.O.Fin.adj
uam.Aug24_99.M6Link.A.Fin.adj
uam.Aug24_99.M6Link.N.Fin.adj
uam.Aug24_99.M6Link.O.Fin.adj
userin.o3.99.235.bas
userin.o3.99.235.bas.1000m
userin.o3.99.235.bas.all
userin.o3.99.236.bas
userin.o3.99.236.bas.1000m
userin.o3.99.236.bas.all

./EPS2/inp/2006:
afs.point.o3.99to06.finalCountyrule_ppup_0
82306
afs.point.o3.99to06.finalCountyrule_ppup_0
82406
chmprf.xref.06.o3.bas
chmspl.splits.06.bas
ctl.factor.ams.o3.ffire.nonatt
ctl.factors.ams.06.nologging
ctl.factors.ams.06.nrdmeas
ctl.factors.ams.o3.99to06.bas
ctl.factors.ams.o3.attarea.emiss
ctl.factors.avi.06.nrdmeas
link.bas.O3.082306
link.bas.O3.082406
links.airp.o3.06.bas
madjin.06.bas
OUTEM_Aug_23_2006_B13
OUTEM_Aug_24_2006_B13
ozattsurg
oznoatsurg
sicasc.glsry.v0393
srgfac.xref.v0400.magozone
tpl.profile.o3.06.bas.final
tpl.profile.o3.9806.bas
tpl.xref.o3.06.bas.final
tpl.xref.o3.9806.bas
uam.Aug23_06.M6Link.A.Fin.adj
uam.Aug23_06.M6Link.N.Fin.adj
uam.Aug23_06.M6Link.O.Fin.adj
uam.Aug24_06.M6Link.A.Fin.adj
uam.Aug24_06.M6Link.N.Fin.adj
uam.Aug24_06.M6Link.O.Fin.adj
userin.o3.06.235.bas.1000m
userin.o3.06.236.bas.1000m

./EPS2/inp/2015:
afs.point.o3.98to15.finalCountyrule_ppup_0
71615
afs.point.o3.98to15.finalCountyrule_ppup_0
71715
afs.point.o3.99to15.bas+rule348_ppup_08231
5
afs.point.o3.99to15.bas+rule348_ppup_08241
5
chmprf.xref.15.o3.bas
chmspl.splits.15.bas
ctl.factor.ams.o3.ffire.nonatt
ctl.factors.ams.15.nologging
ctl.factors.ams.15.nrdmeas
ctl.factors.ams.o3.98to15.bas
ctl.factors.ams.o3.99to15.bas
ctl.factors.ams.o3.attarea.emiss
ctl.factors.avi.15.nrdmeas
link.bas.O3.071615
link.bas.O3.071715
link.bas.O3.082315
link.bas.O3.082415
links.airp.o3.15.bas
links.airp.o3.98.bas
madjin.15.bas
ozattsurg
oznoatsurg
pra.area.o3.98.197.bas.R2.embr
pra.area.o3.98.198.bas.R2.embr
pra.area.o3.99.235.R2.embr
pra.area.o3.99.236.R2.embr
pra.mvoff.o3.98.197.bas.R2.embr
pra.mvoff.o3.98.198.bas.R2.embr
pra.mvoff.o3.99.235.R2.embr
pra.mvoff.o3.99.236.R2.embr
sicasc.glsry.v0393
srgfac.xref.v0400.magozone
tpl.profile.o3.9815.bas
tpl.profile.o3.9915.bas
tpl.xref.o3.9815.bas
tpl.xref.o3.9915.bas
userin.o3.15.197.bas.1000m
userin.o3.15.197.bas.100m
userin.o3.15.197.bas.ptall
userin.o3.15.198.bas.1000m
userin.o3.15.198.bas.100m
userin.o3.15.198.bas.ptall
userin.o3.15.235.bas.1000m
userin.o3.15.235.bas.100m
userin.o3.15.235.bas.ptall
userin.o3.15.236.bas.1000m
userin.o3.15.236.bas.100m
userin.o3.15.236.bas.ptall

./EPS2/inp/2015_ind_measures:
afs.point.o3.99to15.bas+rule348_ppup_08241
5
chmprf.xref.15.o3.bas
chmspl.splits.15.bas
ctl.factor.ams.o3.ffire.nonatt
ctl.factors.ams.15.nologging
ctl.factors.ams.15.nrdmeas
ctl.factors.ams.o3.99to15.bas
ctl.factors.ams.o3.attarea.emiss
ctl.factors.ams.o3.Const_18%Red
ctl.factors.avi.15.nrdmeas
links.airp.o3.15.bas
madjin.15.bas
oznoatsurg
sicasc.glsry.v0393
srgfac.xref.v0400.magozone
tpl.profile.o3.9915.bas
tpl.xref.o3.9915.bas
userin.o3.15.236.bas.1000m

./EPS2/inp/2015_no_measures:
```

```
afs.point.o3.99to15.bas-rule348_ppup_08241
5
chmprf.xref.15.o3.bas
chmspl.splits.15.bas
ctl.factor.ams.o3.ffire.nonatt
ctl.factors.ams.15.nologging
ctl.factors.ams.o3.99to15.bas
ctl.factors.ams.o3.Const_18%Red
lbs.avi.o3.15.236.embr
links.airp.o3.15.bas
links.airp.o3.98.bas
madjin.15.bas
oznoatsurg
sicasc.glsry.v0393
srgfac.xref.v0400.magozone
tpl.profile.o3.9915.bas
tpl.xref.o3.9915.bas
userin.o3.15.236.bas.1000m

./EPS2/job:
1998
1999
2006
2015
2015_ind_measures
2015_no_measures

./EPS2/job/1998:
chm.area.o3.98.197.atarea.R2.job
chm.area.o3.98.197.nonatt.R2.job
chm.area.o3.98.198.atarea.R2.job
chm.area.o3.98.198.nonatt.R2.job
chm.avi.o3.98.197.job
chm.avi.o3.98.198.job
chm.mvoff.o3.98.197.atarea.nolog.job
chm.mvoff.o3.98.197.nolog.job
chm.point.o3.98.197.1000m.job
chm.point.o3.98.197.all.job
chm.point.o3.98.198.1000m.job
chm.point.o3.98.198.all.job
ctl.area.o3.98.197.attainarea.R2.job
ctl.area.o3.98.197.nonattfire.R2.job
ctl.area.o3.98.198.attainarea.R2.job
ctl.area.o3.98.198.nonattfire.R2.job
ctl.mvoff.o3.98.197.attainarea.job
ctl.mvoff.o3.98.197.attainarea.nolog.job
ctl.mvoff.o3.98.197.RFG.job
ctl.mvoff.o3.98.197.RFG.nolog.job
ctl.mvoff.o3.98.198.attainarea.job
ctl.mvoff.o3.98.198.attainarea.nolog.job
ctl.mvoff.o3.98.198.RFG.job
ctl.mvoff.o3.98.198.RFG.nolog.job
grd.area.attain.o3.98.197.R2.job
grd.area.attain.o3.98.198.R2.job
grd.area.nonatt.o3.98.197.R2.job
grd.area.nonatt.o3.98.198.R2.job
grd.avi.nonatt.o3.98.197.job
grd.avi.nonatt.o3.98.198.job
grd.mvoff.attain.o3.98.197.nolog.job
grd.mvoff.attain.o3.98.198.nolog.job
grd.mvoff.nonatt.o3.98.197.nolog.job
grd.mvoff.nonatt.o3.98.198.nolog.job
grd.point.nonatt.o3.98.197.1000m.job
grd.point.nonatt.o3.98.197.all.job
grd.point.nonatt.o3.98.198.1000m.job
grd.point.nonatt.o3.98.198.all.job
lbs.avi.o3.98.197.job
lbs.avi.o3.98.198.job
mrg.o3.98.197.E5.job
mrg.o3.98.198.E5.job
pra.o3.98.197.R2.job
pra.o3.98.198.R2.job
prp.o3.98.197.1000m.job
prp.o3.98.197.all.job
prp.o3.98.198.1000m.job
prp.o3.98.198.all.job
pst.point.o3.98.197.1000m.job
pst.point.o3.98.198.1000m.job
tpl.area.o3.98.197.atarea.R2.job
tpl.area.o3.98.197.nonatt.R2.job
tpl.area.o3.98.198.atarea.R2.job
tpl.area.o3.98.198.nonatt.R2.job
tpl.avi.o3.98.197
tpl.avi.o3.98.198
tpl.mvoff.o3.98.197.atarea.nolog.job
tpl.mvoff.o3.98.197.nolog.job
tpl.mvoff.o3.98.198.atarea.nolog.job
tpl.mvoff.o3.98.198.nolog.job
tpl.pnt.o3.98.197.1000m.job
tpl.pnt.o3.98.197.all.job
tpl.pnt.o3.98.198.1000m.job
tpl.pnt.o3.98.198.all.job

./EPS2/job/1999:
chm.area.o3.99.235.atarea.R2.job
chm.area.o3.99.235.nonatt.R2.job
chm.avi.o3.99.235.job
chm.avi.o3.99.236.job
chm.mvoff.o3.99.235.atarea.nolog.job
chm.mvoff.o3.99.235.nonnolog.job
chm.mvoff.o3.99.236.atarea.nolog.job
chm.mvoff.o3.99.236.nonnolog.job
chm.point.o3.99.235.1000m.job
chm.point.o3.99.235.all.job
chm.point.o3.99.236.1000m.job
chm.point.o3.99.236.all.job
ctl.area.o3.99.235.attainarea.R2.job
ctl.area.o3.99.235.nonattfire.R2.job
ctl.area.o3.99.236.attainarea.R2.job
ctl.area.o3.99.236.nonattfire.R2.job
ctl.mvoff.o3.99.235.attainarea.job
ctl.mvoff.o3.99.235.attainarea.nolog.job
ctl.mvoff.o3.99.235.nonatt.nolog.job
ctl.mvoff.o3.99.235.RFG.job
ctl.mvoff.o3.99.236.attainarea.job
ctl.mvoff.o3.99.236.attainarea.nolog.job
ctl.mvoff.o3.99.236.nonatt.nolog.job
ctl.mvoff.o3.99.236.RFG.job
grd.area.attain.o3.99.235.R2.job
grd.area.attain.o3.99.236.R2.job
grd.area.nonatt.o3.99.235.R2.job
grd.area.nonatt.o3.99.236.R2.job
grd.avi.nonatt.o3.99.235.job
grd.avi.nonatt.o3.99.236.job
grd.mvoff.attain.o3.99.235.nolog.job
grd.mvoff.attain.o3.99.236.nolog.job
grd.mvoff.nonatt.o3.99.235.nolog.job
grd.mvoff.nonatt.o3.99.236.nolog.job
grd.point.nonatt.o3.99.235.1000m.job
grd.point.nonatt.o3.99.235.all.job
grd.point.nonatt.o3.99.236.1000m.job
grd.point.nonatt.o3.99.236.all.job
lbs.avi.o3.99.235.job
lbs.avi.o3.99.236.job
mrg.o3.99.235.E5.job
mrg.o3.99.236.E5.job
pra.o3.99.235.R2.job
pra.o3.99.236.R2.job
prp.o3.99.235.1000m.job
prp.o3.99.235.all.job
prp.o3.99.236.1000m.job
prp.o3.99.236.all.job
pst.point.o3.99.235.1000m.job
pst.point.o3.99.236.1000m.job
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tpl.area.o3.99.235.atarea.R2.job
tpl.area.o3.99.235.nonatt.R2.job
tpl.avi.o3.99.235.job
tpl.avi.o3.99.236.job
tpl.mvoff.o3.99.235.atarea.nolog.job
tpl.mvoff.o3.99.235.nolog.job
tpl.mvoff.o3.99.236.atarea.nolog.job
tpl.mvoff.o3.99.236.nolog.job
tpl.pnt.o3.99.235.1000m.job
tpl.pnt.o3.99.235.all.job
tpl.pnt.o3.99.236.1000m.job
tpl.pnt.o3.99.236.all.job

./EPS2/job/2006:
chm.area.o3.06.235.atarea.job
chm.area.o3.06.235.nonatt.job
chm.area.o3.06.236.atarea.job
chm.area.o3.06.236.nonatt.job
chm.avi.o3.06.235.job
chm.avi.o3.06.235.nrmeas.job
chm.avi.o3.06.236.job
chm.avi.o3.06.236.nrmeas.job
chm.mvoff.o3.06.235.atarea.cmp.job
chm.mvoff.o3.06.235.nonatt.cmp.job
chm.mvoff.o3.06.236.atarea.cmp.job
chm.mvoff.o3.06.236.nonatt.cmp.job
chm.point.o3.06.235.final.pp.job
chm.point.o3.06.236.final.pp.job
ctl.area.o3.06.235.99to06GF.job
ctl.area.o3.06.235.attainarea.job
ctl.area.o3.06.235.nonattfire.job
ctl.area.o3.06.236.99to06GF.job
ctl.area.o3.06.236.attainarea.job
ctl.area.o3.06.236.nonattfire.job
ctl.avi.o3.06.235.nrmeas.job
ctl.avi.o3.06.236.nrmeas.job
ctl.mvoff.o3.06.235.99to06GF.job
ctl.mvoff.o3.06.235.attainarea.cmp.job
ctl.mvoff.o3.06.235.nonatt.nolog.cmp.job
ctl.mvoff.o3.06.235.Nonrd.job
ctl.mvoff.o3.06.236.99to06GF.job
ctl.mvoff.o3.06.236.attainarea.cmp.job
ctl.mvoff.o3.06.236.nonatt.nolog.cmp.job
ctl.mvoff.o3.06.236.Nonrd.job
grd.area.attain.o3.06.235.2.job
grd.area.attain.o3.06.236.2.job
grd.area.nonatt.o3.06.235.2.job
grd.area.nonatt.o3.06.236.2.job
grd.avi.o3.06.235.nrmeas.job
grd.avi.o3.06.236.nrmeas.job
grd.mvoff.attain.o3.06.235.cmp.job
grd.mvoff.attain.o3.06.236.cmp.job
grd.mvoff.nonatt.o3.06.235.cmp.job
grd.mvoff.nonatt.o3.06.236.cmp.job
grd.point.o3.06.235.final.pp.job
grd.point.o3.06.236.final.pp.job
lbs.avi.o3.06.235.job
lbs.avi.o3.06.236.job
mrg.o3.06.235.cmp.E20.job
mrg.o3.06.236.cmp.E20.job
prp.o3.06.235.1000m.finalpt.pp.job
prp.o3.06.236.1000m.finalpt.pp.job
pst.point.o3.06.235.final.pp.job
pst.point.o3.06.236.final.pp.job
tpl.area.o3.06.235.atarea2.job
tpl.area.o3.06.235.nonatt2.job
tpl.area.o3.06.236.atarea2.job
tpl.area.o3.06.236.nonatt2.job
tpl.avi.o3.06.nrmeas.235
tpl.avi.o3.06.nrmeas.236
tpl.mvoff.o3.06.235.atarea.cmp.job
tpl.mvoff.o3.06.235.nonatt.cmp.job
tpl.mvoff.o3.06.236.atarea.cmp.job
tpl.mvoff.o3.06.236.nonatt.cmp.job
tpl.pnt.o3.06.235.final.pp.job
tpl.pnt.o3.06.236.final.pp.job

./EPS2/job/2015:
chm.area.o3.15.197.atarea.E1.job
chm.area.o3.15.197.nonatt.E1.job
chm.area.o3.15.198.atarea.E1.job
chm.area.o3.15.198.nonatt.E1.job
chm.area.o3.15.235.atarea.E1.job
chm.area.o3.15.235.nonatt.E1.job
chm.area.o3.15.236.atarea.E1.job
chm.area.o3.15.236.nonatt.E1.job
chm.avi.o3.15.197.nrmeas.job
chm.avi.o3.15.198.nrmeas.job
chm.avi.o3.15.235.nrmeas.job
chm.avi.o3.15.236.nrmeas.job
chm.mvoff.o3.15.197.atarea.cmp.E1.job
chm.mvoff.o3.15.197.nonatt.cmp.E1.job
chm.mvoff.o3.15.198.atarea.cmp.E1.job
chm.mvoff.o3.15.198.nonatt.cmp.E1.job
chm.mvoff.o3.15.235.atarea.cmp.E1.job
chm.mvoff.o3.15.235.nonatt.cmp.E1.job
chm.mvoff.o3.15.236.atarea.cmp.E1.job
chm.mvoff.o3.15.236.nonatt.cmp.E1.job
chm.point.o3.15.197.popsCR.final.pp.job
chm.point.o3.15.198.popsCR.final.pp.job
chm.point.o3.15.235.popsCR.final.pp.job
chm.point.o3.15.236.popsCR.final.pp.job
ctl.area.o3.15.197.98to15GF.E1.job
ctl.area.o3.15.197.attainarea.E1.job
ctl.area.o3.15.197.nonattfire.E1.job
ctl.area.o3.15.198.98to15GF.E1.job
ctl.area.o3.15.198.attainarea.E1.job
ctl.area.o3.15.198.nonattfire.E1.job
ctl.area.o3.15.235.99to15GF.E1.job
ctl.area.o3.15.235.attainarea.E1.job
ctl.area.o3.15.235.nonattfire.E1.job
ctl.area.o3.15.236.99to15GF.E1.job
ctl.area.o3.15.236.attainarea.E1.job
ctl.area.o3.15.236.nonattfire.E1.job
ctl.avi.o3.15.197.nrmeas.job
ctl.avi.o3.15.198.nrmeas.job
ctl.avi.o3.15.235.nrmeas.job
ctl.avi.o3.15.236.nrmeas.job
ctl.mvoff.o3.15.197.98to15GF.E1.job
ctl.mvoff.o3.15.197.attainarea.cmp.E1.job
ctl.mvoff.o3.15.197.nonatt.constr-18.E1.jo
b
ctl.mvoff.o3.15.197.nonatt.nolog.E1.job
ctl.mvoff.o3.15.197.Nonrd.E1.job
ctl.mvoff.o3.15.198.98to15GF.E1.job
ctl.mvoff.o3.15.198.attainarea.cmp.E1.job
ctl.mvoff.o3.15.198.nonatt.constr-18.E1.jo
b
ctl.mvoff.o3.15.198.nonatt.nolog.E1.job
ctl.mvoff.o3.15.198.Nonrd.E1.job
ctl.mvoff.o3.15.235.99to15GF.E1.job
ctl.mvoff.o3.15.235.attainarea.cmp.E1.job
ctl.mvoff.o3.15.235.nonatt.constr-18.E1.jo
b
ctl.mvoff.o3.15.235.nonatt.nolog.E1.job
ctl.mvoff.o3.15.235.Nonrd.E1.job
ctl.mvoff.o3.15.236.99to15GF.E1.job
ctl.mvoff.o3.15.236.attainarea.cmp.E1.job
ctl.mvoff.o3.15.236.nonatt.constr-18.E1.jo
b
ctl.mvoff.o3.15.236.nonatt.nolog.E1.job
ctl.mvoff.o3.15.236.Nonrd.E1.job
grd.area.attain.o3.15.197.E2.job
grd.area.attain.o3.15.198.E2.job
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grd.area.attain.o3.15.235.E2.job
grd.area.attain.o3.15.236.E2.job
grd.area.nonatt.o3.15.197.E2.job
grd.area.nonatt.o3.15.198.E2.job
grd.area.nonatt.o3.15.235.E2.job
grd.area.nonatt.o3.15.236.E2.job
grd.avi.o3.15.197.nrmeas.job
grd.avi.o3.15.198.nrmeas.job
grd.avi.o3.15.235.nrmeas.job
grd.avi.o3.15.236.nrmeas.job
grd.mvoff.attain.o3.15.197.cmp.E1.job
grd.mvoff.attain.o3.15.198.cmp.E1.job
grd.mvoff.attain.o3.15.235.cmp.E1.job
grd.mvoff.attain.o3.15.236.cmp.E1.job
grd.mvoff.nonatt.o3.15.197.cmp.E1.job
grd.mvoff.nonatt.o3.15.198.cmp.E1.job
grd.mvoff.nonatt.o3.15.235.cmp.E1.job
grd.mvoff.nonatt.o3.15.236.cmp.E1.job
grd.point.nonatt.o3.15.197.popsCR.final.pp
.job
grd.point.nonatt.o3.15.198.popsCR.final.pp
.job
grd.point.nonatt.o3.15.235.popsCR.final.pp
.job
grd.point.nonatt.o3.15.236.popsCR.final.pp
.job
lbs.avi.o3.15.197.job
lbs.avi.o3.15.198.job
lbs.avi.o3.15.235.job
lbs.avi.o3.15.236.job
mrg.o3.15.197.cmp.E9.job
mrg.o3.15.198.cmp.E9.job
mrg.o3.15.235.cmp.E12.job
mrg.o3.15.236.cmp.E12.job
prp.o3.15.197.1000m.popsCR.final.pp.job
prp.o3.15.198.1000m.popsCR.final.pp.job
prp.o3.15.235.1000m.popsCR.final.pp.job
prp.o3.15.236.1000m.popsCR.final.pp.job
pst.point.o3.15.197.popsCR.final.pp.job
pst.point.o3.15.198.popsCR.final.pp.job
pst.point.o3.15.235.popsCR.final.pp.job
pst.point.o3.15.236.popsCR.final.pp.job
tpl.area.o3.15.197.atarea.E2.job
tpl.area.o3.15.197.nonatt.E2.job
tpl.area.o3.15.198.atarea.E2.job
tpl.area.o3.15.198.nonatt.E2.job
tpl.area.o3.15.235.atarea.E2.job
tpl.area.o3.15.235.nonatt.E2.job
tpl.area.o3.15.236.atarea.E2.job
tpl.area.o3.15.236.nonatt.E2.job
tpl.avi.o3.15.nrmeas.197
tpl.avi.o3.15.nrmeas.198
tpl.avi.o3.15.nrmeas.235
tpl.avi.o3.15.nrmeas.236
tpl.mvoff.o3.15.197.atarea.cmp.E1.job
tpl.mvoff.o3.15.197.nonatt.cmp.E1.job
tpl.mvoff.o3.15.198.atarea.cmp.E1.job
tpl.mvoff.o3.15.198.nonatt.cmp.E1.job
tpl.mvoff.o3.15.235.atarea.cmp.E1.job
tpl.mvoff.o3.15.235.nonatt.cmp.E1.job
tpl.mvoff.o3.15.236.atarea.cmp.E1.job
tpl.mvoff.o3.15.236.nonatt.cmp.E1.job
tpl.pnt.o3.15.197.popsCR.final.pp.job
tpl.pnt.o3.15.198.popsCR.final.pp.job
tpl.pnt.o3.15.235.popsCR.final.pp.job
tpl.pnt.o3.16.236.popsCR.final.pp.job

./EPS2/job/2015_ind_measures:
chm.avi.o3.15.236.nrmeas.job
chm.mvoff.o3.15.236.nonatt.cmp.E1.job
chm.point.o3.15.236.popsCR.final.pp.job
ctl.avi.o3.15.236.nrmeas.job
ctl.mvoff.o3.15.236.99to15GF.E1.job
ctl.mvoff.o3.15.236.nonatt.constr-18.E1.jo
b
ctl.mvoff.o3.15.236.nonatt.nolog.E1.job
ctl.mvoff.o3.15.236.Nonrd.E1.job
grd.avi.o3.15.236.nrmeas.job
grd.mvoff.nonatt.o3.15.236.cmp.E1.job
grd.point.nonatt.o3.15.236.popsCR.final.pp
.job
lbs.avi.o3.15.236.job
prp.o3.15.236.1000m.popsCR.final.pp.job
pst.point.o3.15.236.popsCR.final.pp.job
tpl.avi.o3.15.nrmeas.236
tpl.mvoff.o3.15.236.nonatt.cmp.E1.job
tpl.pnt.o3.16.236.popsCR.final.pp.job

./EPS2/job/2015_no_measures:
chm.avi.o3.15.236.bas.job
chm.mvoff.o3.15.236.nonatt.bas.E1.job
chm.point.o3.15.236.baspp-rule348.job
ctl.mvoff.o3.15.236.99to15GF.E1.job
ctl.mvoff.o3.15.236.nonatt.bas+cons-18.job
ctl.mvoff.o3.15.236.nonatt.bas.nolog.job
grd.avi.o3.15.236.bas.job
grd.mvoff.nonatt.o3.15.236.bas.E1.job
grd.point.nonatt.o3.15.236.baspp-rule348.j
ob
lbs.avi.o3.15.236.job
prp.o3.15.236.1000m.baspp-rule348.job
pst.point.o3.15.236.baspp-rule348.job
tpl.avi.o3.15.236.bas.job
tpl.mvoff.o3.15.236.nonatt.bas.E1.job
tpl.pnt.o3.15.236.baspp-rule348.job

./EPS2/msg:
1998
1999
2006
2015
2015_ind_measures
2015_no_measures

./EPS2/msg/1998:
chm.area.o3.98.197.atarea.R2.err
chm.area.o3.98.197.atarea.R2.msg
chm.area.o3.98.197.nonatt.R2.err
chm.area.o3.98.197.nonatt.R2.msg
chm.area.o3.98.198.atarea.R2.err
chm.area.o3.98.198.atarea.R2.msg
chm.area.o3.98.198.nonatt.R2.err
chm.area.o3.98.198.nonatt.R2.msg
chm.avi.o3.98.197.err
chm.avi.o3.98.197.msg
chm.avi.o3.98.198.err
chm.avi.o3.98.198.msg
chm.mvof.o3.98.197.atnolog.err
chm.mvof.o3.98.197.atnolog.msg
chm.mvof.o3.98.197.nonolog.err
chm.mvof.o3.98.197.nonolog.msg
chm.mvof.o3.98.198.atnolog.err
chm.mvof.o3.98.198.atnolog.msg
chm.mvof.o3.98.198.nonolog.err
chm.mvof.o3.98.198.nonolog.msg
chm.point.o3.98.197.1000m.err
chm.point.o3.98.197.1000m.msg
chm.point.o3.98.197.all.err
chm.point.o3.98.197.all.msg
chm.point.o3.98.198.1000m.err
chm.point.o3.98.198.1000m.msg
chm.point.o3.98.198.all.err
chm.point.o3.98.198.all.msg
ctl.area.o3.98.197.atarea.R2.err
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ctl.area.o3.98.197.atarea.R2.msg
ctl.area.o3.98.197.nonatt.R2.err
ctl.area.o3.98.197.nonatt.R2.msg
ctl.area.o3.98.198.atarea.R2.err
ctl.area.o3.98.198.atarea.R2.msg
ctl.area.o3.98.198.nonatt.R2.err
ctl.area.o3.98.198.nonatt.R2.msg
ctl.mvof.o3.98.197.atarea.err
ctl.mvof.o3.98.197.atarea.msg
ctl.mvof.o3.98.197.atnolog.err
ctl.mvof.o3.98.197.atnolog.msg
ctl.mvof.o3.98.197.nonolog.err
ctl.mvof.o3.98.197.nonolog.msg
ctl.mvof.o3.98.197.RFG.err
ctl.mvof.o3.98.197.RFG.msg
ctl.mvof.o3.98.198.atarea.err
ctl.mvof.o3.98.198.atarea.msg
ctl.mvof.o3.98.198.atnolog.err
ctl.mvof.o3.98.198.atnolog.msg
ctl.mvof.o3.98.198.nonolog.err
ctl.mvof.o3.98.198.nonolog.msg
ctl.mvof.o3.98.198.RFG.err
ctl.mvof.o3.98.198.RFG.msg
grd.area.attain.o3.98.197.R2.err
grd.area.attain.o3.98.197.R2.msg
grd.area.attain.o3.98.198.R2.err
grd.area.attain.o3.98.198.R2.msg
grd.area.nonatt.o3.98.197.R2.err
grd.area.nonatt.o3.98.197.R2.msg
grd.area.nonatt.o3.98.198.R2.err
grd.area.nonatt.o3.98.198.R2.msg
grd.avi.nonatt.o3.98.197.err
grd.avi.nonatt.o3.98.197.msg
grd.avi.nonatt.o3.98.198.err
grd.avi.nonatt.o3.98.198.msg
grd.mvof.o3.98.197.atnolog.err
grd.mvof.o3.98.197.atnolog.msg
grd.mvof.o3.98.197.nonolog.err
grd.mvof.o3.98.197.nonolog.msg
grd.mvof.o3.98.198.atnolog.err
grd.mvof.o3.98.198.atnolog.msg
grd.mvof.o3.98.198.nonolog.err
grd.mvof.o3.98.198.nonolog.msg
grd.pnt.nonatt.o3.98.197.1000m.err
grd.pnt.nonatt.o3.98.197.1000m.msg
grd.pnt.nonatt.o3.98.197.all.err
grd.pnt.nonatt.o3.98.197.all.msg
grd.pnt.nonatt.o3.98.198.1000m.err
grd.pnt.nonatt.o3.98.198.1000m.msg
grd.pnt.nonatt.o3.98.198.all.err
grd.pnt.nonatt.o3.98.198.all.msg
lbs.avi.o3.98.197.err
lbs.avi.o3.98.197.msg
lbs.avi.o3.98.198.err
lbs.avi.o3.98.198.msg
mrg.o3.98.197.E5.msg
mrg.o3.98.198.E5.msg
prp.o3.98.197.1000m.err
prp.o3.98.197.1000m.msg
prp.o3.98.197.1000m.stkrpt
prp.o3.98.197.all.err
prp.o3.98.197.all.msg
prp.o3.98.197.all.stkrpt
prp.o3.98.198.1000m.err
prp.o3.98.198.1000m.msg
prp.o3.98.198.1000m.stkrpt
prp.o3.98.198.all.err
prp.o3.98.198.all.msg
prp.o3.98.198.all.stkrpt
pst.o3.98.197.1000m.err
pst.o3.98.197.1000m.msg
pst.o3.98.198.1000m.err
pst.o3.98.198.1000m.msg
tpl.area.o3.98.197.atarea.R2.err
tpl.area.o3.98.197.atarea.R2.msg
tpl.area.o3.98.197.nonatt.R2.err
tpl.area.o3.98.197.nonatt.R2.msg
tpl.area.o3.98.198.atarea.R2.err
tpl.area.o3.98.198.atarea.R2.msg
tpl.area.o3.98.198.nonatt.R2.err
tpl.area.o3.98.198.nonatt.R2.msg
tpl.avi.o3.98.197.err
tpl.avi.o3.98.197.msg
tpl.avi.o3.98.198.err
tpl.avi.o3.98.198.msg
tpl.mvof.o3.98.197.atnolog.err
tpl.mvof.o3.98.197.atnolog.msg
tpl.mvof.o3.98.197.nonolog.err
tpl.mvof.o3.98.197.nonolog.msg
tpl.mvof.o3.98.198.atnolog.err
tpl.mvof.o3.98.198.atnolog.msg
tpl.mvof.o3.98.198.nonolog.err
tpl.mvof.o3.98.198.nonolog.msg
tpl.point.o3.98.197.1000m.err
tpl.point.o3.98.197.1000m.msg
tpl.point.o3.98.197.all.err
tpl.point.o3.98.197.all.msg
tpl.point.o3.98.198.1000m.err
tpl.point.o3.98.198.1000m.msg
tpl.point.o3.98.198.all.err
tpl.point.o3.98.198.all.msg

./EPS2/msg/1999:
chm.area.o3.99.235.atarea.R2.err
chm.area.o3.99.235.atarea.R2.msg
chm.area.o3.99.235.nonatt.R2.err
chm.area.o3.99.235.nonatt.R2.msg
chm.area.o3.99.236.atarea.R2.err
chm.area.o3.99.236.atarea.R2.msg
chm.area.o3.99.236.nonatt.R2.err
chm.area.o3.99.236.nonatt.R2.msg
chm.avi.o3.99.235.err
chm.avi.o3.99.235.msg
chm.avi.o3.99.236.err
chm.avi.o3.99.236.msg
chm.mvoff.o3.99.235.nonolog.err
chm.mvoff.o3.99.235.nonolog.msg
chm.mvoff.o3.99.236.nonolog.err
chm.mvoff.o3.99.236.nonolog.msg
chm.mvof.o3.99.235.atnolog.err
chm.mvof.o3.99.235.atnolog.msg
chm.mvof.o3.99.236.atnolog.err
chm.mvof.o3.99.236.atnolog.msg
chm.point.o3.99.235.1000m.err
chm.point.o3.99.235.1000m.msg
chm.point.o3.99.235.all.err
chm.point.o3.99.235.all.msg
chm.point.o3.99.236.1000m.err
chm.point.o3.99.236.1000m.msg
chm.point.o3.99.236.all.err
chm.point.o3.99.236.all.msg
ctl.area.o3.99.235.atarea.R2.err
ctl.area.o3.99.235.atarea.R2.msg
ctl.area.o3.99.235.nonatt.R2.err
ctl.area.o3.99.235.nonatt.R2.msg
ctl.area.o3.99.236.atarea.R2.err
ctl.area.o3.99.236.atarea.R2.msg
ctl.area.o3.99.236.nonatt.R2.err
ctl.area.o3.99.236.nonatt.R2.msg
ctl.mvof.o3.99.235.atarea.err
ctl.mvof.o3.99.235.atarea.msg
ctl.mvof.o3.99.235.atnolog.err
ctl.mvof.o3.99.235.atnolog.msg
ctl.mvof.o3.99.235.nonnolog.err
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ctl.mvof.o3.99.235.nonnolog.msg
ctl.mvof.o3.99.235.RFG.err
ctl.mvof.o3.99.235.RFG.msg
ctl.mvof.o3.99.236.atarea.err
ctl.mvof.o3.99.236.atarea.msg
ctl.mvof.o3.99.236.atnolog.err
ctl.mvof.o3.99.236.atnolog.msg
ctl.mvof.o3.99.236.nonnolog.err
ctl.mvof.o3.99.236.nonnolog.msg
ctl.mvof.o3.99.236.RFG.err
ctl.mvof.o3.99.236.RFG.msg
grd.area.atarea.o3.99.235.R2.err
grd.area.atarea.o3.99.235.R2.msg
grd.area.atarea.o3.99.236.R2.err
grd.area.atarea.o3.99.236.R2.msg
grd.area.nonatt.o3.99.235.R2.err
grd.area.nonatt.o3.99.235.R2.msg
grd.area.nonatt.o3.99.236.R2.err
grd.area.nonatt.o3.99.236.R2.msg
grd.avi.non.o3.99.235.err
grd.avi.non.o3.99.235.msg
grd.avi.non.o3.99.236.err
grd.avi.non.o3.99.236.msg
grd.mvof.o3.99.235.atnolog.err
grd.mvof.o3.99.235.atnolog.msg
grd.mvof.o3.99.235.nonolog.err
grd.mvof.o3.99.235.nonolog.msg
grd.mvof.o3.99.236.atnolog.err
grd.mvof.o3.99.236.atnolog.msg
grd.mvof.o3.99.236.nonolog.err
grd.mvof.o3.99.236.nonolog.msg
grd.pnt.non.o3.99.235.1000m.err
grd.pnt.non.o3.99.235.1000m.msg
grd.pnt.non.o3.99.235.all.err
grd.pnt.non.o3.99.235.all.msg
grd.pnt.non.o3.99.236.1000m.err
grd.pnt.non.o3.99.236.1000m.msg
grd.pnt.non.o3.99.236.all.err
grd.pnt.non.o3.99.236.all.msg
lbs.avi.o3.99.235.err
lbs.avi.o3.99.235.msg
lbs.avi.o3.99.236.err
lbs.avi.o3.99.236.msg
mrg.o3.99.235.E5.msg
mrg.o3.99.236.E5.msg
pra.o3.99.235.R2.err
pra.o3.99.235.R2.msg
pra.o3.99.236.R2.err
pra.o3.99.236.R2.msg
prp.o3.99.235.1000m.err
prp.o3.99.235.1000m.msg
prp.o3.99.235.1000m.stkrpt
prp.o3.99.235.all.err
prp.o3.99.235.all.msg
prp.o3.99.235.all.stkrpt
prp.o3.99.236.1000m.err
prp.o3.99.236.1000m.msg
prp.o3.99.236.1000m.stkrpt
prp.o3.99.236.all.err
prp.o3.99.236.all.msg
prp.o3.99.236.all.stkrpt
pst.o3.99.235.1000m.err
pst.o3.99.235.1000m.msg
pst.o3.99.236.1000m.err
pst.o3.99.236.1000m.msg
tpl.area.o3.99.235.atarea.R2.err
tpl.area.o3.99.235.atarea.R2.msg
tpl.area.o3.99.235.nonatt.R2.err
tpl.area.o3.99.235.nonatt.R2.msg
tpl.area.o3.99.236.atarea.R2.err
tpl.area.o3.99.236.atarea.R2.msg
tpl.area.o3.99.236.nonatt.R2.err
tpl.area.o3.99.236.nonatt.R2.msg
tpl.avi.o3.99.235.err
tpl.avi.o3.99.235.msg
tpl.avi.o3.99.236.err
tpl.avi.o3.99.236.msg
tpl.mvoff.o3.99.235.atnolog.err
tpl.mvoff.o3.99.235.atnolog.msg
tpl.mvoff.o3.99.235.nonolog.err
tpl.mvoff.o3.99.235.nonolog.msg
tpl.mvoff.o3.99.236.atnolog.err
tpl.mvoff.o3.99.236.atnolog.msg
tpl.mvoff.o3.99.236.nonolog.err
tpl.mvoff.o3.99.236.nonolog.msg
tpl.point.o3.99.235.1000m.err
tpl.point.o3.99.235.1000m.msg
tpl.point.o3.99.235.all.err
tpl.point.o3.99.235.all.msg
tpl.point.o3.99.236.1000m.err
tpl.point.o3.99.236.1000m.msg
tpl.point.o3.99.236.all.err
tpl.point.o3.99.236.all.msg

./EPS2/msg/2006:
chm.area.o3.06.235.atarea.err
chm.area.o3.06.235.atarea.msg
chm.area.o3.06.235.nonat.err
chm.area.o3.06.235.nonat.msg
chm.area.o3.06.236.atarea.err
chm.area.o3.06.236.atarea.msg
chm.area.o3.06.236.nonat.err
chm.area.o3.06.236.nonat.msg
chm.avi.o3.06.235.err
chm.avi.o3.06.235.msg
chm.avi.o3.06.235.nrmeas.err
chm.avi.o3.06.235.nrmeas.msg
chm.avi.o3.06.236.err
chm.avi.o3.06.236.msg
chm.avi.o3.06.236.nrmeas.err
chm.avi.o3.06.236.nrmeas.msg
chm.mvoff.o3.06.235.nonatcmp.err
chm.mvoff.o3.06.235.nonatcmp.msg
chm.mvoff.o3.06.236.nonatcmp.err
chm.mvoff.o3.06.236.nonatcmp.msg
chm.mvof.o3.06.235.atcmp.err
chm.mvof.o3.06.235.atcmp.msg
chm.mvof.o3.06.236.atcmp.err
chm.mvof.o3.06.236.atcmp.msg
chm.pnt.o3.06.235.final.pp.err
chm.pnt.o3.06.235.final.pp.msg
chm.pnt.o3.06.236.final.pp.err
chm.pnt.o3.06.236.final.pp.msg
ctl.area.o3.06.235.9906GF.err
ctl.area.o3.06.235.9906GF.msg
ctl.area.o3.06.235.atarea.err
ctl.area.o3.06.235.atarea.msg
ctl.area.o3.06.235.nonat.err
ctl.area.o3.06.235.nonat.msg
ctl.area.o3.06.236.9906GF.err
ctl.area.o3.06.236.9906GF.msg
ctl.area.o3.06.236.atarea.err
ctl.area.o3.06.236.atarea.msg
ctl.area.o3.06.236.nonat.err
ctl.area.o3.06.236.nonat.msg
ctl.mvoff.o3.06.235.9906GF.err
ctl.mvoff.o3.06.235.9906GF.msg
ctl.mvoff.o3.06.235.NRcmp.err
ctl.mvoff.o3.06.235.NRcmp.msg
ctl.mvoff.o3.06.236.9906GF.err
ctl.mvoff.o3.06.236.9906GF.msg
ctl.mvoff.o3.06.236.NRcmp.err
ctl.mvoff.o3.06.236.NRcmp.msg
ctl.mvof.o3.06.235.atcmp.err
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ctl.mvof.o3.06.235.atcmp.msg
ctl.mvof.o3.06.235.nonnolog.cmp.err
ctl.mvof.o3.06.235.nonnolog.cmp.msg
ctl.mvof.o3.06.236.atcmp.err
ctl.mvof.o3.06.236.atcmp.msg
ctl.mvof.o3.06.236.nonnolog.cmp.err
ctl.mvof.o3.06.236.nonnolog.cmp.msg
grd.area.atarea.o3.06.235.2.err
grd.area.atarea.o3.06.235.2.msg
grd.area.atarea.o3.06.236.2.err
grd.area.atarea.o3.06.236.2.msg
grd.area.nonat.o3.06.235.2.err
grd.area.nonat.o3.06.235.2.msg
grd.area.nonat.o3.06.236.2.err
grd.area.nonat.o3.06.236.2.msg
grd.avi.nonatt.o3.06.235.err
grd.avi.nonatt.o3.06.235.msg
grd.avi.nonatt.o3.06.236.err
grd.avi.nonatt.o3.06.236.msg
grd.avi.o3.06.235.nrmeas.err
grd.avi.o3.06.235.nrmeas.msg
grd.avi.o3.06.236.nrmeas.err
grd.avi.o3.06.236.nrmeas.msg
grd.mvof.atcmp.o3.06.235.err
grd.mvof.atcmp.o3.06.235.msg
grd.mvof.atcmp.o3.06.236.err
grd.mvof.atcmp.o3.06.236.msg
grd.mvof.nonatcmp.o3.06.235.err
grd.mvof.nonatcmp.o3.06.235.msg
grd.mvof.nonatcmp.o3.06.236.err
grd.mvof.nonatcmp.o3.06.236.msg
grd.pnt.o3.06.235.final.pp.err
grd.pnt.o3.06.235.final.pp.msg
grd.pnt.o3.06.236.final.pp.err
grd.pnt.o3.06.236.final.pp.msg
lbs.avi.o3.06.235.err
lbs.avi.o3.06.235.msg
lbs.avi.o3.06.236.err
lbs.avi.o3.06.236.msg
mrg.o3.06.235.cmp.E20.msg
mrg.o3.06.236.cmp.E20.msg
prp.o3.06.235.final.pp.err
prp.o3.06.235.final.pp.msg
prp.o3.06.235.final.pp.stkrpt
prp.o3.06.236.final.pp.err
prp.o3.06.236.final.pp.msg
prp.o3.06.236.final.pp.stkrpt
pst.o3.06.235.final.pp.err
pst.o3.06.235.final.pp.msg
pst.o3.06.236.final.pp.err
pst.o3.06.236.final.pp.msg
tpl.area.o3.06.235.atarea2.err
tpl.area.o3.06.235.atarea2.msg
tpl.area.o3.06.235.nonat2.err
tpl.area.o3.06.235.nonat2.msg
tpl.area.o3.06.236.atarea2.err
tpl.area.o3.06.236.atarea2.msg
tpl.area.o3.06.236.nonat2.err
tpl.area.o3.06.236.nonat2.msg
tpl.avi.o3.06.235.err
tpl.avi.o3.06.235.msg
tpl.avi.o3.06.235.nrmeas.err
tpl.avi.o3.06.235.nrmeas.msg
tpl.avi.o3.06.236.err
tpl.avi.o3.06.236.msg
tpl.avi.o3.06.236.nrmeas.err
tpl.avi.o3.06.236.nrmeas.msg
tpl.mvof.o3.06.235.atcmp.err
tpl.mvof.o3.06.235.atcmp.msg
tpl.mvof.o3.06.235.nonatcmp.err
tpl.mvof.o3.06.235.nonatcmp.msg
tpl.mvof.o3.06.236.atcmp.err
tpl.mvof.o3.06.236.atcmp.msg
tpl.mvof.o3.06.236.nonatcmp.err
tpl.mvof.o3.06.236.nonatcmp.msg
tpl.pnt.o3.06.235.final.pp.err
tpl.pnt.o3.06.235.final.pp.msg
tpl.pnt.o3.06.236.final.pp.err
tpl.pnt.o3.06.236.final.pp.msg

./EPS2/msg/2015:
chm.area.o3.15.197.atarE1.err
chm.area.o3.15.197.atarE1.msg
chm.area.o3.15.197.nonatE1.err
chm.area.o3.15.197.nonatE1.msg
chm.area.o3.15.198.atarE1.err
chm.area.o3.15.198.atarE1.msg
chm.area.o3.15.198.nonatE1.err
chm.area.o3.15.198.nonatE1.msg
chm.area.o3.15.235.atarE1.err
chm.area.o3.15.235.atarE1.msg
chm.area.o3.15.235.nonatE1.err
chm.area.o3.15.235.nonatE1.msg
chm.area.o3.15.236.atarE1.err
chm.area.o3.15.236.atarE1.msg
chm.area.o3.15.236.nonatE1.err
chm.area.o3.15.236.nonatE1.msg
chm.avi.o3.15.197.nrmeas.err
chm.avi.o3.15.197.nrmeas.msg
chm.avi.o3.15.198.nrmeas.err
chm.avi.o3.15.198.nrmeas.msg
chm.avi.o3.15.235.nrmeas.err
chm.avi.o3.15.235.nrmeas.msg
chm.avi.o3.15.236.nrmeas.err
chm.avi.o3.15.236.nrmeas.msg
chm.mvoff.o3.15.197.nonatcmpE1.err
chm.mvoff.o3.15.197.nonatcmpE1.msg
chm.mvoff.o3.15.198.nonatcmpE1.err
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chm.mvof.o3.15.197.atcmpE1.err
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chm.mvof.o3.15.198.atcmpE1.msg
chm.mvof.o3.15.235.atcmpE1.err
chm.mvof.o3.15.235.atcmpE1.msg
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chm.mvof.o3.15.236.atcmpE1.msg
chm.pnt.o3.15.197.final.pp.err
chm.pnt.o3.15.197.final.pp.msg
chm.pnt.o3.15.198.final.pp.err
chm.pnt.o3.15.198.final.pp.msg
chm.pnt.o3.15.235.final.pp.err
chm.pnt.o3.15.235.final.pp.msg
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chm.pnt.o3.15.236.final.pp.msg
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ctl.area.o3.15.197.9815GF.E1.msg
ctl.area.o3.15.197.atarE1.err
ctl.area.o3.15.197.atarE1.msg
ctl.area.o3.15.197.nonat.E1.err
ctl.area.o3.15.197.nonat.E1.msg
ctl.area.o3.15.198.9815GF.E1.err
ctl.area.o3.15.198.9815GF.E1.msg
ctl.area.o3.15.198.atarE1.err
ctl.area.o3.15.198.atarE1.msg
ctl.area.o3.15.198.nonat.E1.err
ctl.area.o3.15.198.nonat.E1.msg
ctl.area.o3.15.235.9915GF.E1.err
ctl.area.o3.15.235.9915GF.E1.msg
ctl.area.o3.15.235.atarE1.err
```

ctl.area.o3.15.235.atarE1.msg
ctl.area.o3.15.235.nonat.E1.err
ctl.area.o3.15.235.nonat.E1.msg
ctl.area.o3.15.236.9915GF.E1.err
ctl.area.o3.15.236.9915GF.E1.msg
ctl.area.o3.15.236.atarE1.err
ctl.area.o3.15.236.atarE1.msg
ctl.area.o3.15.236.nonat.E1.err
ctl.area.o3.15.236.nonat.E1.msg
ctl.avi.o3.15.197.nrmeas.err
ctl.avi.o3.15.197.nrmeas.msg
ctl.avi.o3.15.198.nrmeas.err
ctl.avi.o3.15.198.nrmeas.msg
ctl.avi.o3.15.235.nrmeas.err
ctl.avi.o3.15.235.nrmeas.msg
ctl.avi.o3.15.236.nrmeas.err
ctl.avi.o3.15.236.nrmeas.msg
ctl.mvoff.o3.15.197.9815GF.E1.err
ctl.mvoff.o3.15.197.9815GF.E1.msg
ctl.mvoff.o3.15.197.NRcmp.E1.err
ctl.mvoff.o3.15.197.NRcmp.E1.msg
ctl.mvoff.o3.15.198.9815GF.E1.err
ctl.mvoff.o3.15.198.9815GF.E1.msg
ctl.mvoff.o3.15.198.NRcmp.E1.err
ctl.mvoff.o3.15.198.NRcmp.E1.msg
ctl.mvoff.o3.15.235.9915GF.E1.err
ctl.mvoff.o3.15.235.9915GF.E1.msg
ctl.mvoff.o3.15.235.NRcmp.E1.err
ctl.mvoff.o3.15.235.NRcmp.E1.msg
ctl.mvoff.o3.15.236.9915GF.E1.err
ctl.mvoff.o3.15.236.9915GF.E1.msg
ctl.mvoff.o3.15.236.NRcmp.E1.err
ctl.mvoff.o3.15.236.NRcmp.E1.msg
ctl.mvof.o3.15.197.atcmpE1.err
ctl.mvof.o3.15.197.atcmpE1.msg
ctl.mvof.o3.15.197.Const.E1.err
ctl.mvof.o3.15.197.Const.E1.msg
ctl.mvof.o3.15.197.nonnolog.E1.err
ctl.mvof.o3.15.197.nonnolog.E1.msg
ctl.mvof.o3.15.198.atcmpE1.err
ctl.mvof.o3.15.198.atcmpE1.msg
ctl.mvof.o3.15.198.Const.E1.err
ctl.mvof.o3.15.198.Const.E1.msg
ctl.mvof.o3.15.198.nonnolog.E1.err
ctl.mvof.o3.15.198.nonnolog.E1.msg
ctl.mvof.o3.15.235.atcmpE1.err
ctl.mvof.o3.15.235.atcmpE1.msg
ctl.mvof.o3.15.235.Const.E1.err
ctl.mvof.o3.15.235.Const.E1.msg
ctl.mvof.o3.15.235.nonnolog.E1.err
ctl.mvof.o3.15.235.nonnolog.E1.msg
ctl.mvof.o3.15.236.atcmpE1.err
ctl.mvof.o3.15.236.atcmpE1.msg
ctl.mvof.o3.15.236.Const.E1.err
ctl.mvof.o3.15.236.Const.E1.msg
ctl.mvof.o3.15.236.nonnolog.E1.err
ctl.mvof.o3.15.236.nonnolog.E1.msg
grd.area.atE2.o3.15.197.err
grd.area.atE2.o3.15.197.msg
grd.area.atE2.o3.15.198.err
grd.area.atE2.o3.15.198.msg
grd.area.atE2.o3.15.235.err
grd.area.atE2.o3.15.235.msg
grd.area.atE2.o3.15.236.err
grd.area.atE2.o3.15.236.msg
grd.area.nonatE2.o3.15.197.err
grd.area.nonatE2.o3.15.197.msg
grd.area.nonatE2.o3.15.198.err
grd.area.nonatE2.o3.15.198.msg
grd.area.nonatE2.o3.15.235.err
grd.area.nonatE2.o3.15.235.msg
grd.area.nonatE2.o3.15.236.err
grd.area.nonatE2.o3.15.236.msg
grd.avi.o3.15.197.nrmeas.err
grd.avi.o3.15.197.nrmeas.msg
grd.avi.o3.15.198.nrmeas.err
grd.avi.o3.15.198.nrmeas.msg
grd.avi.o3.15.235.nrmeas.err
grd.avi.o3.15.235.nrmeas.msg
grd.avi.o3.15.236.nrmeas.err
grd.avi.o3.15.236.nrmeas.msg
grd.mvof.atcmpE1.o3.15.197.err
grd.mvof.atcmpE1.o3.15.197.msg
grd.mvof.atcmpE1.o3.15.198.err
grd.mvof.atcmpE1.o3.15.198.msg
grd.mvof.atcmpE1.o3.15.235.err
grd.mvof.atcmpE1.o3.15.235.msg
grd.mvof.atcmpE1.o3.15.236.err
grd.mvof.atcmpE1.o3.15.236.msg
grd.mvof.nonatcmpE1.o3.15.197.err
grd.mvof.nonatcmpE1.o3.15.197.msg
grd.mvof.nonatcmpE1.o3.15.198.err
grd.mvof.nonatcmpE1.o3.15.198.msg
grd.mvof.nonatcmpE1.o3.15.235.err
grd.mvof.nonatcmpE1.o3.15.235.msg
grd.mvof.nonatcmpE1.o3.15.236.err
grd.mvof.nonatcmpE1.o3.15.236.msg
grd.pnt.nonatt.o3.15.197.final.pp.err
grd.pnt.nonatt.o3.15.197.final.pp.msg
grd.pnt.nonatt.o3.15.198.final.pp.err
grd.pnt.nonatt.o3.15.198.final.pp.msg
grd.pnt.nonatt.o3.15.235.final.pp.err
grd.pnt.nonatt.o3.15.235.final.pp.msg
grd.pnt.nonatt.o3.15.236.final.pp.err
grd.pnt.nonatt.o3.15.236.final.pp.msg
lbs.avi.o3.15.197.err
lbs.avi.o3.15.197.msg
lbs.avi.o3.15.198.err
lbs.avi.o3.15.198.msg
lbs.avi.o3.15.235.err
lbs.avi.o3.15.235.msg
lbs.avi.o3.15.236.err
lbs.avi.o3.15.236.msg
mrg.o3.15.197.cmp.E9.msg
mrg.o3.15.198.cmp.E9.msg
mrg.o3.15.235.cmp.E12.msg
mrg.o3.15.236.cmp.E12.msg
prp.o3.15.197.final.pp.err
prp.o3.15.197.final.pp.msg
prp.o3.15.197.final.pp.stkrpt
prp.o3.15.198.final.pp.err
prp.o3.15.198.final.pp.msg
prp.o3.15.198.final.pp.stkrpt
prp.o3.15.235.final.pp.err
prp.o3.15.235.final.pp.msg
prp.o3.15.235.final.pp.stkrpt
prp.o3.15.236.final.pp.err
prp.o3.15.236.final.pp.msg
prp.o3.15.236.final.pp.stkrpt
pst.o3.15.197.final.pp.err
pst.o3.15.197.final.pp.msg
pst.o3.15.198.final.pp.err
pst.o3.15.198.final.pp.msg
pst.o3.15.235.final.pp.err
pst.o3.15.235.final.pp.msg
pst.o3.15.236.final.pp.err
pst.o3.15.236.final.pp.msg
tpl.area.o3.15.197.atarE2.err
tpl.area.o3.15.197.atarE2.msg
tpl.area.o3.15.197.nonatE2.err
tpl.area.o3.15.197.nonatE2.msg
tpl.area.o3.15.198.atarE2.err
tpl.area.o3.15.198.atarE2.msg
tpl.area.o3.15.198.nonatE2.err

```
tpl.area.o3.15.198.nonatE2.msg
tpl.area.o3.15.235.atarE2.err
tpl.area.o3.15.235.atarE2.msg
tpl.area.o3.15.235.nonatE2.err
tpl.area.o3.15.235.nonatE2.msg
tpl.area.o3.15.236.atarE2.err
tpl.area.o3.15.236.atarE2.msg
tpl.area.o3.15.236.nonatE2.err
tpl.area.o3.15.236.nonatE2.msg
tpl.avi.o3.15.197.nrmeas.err
tpl.avi.o3.15.197.nrmeas.msg
tpl.avi.o3.15.198.nrmeas.err
tpl.avi.o3.15.198.nrmeas.msg
tpl.avi.o3.15.235.nrmeas.err
tpl.avi.o3.15.235.nrmeas.msg
tpl.avi.o3.15.236.nrmeas.err
tpl.avi.o3.15.236.nrmeas.msg
tpl.mvof.o3.15.197.atcmpE1.err
tpl.mvof.o3.15.197.atcmpE1.msg
tpl.mvof.o3.15.197.nonatcmpE1.err
tpl.mvof.o3.15.197.nonatcmpE1.msg
tpl.mvof.o3.15.198.atcmpE1.err
tpl.mvof.o3.15.198.atcmpE1.msg
tpl.mvof.o3.15.198.nonatcmpE1.err
tpl.mvof.o3.15.198.nonatcmpE1.msg
tpl.mvof.o3.15.235.atcmpE1.err
tpl.mvof.o3.15.235.atcmpE1.msg
tpl.mvof.o3.15.235.nonatcmpE1.err
tpl.mvof.o3.15.235.nonatcmpE1.msg
tpl.mvof.o3.15.236.atcmpE1.err
tpl.mvof.o3.15.236.atcmpE1.msg
tpl.mvof.o3.15.236.nonatcmpE1.err
tpl.mvof.o3.15.236.nonatcmpE1.msg
tpl.pnt.o3.15.197.final.pp.err
tpl.pnt.o3.15.197.final.pp.msg
tpl.pnt.o3.15.198.final.pp.err
tpl.pnt.o3.15.198.final.pp.msg
tpl.pnt.o3.15.235.final.pp.err
tpl.pnt.o3.15.235.final.pp.msg
tpl.pnt.o3.15.236.final.pp.err
tpl.pnt.o3.15.236.final.pp.msg

./EPS2/msg/2015_ind_measures:
chm.avi.o3.15.236.nrmeas.err
chm.avi.o3.15.236.nrmeas.msg
chm.mvoff.o3.15.236.nonatcmpE1.err
chm.mvoff.o3.15.236.nonatcmpE1.msg
chm.pnt.o3.15.236.final.pp.err
chm.pnt.o3.15.236.final.pp.msg
ctl.avi.o3.15.236.nrmeas.err
ctl.avi.o3.15.236.nrmeas.msg
ctl.mvoff.o3.15.236.9915GF.E1.err
ctl.mvoff.o3.15.236.9915GF.E1.msg
ctl.mvoff.o3.15.236.NRcmp.E1.err
ctl.mvoff.o3.15.236.NRcmp.E1.msg
ctl.mvof.o3.15.236.Const.E1.err
ctl.mvof.o3.15.236.Const.E1.msg
ctl.mvof.o3.15.236.nonnolog.E1.err
ctl.mvof.o3.15.236.nonnolog.E1.msg
grd.avi.o3.15.236.nrmeas.err
grd.avi.o3.15.236.nrmeas.msg
grd.mvof.nonatcmpE1.o3.15.236.err
grd.mvof.nonatcmpE1.o3.15.236.msg
grd.pnt.nonatt.o3.15.236.final.pp.err
grd.pnt.nonatt.o3.15.236.final.pp.msg
lbs.avi.o3.15.236.err
lbs.avi.o3.15.236.msg
prp.o3.15.236.final.pp.err
prp.o3.15.236.final.pp.msg
prp.o3.15.236.final.pp.stkrpt
pst.o3.15.236.final.pp.err
pst.o3.15.236.final.pp.msg
tpl.avi.o3.15.236.nrmeas.err
tpl.avi.o3.15.236.nrmeas.msg
tpl.mvof.o3.15.236.nonatcmpE1.err
tpl.mvof.o3.15.236.nonatcmpE1.msg
tpl.pnt.o3.15.236.final.pp.err
tpl.pnt.o3.15.236.final.pp.msg

./EPS2/msg/2015_no_measures:
chm.avi.o3.15.236.bas.err
chm.avi.o3.15.236.bas.msg
chm.mvoff.o3.15.236.nonatbasE1.err
chm.mvoff.o3.15.236.nonatbasE1.msg
chm.pnt.o3.15.236.baspp-rule348.err
chm.pnt.o3.15.236.baspp-rule348.msg
ctl.mvoff.o3.15.236.9915GF.E1.err
ctl.mvoff.o3.15.236.9915GF.E1.msg
ctl.mvof.o3.15.236.bas.Const.err
ctl.mvof.o3.15.236.bas.Const.msg
ctl.mvof.o3.15.236.bas.nonnolog.err
ctl.mvof.o3.15.236.bas.nonnolog.msg
grd.avi.o3.15.236.bas.err
grd.avi.o3.15.236.bas.msg
grd.mvof.nonatbasE1.o3.15.236.err
grd.mvof.nonatbasE1.o3.15.236.msg
grd.pnt.non.o3.15.236.baspp-r348.err
grd.pnt.non.o3.15.236.baspp-r348.msg
lbs.avi.o3.15.236.err
lbs.avi.o3.15.236.msg
prp.o3.15.236.baspp-rule348.err
prp.o3.15.236.baspp-rule348.msg
prp.o3.15.236.baspp-rule348.stkrpt
pst.o3.15.236.baspp-rule348.err
pst.o3.15.236.baspp-rule348.msg
tpl.avi.o3.15.236.bas.err
tpl.avi.o3.15.236.bas.msg
tpl.mvof.o3.15.236.nonatbasE1.err
tpl.mvof.o3.15.236.nonatbasE1.msg
tpl.pnt.o3.15.236.baspp-rule348.err
tpl.pnt.o3.15.236.baspp-rule348.msg

./EPS2/out:
1998
1999
2006
2015
2015_ind_measures
2015_no_measures

./EPS2/out/1998:
chm.area.o3.98.197.atarea.R2.embr
chm.area.o3.98.197.nonatt.R2.embr
chm.area.o3.98.198.atarea.R2.embr
chm.area.o3.98.198.nonatt.R2.embr
chm.avi.o3.98.197.embr
chm.avi.o3.98.198.embr
chm.mvof.o3.98.197.atnolog.embr
chm.mvof.o3.98.197.nonolog.embr
chm.mvof.o3.98.198.atnolog.embr
chm.mvof.o3.98.198.nonolog.embr
chm.point.o3.98.197.1000m.embr
chm.point.o3.98.198.1000m.embr
ctl.area.o3.98.197.atarea.R2.embr
ctl.area.o3.98.197.nonatt.R2.embr
ctl.area.o3.98.198.atarea.R2.embr
ctl.area.o3.98.198.nonatt.R2.embr
ctl.mvof.o3.98.197.atnolog.embr
ctl.mvof.o3.98.197.nonolog.embr
ctl.mvof.o3.98.197.RFG.embr
ctl.mvof.o3.98.198.atnolog.embr
ctl.mvof.o3.98.198.nonolog.embr
ctl.mvof.o3.98.198.RFG.embr
grd.area.attain.o3.98.197.R2.embr
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grd.area.attain.o3.98.198.R2.embr
grd.area.nonatt.o3.98.197.R2.embr
grd.area.nonatt.o3.98.198.R2.embr
grd.avi.nonatt.o3.98.197.emiss
grd.avi.nonatt.o3.98.198.emiss
grd.mvof.o3.98.197.atnolog.embr
grd.mvof.o3.98.197.nonolog.embr
grd.mvof.o3.98.198.atnolog.embr
grd.mvof.o3.98.198.nonolog.embr
grd.pnt.nonatt.o3.98.197.1000m.embr
grd.pnt.nonatt.o3.98.198.1000m.embr
lbs.avi.o3.98.197.embr
lbs.avi.o3.98.198.embr
mrg.o3.98.197.E5.emiss
mrg.o3.98.198.E5.emiss
pra.area.o3.98.197.bas.R2.embr
pra.area.o3.98.198.bas.R2.embr
prp.o3.98.197.1000m.embr
prp.o3.98.198.1000m.embr
pst.o3.98.197.1000m.emiss
pst.o3.98.198.1000m.emiss
tpl.area.o3.98.197.atarea.R2.embr
tpl.area.o3.98.197.nonatt.R2.embr
tpl.area.o3.98.198.atarea.R2.embr
tpl.area.o3.98.198.nonatt.R2.embr
tpl.avi.o3.98.197.embr
tpl.avi.o3.98.198.embr
tpl.mvof.o3.98.197.atnolog.embr
tpl.mvof.o3.98.197.nonolog.embr
tpl.mvof.o3.98.198.atnolog.embr
tpl.mvof.o3.98.198.nonolog.embr
tpl.point.o3.98.197.1000m.embr
tpl.point.o3.98.198.1000m.embr

./EPS2/out/1999:
chm.area.o3.99.235.atarea.R2.embr
chm.area.o3.99.235.nonatt.R2.embr
chm.area.o3.99.236.atarea.R2.embr
chm.area.o3.99.236.nonatt.R2.embr
chm.avi.o3.99.235.embr
chm.avi.o3.99.236.embr
chm.mvoff.o3.99.235.nonolog.embr
chm.mvoff.o3.99.236.nonolog.embr
chm.mvof.o3.99.235.atnolog.embr
chm.mvof.o3.99.236.atnolog.embr
chm.point.o3.99.235.1000m.embr
chm.point.o3.99.236.1000m.embr
ctl.area.o3.99.235.atarea.R2.embr
ctl.area.o3.99.235.nonatt.R2.embr
ctl.area.o3.99.236.atarea.R2.embr
ctl.area.o3.99.236.nonatt.R2.embr
ctl.mvof.o3.99.235.atarea.embr
ctl.mvof.o3.99.235.atnolog.embr
ctl.mvof.o3.99.235.nonnolog.embr
ctl.mvof.o3.99.235.RFG.embr
ctl.mvof.o3.99.236.atarea.embr
ctl.mvof.o3.99.236.atnolog.embr
ctl.mvof.o3.99.236.nonnolog.embr
ctl.mvof.o3.99.236.RFG.embr
grd.area.atarea.o3.99.235.R2.embr
grd.area.atarea.o3.99.236.R2.embr
grd.area.nonatt.o3.99.235.R2.embr
grd.area.nonatt.o3.99.236.R2.embr
grd.avi.non.o3.99.235.emiss
grd.avi.non.o3.99.236.emiss
grd.mvof.o3.99.235.atnolog.embr
grd.mvof.o3.99.235.nonolog.embr
grd.mvof.o3.99.236.atnolog.embr
grd.mvof.o3.99.236.nonolog.embr
grd.pnt.non.o3.99.235.1000m.embr
grd.pnt.non.o3.99.236.1000m.embr
lbs.avi.o3.99.235.embr
lbs.avi.o3.99.236.embr
mrg.o3.99.235.E5.emiss
mrg.o3.99.236.E5.emiss
pra.area.o3.99.235.R2.embr
pra.area.o3.99.236.R2.embr
prp.o3.99.235.1000m.embr
prp.o3.99.236.1000m.embr
pst.o3.99.235.1000m.emiss
pst.o3.99.236.1000m.emiss
tpl.area.o3.99.235.atarea.R2.embr
tpl.area.o3.99.235.nonatt.R2.embr
tpl.area.o3.99.236.atarea.R2.embr
tpl.area.o3.99.236.nonatt.R2.embr
tpl.avi.o3.99.235.embr
tpl.avi.o3.99.236.embr
tpl.mvoff.o3.99.235.atnolog.embr
tpl.mvoff.o3.99.235.nonolog.embr
tpl.mvoff.o3.99.236.atnolog.embr
tpl.mvoff.o3.99.236.nonolog.embr
tpl.point.o3.99.235.1000m.embr
tpl.point.o3.99.236.1000m.embr

./EPS2/out/2006:
chm.area.o3.06.235.atarea.embr
chm.area.o3.06.235.nonat.embr
chm.area.o3.06.236.atarea.embr
chm.area.o3.06.236.nonat.embr
chm.avi.o3.06.235.nrmeas.embr
chm.avi.o3.06.236.nrmeas.embr
chm.mvoff.o3.06.235.nonatcmp.embr
chm.mvoff.o3.06.236.nonatcmp.embr
chm.mvof.o3.06.235.atcmp.embr
chm.mvof.o3.06.236.atcmp.embr
chm.pnt.o3.06.235.final.pp.embr
chm.pnt.o3.06.236.final.pp.embr
ctl.area.o3.06.235.9906GF.embr
ctl.area.o3.06.235.atarea.embr
ctl.area.o3.06.235.nonat.embr
ctl.area.o3.06.236.9906GF.embr
ctl.area.o3.06.236.atarea.embr
ctl.area.o3.06.236.nonat.embr
ctl.avi.o3.06.235.nrmeas.embr
ctl.avi.o3.06.236.nrmeas.embr
ctl.mvoff.o3.06.235.9906GF.embr
ctl.mvoff.o3.06.235.NRcmp.embr
ctl.mvoff.o3.06.236.9906GF.embr
ctl.mvoff.o3.06.236.NRcmp.embr
ctl.mvof.o3.06.235.atcmp.embr
ctl.mvof.o3.06.235.nonnolog.cmp.embr
ctl.mvof.o3.06.236.atcmp.embr
ctl.mvof.o3.06.236.nonnolog.cmp.embr
grd.area.atarea.o3.06.235.2.embr
grd.area.atarea.o3.06.236.2.embr
grd.area.nonat.o3.06.235.2.embr
grd.area.nonat.o3.06.236.2.embr
grd.avi.o3.06.235.nrmeas.emiss
grd.avi.o3.06.236.nrmeas.emiss
grd.mvof.atcmp.o3.06.235.embr
grd.mvof.atcmp.o3.06.236.embr
grd.mvof.nonatcmp.o3.06.235.embr
grd.mvof.nonatcmp.o3.06.236.embr
grd.pnt.o3.06.235.final.pp.embr
grd.pnt.o3.06.236.final.pp.embr
lbs.avi.o3.06.235.embr
lbs.avi.o3.06.236.embr
mrg.o3.06.235.cmp.E20.emiss
mrg.o3.06.236.cmp.E20.emiss
prp.o3.06.235.final.pp.embr
prp.o3.06.236.final.pp.embr
pst.o3.06.235.final.pp.emiss
pst.o3.06.236.final.pp.emiss
tpl.area.o3.06.235.atarea2.embr
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tpl.area.o3.06.235.nonat2.embr
tpl.area.o3.06.236.atarea2.embr
tpl.area.o3.06.236.nonat2.embr
tpl.avi.o3.06.235.nrmeas.embr
tpl.avi.o3.06.236.nrmeas.embr
tpl.mvof.o3.06.235.atcmp.embr
tpl.mvof.o3.06.235.nonatcmp.embr
tpl.mvof.o3.06.236.atcmp.embr
tpl.mvof.o3.06.236.nonatcmp.embr
tpl.pnt.o3.06.235.final.pp.embr
tpl.pnt.o3.06.236.final.pp.embr

./EPS2/out/2015:
chm.area.o3.15.197.atarE1.embr
chm.area.o3.15.197.nonatE1.embr
chm.area.o3.15.198.atarE1.embr
chm.area.o3.15.198.nonatE1.embr
chm.area.o3.15.235.atarE1.embr
chm.area.o3.15.235.nonatE1.embr
chm.area.o3.15.236.atarE1.embr
chm.area.o3.15.236.nonatE1.embr
chm.avi.o3.15.197.nrmeas.embr
chm.avi.o3.15.198.nrmeas.embr
chm.avi.o3.15.235.nrmeas.embr
chm.avi.o3.15.236.nrmeas.embr
chm.mvoff.o3.15.197.nonatcmpE1.embr
chm.mvoff.o3.15.198.nonatcmpE1.embr
chm.mvoff.o3.15.235.nonatcmpE1.embr
chm.mvoff.o3.15.236.nonatcmpE1.embr
chm.mvof.o3.15.197.atcmpE1.embr
chm.mvof.o3.15.198.atcmpE1.embr
chm.mvof.o3.15.235.atcmpE1.embr
chm.mvof.o3.15.236.atcmpE1.embr
chm.pnt.o3.15.197.final.pp.embr
chm.pnt.o3.15.198.final.pp.embr
chm.pnt.o3.15.235.final.pp.embr
chm.pnt.o3.15.236.final.pp.embr
ctl.area.o3.15.197.9815GF.E1.embr
ctl.area.o3.15.197.atarE1.embr
ctl.area.o3.15.197.nonat.E1.embr
ctl.area.o3.15.198.9815GF.E1.embr
ctl.area.o3.15.198.atarE1.embr
ctl.area.o3.15.198.nonat.E1.embr
ctl.area.o3.15.235.9915GF.E1.embr
ctl.area.o3.15.235.atarE1.embr
ctl.area.o3.15.235.nonat.E1.embr
ctl.area.o3.15.236.9915GF.E1.embr
ctl.area.o3.15.236.atarE1.embr
ctl.area.o3.15.236.nonat.E1.embr
ctl.avi.o3.15.197.nrmeas.embr
ctl.avi.o3.15.198.nrmeas.embr
ctl.avi.o3.15.235.nrmeas.embr
ctl.avi.o3.15.236.nrmeas.embr
ctl.mvoff.o3.15.197.9815GF.E1.embr
ctl.mvoff.o3.15.197.NRcmp.E1.embr
ctl.mvoff.o3.15.198.9815GF.E1.embr
ctl.mvoff.o3.15.198.NRcmp.E1.embr
ctl.mvoff.o3.15.235.9915GF.E1.embr
ctl.mvoff.o3.15.235.NRcmp.E1.embr
ctl.mvoff.o3.15.236.9915GF.E1.embr
ctl.mvoff.o3.15.236.NRcmp.E1.embr
ctl.mvof.o3.15.197.atcmpE1.embr
ctl.mvof.o3.15.197.Const.E1.embr
ctl.mvof.o3.15.197.nonnolog.E1.embr
ctl.mvof.o3.15.198.atcmpE1.embr
ctl.mvof.o3.15.198.Const.E1.embr
ctl.mvof.o3.15.198.nonnolog.E1.embr
ctl.mvof.o3.15.235.atcmpE1.embr
ctl.mvof.o3.15.235.Const.E1.embr
ctl.mvof.o3.15.235.nonnolog.E1.embr
ctl.mvof.o3.15.236.atcmpE1.embr
ctl.mvof.o3.15.236.Const.E1.embr
ctl.mvof.o3.15.236.nonnolog.E1.embr
grd.area.atE2.o3.15.197.embr
grd.area.atE2.o3.15.198.embr
grd.area.atE2.o3.15.235.embr
grd.area.atE2.o3.15.236.embr
grd.area.nonatE2.o3.15.197.embr
grd.area.nonatE2.o3.15.198.embr
grd.area.nonatE2.o3.15.235.embr
grd.area.nonatE2.o3.15.236.embr
grd.avi.o3.15.197.nrmeas.emiss
grd.avi.o3.15.198.nrmeas.emiss
grd.avi.o3.15.235.nrmeas.emiss
grd.avi.o3.15.236.nrmeas.emiss
grd.mvof.atcmpE1.o3.15.197.embr
grd.mvof.atcmpE1.o3.15.198.embr
grd.mvof.atcmpE1.o3.15.235.embr
grd.mvof.atcmpE1.o3.15.236.embr
grd.mvof.nonatcmpE1.o3.15.197.embr
grd.mvof.nonatcmpE1.o3.15.198.embr
grd.mvof.nonatcmpE1.o3.15.235.embr
grd.mvof.nonatcmpE1.o3.15.236.embr
grd.pnt.nonatt.o3.15.197.final.pp.embr
grd.pnt.nonatt.o3.15.198.final.pp.embr
grd.pnt.nonatt.o3.15.235.final.pp.embr
grd.pnt.nonatt.o3.15.236.final.pp.embr
lbs.avi.o3.15.197.embr
lbs.avi.o3.15.198.embr
lbs.avi.o3.15.235.embr
lbs.avi.o3.15.236.embr
mrg.o3.15.197.cmp.E9.emiss
mrg.o3.15.198.cmp.E9.emiss
mrg.o3.15.235.cmp.E12.emiss
mrg.o3.15.236.cmp.E12.emiss
prp.o3.15.197.final.pp.embr
prp.o3.15.198.final.pp.embr
prp.o3.15.235.final.pp.embr
prp.o3.15.236.final.pp.embr
pst.o3.15.197.final.pp.emiss
pst.o3.15.198.final.pp.emiss
pst.o3.15.235.final.pp.emiss
pst.o3.15.236.final.pp.emiss
tpl.area.o3.15.197.atarE2.embr
tpl.area.o3.15.197.nonatE2.embr
tpl.area.o3.15.198.atarE2.embr
tpl.area.o3.15.198.nonatE2.embr
tpl.area.o3.15.235.atarE2.embr
tpl.area.o3.15.235.nonatE2.embr
tpl.area.o3.15.236.atarE2.embr
tpl.area.o3.15.236.nonatE2.embr
tpl.avi.o3.15.197.nrmeas.embr
tpl.avi.o3.15.198.nrmeas.embr
tpl.avi.o3.15.235.nrmeas.embr
tpl.avi.o3.15.236.nrmeas.embr
tpl.mvof.o3.15.197.atcmpE1.embr
tpl.mvof.o3.15.197.nonatcmpE1.embr
tpl.mvof.o3.15.198.atcmpE1.embr
tpl.mvof.o3.15.198.nonatcmpE1.embr
tpl.mvof.o3.15.235.atcmpE1.embr
tpl.mvof.o3.15.235.nonatcmpE1.embr
tpl.mvof.o3.15.236.atcmpE1.embr
tpl.mvof.o3.15.236.nonatcmpE1.embr
tpl.pnt.o3.15.197.final.pp.embr
tpl.pnt.o3.15.198.final.pp.embr
tpl.pnt.o3.15.235.final.pp.embr
tpl.pnt.o3.15.236.final.pp.embr

./EPS2/out/2015_ind_measures:
chm.avi.o3.15.236.nrmeas.embr
chm.mvoff.o3.15.236.nonatcmpE1.embr
chm.pnt.o3.15.236.final.pp.embr
ctl.avi.o3.15.236.nrmeas.embr
ctl.mvoff.o3.15.236.9915GF.E1.embr
```

```
ctl.mvoff.o3.15.236.NRcmp.E1.embr
ctl.mvof.o3.15.236.Const.E1.embr
ctl.mvof.o3.15.236.nonnolog.E1.embr
grd.avi.o3.15.236.nrmeas.emiss
grd.mvof.nonatcmpE1.o3.15.236.embr
grd.pnt.nonatt.o3.15.236.final.pp.embr
lbs.avi.o3.15.236.embr
prp.o3.15.236.final.pp.embr
pst.o3.15.236.final.pp.emiss
tpl.avi.o3.15.236.nrmeas.embr
tpl.mvof.o3.15.236.nonatcmpE1.embr
tpl.pnt.o3.15.236.final.pp.embr

./EPS2/out/2015_no_measures:
chm.avi.o3.15.236.bas.embr
chm.mvoff.o3.15.236.nonatbasE1.embr
chm.pnt.o3.15.236.baspp-rule348.embr
ctl.mvoff.o3.15.236.9915GF.E1.embr
ctl.mvof.o3.15.236.bas.Const.embr
ctl.mvof.o3.15.236.bas.nonnolog.embr
grd.avi.o3.15.236.bas.emiss
grd.mvof.nonatbasE1.o3.15.236.embr
grd.pnt.non.o3.15.236.baspp-r348.embr
lbs.avi.o3.15.236.embr
prp.o3.15.236.baspp-rule348.embr
pst.o3.15.236.baspp-rule348.emiss
tpl.avi.o3.15.236.bas.embr
tpl.mvof.o3.15.236.nonatbasE1.embr
tpl.pnt.o3.15.236.baspp-rule348.embr

./M6Link:
ControlFiles
JobFiles
out
Part1Inputs
Part2Inputs
sourcecode

./M6Link/ControlFiles:
Aug23_06.ctl.A.Fin
Aug23_06.ctl.N.Fin
Aug23_06.ctl.O.Fin
Aug23_15.ctl.A.base
Aug23_15.ctl.A.Fin
Aug23_15.ctl.N.base
Aug23_15.ctl.N.Fin
Aug23_15.ctl.O.base
Aug23_15.ctl.O.Fin
Aug23_99.ctl.A.Fin
Aug23_99.ctl.N.Fin
Aug23_99.ctl.O.Fin
Aug24_06.ctl.A.Fin
Aug24_06.ctl.N.Fin
Aug24_06.ctl.O.Fin
Aug24_15.ctl.A.base
Aug24_15.ctl.A.Fin
Aug24_15.ctl.N.1wvr
Aug24_15.ctl.N.base
Aug24_15.ctl.N.cut
Aug24_15.ctl.N.Fin
Aug24_15.ctl.N.RFG
Aug24_15.ctl.N.TougherEnf
Aug24_15.ctl.O.base
Aug24_15.ctl.O.Fin
Aug24_99.ctl.A.Fin
Aug24_99.ctl.N.Fin
Aug24_99.ctl.O.Fin
Jul16_15.ctl.A.Fin
Jul16_15.ctl.N.Fin
Jul16_15.ctl.O.Fin
Jul16_98.ctl.N.Fin
Jul16_98.ctl.O.Fin
Jul17_15.ctl.A.Fin
Jul17_15.ctl.N.Fin
Jul17_15.ctl.O.Fin
Jul17_98.ctl.N.Fin
Jul17_98.ctl.O.Fin

./M6Link/JobFiles:
FinO3.job.allyears
FinO3.job.IndMeasures

./M6Link/out:
grdms.out.Aug23_06.A.Fin.gz
grdms.out.Aug23_06.N.Fin.gz
grdms.out.Aug23_06.O.Fin.gz
grdms.out.Aug23_15.A.Fin.gz
grdms.out.Aug23_15.N.Fin.gz
grdms.out.Aug23_15.O.Fin.gz
grdms.out.Aug23_99.A.Fin.gz
grdms.out.Aug23_99.N.Fin.gz
grdms.out.Aug23_99.O.Fin.gz
grdms.out.Aug24_06.A.Fin.gz
grdms.out.Aug24_06.N.Fin.gz
grdms.out.Aug24_06.O.Fin.gz
grdms.out.Aug24_15.A.Fin.gz
grdms.out.Aug24_15.N.Fin.gz
grdms.out.Aug24_15.O.Fin.gz
grdms.out.Aug24_99.A.Fin.gz
grdms.out.Aug24_99.N.Fin.gz
grdms.out.Aug24_99.O.Fin.gz
grdms.out.Jul16_15.A.Fin.gz
grdms.out.Jul16_15.N.Fin.gz
grdms.out.Jul16_15.O.Fin.gz
grdms.out.Jul16_98.N.Fin.gz
grdms.out.Jul16_98.O.Fin.gz
grdms.out.Jul17_15.A.Fin.gz
grdms.out.Jul17_15.N.Fin.gz
grdms.out.Jul17_15.O.Fin.gz
grdms.out.Jul17_98.N.Fin.gz
grdms.out.Jul17_98.O.Fin.gz

./M6Link/Part1Inputs:
M6LinkPart1Input.zip

./M6Link/Part2Inputs:
AggregateFactors.txt.1998
AggregateFactors.txt.2006
AggregateFactors.txt.2015
L06amo.txt.gz
L06atu.txt.gz
L06nmo.txt.gz
L06ntu.txt.gz
L06omo.txt.gz
L06otu.txt.gz
L15amo.txt.gz
L15atu.txt.gz
L15nmo.txt.gz
L15ntu.txt.gz
L15omo.txt.gz
L15otu.txt.gz
L98afr.txt.gz
L98ath.txt.gz
L98nfr.txt.gz
L98nth.txt.gz
L99amo.txt.gz
L99atu.txt.gz
L99nmo.txt.gz
L99ntu.txt.gz
L99omo.txt.gz
L99otu.txt.gz

./M6Link/sourcecode:
cord.for
```

```
factor.for
hourfac.for
link2m6.for
mob6shift.f
ozoneprog.f
ozoneprog.FMS.f
splitlink.for

./MAGBEIS:
Aug_23_2006_B13
Aug_23_2015_B14
Aug_23_99_B11
Aug_24_2006_B13
Aug_24_2015_B14
Aug_24_99_B11
Jul_16_2015_B14
Jul_16_98_B11
Jul_17_2015_B14
Jul_17_98_B11
MAGLAND

./MAGBEIS/Aug_23_2006_B13:
INPUT
LANDCAN
LANDUSA
Magbeis.steve.job
NORMEMFL
OUTEM
OUTEM.ASC
OUTEM.ASC.TEMPORAL
OUTEM.ASC.TOT
SUMFAC
SURMET1
SWITCHFL
TEMPRTR

./MAGBEIS/Aug_23_2015_B14:
INPUT
LANDCAN
LANDUSA
Magbeis.steve.job
NORMEMFL
OUTEM
OUTEM.ASC
OUTEM.ASC.TEMPORAL
OUTEM.ASC.TOT
SUMFAC
SURMET1
SWITCHFL
TEMPRTR

./MAGBEIS/Aug_23_99_B11:
INPUT_99
LANDUSA
Magbeis.Aug99.job
Magbeis.Aug99.job~
OUTEM_990823_B11
OUTEM.ASC_990823_B11
OUTEM.ASC.TEMPORAL_990823_B11
OUTEM.ASC.TOT_990823_B11
SUMFAC
SURMET1_99_new
TEMPRTR_99

./MAGBEIS/Aug_24_2006_B13:
INPUT
LANDCAN
LANDUSA
Magbeis.steve.job
NORMEMFL
OUTEM
OUTEM.ASC
OUTEM.ASC.TEMPORAL
OUTEM.ASC.TOT
SUMFAC
SURMET1
SWITCHFL
TEMPRTR

./MAGBEIS/Aug_24_2015_B14:
INPUT
LANDCAN
LANDUSA
Magbeis.steve.job
NORMEMFL
OUTEM
OUTEM.ASC
OUTEM.ASC.TEMPORAL
OUTEM.ASC.TOT
SUMFAC
SURMET1
SWITCHFL
TEMPRTR

./MAGBEIS/Aug_24_99_B11:
INPUT_99
LANDUSA
NORMEMFL_990824_B11
OUTEM_990824_B11
OUTEM.ASC_990824_B11
OUTEM.ASC.TEMPORAL_990824_B11
OUTEM.ASC.TOT_990824_B11
SUMFAC
SURMET1_99_new
TEMPRTR_99

./MAGBEIS/Jul_16_2015_B14:
INPUT
LANDCAN
LANDUSA
Magbeis.steve.job
NORMEMFL
OUTEM
OUTEM.ASC
OUTEM.ASC.TEMPORAL
OUTEM.ASC.TOT
SUMFAC
SURMET1
SWITCHFL
TEMPRTR

./MAGBEIS/Jul_16_98_B11:
INPUT_98
LANDUSA
Magbeis.July_98.job
NORMEMFL_980716_B11
OUTEM_980716_B11
OUTEM.ASC_980716_B11
OUTEM.ASC.TEMPORAL_980716_B11
OUTEM.ASC.TOT_980716_B11
SUMFAC
TEMPRTR_98

./MAGBEIS/Jul_17_2015_B14:
INPUT
LANDCAN
LANDUSA
Magbeis.steve.job
NORMEMFL
OUTEM
OUTEM.ASC
OUTEM.ASC.TEMP_198_2015
OUTEM.ASC.TEMPORAL
OUTEM.ASC.TOT
```

```
SUMFAC
SURMET1
SWITCHFL
TEMPRTR

./MAGBEIS/Jul_17_98_B11:
INPUT_98
LANDUSA
NORMEMFL_980717_B11
OUTEM_980717_B11
OUTEM.ASC_980717_B11
OUTEM.ASC.TEMPORAL_980717_B11
OUTEM.ASC.TOT_980717_B11
SUMFAC
SURMET1_jul_98
TEMPRTR_98

./MAGBEIS/MAGLAND:
2000B5
2006B13
2015B14

./MAGBEIS/MAGLAND/2000B5:
EXSTPROP.TXT
LANDUSA
MAGLAND2.ASC
magland2.linux
MAGLAND2.RPT
SWITCHFL

./MAGBEIS/MAGLAND/2006B13:
EXSTPROP.TXT
LANDUSA
MAGLAND2.ASC
magland2b.x
MAGLAND2.RPT
SWITCHFL

./MAGBEIS/MAGLAND/2015B14:
EXSTPROP.TXT
LANDUSA
MAGLAND2.ASC
magland2b.x
MAGLAND2.RPT
SWITCHFL

./Medexplora:
inputs
JobFiles
Outputs

./Medexplora/inputs:
chmprf.xref.thc.mag99
readme.txt
splitfac.thc.mag
userin.Aug23_99.M6Link
userin.Aug24_99.M6Link
userin.Jul16_98.M6Link
userin.Jul17_98.M6Link
userin.med

./Medexplora/JobFiles:
medexp.Fin.AllYears
medexp.Fin.base2015

./Medexplora/Outputs:
uam.Aug23_06.M6Link.A.Fin.gz
uam.Aug23_06.M6Link.N.Fin.gz
uam.Aug23_06.M6Link.O.Fin.gz
uam.Aug23_15.M6Link.A.Fin.gz
uam.Aug23_15.M6Link.N.Fin.gz
uam.Aug23_15.M6Link.O.Fin.gz
uam.Aug23_99.M6Link.A.Fin.gz
uam.Aug23_99.M6Link.N.Fin.gz
uam.Aug23_99.M6Link.O.Fin.gz
uam.Aug24_06.M6Link.A.Fin.gz
uam.Aug24_06.M6Link.N.Fin.gz
uam.Aug24_06.M6Link.O.Fin.gz
uam.Aug24_15.M6Link.A.Fin.gz
uam.Aug24_15.M6Link.N.Fin.gz
uam.Aug24_15.M6Link.O.Fin.gz
uam.Aug24_99.M6Link.A.Fin.gz
uam.Aug24_99.M6Link.N.Fin.gz
uam.Aug24_99.M6Link.O.Fin.gz
uam.Jul16_06.M6Link.A.Fin.gz
uam.Jul16_06.M6Link.N.Fin.gz
uam.Jul16_06.M6Link.O.Fin.gz
uam.Jul16_15.M6Link.A.Fin.gz
uam.Jul16_15.M6Link.N.Fin.gz
uam.Jul16_15.M6Link.O.Fin.gz
uam.Jul16_98.M6Link.N.Fin.gz
uam.Jul16_98.M6Link.O.Fin.gz
uam.Jul17_06.M6Link.A.Fin.gz
uam.Jul17_06.M6Link.N.Fin.gz
uam.Jul17_06.M6Link.O.Fin.gz
uam.Jul17_15.M6Link.A.Fin.gz
uam.Jul17_15.M6Link.N.Fin.gz
uam.Jul17_15.M6Link.O.Fin.gz
uam.Jul17_98.M6Link.N.Fin.gz
uam.Jul17_98.M6Link.O.Fin.gz

./Mobile6:
forM6Link
forPostProc

./Mobile6/forM6Link:
1998Inp
1999Inp
2006Inp
2015InpCMP
2015InpIndMeas
GenericInputs
SampleOutput

./Mobile6/forM6Link/1998Inp:
98i1fn.in
98i1rn.in
98i1wn.in
98i2fn.in
98i2rn.in
98i2wn.in
98i3fn.in
98i3rn.in
98i3wn.in
98i4fn.in
98i4rn.in
98i4wn.in
98i5fn.in
98i5rn.in
98i5wn.in
98n1fn.in
98n1fo.in
98n1rn.in
98n1ro.in
98n1wn.in
98n1wo.in
98n2fn.in
98n2fo.in
98n2rn.in
98n2ro.in
98n2wn.in
98n2wo.in
98n3fn.in
98n3fo.in
```

```
98n3rn.in
98n3ro.in
98n3wn.in
98n3wo.in
98n4fn.in
98n4fo.in
98n4rn.in
98n4ro.in
98n4wn.in
98n4wo.in
98n5fn.in
98n5fo.in
98n5rn.in
98n5ro.in
98n5wn.in
98n5wo.in
s98aa1fr.txt
s98aa1th.txt
s98aa2fr.txt
s98aa2th.txt
s98aa3fr.txt
s98aa3th.txt
s98aa4fr.txt
s98aa4th.txt
s98aa5fr.txt
s98aa5th.txt
s98na1fr.txt
s98na1th.txt
s98na2fr.txt
s98na2th.txt
s98na3fr.txt
s98na3th.txt
s98na4fr.txt
s98na4th.txt
s98na5fr.txt
s98na5th.txt

./Mobile6/forM6Link/1999Inp:
99i1ma.in
99i1mn.in
99i1sa.in
99i1sn.in
99i1ta.in
99i1tn.in
99i2ma.in
99i2mn.in
99i2sa.in
99i2sn.in
99i2ta.in
99i2tn.in
99i3ma.in
99i3mn.in
99i3sa.in
99i3sn.in
99i3ta.in
99i3tn.in
99i4ma.in
99i4mn.in
99i4sa.in
99i4sn.in
99i4ta.in
99i4tn.in
99i5ma.in
99i5mn.in
99i5sa.in
99i5sn.in
99i5ta.in
99i5tn.in
99n1ma.in
99n1mn.in
99n1mo.in
99n1sa.in
99n1sn.in
99n1so.in
99n1ta.in
99n1tn.in
99n1to.in
99n2ma.in
99n2mn.in
99n2mo.in
99n2sa.in
99n2sn.in
99n2so.in
99n2ta.in
99n2tn.in
99n2to.in
99n3ma.in
99n3mn.in
99n3mo.in
99n3sa.in
99n3sn.in
99n3so.in
99n3ta.in
99n3tn.in
99n3to.in
99n4ma.in
99n4mn.in
99n4mo.in
99n4sa.in
99n4sn.in
99n4so.in
99n4ta.in
99n4tn.in
99n4to.in
99n5ma.in
99n5mn.in
99n5mo.in
99n5sa.in
99n5sn.in
99n5so.in
99n5ta.in
99n5tn.in
99n5to.in
s99aa1mo.txt
s99aa1tu.txt
s99aa2mo.txt
s99aa2tu.txt
s99aa3mo.txt
s99aa3tu.txt
s99aa4mo.txt
s99aa4tu.txt
s99aa5mo.txt
s99aa5tu.txt
s99na1mo.txt
s99na1tu.txt
s99na2mo.txt
s99na2tu.txt
s99na3mo.txt
s99na3tu.txt
s99na4mo.txt
s99na4tu.txt
s99na5mo.txt
s99na5tu.txt
s99oa1mo.txt
s99oa1tu.txt
s99oa2mo.txt
s99oa2tu.txt
s99oa3mo.txt
s99oa3tu.txt
s99oa4mo.txt
s99oa4tu.txt
s99oa5mo.txt
s99oa5tu.txt
```

```
./Mobile6/forM6Link/2006Inp:
06i1ma.in
06i1mn.in
06i1sa.in
06i1sn.in
06i1ta.in
06i1tn.in
06i2ma.in
06i2mn.in
06i2sa.in
06i2sn.in
06i2ta.in
06i2tn.in
06i3ma.in
06i3mn.in
06i3sa.in
06i3sn.in
06i3ta.in
06i3tn.in
06i4ma.in
06i4mn.in
06i4sa.in
06i4sn.in
06i4ta.in
06i4tn.in
06i5ma.in
06i5mn.in
06i5sa.in
06i5sn.in
06i5ta.in
06i5tn.in
06n1ma.in
06n1mn.in
06n1mo.in
06n1sa.in
06n1sn.in
06n1so.in
06n1ta.in
06n1tn.in
06n1to.in
06n2ma.in
06n2mn.in
06n2mo.in
06n2sa.in
06n2sn.in
06n2so.in
06n2ta.in
06n2tn.in
06n2to.in
06n3ma.in
06n3mn.in
06n3mo.in
06n3sa.in
06n3sn.in
06n3so.in
06n3ta.in
06n3tn.in
06n3to.in
06n4ma.in
06n4mn.in
06n4mo.in
06n4sa.in
06n4sn.in
06n4so.in
06n4ta.in
06n4tn.in
06n4to.in
06n5ma.in
06n5mn.in
06n5mo.in
06n5sa.in
06n5sn.in
06n5so.in
06n5ta.in
06n5tn.in
06n5to.in
s06aa1fr.txt
s06aa1mo.txt
s06aa1th.txt
s06aa1tu.txt
s06aa2fr.txt
s06aa2mo.txt
s06aa2th.txt
s06aa2tu.txt
s06aa3fr.txt
s06aa3mo.txt
s06aa3th.txt
s06aa3tu.txt
s06aa4fr.txt
s06aa4mo.txt
s06aa4th.txt
s06aa4tu.txt
s06aa5fr.txt
s06aa5mo.txt
s06aa5th.txt
s06aa5tu.txt
s06na1fr.txt
s06na1mo.txt
s06na1th.txt
s06na1tu.txt
s06na2fr.txt
s06na2mo.txt
s06na2th.txt
s06na2tu.txt
s06na3fr.txt
s06na3mo.txt
s06na3th.txt
s06na3tu.txt
s06na4fr.txt
s06na4mo.txt
s06na4th.txt
s06na4tu.txt
s06na5fr.txt
s06na5mo.txt
s06na5th.txt
s06na5tu.txt
s06oa1fr.txt
s06oa1mo.txt
s06oa1th.txt
s06oa1tu.txt
s06oa2fr.txt
s06oa2mo.txt
s06oa2th.txt
s06oa2tu.txt
s06oa3fr.txt
s06oa3mo.txt
s06oa3th.txt
s06oa3tu.txt
s06oa4fr.txt
s06oa4mo.txt
s06oa4th.txt
s06oa4tu.txt
s06oa5fr.txt
s06oa5mo.txt
s06oa5th.txt
s06oa5tu.txt

./Mobile6/forM6Link/2015InpCMP:
15i1fa.in
15i1fn.in
15i1ma.in
15i1mn.in
15i1ra.in
15i1rn.in
```

15i1sa.in
15i1sn.in
15i1ta.in
15i1tn.in
15i1wa.in
15i1wn.in
15i2fa.in
15i2fn.in
15i2ma.in
15i2mn.in
15i2ra.in
15i2rn.in
15i2sa.in
15i2sn.in
15i2ta.in
15i2tn.in
15i2wa.in
15i2wn.in
15i3fa.in
15i3fn.in
15i3ma.in
15i3mn.in
15i3ra.in
15i3rn.in
15i3sa.in
15i3sn.in
15i3ta.in
15i3tn.in
15i3wa.in
15i3wn.in
15i4fa.in
15i4fn.in
15i4ma.in
15i4mn.in
15i4ra.in
15i4rn.in
15i4sa.in
15i4sn.in
15i4ta.in
15i4tn.in
15i4wa.in
15i4wn.in
15i5fa.in
15i5fn.in
15i5ma.in
15i5mn.in
15i5ra.in
15i5rn.in
15i5sa.in
15i5sn.in
15i5ta.in
15i5tn.in
15i5wa.in
15i5wn.in
15n1fa.in
15n1fn.in
15n1fo.in
15n1ma.in
15n1mn.in
15n1mo.in
15n1ra.in
15n1rn.in
15n1ro.in
15n1sa.in
15n1sn.in
15n1so.in
15n1ta.in
15n1tn.in
15n1to.in
15n1wa.in
15n1wn.in
15n1wo.in
15n2fa.in
15n2fn.in
15n2fo.in
15n2ma.in
15n2mn.in
15n2mo.in
15n2ra.in
15n2rn.in
15n2ro.in
15n2sa.in
15n2sn.in
15n2so.in
15n2ta.in
15n2tn.in
15n2to.in
15n2wa.in
15n2wn.in
15n2wo.in
15n3fa.in
15n3fn.in
15n3fo.in
15n3ma.in
15n3mn.in
15n3mo.in
15n3ra.in
15n3rn.in
15n3ro.in
15n3sa.in
15n3sn.in
15n3so.in
15n3ta.in
15n3tn.in
15n3to.in
15n3wa.in
15n3wn.in
15n3wo.in
15n4fa.in
15n4fn.in
15n4fo.in
15n4ma.in
15n4mn.in
15n4mo.in
15n4ra.in
15n4rn.in
15n4ro.in
15n4sa.in
15n4sn.in
15n4so.in
15n4ta.in
15n4tn.in
15n4to.in
15n4wa.in
15n4wn.in
15n4wo.in
15n5fa.in
15n5fn.in
15n5fo.in
15n5ma.in
15n5mn.in
15n5mo.in
15n5ra.in
15n5rn.in
15n5ro.in
15n5sa.in
15n5sn.in
15n5so.in
15n5ta.in
15n5tn.in
15n5to.in
15n5wa.in
15n5wn.in
15n5wo.in

```
s15aa1fr.txt
s15aa1mo.txt
s15aa1th.txt
s15aa1tu.txt
s15aa2fr.txt
s15aa2mo.txt
s15aa2th.txt
s15aa2tu.txt
s15aa3fr.txt
s15aa3mo.txt
s15aa3th.txt
s15aa3tu.txt
s15aa4fr.txt
s15aa4mo.txt
s15aa4th.txt
s15aa4tu.txt
s15aa5fr.txt
s15aa5mo.txt
s15aa5th.txt
s15aa5tu.txt
s15na1fr.txt
s15na1mo.txt
s15na1th.txt
s15na1tu.txt
s15na2fr.txt
s15na2mo.txt
s15na2th.txt
s15na2tu.txt
s15na3fr.txt
s15na3mo.txt
s15na3th.txt
s15na3tu.txt
s15na4fr.txt
s15na4mo.txt
s15na4th.txt
s15na4tu.txt
s15na5fr.txt
s15na5mo.txt
s15na5th.txt
s15na5tu.txt
s15oa1fr.txt
s15oa1mo.txt
s15oa1th.txt
s15oa1tu.txt
s15oa2fr.txt
s15oa2mo.txt
s15oa2th.txt
s15oa2tu.txt
s15oa3fr.txt
s15oa3mo.txt
s15oa3th.txt
s15oa3tu.txt
s15oa4fr.txt
s15oa4mo.txt
s15oa4th.txt
s15oa4tu.txt
s15oa5fr.txt
s15oa5mo.txt
s15oa5th.txt
s15oa5tu.txt

./Mobile6/forM6Link/2015InpIndMeas:
BaseCase
CBG
OneTimeWaiver
Phased-InCutpoints

./Mobile6/forM6Link/2015InpIndMeas/BaseCas
e:
I1mobase.in
I1tubase.in
I2mobase.in
I2tubase.in
I3mobase.in
I3tubase.in
I4mobase.in
I4tubase.in
I5mobase.in
I5tubase.in
n1mobase.in
n1tubase.in
n2mobase.in
n2tubase.in
n3mobase.in
n3tubase.in
n4mobase.in
n4tubase.in
n5mobase.in
n5tubase.in
NoNLEV.D
P94IMP.D
s15na1mo.txt
s15na1tu.txt
s15na2mo.txt
s15na2tu.txt
s15na3mo.txt
s15na3tu.txt
s15na4mo.txt
s15na4tu.txt
s15na5mo.txt
s15na5tu.txt

./Mobile6/forM6Link/2015InpIndMeas/CBG:
I1moRFG.in
I1tuRFG.in
I2moRFG.in
I2tuRFG.in
I3moRFG.in
I3tuRFG.in
I4moRFG.in
I4tuRFG.in
I5moRFG.in
I5tuRFG.in
n1moRFG.in
n1tuRFG.in
n2moRFG.in
n2tuRFG.in
n3moRFG.in
n3tuRFG.in
n4moRFG.in
n4tuRFG.in
n5moRFG.in
n5tuRFG.in

./Mobile6/forM6Link/2015InpIndMeas/OneTime
Waiver:
I1mo1wvr.in
I1tu1wvr.in
I2mo1wvr.in
I2tu1wvr.in
I3mo1wvr.in
I3tu1wvr.in
I4mo1wvr.in
I4tu1wvr.in
I5mo1wvr.in
I5tu1wvr.in

./Mobile6/forM6Link/2015InpIndMeas/Phased-
InCutpoints:
I1mocut.in
I1tucut.in
I2mocut.in
I2tucut.in
I3mocut.in
```

```
I3tucut.in
I4mocut.in
I4tucut.in
I5mocut.in
I5tucut.in

./Mobile6/forM6Link/GenericInputs:
02Reg06.d
02Reg15.d
99reg98.d
99reg99.d
cutbas15.d
cutbas98.d
cutbas99.d
cutCMP15.d
cutpnt06.d

./Mobile6/forM6Link/SampleOutput:
15I1FN.TB1
15I1FN.TXT
ReadMe

./Mobile6/forPostProc:
ITSandTSS

./Mobile6/forPostProc/ITSandTSS:
IMITS.in
ITSbase2015.wpd
noIMITS.in
TSSbase2015.wpd

./UAM:
inputs
job
msg
outputs

./UAM/inputs:
06in
15in
98in
99in

./UAM/inputs/06in:
pst.o3.06.235.final.pp.emiss
pst.o3.06.236.final.pp.emiss

./UAM/inputs/15in:
pst.o3.15.197.final.pp.emiss
pst.o3.15.198.final.pp.emiss
pst.o3.15.235.final.pp.emiss
pst.o3.15.236.final.pp.emiss

./UAM/inputs/98in:
aq9807-99super-r34.in
aq9807-r40.bin
aq9807-zero.in
bndry9807-r40.bin
bndry9807-zero.in
bndry-veop-r37.in
chemparm.bin
dbpack-98r40.txt
dfbk_98R40.bin
diagno-r40.in0716
diagno-r40.in0717
diagno-r40.out716
diagno-r40.out717
mrg.o3.98.197.E5.emiss
mrg.o3.98.198.E5.emiss
mtscal9807.bin
mtscalar.dat
presfc.out716
presfc.out717
preupr_r40m.out716
preupr_r40m.out717
pst.o3.98.197.1000m.emiss
pst.o3.98.198.1000m.emiss
ptsrce.oz98197.r40.emi
ptsrce.oz98198.r40.emi
rt98_5400.bin
rt98_5400.in
tc9807.in
tc9807-r40.bin
temp798.txt
terrain.bin
tmprtr0798.bin
uamlu00.in
uamwnd.in0716
uamwnd.in0717
wind_r40.bin0716
wind_r40.bin0717

./UAM/inputs/99in:
aq9908-r61.bin
aq9908-super-r61.in
aq9908-zero.in
bndry9908-r57.bin
bndry9908-veop.in
bndry9908-zero.in
chemparm.bin
dbpack-r28.dat
dfbk9908-r28.bin
diagno.in0823
diagno.in0824
diagno-r49.out823
diagno-r49.out824
mrg.o3.99.235.E5.emiss
mrg.o3.99.236.E5.emiss
mtscal.bin
mtscal.dat
presfc.out823
presfc.out824
preupr-r49m.out823
preupr-r49m.out824
pst.o3.99.235.1000m.emiss
pst.o3.99.236.1000m.emiss
ptsrce.oz99235.r28.emi
ptsrce.oz99236.r28.emi
rt4800.bin
rt4800.in
tc9908.in
tc9908-r56.bin
terrain.bin
tmprtr0899.bin
tmprtr0899.dat
uamlu00.in
uamwnd.in0823
uamwnd.in0824
wind-r49.bin0823
wind-r49.bin0824

./UAM/job:
1998
1999
2006
2015

./UAM/job/1998:
aq-r40.job
aq-zero.job
bndry-r40.job
bndry-zero.job
chemparam.job
creter.job
```

```
dfsnbk_98R40.job
dwm-r40.job
metscl.job
ptsrce-r40.job
regntp_r40.job
tmprtr.job
topconc-r40.job
uam_ozmt_r41.job
uam_ozmt_zero_aq.job
uam_ozmt_zero_bnd.job
uamwnd-r40.job

./UAM/job/1999:
aq-r61.job
aq-zero.job
bndry-r57.job
bndry-zero.job
chemparam.job
creter.job
dfsnbk_r28.job
dwm-r49.job
metscl.job
ptsrce.job
rt4800.job
tmprtr.job
topconc-r56.job
uam_ozmt_r66.job
uam_ozmt_zero_aq.job
uam_ozmt_zero_bnd.job
uamwnd-r49.job

./UAM/job/2006:
ptsrce0608r8.job
uam_ozmt_06r24_8.job

./UAM/job/2015:
ptsrce1507r25.job
ptsrce1508r25.job
uam_ozmt_1507R26.job
uam_ozmt_1508R26.job

./UAM/msg:
06in
15in
98in
99in

./UAM/msg/06in:
ptsrce.oz06.235.r8.msg
ptsrce.oz06.236.r8.msg
ptsrce.oz15197.r25.msg
ptsrce.oz15198.r25.msg
ptsrce.oz15235.r26.msg
ptsrce.oz15236.r26.msg

./UAM/msg/15in:

./UAM/msg/98in:
aq9807-r40.msg
aq9807-zero.msg
bndry9807-r40.msg
bndry9807-zero.msg
dfbk_98R40.msg
diagno-r40.prt716
diagno-r40.prt717
mtscal9807.asc
ptsrce.oz98197.r40.msg
ptsrce.oz98198.r40.msg
rt98_5400.msg
tc9807-r40.msg
tmprtr0798.log
uamwnd_r40.int0716
uamwnd_r40.int0717
wndplt_r40.out0716
wndplt_r40.out0717

./UAM/msg/99in:
aq9908-r61.msg
aq9908-zero.msg
bndry9908-r57.msg
bndry9908-zero.msg
dfbk9908-r28.msg
diagno-r49.prt823
diagno-r49.prt824
mtscal.asc
ptsrce.oz99235.r28.msg
ptsrce.oz99236.r28.msg
rt4800.msg
tc9908-r56.msg
tmprtr0899.log
uamwnd-r49.int0823
uamwnd-r49.int0824
wndplt-r49.out0823
wndplt-r49.out0824

./UAM/outputs:
1998
1999
2006
2015

./UAM/outputs/1998:
avrg.bin0716
avrg.bin0717
depn.bin0716
depn.bin0717
inst.bin0716
inst.bin0717
mesg.asc0716
mesg.asc0717

./UAM/outputs/1999:
avrg.bin0823
avrg.bin0824
depn.bin0823
depn.bin0824
inst.bin0823
inst.bin0824
mesg.asc0823
mesg.asc0824
sp.bin0823
sp.bin0824

./UAM/outputs/2006:
output7
output8

./UAM/outputs/2006/output7:
avrg.bin0716
avrg.bin0717
depn.bin0716
depn.bin0717
inst.bin0716
inst.bin0717
mesg.asc0716
mesg.asc0717

./UAM/outputs/2006/output8:
avrg.bin0823
avrg.bin0824
depn.bin0823
depn.bin0824
inst.bin0823
inst.bin0824
```

```
mesg.asc0823
mesg.asc0824
sp.bin0823
sp.bin0824

./UAM/outputs/2015:
output7
output8

./UAM/outputs/2015/output7:
avrg.bin0716
avrg.bin0717
depn.bin0716
depn.bin0717
inst.bin0716
inst.bin0717
mesg.asc0716
mesg.asc0717
sp.bin0716
sp.bin0717

./UAM/outputs/2015/output8:
avrg.bin0823
avrg.bin0824
depn.bin0823
depn.bin0824
inst.bin0823
inst.bin0824
mesg.asc0823
mesg.asc0824
sp.bin0823
sp.bin0824
```

# APPENDIX III

## BASE YEARS EMISSION INVENTORY DEVELOPMENT
## (1998 and 1999)

App.III-i

Onroad Vehicle Emission Factor Estimation Procedure for 1998 and 1999

App.III-i is followed by an attachment containing a sample of the MOBILE6 input files for 1998.

## ONROAD VEHICLE EMISSION FACTOR ESTIMATION PROCEDURE FOR 1998 AND 1999

Emission Factor Model

Hydrocarbons in the form of total organic gases (TOGs), carbon monoxide (CO), and oxides of nitrogen (NOx) vehicle exhaust emission factors were calculated using MOBILE6, a model developed by the Environmental Protection Agency (EPA) for the purpose of estimating motor vehicle emission factors. The MOBILE6 runs were executed by the Maricopa Association of Governments (MAG). The contact person for the MOBILE6 emission estimates is Roger Roy (602-254-6300). More information about the MOBILE6 model may be found in the EPA User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, October 2002, EPA420-R-02-026, which may be found at the web site http://www.epa.gov/otaq/models.htm.

A series of MOBILE6 runs were performed to create a complete set of emission factors for input to the M6Link model.

Two Inspection/maintenance (I/M) scenarios were modeled:

1. With an I/M program in place.
2. No I/M program in place.

Five area types were modeled:

1. Central Business District
2. Urban Area
3. Urban Fringe
4. Suburban
5. Rural

Three days were modeled for each base year:

1. Wednesday, Thursday, and Friday (1998)
2. Sunday, Monday, and Tuesday (1999)

Two sets of control measures were applied to the MOBILE6 inputs, depending upon the location:

1. Attainment Area

2. Nonattainment Area

Note that for the 1999 and later years, the Attainment Area was further divided into outside Area A and inside Area A.

Combinations of the above scenarios were processed through the MOBILE6 model for the creation of detailed MOBILE6 output files for each base year (2 I/M status conditions X 5 area types X 3 days X 2 control measure subareas).

The results of the I/M and non-I/M runs for each of the five area types were combined to reflect the proportions of I/M and non I/M vehicles by the M6Link program. The term I/M vehicles means vehicles which are required to undergo an emission test and inspection under the Arizona Vehicle Inspection/Maintenance Program. It is important to note that the I/M program is required for all vehicles of the appropriate age *registered* in the nonattainment area. However, it is assumed that 91.0 percent of the vehicles *operating* within the nonattainment area will participate in the I/M program, and that 9.0 percent will not participate in the program during the 1998 time period. These values are 91.7 percent and 8.3 percent for the 1999 time period. Refer to ATTACHMENT ONE for the actual input files for the 1998 run.

Development of Model Inputs

The inputs to MOBILE6 are grouped into three categories: Header inputs, Run inputs, and Scenario inputs. The input values used in the above described MOBILE6 runs are specified and explained below.

**Header Section**

1. **MOBILE6 INPUT FILE** identifies a MOBILE6 input file as a regular command input file rather than a batch file.

2. **DATABASE OUTPUT** instructs MOBILE6 to report output in database format.

3. **WITH FIELDNAMES** specifies that a header record of field names is to be generated for the database output file.

4. **DATABASE EMISSIONS : 2222 2222** indicates that all emissions types are reported in database output format if appropriate. The eight emission types are exhaust running emissions, exhaust start emissions, evaporative hot soak emissions, evaporative diurnal emissions, evaporative resting loss emissions,

evaporative running loss emissions, evaporative crankcase emissions, and evaporative refueling emissions. For carbon monoxide and NOx, only exhaust running emissions and exhaust start emissions are relevant. For HC, all eight emission types were included in the MOBILE6 runs, although the evaporative refueling emissions were omitted from subsequent analyses because refueling emissions are included in the area source emission class.

5. **DATABASE FACILITIES : Arterial Freeway Local Ramp None** instructs MOBILE6 to output emissions in the database output table specific to each of the four roadway types modeled by MOBILE6. Also, emissions that are independent of roadway type are output separately by MOBILE6.

6. **DATABASE VEHICLES : 22222 22222222 2 222 22222222 222** instructs MOBILE6 to output emission factors for all 28 vehicle classes considered by MOBILE6.

**Run Data Section**

The run data section includes information about the local inspection and maintenance programs, the anti-tampering program, and local vehicle registration data. For the data lines I/M PROGRAM, I/M MODEL YEARS, I/M VEHICLES, I/M STRINGENCY, I/M COMPLIANCE, and I/M WAIVER RATE the first "1" indicates that the data to follow reflects component number one of the I/M program where an I/M program may have many components. For the runs described in this report, there are three components to the I/M program in 1998 and 1999 and five components to the I/M program in 2006 and 2015.

1. **I/M PROGRAM :1 1977 2050 1 T/O LOADED/IDLE** instructs MOBILE6 to model an I/M program with an I/M program start year of 1977 and 2050 end year. The program is an annual program "1". The program is a Test only rather than test and repair program "T/O". Finally, the program is a loaded/idle program.

2. **I/M MODEL YEARS : 1 1967 2050** instructs MOBILE6 that the portion of the I/M program defined in the "I/M PROGRAM" line is applied to model year 1967 through 2050 model year vehicles.

3. **I/M VEHICLES : 1 11111 22222222 2** this instructs MOBILE6 which vehicle classes are subject to this component of the I/M program where the number two indicates that a particular vehicle class is subject to the program and the number one indicates that a particular vehicle class is not subject to the program.

4. **I/M STRINGENCY : 1 28.0** defines that the expected exhaust inspection failure rate for pre-1981 model year vehicles covered by the I/M program is 28.0 percent.

5. **I/M COMPLIANCE : 1 97.0** describes the expected compliance rate within this portion of the I/M program where the compliance rate is the percentage of vehicles

in the fleet that complete the I/M program and receive either a certificate of compliance or a waiver.

6. **I/M WAIVER RATES: 1 2.0 2.3** specifies the percentage of vehicles that fail an initial I/M test and do not pass a retest but receive a certificate of compliance. This input instructs MOBILE6 to set the waiver rate at 2.0 percent for pre-1981 model years and 2.3 percent for 1981 and later model years for this portion of the I/M program during the 1998 time period.

7. **ANTI-TAMP PROG : 87 75 80 22222 22222222 2 11 097. 22111222** indicates information for the local anti-tampering program. Note that there may be more than one component of an anti-tampering program, requiring multiple inputs of this data.

   "**87**" indicates that the program began in 1987.
   "**75**" indicates that the earliest model year covered by the program is 1975.
   "**80**" indicates that the last model year covered by the program is 1980.
   "**22222**" indicates that the five light duty gasoline vehicle classes considered by MOBILE6 are all subject to this portion of the anti-tampering program.
   "**22222222**" indicates that the eight heavy duty gasoline vehicle classes considered by MOBILE6 are all subject to this portion of the anti-tampering program.
   "**2**" indicates that the gasoline powered buses are subject to this portion of the anti-tampering program.
   "**11**" indicates that credit is to be taken for the anti-tampering program and that the test is performed annually.
   **"097.**" indicates that the program compliance rate is 97 percent.
   "**22111222**" indicates that the ATP program consists of an air pump system disablement test, catalyst removal test, PCV system disablement test, evaporative system disablement test, and gas cap test. Omitted from the program are an EGR disablement test, fuel inlet restrictor disablement test, and tailpipe lead deposit test.

8. **REG DIST: 99reg98.d** indicates that local registration distribution data is provided for MOBILE6 use, rather than national default data, and that these data may be found in the external data file 99reg98.d. The data input to the runs performed for this analysis reflect ADOT registration data developed in 1999.

9. **DIESEL FRACTIONS :** indicates that the user is inputting data to reflect the fraction of vehicles by vehicle class that are diesel powered, where appropriate. In the case of MAG analysis, local data is used for the vehicle classes light duty gasoline vehicles, light duty trucks 1, and light duty trucks 2. For the remaining vehicle classes, MOBILE6 default data was input. Please note that the 42 lines of registration data following the

DIESEL FRACTIONS: command have not been reproduced here, but may be seen in the sample MOBILE6 input file provided with this document.

**Scenario Data Section**

1. **SCENARIO RECORD : I/M Scenario** is a required field that provides a unique identifier to each scenario analyzed. The individual MOBILE6 runs performed by MAG for this analysis each have only one scenario.

2. **CALENDAR YEAR : 1998** indicates that the year analyzed is 1998 (or 1999 for the case of 1999).

3. **EVALUATION MONTH : 7** indicates that the month analyzed was July (where January and July are the only months available for analysis by MOBILE6). Since the period subject to analysis was July and August, the closest month available to model was July.

4. **ALTITUDE : 1** indicates that the runs are being performed for a low-altitude region. The low altitude flag represents approximately 500 feet above sea level and the high altitude flag represents approximately 5,500 feet above sea level.

5. **HOURLY TEMPERATURES:** indicates the 24 hourly temperatures for the day being modeled, starting at 6 a.m. and ending at 5 a.m. the next morning in degrees Fahrenheit.

6. **RELATIVE HUMIDITY:** indicates the 24 hourly humidity values for the day being modeled, starting at 6 a.m. and ending at 5 a.m. the next morning in percent.

7. **BAROMETRIC PRESSURE: 28.63** indicates the average daily barometric pressure expressed in inches of mercury.

8. **SPEED VMT: s98na3fr.txt** indicates that the user has chosen to provide an external data file, s98na3fr.txt, that contains hourly speed distributions for both freeway and arterial roadway types. In this case, the file reflects area type 3, “a3" in the nonattainment area “n” for the Friday design day “fr” in 1998 “98".

9. **FUEL RVP : 6.64** indicates that the fuel volatility Reid Vapor Pressure was measured at 6.64 pounds per square inch during the period modeled.

10. **SULFUR CONTENT : 78.0** instructs MOBILE6 that the user will supply the gasoline sulfur levels, expressed as parts per million. The runs performed for this analysis indicate a sulfur content of 78 parts per million.

11. **OXYGENATED FUELS : 1.000 0.000 0.021 0.000 1** indicates that the gasoline sold during the time period modeled is expected to have 100 percent market share of ether and a 0 percent market share of ethanol as an oxygenate additive. The average oxygen content of ether blend fuels is 2.1 percent by weight. The number 1 indicates that there is no RVP waiver granted for alcohol based oxygenates.

Model Outputs

MOBILE6 was executed with the inputs described above to obtain a database of emission factors in grams per mile (g/mi) for CO, NOx, and the hydrocarbon emissions. The database of emission factors represented emission factors split out by the vehicle classes, vehicle ages, hour of the day, roadway (facility) type on which the vehicle is driving. These outputs, in the units of grams per mile were input to the M6Link system for further processing.

## ATTACHMENT ONE

## MOBILE6 INPUT FILES

Attachment One contains a portion of the MOBILE6 input files for the I/M and no I/M runs for the modeling year 1998. The sample inputs reflects Area Type number 1 (central business district) and the Friday modeling day. The I/M input appears first followed by the no I/M input.

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222


RUN DATA
EXPRESS HC AS TOG  :
I/M PROGRAM        : 1 1977 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 2050
I/M VEHICLES       : 1 11111 22222222 2
I/M STRINGENCY     : 1 28.0
I/M COMPLIANCE     : 1 97.0
I/M WAIVER RATES   : 1 2.0 2.3
I/M PROGRAM        : 2 1977 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 2050
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 28.0
I/M COMPLIANCE     : 2 97.0
I/M WAIVER RATES   : 2 2.0 2.3
I/M CUTPOINTS      : 2 CUTbas98.d
I/M PROGRAM        : 3 1977 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 3 1967 1980
I/M VEHICLES       : 3 22222 11111111 1
I/M STRINGENCY     : 3 28.0
I/M COMPLIANCE     : 3 97.0
I/M WAIVER RATES   : 3 2.0 2.3


ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 097. 22111222
ANTI-TAMP PROG     :
87 81 94 11111 22222222 2 11 097. 22111222

*the tech12.d file must be located with Mobile6 execution file
*the user tech file tech12.1me should be renamed as tech12.d
*Two more I/M programs should not have overlapped motor vehicles.

REG DIST           : 99reg98.d
DIESEL FRACTIONS   :
0.0040 0.0030 0.0030 0.0030 0.0020 0.0020 0.0030 0.0030 0.0030 0.0030
0.0040 0.0060 0.0060 0.0110 0.0150 0.0260 0.0370 0.0330 0.0370 0.0210
0.0130 0.0090 0.0090 0.0110 0.0040
0.0290 0.0550 0.0470 0.0360 0.0240 0.0390 0.0310 0.0230 0.0220 0.0140
0.0110 0.0170 0.0210 0.0280 0.0400 0.0440 0.0660 0.0370 0.0360 0.0160
0.0100 0.0040 0.0060 0.0080 0.0060
0.0290 0.0550 0.0470 0.0360 0.0240 0.0390 0.0310 0.0230 0.0220 0.0140
0.0110 0.0170 0.0210 0.0280 0.0400 0.0440 0.0660 0.0370 0.0360 0.0160
0.0100 0.0040 0.0060 0.0080 0.0060
0.0126 0.0126 0.0126 0.0115 0.0111 0.0145 0.0115 0.0129 0.0096 0.0083
0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013 0.0006 0.0011
0.0001 0.0000 0.0000 0.0000 0.0001
0.0126 0.0126 0.0126 0.0115 0.0111 0.0145 0.0115 0.0129 0.0096 0.0083
0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013 0.0006 0.0011
0.0001 0.0000 0.0000 0.0000 0.0001
0.1998 0.1998 0.1998 0.2578 0.2515 0.3263 0.2784 0.2963 0.2384 0.2058
```

```
0.1756 0.1958 0.2726 0.2743 0.3004 0.2918 0.2859 0.0138 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.6774 0.6774 0.6774 0.7715 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940
0.7488 0.7789 0.7842 0.6145 0.5139 0.5032 0.4277 0.0079 0.0000 0.0000
0.0001 0.0003 0.0010 0.0028 0.0248
0.8606 0.8606 0.8606 0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7158
0.5647 0.3178 0.2207 0.1968 0.1570 0.0738 0.0341 0.0414 0.0003 0.0000
0.0000 0.0000 0.0259 0.0078 0.0004
0.4647 0.4647 0.4647 0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616
0.1543 0.0615 0.0383 0.0333 0.0255 0.0111 0.0049 0.0060 0.0000 0.0000
0.0000 0.0000 0.0037 0.0011 0.0001
0.6300 0.6300 0.6300 0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537
0.4216 0.4734 0.4705 0.4525 0.4310 0.3569 0.3690 0.4413 0.3094 0.1679
0.1390 0.0808 0.0476 0.0365 0.0288
0.8563 0.8563 0.8563 0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440
0.7184 0.7588 0.7567 0.7431 0.7261 0.6602 0.6717 0.7344 0.6107 0.4140
0.3610 0.2353 0.1489 0.1170 0.0940
0.9992 0.9992 0.9992 0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979
0.9969 0.9978 0.9980 0.9979 0.9976 0.9969 0.9978 0.9982 0.9974 0.9965
0.9964 0.9949 0.9920 0.9936 0.9819
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710
0.7502 0.7345 0.6733 0.5155 0.3845 0.3238 0.3260 0.2639 0.0594 0.0460
0.0291 0.0240 0.0086 0.0087 0.0000

SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 1998
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 86.2 89.5 94.7 98.4 101.0 103.1 105.0 106.7 108.1 108.9 109.5
108.7
                     104.1 98.8 96.5 94.5 92.0 89.3 92.4 91.5 89.9 88.1 86.2 84.4
RELATIVE HUMIDITY  : 32. 27. 22. 20. 19. 18. 17. 16. 16. 16. 16. 16.
                     27. 28. 23. 26. 37. 37. 37. 37. 37. 37. 37. 37.
BAROMETRIC PRES    : 28.67
SPEED VMT          : s98na1fr.txt
FUEL RVP           : 6.64
SULFUR CONTENT     : 78.0
OXYGENATED FUELS   : 1.000 0.000 0.021 0.000 1

END OF RUN
```

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222


RUN DATA
EXPRESS HC AS TOG  :


*the tech12.d file must be located with Mobile6 execution file
*the user tech file tech12.1me should be renamed as tech12.d
*Two more I/M programs should not have overlapped motor vehicles.

REG DIST           : 99reg98.d
DIESEL FRACTIONS   :
0.0040 0.0030 0.0030 0.0030 0.0020 0.0020 0.0030 0.0030 0.0030 0.0030
0.0040 0.0060 0.0060 0.0110 0.0150 0.0260 0.0370 0.0330 0.0370 0.0210
0.0130 0.0090 0.0090 0.0110 0.0040
0.0290 0.0550 0.0470 0.0360 0.0240 0.0390 0.0310 0.0230 0.0220 0.0140
0.0110 0.0170 0.0210 0.0280 0.0400 0.0440 0.0660 0.0370 0.0360 0.0160
0.0100 0.0040 0.0060 0.0080 0.0060
0.0290 0.0550 0.0470 0.0360 0.0240 0.0390 0.0310 0.0230 0.0220 0.0140
0.0110 0.0170 0.0210 0.0280 0.0400 0.0440 0.0660 0.0370 0.0360 0.0160
0.0100 0.0040 0.0060 0.0080 0.0060
0.0126 0.0126 0.0126 0.0115 0.0111 0.0145 0.0115 0.0129 0.0096 0.0083
0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013 0.0006 0.0011
0.0001 0.0000 0.0000 0.0000 0.0001
0.0126 0.0126 0.0126 0.0115 0.0111 0.0145 0.0115 0.0129 0.0096 0.0083
0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013 0.0006 0.0011
0.0001 0.0000 0.0000 0.0000 0.0001
0.1998 0.1998 0.1998 0.2578 0.2515 0.3263 0.2784 0.2963 0.2384 0.2058
0.1756 0.1958 0.2726 0.2743 0.3004 0.2918 0.2859 0.0138 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.6774 0.6774 0.6774 0.7715 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940
0.7488 0.7789 0.7842 0.6145 0.5139 0.5032 0.4277 0.0079 0.0000 0.0000
0.0001 0.0003 0.0010 0.0028 0.0248
0.8606 0.8606 0.8606 0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7158
0.5647 0.3178 0.2207 0.1968 0.1570 0.0738 0.0341 0.0414 0.0003 0.0000
0.0000 0.0000 0.0259 0.0078 0.0004
0.4647 0.4647 0.4647 0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616
0.1543 0.0615 0.0383 0.0333 0.0255 0.0111 0.0049 0.0060 0.0000 0.0000
0.0000 0.0000 0.0037 0.0011 0.0001
0.6300 0.6300 0.6300 0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537
0.4216 0.4734 0.4705 0.4525 0.4310 0.3569 0.3690 0.4413 0.3094 0.1679
0.1390 0.0808 0.0476 0.0365 0.0288
0.8563 0.8563 0.8563 0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440
0.7184 0.7588 0.7567 0.7431 0.7261 0.6602 0.6717 0.7344 0.6107 0.4140
0.3610 0.2353 0.1489 0.1170 0.0940
0.9992 0.9992 0.9992 0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979
0.9969 0.9978 0.9980 0.9979 0.9976 0.9969 0.9978 0.9982 0.9974 0.9965
0.9964 0.9949 0.9920 0.9936 0.9819
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710
```

```
0.7502 0.7345 0.6733 0.5155 0.3845 0.3238 0.3260 0.2639 0.0594 0.0460
0.0291 0.0240 0.0086 0.0087 0.0000

SCENARIO RECORD    : non-I/M Scenario
CALENDAR YEAR      : 1998
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 86.2 89.5 94.7 98.4 101.0 103.1 105.0 106.7 108.1 108.9 109.5
108.7
                     104.1 98.8 96.5 94.5 92.0 89.3 92.4 91.5 89.9 88.1 86.2 84.4
RELATIVE HUMIDITY  : 32. 27. 22. 20. 19. 18. 17. 16. 16. 16. 16. 16.
                     27. 28. 23. 26. 37. 37. 37. 37. 37. 37. 37. 37.
BAROMETRIC PRES    : 28.67
SPEED VMT          : s98na1fr.txt
FUEL RVP           : 6.64
SULFUR CONTENT     : 78.0
OXYGENATED FUELS   : 1.000 0.000 0.021 0.000 1

END OF RUN
```

App.III-ii

# The M6Link System

App.III-ii contains a description of the M6Link system which is a tool that combines onroad vehicle traffic data with onroad vehicle emission factors to create an onroad vehicle emissions inventory.

**The M6Link System**

The M6Link system is a series of two FORTRAN-based programs that integrates travel demand modeling output from the EMME/2 and emission factors from MOBILE6 to produce estimates of total onroad vehicle emissions. The vehicle travel component of M6Link reads in the output from the travel demand models that are processed through GIS software. The output from the travel demand models reflect four times of day; a.m. peak, midday, p.m. peak, and nighttime. The outputs also reflect four vehicle classes; light duty commercial vehicles, medium duty commercial vehicles, heavy duty commercial vehicles, and all other vehicles. Other components of the data produced by the travel demand models are the coordinates of each modeled roadway link and individualized traffic estimates for that link, the facility type of the link, the area type, and more.

The vehicle travel component of M6Link reads in data produced from the travel demand models and produces vehicle miles traveled (VMT) estimates that have been changed from being link-specific to grid cell specific. The estimates have also been converted from reflecting a total for the four time periods of the day to hourly estimates.

The EMME/2 model produces estimates of vehicle trips and vehicle speeds for each modeled transportation link (roadway segment) for each of the four time periods of the day of a.m. peak (6 a.m. to 9 a.m.), midday (9 a.m. to 3 p.m.), p.m. peak (3 p.m. to 6 p.m.) and nighttime (6 p.m. to 6 a.m.). The traffic volumes for each of these time periods was split to produce hourly traffic volumes. The volumes by time period are split into hourly volumes by M6Link using hourly VMT splits from the MAG document 1998 MAG Regional Congestion Study, September 2000.

In this component of M6Link, Highway Performance Monitoring System (HPMS) factors are applied to reconcile VMT generated by the EMME/2 travel demand models with actual VMT reported by HPMS. HPMS data for the State is submitted annually to the Federal Highway Administration by the Arizona Department of Transportation. Actual HPMS VMTs for 1994 and 1995 were used to convert EMME/2 modeled VMT to HPMS-consistent values. Appendix III-iv describes the procedure used to develop HPMS factors for years after 1997 (i.e., 2015). Reconciliation of travel demand modeled VMT with HPMS is a practice recommended by EPA[31].

All VMT estimates contained in the travel demand model are generated for an average weekday. To take into account traffic volumes for a specific episode day, adjustment factors are calculated and used to convert the "typical" weekday traffic volumes into volumes for a the ozone season days considered in this plan. The month-specific adjustment factors are 0.8149 for July and 0.8582 for August. The factors that reflect the specific day of the week are 1.1080 for Monday (August) and 1.1223 for Tuesday (August), 1.1407 for Thursday (July), and 1.0876 for Friday (July). The resulting combined factors are 0.93 for the Monday in August, 0.89 for Tuesday in August, 0.95 for Thursday in July, and 0.96 for Friday in July. These factors and the factors for all day of the week and month combinations are documented in the August 7, 1996 MAG memo from Cathy Arthur to

Roger Herzog titled Conversion of Modeled Traffic Volumes to a Specific Month and Day of the Year.

The highway network VMT data, created with the EMME/2 transportation model, that is read in by M6Link reemerges from M6Link in the form of a VMT table. The VMT table that is output by M6Link includes the estimated VMT for each grid cell, for each hour, and for each combination of area type, facility type, and vehicle class. This file includes individual VMT estimates for approximately two million area type/hour/vehicle class/grid cell/facility type combinations. Each of these VMT estimates is combined with an emissions factor (in grams per VMT) in the second portion of M6Link.

There are several inputs required by the emissions portion of M6Link. In addition to the very detailed outputs of the vehicle travel component of M6Link, other inputs include the emission factor outputs from MOBILE6 in the database format, a job file that includes information such as the year that is being modeled and the names of the MOBILE6 files to use, and a file that assists in converting the 28 vehicle classes considered by the MOBILE6 model into the four classes included in the travel demand models. The MOBILE6 outputs that reflect the I/M scenario and the outputs that reflect the non-I/M scenario reside in different electronic files. The program reads in the I/M and non-I/M emission factor for each scenario and weights them internally to produce a single emission factor for each area type/vehicle type/facility type/hour combination.

The aforementioned conversion between vehicle classes is needed because the MOBILE6 model outputs emission factors as one of 28 vehicle classes as described on page 13 in the User's Guide to MOBILE6.0 Mobile Source Emission Factor Model, EPA420-R-02-001, January 2002 which may be found at the web site http://www.epa.gov/otaq/models/mobile6/r02001.pdf. Conversely, the EMME/2 transportation model produces estimates of vehicle trips in four categories; commercial light duty vehicles, commercial medium duty vehicles, commercial heavy duty vehicles, and all other vehicles. Using data developed in the February 1992 Arizona Department of Transportation report FHWA-AZ92-314 Development of an Urban Truck Travel Model for the Phoenix Metropolitan Area, a series of factors were developed that are used to appropriately weight the VMT ratios from the 28 vehicle classes into the four vehicle classes described above.

Additionally, while the MOBILE6 model produces estimates of cold starts emission factors independent of facility type, cold start emissions are generally more likely to occur on smaller roadways such as arterials and local roadways. It is unlikely that vehicles would produce cold start emissions while on a freeway since it would generally take several minutes to reach a freeway from where the vehicle had been at rest (such as a home or workplace). As such, cold start emissions have been applied to all roadway types except for freeways and freeway ramps to improve the spatial allocation of these emissions.

Using the emission factors output by MOBILE6, M6Link calculates and spatially allocate the onroad mobile emissions in the modeling domain. The emissions are spatially

allocated into one square mile cells, and the modeling domain consists of 33 grid cells in the east-west direction and 24 grid cells in the north-south direction. The hourly emissions output from M6Link are processed through MEDEXPLORA, which is a component of the EXPLORA modeling system used in the Serious Area CO Plan analysis, to provide UAM-ready input files. Control measures that result in across-the-board adjustments are applied to the UAM-ready input files through the EMSCOR utility.

The M6Link program is run using a control file to provide needed inputs. The inputs to a M6Link run performed for this analysis, in particular the 1998 analysis for Friday, are described below. The inputs to a M6Link run for the 1999, 2006, or 2015 scenarios would follow the same pattern.

1. **/VERSION/**
   **1.1 ozone**

   identifies the M6Link control file as being appropriate for use with a particular version of the model. This run was performed with the M6Link executable version 1.1 ozone.

2. **/XCELLS/**
   **92**

   instructs the M6Link model to include 92 grid cells of emissions in the east-west direction in the active modeling domain.

3. **/YCELLS/**
   **43**

   instructs the M6Link model to include 43 grid cells of emissions in the north-south direction in the active modeling domain.

4. **/YEAR/**
   **1998**

   instructs the M6Link model to condense the 28 MOBILE6 vehicle class emission factors to four vehicle classes using weighting factors appropriate for the 1998 time period. The weighting factors differ over time due to changes in overall fleet characteristics.

5. **/MOBILEIN/**
   **98I1FN.TB1.ADJ**
   **98I2FN.TB1.ADJ**
   **98I3FN.TB1.ADJ**
   **98I4FN.TB1.ADJ**
   **98I5FN.TB1.ADJ**

**98N1FN.TB1.ADJ**
**98N2FN.TB1.ADJ**
**98N3FN.TB1.ADJ**
**98N4FN.TB1.ADJ**
**98N5FN.TB1.ADJ**

instructs the M6Link model which ten MOBILE6 output files to access to derive emission factors appropriate for the particular analysis where the first five MOBILE6 files reflect an I/M program present and area types one through five and the second five MOBILE6 files reflect no I/M program.

6. **/MESSAGES/**
   **YES**
   **YES**
   **YES**
   **YES**

   instructs the M6Link model to include all four optional message output files available.

7. **/LINK FILE/**
   **L98nfr.txt**

   instructs the M6Link model to access the file named l98nfr.txt as containing the transportation modeling data appropriate for use in developing emission totals.

8. **/WEIGHTS/**
   **91.0**
   **9.0**

   instructs the M6Link model to weight the MOBILE6 factors as 91.0 percent of vehicles of the appropriate age and class participate in the I/M program and the remaining 9.0 percent do not.

9. **/FACTORS/**
   **1.0000**
   **1.0000**
   **1.0000**
   **etc...**

instructs the M6Link model to apply an adjustment factor to hourly vehicle miles of travel estimates.

10. **/MC IM /**
    **YES**

    instructs the M6Link model to apply credit for the motorcycle component of the inspection and maintenance program.

App.III-iii

Development of the Spatial Surrogates

# DEVELOPMENT OF SPATIAL ALLOCATION SURROGATES FOR ONE-HOUR OZONE MAINTENANCE UAM MODELING

## 1. Background

Since the Urban Airshed Model (UAM) predicts carbon monoxide and ozone concentrations at grid level, it must be supplied with the same degree of grid-level emissions data. The amount of efforts to derive grid-level emissions varies depending on the type of emission source. Two methods are generally used to allocate emissions to grid cells: One method is to directly obtain emissions for each grid cell and the other is to use spatial surrogates of emission levels (e.g., the number of houses or type of land use). The former is the most accurate method to obtain grid-level emissions, but it is absolutely dependent upon available resources such as time, money, and data. It has been applied to point or onroad mobile source emissions since existing databases of point and onroad mobile source emissions contain location data for each source or each link, allowing direct assignment to the appropriate grid cells. The latter assumes that emissions from each source behave spatially in the same manner as the spatial surrogate. It has been used for the spatial allocation of area and nonroad mobile source emissions because specific location data for each area or nonroad mobile source are not available. Fifteen categories of spatial surrogates shown in Table 1 were developed for area and nonroad mobile source emissions in conjunction with one-hour ozone maintenance UAM modeling. A typical spatial surrogate is defined as the ratio of a grid-level to ozone nonattainment or attainment land use area. This document describes the development of spatial surrogates to spatially allocate area and nonroad mobile source emissions to the ozone modeling domain. The result of this effort is a gridded spatial surrogate file for use with the GRDEM module of EPS2.0.

## 2. Development Procedures

### 2.1 Ozone Modeling Domain

Ozone modeling domain was developed using the GENERATE ARC command of ARC/INFO. The origin of the modeling domain is located at 297,000 meters and 3,675,000 meters in UTM zone 12. Gridded modeling domain has 92 grid cells in x direction (easting) and 43 grid cells in y direction (northing) and each grid cell size is 2,000 meters by 2,000 meters.

### 2.2 Spatial Surrogates

Two sets of fifteen spatial surrogates were developed for both of ozone nonattainment and attainment areas since area and nonroad mobile source emissions inventories were developed for ozone nonattainment and attainment areas, respectively. Categories and data sources used to develop spatial surrogates are shown in Table 1.

To develop housing spatial surrogate 2000 census and census block data were intersected by a gridded ozone modeling domain, which has ozone nonattainment and attainment area boundaries, using INTERSECT command in PC ArcView “xtools” extension. Since 2000 census and block data provide for total number of houses by census block, houses per unit area for each census block were calculated, and then multiplied by census block areas for a grid cell or ozone nonattainment or attainment areas. Total house number in a grid cell was extracted to calculate the ratio of the number of houses in a grid cell to the number of houses in ozone nonattainment or attainment area.

Industrial and non-industrial spatial surrogates were based on the MAG 2000 land use data. Industrial and non-industrial areas for grid cells, and ozone nonattainment and attainment areas were extracted by intersecting the MAG 2000 land use data with the gridded ozone modeling domain. Industrial land use category in the MAG 2000 land use data was used for the industrial spatial surrogate while land use categories such as business parks, commercial retail centers, warehouse/distribution centers, hotels, motels, resorts, retail centers, large assembly areas, offices and public facilities were included in developing the non-industrial spatial surrogate.

The spatial surrogates for undeveloped total and developed total were developed based on the MAG 2000 land use data and the gridded ozone modeling domain. The undeveloped total spatial surrogate was based on the MAG 2000 land use code #900. The developed total surrogate was based on the MAG 2000 land use codes #100 through 590 and 810. The MAG 2000 land use was intersected with the gridded ozone modeling domain. Acres of land use categories by grid cell were extracted to calculate the ratio of grid area to the ozone nonattainment or attainment area. Airport, golf course, and water spatial surrogates were developed based on the MAG 2000 land use intersected with the gridded ozone modeling domain.

The MAG 1990 land use contains three categories of agricultural land: Agriculture-Citrus, Agriculture-Other Crops, and Agriculture-Stockyards. The MAG 2000 land use contains only total agriculture. In an effort to maintain the spatial distinction among agricultural land uses, updated agricultural surrogates were created using the change in total agricultural land from 1990 to 2000 and applying the change to the 1990 agriculture land use categories. The updated agricultural surrogates are Agricultural-Stockyard and Agricultural-Other Crops. Total acres of agricultural land within each grid cell were extracted for 1990 and 2000. The difference in total agricultural acres per grid cell between 1990 and 2000 was divided by total 1990 agricultural acres per grid cell. This fractional change was subtracted from one. The difference was multiplied by the 1990 Agricultural Stockyard acres per grid cell and 1990 Agricultural-Other Crops acres per grid cell to calculate the 2000 Agriculture-Stockyard acres per grid cell and the 2000 Agricultural-Other Crops acres per grid cell, respectively.

Construction spatial surrogates such as residential, commercial and total construction were developed using the following databases: 1996 TAZ, 2000 land use, the MAG general plan and TAZPRJ97.DBF. To estimate the amount of development between 1995 and

2000, the increase in households per TAZ was divided by 7 household per acre and the increase in total employment per TAZ was divided by 20 employees per acre. This calculation estimates the new household acres and employment acres per TAZ. The number of acres of vacant land from the MAG 2000 land use coverage that were also coded as residential or commercial acreage in the MAG General Plan were calculated by TAZ. This calculation represents the maximum new acres of residential and commercial use per TAZ. The new household acres and employment acres per TAZ were converted to the new household acres and employment acres per grid cells. The new household acres were used as the spatial surrogate for residential construction. The new employment acres were used as the spatial surrogate for commercial construction. The sum of new household and employment acres were used as the total construction spatial surrogate.

The MAG 1990 land use coverage was used to develop the remaining spatial surrogates including non-developable forest and railroad because the MAG 2000 land use data do not provide such land use categories. The 1990 land use was intersected with gridded ozone modeling domain and the acres of non-developable forest and railroad by each grid cell were extracted from the intersected coverage.

The separately generated 15 spatial surrogates for each of nonattainment and attainment areas were combined into one file and formatted by a FORTRAN program to use in the GRDEM module of EPS2.0. Using the GRDEM module with the developed two sets of spatial surrogates, the ozone nonattainment and attainment area emissions were separately allocated to grid cells and then the separately gridded ozone nonattainment and attainment emissions were merged with the MRGUAM module of EPS2.0.

**Table 1. Spatial Surrogate Codes and Categories**

| Code | Categories | Data Source |
|---|---|---|
| 1 | Housing | 2000 Census Data |
| 2 | Industrial | 1995 Land Use |
| 3 | Non-industrial | 1995 Land Use |
| 4 | Undeveloped Total | 1995 Land Use |
| 5 | Developed Total | 1995 Land Use |
| 6 | Residential Construction | 1995 Land Use + 1996 TAZ + General Plan |
| 7 | Agriculture - Stockyards | 1990 Land Use + 1995 Land Use |
| 8 | Agriculture - Other Crops | 1990 Land Use + 1995 Land Use |

| | | |
|---|---|---|
| 9 | Commercial Construction | 1995 Land Use + 1996 TAZ + General Plan |
| 10 | Non-developable Forest | 1990 Land Use |
| 11 | Railroad | 1990 Land Use |
| 12 | Water | 1995 Land Use |
| 13 | Golf Course | 1995 Land Use |
| 14 | Total Construction | 1995 Land Use + 1996 TAZ + General Plan + TAZPRJ97.dbf |
| 15 | Airport | 1995 Land Use |

**Table 2. Spatial Surrogate Assignments**

| Area Source Category | Spatial Surrogate Code | Source Category Description |
|---|---|---|
| 2102000000 | 2 | Industrial; External Combustion |
| 2102006000 | 2 | Industrial; Natural Gas; External Combustion |
| 2103006000 | 3 | Com/Inst; Nat Gas; External Combustion |
| 2104006000 | 1 | Residential; Nat Gas; External Combustion |
| 2104008000 | 1 | Residential; Barbecues/Firepits |
| 2104008001 | 1 | Residential; Fireplaces |
| 2104008010 | 1 | Residential; Wood Stoves |
| 2199000000 | 5 | Total Area; External Combustion |
| 2260001010 | 4 | Off-Road Motorcycles, Gasoline, 2-stroke, Mobile |
| 2260001030 | 4 | All Terrain Vehicles (ATVs), Gasoline, 2-stroke, Mobile |
| 2260001040 | 4 | Minibikes, Gasoline, 2-stroke, Mobile |
| 2260001050 | 13 | Golf Carts, Gasoline, 2-stroke, Mobile |
| 2260001060 | 5 | Specialty Vehicles Carts, Gasoline, 2-stroke, Mobile |
| 2260002003 | 14 | Asphalt Pavers, Gasoline, 2-stroke, Mobile |
| 2260002006 | 14 | Tampers/Rammers, Gasoline, 2-stroke, Mobile |
| 2260002009 | 14 | Plate Compactors, Gasoline, 2-stroke, Mobile |
| 2260002012 | 14 | Concrete Pavers, Gasoline, 2-stroke, Mobile |
| 2260002015 | 14 | Rollers, Gasoline, 2-stroke, Mobile |

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|---|---|---|
| 2260002018 | 14 | Scrapers, Gasoline, 2-stroke, Mobile |
| 2260002021 | 14 | Paving Equipment, Gasoline, 2-stroke, Mobile |
| 2260002024 | 14 | Surfacing Equipment, Gasoline, 2-stroke, Mobile |
| 2260002027 | 14 | Signal Boards, Gasoline, 2-stroke, Mobile |
| 2260002030 | 14 | Trenchers, Gasoline, 2-stroke, Mobile |
| 2260002033 | 14 | Bore/Drill Rigs, Gasoline, 2-stroke, Mobile |
| 2260002036 | 14 | Excavators, Gasoline, 2-stroke, Mobile |
| 2260002039 | 14 | Concrete/Industrial Saws, Gasoline, 2-stroke, Mobile |
| 2260002042 | 14 | Cement and Mortar Mixers, Gasoline, 2-stroke, Mobile |
| 2260002045 | 14 | Cranes, Gasoline, 2-stroke, Mobile |
| 2260002048 | 14 | Graders, Gasoline, 2-stroke, Mobile |
| 2260002051 | 14 | Off-Highway Trucks, Gasoline, 2-stroke, Mobile |
| 2260002054 | 14 | Crushing/Proc. Equipment, Gasoline, 2-stroke, Mobile |
| 2260002057 | 14 | Rough Terrain Forklifts, Gasoline, 2-stroke, Mobile |
| 2260002060 | 14 | Rubber Tired Loaders, Gasoline, 2-stroke, Mobile |
| 2260002063 | 14 | Rubber Tired Dozers, Gasoline, 2-stroke, Mobile |
| 2260002066 | 14 | Tractors/Loaders/Backhoes, Gasoline, 2-stroke, Mobile |
| 2260002069 | 14 | Crawler Tractors, Gasoline, 2-stroke, Mobile |
| 2260002072 | 14 | Skid Steer Loaders, Gasoline, 2-stroke, Mobile |
| 2260002075 | 14 | Off-Highway Tractors, Gasoline, 2-stroke, Mobile |
| 2260002078 | 14 | Dumpers/Tenders, Gasoline, 2-stroke, Mobile |
| 2260002081 | 14 | Other Construction Equipment, Gasoline, 2-stroke, Mobile |
| 2260003010 | 2 | Aerial Lifts, Gasoline, 2-stroke, Mobile |
| 2260003020 | 2 | Forklifts, Gasoline, 2-stroke, Mobile |
| 2260003030 | 2 | Sweepers/Scrubbers, Gasoline, 2-stroke, Mobile |
| 2260003040 | 2 | Other General Industrial Equipment, Gasoline, 2-stroke, Mobile |
| 2260003050 | 2 | Other Material Handling Equipment, Gasoline, 2-stroke, Mobile |
| 2260004010 | 5 | Lawn Mowers, Gasoline, 2-stroke, Mobile |
| 2260004015 | 5 | Tillers <5 HP, Gasoline, 2-stroke, Mobile |
| 2260004020 | 5 | Chainsaws <4 HP, Gasoline, 2-stroke, Mobile |
| 2260004025 | 5 | Trimmers/Edgers/Brush Cutters, Gasoline, 2-stroke, Mobile |
| 2260004030 | 5 | Leaf Blowers/Vacuums, Gasoline, 2-stroke, Mobile |
| 2260004040 | 5 | Rear Engine Riding Mowers, Gasoline, 2-stroke, Mobile |

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| 2260004045 | 5 | Front Mowers, Gasoline, 2-stroke, Mobile |
| 2260004050 | 5 | Shredders <5 HP, Gasoline, 2-stroke, Mobile |
| 2260004055 | 5 | Lawn & Garden Tractors, Gasoline, 2-stroke, Mobile |
| 2260004060 | 5 | Wood Splitters, Gasoline, 2-stroke, Mobile |
| 2260004065 | 5 | Chippers/Stump Grinders, Gasoline, 2-stroke, Mobile |
| 2260004070 | 5 | Commercial Turf Equipment, Gasoline, 2-stroke, Mobile |
| 2260004075 | 5 | Other Lawn & Garden Equipment, Gasoline, 2-stroke, Mobile |
| 2260005010 | 8 | 2-Wheel Tractors, Gasoline, 2-stroke, Mobile |
| 2260005015 | 8 | Agricultural Tractors, Gasoline, 2-stroke, Mobile |
| 2260005020 | 8 | Combines, Gasoline, 2-stroke, Mobile |
| 2260005025 | 8 | Balers, Gasoline, 2-stroke, Mobile |
| 2260005030 | 8 | Agricultural Mowers, Gasoline, 2-stroke, Mobile |
| 2260005035 | 8 | Sprayers, Gasoline, 2-stroke, Mobile |
| 2260005040 | 8 | Tillers >5 HP, Gasoline, 2-stroke, Mobile |
| 2260005045 | 8 | Swathers, Gasoline, 2-stroke, Mobile |
| 2260005050 | 8 | Hydro Power Units, Gasoline, 2-stroke, Mobile |
| 2260005055 | 8 | Other Agricultural Equipment, Gasoline, 2-stroke, Mobile |
| 2260006005 | 3 | Generator Sets <50 HP, Gasoline, 2-stroke, Mobile |
| 2260006010 | 3 | Pumps <50 HP, Gasoline, 2-stroke, Mobile |
| 2260006015 | 3 | Air Compressors <50 HP, Gasoline, 2-stroke, Mobile |
| 2260006020 | 3 | Gas Compressors <50 HP, Gasoline, 2-stroke, Mobile |
| 2260006025 | 3 | Welders <50 HP, Gasoline, 2-stroke, Mobile |
| 2260006030 | 3 | Pressure Washers <50 HP, Gasoline, 2-stroke, Mobile |
| 2260007005 | 10 | Chainsaws >4 HP, Gasoline, 2-stroke, Mobile |
| 2260007010 | 10 | Shredders >5 HP, Gasoline, 2-stroke, Mobile |
| 2260007015 | 10 | Skidders, Gasoline, 2-stroke, Mobile |
| 2260007020 | 10 | Fellers/Bunchers, Gasoline, 2-stroke, Mobile |
| 2260008005 | 15 | Aircraft Support Equipment, Gasoline, 2-stroke, Mobile |
| 2260008010 | 15 | Terminal Tractors, Gasoline, 2-stroke, Mobile |
| 2265001010 | 4 | Off-Road Motorcycles, Gasoline, 4-stroke, Mobile |
| 2265001030 | 4 | All Terrain Vehicles (ATVs), Gasoline, 4-stroke, Mobile |
| 2265001040 | 4 | Minibikes, Gasoline, 4-stroke, Mobile |
| 2265001050 | 13 | Golf Carts, Gasoline, 4-stroke, Mobile |

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|---|---|---|
| 2265001060 | 5 | Specialty Vehicles Carts, Gasoline, 4-stroke, Mobile |
| 2265002003 | 14 | Asphalt Pavers, Gasoline, 4-stroke, Mobile |
| 2265002006 | 14 | Tampers/Rammers, Gasoline, 4-stroke, Mobile |
| 2265002009 | 14 | Plate Compactors, Gasoline, 4-stroke, Mobile |
| 2265002012 | 14 | Concrete Pavers, Gasoline, 4-stroke, Mobile |
| 2265002015 | 14 | Rollers, Gasoline, 4-stroke, Mobile |
| 2265002018 | 14 | Scrapers, Gasoline, 4-stroke, Mobile |
| 2265002021 | 14 | Paving Equipment, Gasoline, 4-stroke, Mobile |
| 2265002024 | 14 | Surfacing Equipment, Gasoline, 4-stroke, Mobile |
| 2265002027 | 14 | Signal Boards, Gasoline, 4-stroke, Mobile |
| 2265002030 | 14 | Trenchers, Gasoline, 4-stroke, Mobile |
| 2265002033 | 14 | Bore/Drill Rigs, Gasoline, 4-stroke, Mobile |
| 2265002036 | 14 | Excavators, Gasoline, 4-stroke, Mobile |
| 2265002039 | 14 | Concrete/Industrial Saws, Gasoline, 4-stroke, Mobile |
| 2265002042 | 14 | Cement and Mortar Mixers, Gasoline, 4-stroke, Mobile |
| 2265002045 | 14 | Cranes, Gasoline, 4-stroke, Mobile |
| 2265002048 | 14 | Graders, Gasoline, 4-stroke, Mobile |
| 2265002051 | 14 | Off-Highway Trucks, Gasoline, 4-stroke, Mobile |
| 2265002054 | 14 | Crushing/Proc. Equipment, Gasoline, 4-stroke, Mobile |
| 2265002057 | 14 | Rough Terrain Forklifts, Gasoline, 4-stroke, Mobile |
| 2265002060 | 14 | Rubber Tired Loaders, Gasoline, 4-stroke, Mobile |
| 2265002063 | 14 | Rubber Tired Dozers, Gasoline, 4-stroke, Mobile |
| 2265002066 | 14 | Tractors/Loaders/Backhoes, Gasoline, 4-stroke, Mobile |
| 2265002069 | 14 | Crawler Tractors, Gasoline, 4-stroke, Mobile |
| 2265002072 | 14 | Skid Steer Loaders, Gasoline, 4-stroke, Mobile |
| 2265002075 | 14 | Off-Highway Tractors, Gasoline, 4-stroke, Mobile |
| 2265002078 | 14 | Dumpers/Tenders, Gasoline, 4-stroke, Mobile |
| 2265002081 | 14 | Other Construction Equipment, Gasoline, 4-stroke, Mobile |
| 2265003010 | 2 | Aerial Lifts, Gasoline, 4-stroke, Mobile |
| 2265003020 | 2 | Forklifts, Gasoline, 4-stroke, Mobile |
| 2265003030 | 2 | Sweepers/Scrubbers, Gasoline, 4-stroke, Mobile |
| 2265003040 | 2 | Other General Industrial Equipment, Gasoline, 4-stroke, Mobile |
| 2265003050 | 2 | Other Material Handling Equipment, Gasoline, 4-stroke, Mobile |

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|---|---|---|
| 2265004010 | 5 | Lawn Mowers, Gasoline, 4-stroke, Mobile |
| 2265004015 | 5 | Tillers <5 HP, Gasoline, 4-stroke, Mobile |
| 2265004020 | 5 | Chainsaws <4 HP, Gasoline, 4-stroke, Mobile |
| 2265004025 | 5 | Trimmers/Edgers/Brush Cutters, Gasoline, 4-stroke, Mobile |
| 2265004030 | 5 | Leaf Blowers/Vacuums, Gasoline, 4-stroke, Mobile |
| 2265004040 | 5 | Rear Engine Riding Mowers, Gasoline, 4-stroke, Mobile |
| 2265004045 | 5 | Front Mowers, Gasoline, 4-stroke, Mobile |
| 2265004050 | 5 | Shredders <5 HP, Gasoline, 4-stroke, Mobile |
| 2265004055 | 5 | Lawn & Garden Tractors, Gasoline, 4-stroke, Mobile |
| 2265004060 | 5 | Wood Splitters, Gasoline, 4-stroke, Mobile |
| 2265004065 | 5 | Chippers/Stump Grinders, Gasoline, 4-stroke, Mobile |
| 2265004070 | 5 | Commercial Turf Equipment, Gasoline, 4-stroke, Mobile |
| 2265004075 | 5 | Other Lawn & Garden Equipment, Gasoline, 4-stroke, Mobile |
| 2265005010 | 8 | 2-Wheel Tractors, Gasoline, 4-stroke, Mobile |
| 2265005015 | 8 | Agricultural Tractors, Gasoline, 4-stroke, Mobile |
| 2265005020 | 8 | Combines, Gasoline, 4-stroke, Mobile |
| 2265005025 | 8 | Balers, Gasoline, 4-stroke, Mobile |
| 2265005030 | 8 | Agricultural Mowers, Gasoline, 4-stroke, Mobile |
| 2265005035 | 8 | Sprayers, Gasoline, 4-stroke, Mobile |
| 2265005040 | 8 | Tillers >5 HP, Gasoline, 4-stroke, Mobile |
| 2265005045 | 8 | Swathers, Gasoline, 4-stroke, Mobile |
| 2265005050 | 8 | Hydro Power Units, Gasoline, 4-stroke, Mobile |
| 2265005055 | 8 | Other Agricultural Equipment, Gasoline, 4-stroke, Mobile |
| 2265006005 | 2 | Generator Sets <50 HP, Gasoline, 4-stroke, Mobile |
| 2265006010 | 2 | Pumps <50 HP, Gasoline, 4-stroke, Mobile |
| 2265006015 | 2 | Air Compressors <50 HP, Gasoline, 4-stroke, Mobile |
| 2265006020 | 2 | Gas Compressors <50 HP, Gasoline, 4-stroke, Mobile |
| 2265006025 | 2 | Welders <50 HP, Gasoline, 4-stroke, Mobile |
| 2265006030 | 2 | Pressure Washers <50 HP, Gasoline, 4-stroke, Mobile |
| 2265007005 | 10 | Chainsaws >4 HP, Gasoline, 4-stroke, Mobile |
| 2265007010 | 10 | Shredders >5 HP, Gasoline, 4-stroke, Mobile |
| 2265007015 | 10 | Skidders, Gasoline, 4-stroke, Mobile |
| 2265007020 | 10 | Fellers/Bunchers, Gasoline, 4-stroke, Mobile |
| 2265008005 | 15 | Aircraft Support Equipment, Gasoline, 4-stroke, Mobile |

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|---|---|---|
| 2265008010 | 15 | Terminal Tractors, Gasoline, 4-stroke, Mobile |
| 2270001010 | 4 | Off-Road Motorcycles, Diesel, Mobile |
| 2270001030 | 4 | All Terrain Vehicles (ATVs), Diesel, Mobile |
| 2270001040 | 4 | Minibikes, Diesel, Mobile |
| 2270001050 | 13 | Golf Carts, Diesel, Mobile |
| 2270001060 | 5 | Specialty Vehicles Carts, Diesel, Mobile |
| 2270002003 | 14 | Asphalt Pavers, Diesel, Mobile |
| 2270002006 | 14 | Tampers/Rammers, Diesel, Mobile |
| 2270002009 | 14 | Plate Compactors, Diesel, Mobile |
| 2270002012 | 14 | Concrete Pavers, Diesel, Mobile |
| 2270002015 | 14 | Rollers, Diesel, Mobile |
| 2270002018 | 14 | Scrapers, Diesel, Mobile |
| 2270002021 | 14 | Paving Equipment, Diesel, Mobile |
| 2270002024 | 14 | Surfacing Equipment, Diesel, Mobile |
| 2270002027 | 14 | Signal Boards, Diesel, Mobile |
| 2270002030 | 14 | Trenchers, Diesel, Mobile |
| 2270002033 | 14 | Bore/Drill Rigs, Diesel, Mobile |
| 2270002036 | 14 | Excavators, Diesel, Mobile |
| 2270002039 | 14 | Concrete/Industrial Saws, Diesel, Mobile |
| 2270002042 | 14 | Cement and Mortar Mixers, Diesel, Mobile |
| 2270002045 | 14 | Cranes, Diesel, Mobile |
| 2270002048 | 14 | Graders, Diesel, Mobile |
| 2270002051 | 14 | Off-Highway Trucks, Diesel, Mobile |
| 2270002054 | 14 | Crushing/Proc. Equipment, Diesel, Mobile |
| 2270002057 | 14 | Rough Terrain Forklifts, Diesel, Mobile |
| 2270002060 | 14 | Rubber Tired Loaders, Diesel, Mobile |
| 2270002063 | 14 | Rubber Tired Dozers, Diesel, Mobile |
| 2270002066 | 14 | Tractors/Loaders/Backhoes, Diesel, Mobile |
| 2270002069 | 14 | Crawler Tractors, Diesel, Mobile |
| 2270002072 | 14 | Skid Steer Loaders, Diesel, Mobile |
| 2270002075 | 14 | Off-Highway Tractors, Diesel, Mobile |
| 2270002078 | 14 | Dumpers/Tenders, Diesel, Mobile |
| 2270002081 | 14 | Other Construction Equipment, Diesel, Mobile |
| 2270003010 | 2 | Aerial Lifts, Diesel, Mobile |
| 2270003020 | 2 | Forklifts, Diesel, Mobile |

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|---|---|---|
| 2270003030 | 2 | Sweepers/Scrubbers, Diesel, Mobile |
| 2270003040 | 2 | Other General Industrial Equipment, Diesel, Mobile |
| 2270003050 | 2 | Other Material Handling Equipment, Diesel, Mobile |
| 2270004010 | 5 | Lawn Mowers, Diesel, Mobile |
| 2270004015 | 5 | Tillers <5 HP, Diesel, Mobile |
| 2270004020 | 5 | Chainsaws <4 HP, Diesel, Mobile |
| 2270004025 | 5 | Trimmers/Edgers/Brush Cutters, Diesel, Mobile |
| 2270004030 | 5 | Leaf Blowers/Vacuums, Diesel, Mobile |
| 2270004040 | 5 | Rear Engine Riding Mowers, Diesel, Mobile |
| 2270004045 | 5 | Front Mowers, Diesel, Mobile |
| 2270004050 | 5 | Shredders <5 HP, Diesel, Mobile |
| 2270004055 | 5 | Lawn & Garden Tractors, Diesel, Mobile |
| 2270004060 | 5 | Wood Splitters, Diesel, Mobile |
| 2270004065 | 5 | Chippers/Stump Grinders, Diesel, Mobile |
| 2270004070 | 5 | Commercial Turf Equipment, Diesel, Mobile |
| 2270004075 | 5 | Other Lawn & Garden Equipment, Diesel, Mobile |
| 2270005010 | 8 | 2-Wheel Tractors, Diesel, Mobile |
| 2270005015 | 8 | Agricultural Tractors, Diesel, Mobile |
| 2270005020 | 8 | Combines, Diesel, Mobile |
| 2270005025 | 8 | Balers, Diesel, Mobile |
| 2270005030 | 8 | Agricultural Mowers, Diesel, Mobile |
| 2270005035 | 8 | Sprayers, Diesel, Mobile |
| 2270005040 | 8 | Tillers >5 HP, Diesel, Mobile |
| 2270005045 | 8 | Swathers, Diesel, Mobile |
| 2270005050 | 8 | Hydro Power Units, Diesel, Mobile |
| 2270005055 | 8 | Other Agricultural Equipment, Diesel, Mobile |
| 2270006005 | 3 | Generator Sets <50 HP, Diesel, Mobile |
| 2270006010 | 3 | Pumps <50 HP, Diesel, Mobile |
| 2270006015 | 3 | Air Compressors <50 HP, Diesel, Mobile |
| 2270006020 | 3 | Gas Compressors <50 HP, Diesel, Mobile |
| 2270006025 | 3 | Welders <50 HP, Diesel, Mobile |
| 2270006030 | 3 | Pressure Washers <50 HP, Diesel, Mobile |
| 2270007005 | 10 | Chainsaws >4 HP, Diesel, Mobile |
| 2270007010 | 10 | Shredders >5 HP, Diesel, Mobile |
| 2270007015 | 10 | Skidders, Diesel, Mobile |

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|---|---|---|
| 2270007020 | 10 | Fellers/Bunchers, Diesel, Mobile |
| 2270008005 | 15 | Aircraft Support Equipment, Diesel, Mobile |
| 2270008010 | 15 | Terminal Tractors, Diesel, Mobile |
| 2282005005 | 12 | Pleasure Craft; Gasoline, 2-stroke Inboard |
| 2282005010 | 12 | Pleasure Craft; Gasoline, 2-stroke Outboard |
| 2282005015 | 12 | Pleasure Craft; Gasoline, 2-stroke Sterndrive |
| 2282005020 | 12 | Pleasure Craft; Gasoline, 2-stroke Sailboat Aux. Inboard |
| 2282005025 | 12 | Pleasure Craft; Gasoline, 2-stroke Sailboat Aux. Outboard |
| 2282010005 | 12 | Pleasure Craft; Gasoline, 4-stroke Inboard |
| 2282010010 | 12 | Pleasure Craft; Gasoline, 4-stroke Outboard |
| 2282010015 | 12 | Pleasure Craft; Gasoline, 4-stroke Sterndrive |
| 2282010020 | 12 | Pleasure Craft; Gasoline, 4-stroke Sailboat Aux. Inboard |
| 2282010025 | 12 | Pleasure Craft; Gasoline, 4-stroke Sailboat Aux. Outboard |
| 2282020005 | 12 | Pleasure Craft; Diesel Inboard |
| 2282020010 | 12 | Pleasure Craft; Diesel Outboard |
| 2282020015 | 12 | Pleasure Craft; Diesel Sterndrive |
| 2282020020 | 12 | Pleasure Craft; Diesel Sailboat Aux. Inboard |
| 2282020025 | 12 | Pleasure Craft; Diesel Sailboat Aux. Outboard |
| 2285002005 | 11 | Railroads Locomotives |
| 2285002010 | 11 | Railroads Yard |
| 2302002000 | 5 | Charbroiling |
| 2311010000 | 6 | Residential Construction |
| 2311000040 | 5 | Unpaved Parking lots |
| 2311000070 | 14 | Construction Trackout |
| 2311020000 | 9 | Commercial Construction |
| 2401001000 | 14 | Surface Coating -Architectural Coatings |
| 2401005000 | 2 | Surface Coating-Auto Refinishing |
| 2401008000 | 5 | Surface Coating-Traffic Markings |
| 2401010000 | 2 | Surface Coating-Fabric Products |
| 2401015000 | 2 | Surface Coating-Factory Finished Wood |
| 2401020000 | 2 | Surface Coating-Wood Furniture |
| 2401025000 | 2 | Surface Coating-Metal Furniture |
| 2401030000 | 2 | Surface Coating-Papers |
| 2401035000 | 2 | Surface Coating-Plastic Products |
| 2401045000 | 2 | Surface Coating- Metal Coils |

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|---|---|---|
| 2401050000 | 2 | Surface Coating-Misc. Finished Metals |
| 2401055000 | 2 | Surface Coating-Machinery and Equipment |
| 2401060000 | 2 | Surface Coating-Large Appliances |
| 2401075000 | 15 | Surface Coating-Aircraft Solvent Utilization |
| 2401080000 | 2 | Surface Coating-Marines |
| 2401090000 | 2 | Surface Coating-Misc. Manufacturing |
| 2401100000 | 2 | Surface Coating-Industrial Maintenance Coating |
| 2401200000 | 2 | Surface Coating-Other Specific Purpose Coating |
| 2415000000 | 2 | Degreasing -Solvent Utilization |
| 2415045000 | 2 | Degreasing-Misc. Manufacturing |
| 2420000370 | 3 | All Processes-Drying Cleaning |
| 2425000000 | 3 | Graphic Arts Solvent Utilization |
| 2440000000 | 2 | Solvent Utilization - Misc. Industrial |
| 2461021000 | 14 | Misc. Non-Industrial: Cutback Asphalt |
| 2461022000 | 14 | Misc. Non-Industrial: Emulsified Asphalt |
| 2461023000 | 14 | Misc. Non-Industrial-Asphalt Roofing |
| 2461800000 | 8 | Misc. Non-Industrial-Pestcide Application |
| 2461900000 | 3 | Misc. Non-Industrial-Misc. Products-NEC |
| 2465000000 | 1 | Misc. Non-Industrial-Consumer Solvent Use |
| 2501050120 | 3 | Bulk Stations Terminals-Breathing Loss Gasoline |
| 2501060051 | 5 | Gasoline Service Stations- Tank Truck Unloading |
| 2501060053 | 5 | Gasoline Service Stations-Tank Truck Unloading |
| 2501060100 | 5 | Gasoline Service Stations-Vehicle Refueling |
| 2501060201 | 5 | Gasoline Service Stations-Underground Tank Breathing Losses |
| 2501995180 | 15 | Local Storage-Only for Airport AV Gasoline |
| 2505000900 | 3 | Tank Truck Cleaning |
| 2505030120 | 5 | Tank Truck in Transit |
| 2510000000 | 2 | Organic Chemical Storage and Transport |
| 2601000000 | 2 | On-Site Incineration Waste Disposal |
| 2610000000 | 5 | Open Burning Waste Disposal |
| 2620030000 | 3 | Landfills -Municipal |
| 2630020000 | 3 | Wastewater Treatment -Public Owned |
| 2660000000 | 5 | Leaking -Underground Storage Tanks |
| 2701000000 | 8 | Biogenic-natural Sources |

| | | |
|---|---|---|
| 2701400000 | 8 | Biogenic |
| 2801000000 | 8 | Agricutural Production - Crops |
| 2801000003 | 8 | Agriculture - Crops; Tilling |
| 2801000005 | 8 | Agriculture - Crops; Harvesting |
| 2805000000 | 7 | Agriculture - Livestock |
| 2805001000 | 7 | Agriculture - Livestock; Beef Cattle Feedlots |
| 2810000000 | 5 | Other Combustion |
| 2810030000 | 5 | Other Combustion- Structure Fires |
| 2810050000 | 5 | Other Combustion-Motor Vehicle Fire |
| 2810001000 | 10 | Forest Wildfires |

App.III-iv

HPMS Reconciliation Factors

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION IX**
**75 Hawthorne Street**
**San Francisco, CA 94105-3901**

November 18, 2002

Maricopa Association of Governments
Received
NOV 25 2002

Ms. Lindy Bauer
Environmental Manager
Maricopa Association of Governments
302 N. 1st Avenue, Suite 300
Phoenix, AZ 85003

Dear Lindy:

Earlier this year I received a letter describing the methodology MAG has developed to reconcile vehicle miles of travel (VMT) output by the MAG EMME/2 transportation models with VMT estimates from the Highway Performance Monitoring System (HPMS). The letter requested approval from EPA Region IX to apply the HPMS reconciliation methodology in preparing on-road mobile source emissions for future air quality plans and transportation conformity analyses.

Reconciliation of network-based travel model VMT with HPMS is recommended in EPA's *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources.* It is also required in EPA's Transportation Conformity Rule, Section 93.122(b)(3), for nonattainment areas such as Maricopa County that are classified as Serious for ozone and carbon monoxide.

I reviewed the MAG HPMS reconciliation methodology, which is based on 5,000 traffic counts and the latest MAG transportation model validation for the year 1998. On March 11, 2002, I called Cathy Arthur of your staff and approved the methodology for use in future transportation conformity analyses and air quality plans, including the carbon monoxide and ozone maintenance plans.

This letter confirms that EPA Region IX has approved the HPMS reconciliation methodology documented in your letter with attachments of January 8, 2002.

Sincerely,

Frances Wicher
Office of Air Planning

# DERIVATION OF HPMS RECONCILIATION FACTORS

| 1998 Transportation Model VMT[1]<br>By Facility Type (Based on AWDT[2]) | Urbanized Area[3] | Donut Area[3] |
|---|---|---|
| #1 - Freeways | 14,329,934 | 2,140,463 |
| #2 - Expressways | 441,383 | 1,196,360 |
| #3 - Collectors | 1,996,676 | 426,879 |
| #4 - 6-Leg Arterials | 748,358 | 0 |
| #5 - Centroids | 6,059,922 | 765,899 |
| #6 - Arterials | 33,374,324 | 3,759,702 |
| #7 - Ramps (Unmetered) | 628,886 | 53,949 |
| #8 - Metered Ramps | 31,085 | 2,024 |
| #9 - Penalty Links | 12,112 | 1,952 |
| #10 - HOV Lanes | 444,901 | 0 |
| TOTAL | 58,067,581 | 8,347,228 |

| 1998 HPMS VMT - Urbanized Area #33<br>By Functional System (Based on AADT[4]) | Urbanized Area[5] | Conversion to AWDT[6] |
|---|---|---|
| Interstate | 7,526,000 | 8,270,330 |
| Other Freeways | 7,477,000 | 8,216,484 |
| Other Principal Arterial | 18,062,000 | 19,848,352 |
| Minor Arterial | 9,229,000 | 10,141,758 |
| Collector | 5,099,000 | 5,603,297 |
| Local | 5,158,000 | 5,668,132 |
| TOTAL | 52,551,000 | 57,748,353 |

| 1998 HPMS VMT - Donut Area #33<br>By Functional System (Based on AADT[4]) | Donut Area[5,7] | Conversion to AWDT[6] |
|---|---|---|
| Principal Arterial | 2,328,000 | 2,558,242 |
| Minor Arterial and (Major) Collector | 2,238,000 | 2,459,341 |
| Minor Collector and Local | 415,000 | 456,044 |
| TOTAL | 4,981,000 | 5,473,627 |

[1]Based on the 1998LR3 EMME/2 validation traffic assignment.
[2]AWDT = Average Weekday Traffic (average daily traffic on a typical weekday).
[3]ArcInfo GIS software was used to identify EMME/2 links inside the HPMS urbanized and donut areas.
[4]AADT = Annual Average Daily Traffic (average daily traffic for a seven-day week).
[5]See the 1998 HPMS System Length and Daily Vehicle Travel summaries submitted to the Federal Highway Administration by the Arizona Department of Transportation on October 7, 1999.
[6]Divide by 0.91 to convert AADT to AWDT for comparison with transportation model output. This factor is based on continuous Automated Traffic Recorder (ATR) data for the Phoenix metropolitan area.
[7]The HPMS donut area is the area inside the PM-10 nonattainment area boundary, but outside the urbanized area boundary, as defined by the 1990 Census.

## DERIVATION OF HPMS RECONCILIATION FACTORS (CONTINUED)

### URBANIZED AREA #33

| 1998 HPMS VMT (By Functional System) | Column A |
|---|---|
| Freeways (Interstate + Other Freeways) | 16,486,814 |
| Arterials (Other Principal Arterial + Minor Arterial) | 29,990,110 |
| Collector | 5,603,297 |
| Local | 5,668,132 |
| TOTAL | 57,748,353 |

| 1998 Transportation Model VMT (By Facility Type) | Column B |
|---|---|
| Freeways (#1 + #7 + #8 + #10) | 15,434,806 |
| Arterials (#2 + #4 + #6 + #9) | 34,576,177 |
| Collectors (#3) | 1,996,676 |
| Locals (#5) | 6,059,922 |
| TOTAL | 58,067,581 |

| HPMS Factors (By Facility Type) | Urbanized Area[8] |
|---|---|
| Freeways (#1 + #7 +#8 + #10) | 1.0682[9] |
| Arterials (#2 + #4 + #6 + #9) | 0.8674[9] |
| Collectors (#3) | 1.0000[10] |
| Locals (#5) | 1.5305[10] |

[8] The HPMS Factors for Urbanized Area #33 are applied to the VMT on each transportation model link located in the urbanized area, based on the facility type of the link.

[9]Obtained by dividing the 1998 HPMS VMT in Column A by the corresponding 1998 Model VMT in Column B for freeways and arterials.

[10]Although the factor derived by dividing collector VMT in Column A by Column B would be 2.8063, applying this factor to VMT on collector links from the transportation model would unrealistically overload the traffic volumes on the small number of collectors that are actually coded in the highway networks. The transportation model assumes that the remaining collector travel is included in the local (centroid) VMT. Therefore, the collector VMT on the highway network is left unfactored, and the additional HPMS collector VMT is added to the modeled local (centroid) VMT. The local factor is derived by summing HPMS collector and local VMT in Column A, subtracting the collector VMT in Column B, and dividing by the local VMT in Column B.

## DERIVATION OF HPMS RECONCILIATION FACTORS (CONTINUED)

### DONUT AREA #33

| 1998 HPMS VMT (By Functional System) | Column C |
|---|---|
| Principal Arterials | 2,558,242 |
| Minor Arterials and Major Collectors | 2,459,341 |
| SUBTOTAL | 5,017,583 |
| Minor Collectors and Locals | 456,044 |
| TOTAL | 5,473,627 |

| 1998 Model VMT (By Facility Type) | Column D1 | Column D2[11] | Column D3 |
|---|---|---|---|
| Freeways (#1 + #7 + #8 + #10) | 2,196,436 | 2,346,141 | 1,664,253[12] |
| Arterials (#2 + #4 + #6 + #9) | 4,958,014 | 4,300,400 | 3,050,521[12] |
| Collectors (#3) | 426,879 | 426,879 | 302,810[12] |
| SUBTOTAL | 7,581,329 | 7,073,420 | 5,017,584 |
| Locals (#5) | 765,899 | | 456,044[13] |
| TOTAL | 8,347,228 | | 5,473,628 |

| HPMS Factors (By Facility Type) | Donut Area[14] |
|---|---|
| Freeways (#1 + #7 + #8 + #10) | 0.7577 |
| Arterials (#2 + #4 + #6 + #9) | 0.6153 |
| Collectors (#3) | 0.7094 |
| Locals (#5) | 0.5954 |

[11]Since more than 90% of the VMT in the PM-10 nonattainment area occurs in the urbanized area, the methodology used to derive factors for the urbanized area is also used to reconcile transportation model VMT by facility type with HPMS VMT by functional system in the donut area. For freeways and arterials, Column D2 is derived by dividing Column A by Column B and multiplying by Column D1. For collectors, the urbanized area factor of 1.0 is applied to Column D1 to obtain Column D2.
[12]Obtained by multiplying Column D2 by the SUBTOTAL in Column C divided by the SUBTOTAL in Column D2. This normalizes the model VMT for freeways, arterials and collectors to the HPMS VMT for principal arterials, minor arterials and major collectors. It is assumed that all arterials and major collectors in the donut area are included in the highway network. This is a reasonable assumption, because only collectors carrying the highest levels of traffic are coded in the highway network in the donut area.
[13]From Column C for minor collectors and locals. It is assumed that the VMT for minor collectors and locals is included in the local (centroid) VMT from the transportation model.
[14]The HPMS Factors for Donut Area #33 are derived by dividing Column D3 by Column D1. These are applied to the VMT on each transportation model link located in the donut area, based on the facility type of the link.

App.III-v

Conversion of Modeled Traffic Volumes to a Specific Month and Day of the Year

MARICOPA ASSOCIATION OF GOVERNMENTS
TRANSPORTATION AND PLANNING OFFICE

**OFFICE MEMO**

August 7, 1996

TO: Roger Herzog, Transportation Modeling and Air Quality Manager

FROM: Cathy Arthur, Transportation Planning Consultant

SUBJECT: Conversion of Modeled Traffic Volumes to a Specific Month and Day of the Year

The methodology to convert average weekday traffic volumes to a specific month and day of the year is as follows:

$$VOL_{ij} = \frac{AWDT * AADTFAC_j * DOWFAC_{ij}}{MOFAC_j}$$

where:
$i$ = Day of the week
$j$ = Month of the year
$VOL_{ij}$ = Daily traffic volume for day $i$ and month $j$
AWDT = Average weekday traffic volume from travel demand models
$AADTFAC_j$ = Average annual daily traffic factor for the month $j$ (Table 1)
$DOWFAC_{ij}$ = Day of the week factor for day $i$ and month $j$ (Table 2)
$MOFAC_j$ = Month factor for month $j$ (Table 3).

AADTFAC converts average weekday volumes to average annual daily traffic (AADT). DOWFAC and MOFAC convert AADTs to volumes for the specified month and day of the year. The source for the factors in Tables 1-3 is 1993 automated traffic recorder data, as reported in the MAG Highway Performance Monitoring System Update Study, Final Report, January 1995.

TABLE 1. Average Annual Daily Traffic Volume Factor

| | AADTFAC |
|---|---|
| January | 0.9040 |
| February | 0.9085 |
| March | 0.9131 |
| April | 0.9069 |
| May | 0.9050 |
| June | 0.8959 |
| July | 0.8801 |
| August | 0.8955 |
| September | 0.9030 |
| October | 0.9084 |
| November | 0.9168 |
| December | 0.9133 |

TABLE 2. Day of the Week Factor

| DOWFAC | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| January | 0.6447 | 1.0554 | 1.1115 | 1.0116 | 1.1136 | 1.1784 | 0.8085 |
| February | 0.6780 | 1.0385 | 1.0948 | 1.1178 | 1.1078 | 1.1780 | 0.8277 |
| March | 0.6923 | 1.0498 | 1.0912 | 1.1077 | 1.1049 | 1.1552 | 0.8407 |
| April | 0.6665 | 1.0588 | 1.0786 | 1.0865 | 1.1027 | 1.1523 | 0.8106 |
| May | 0.6670 | 0.9808 | 1.1213 | 1.1363 | 1.1486 | 1.1992 | 0.8242 |
| June | 0.6259 | 1.0774 | 1.0929 | 1.1108 | 1.1168 | 1.1474 | 0.7840 |
| July | 0.6125 | 1.0863 | 1.1118 | 1.1307 | 1.1407 | 1.0876 | 0.6779 |
| August | 0.6373 | 1.1080 | 1.1223 | 1.1262 | 1.1530 | 1.1815 | 0.8068 |
| September | 0.6489 | 0.9644 | 1.1140 | 1.1299 | 1.1311 | 1.1791 | 0.8091 |
| October | 0.6653 | 1.0448 | 1.0828 | 1.0859 | 1.0990 | 1.1625 | 0.8226 |
| November | 0.6954 | 1.1062 | 1.1166 | 1.1278 | 1.0077 | 1.1258 | 0.8598 |
| December | 0.6802 | 1.0754 | 1.0955 | 1.1167 | 1.0856 | 1.0405 | 0.8280 |

TABLE 3. Month of the Year Factor

| | MOFAC |
|---|---|
| January | 1.0540 |
| February | 0.9811 |
| March | 0.9506 |
| April | 0.9476 |
| May | 1.0143 |
| June | 0.9874 |
| July | 1.0800 |
| August | 1.0435 |
| September | 1.0146 |
| October | 0.9786 |
| November | 0.9983 |
| December | 0.9962 |

# APPENDIX IV

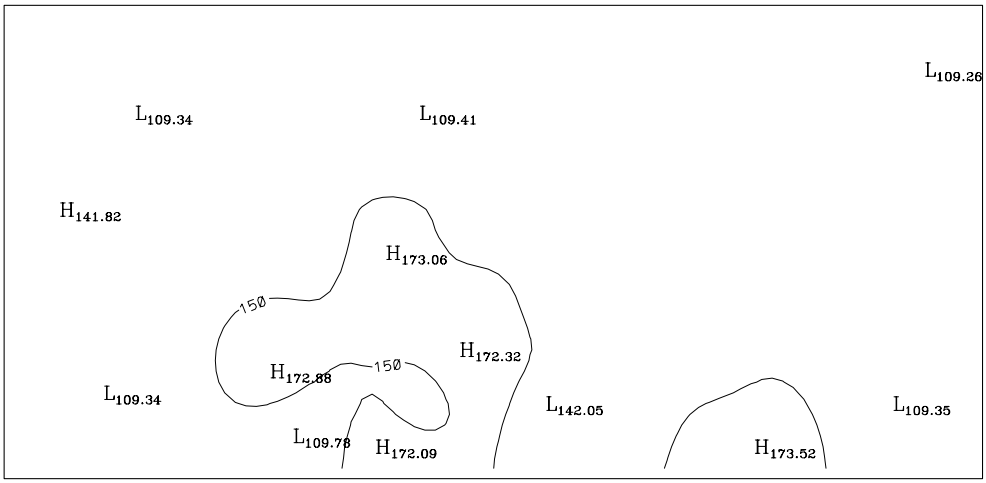
# MODELING ANALYSES

Appendix IV-i

# HOURLY MIXING HEIGHTS FIELDS FOR 1998 EPISODE

The isopleth plots shown here are the simulated mixing heights for each hour. These hourly plots are from hour 0 on July 16, 1998 to hour 2400 on July 17, 1998.

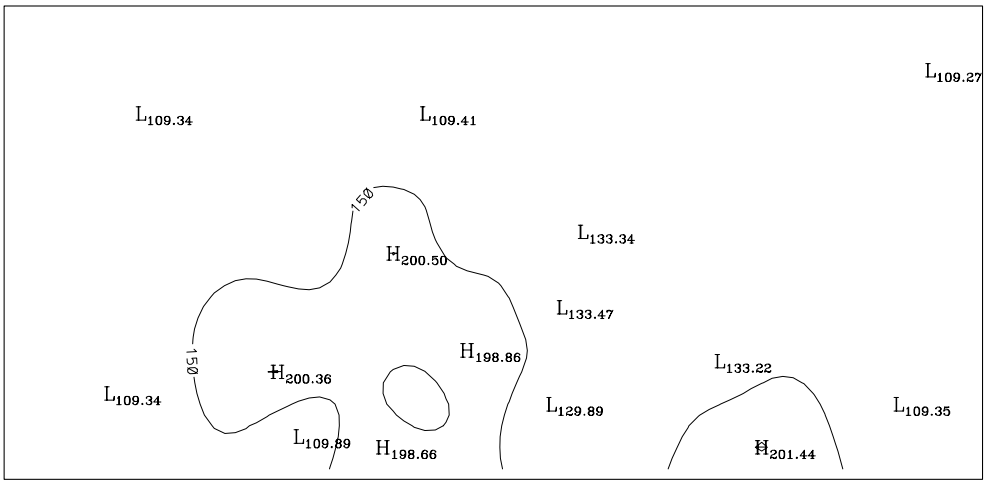
UAM DIFFUSION BREAK (M)
7/16/1998 0000-0100 MST




SIMULATED MAX 173.5 MIN 109.3 AVG 138.6

MAX AT (73,04)

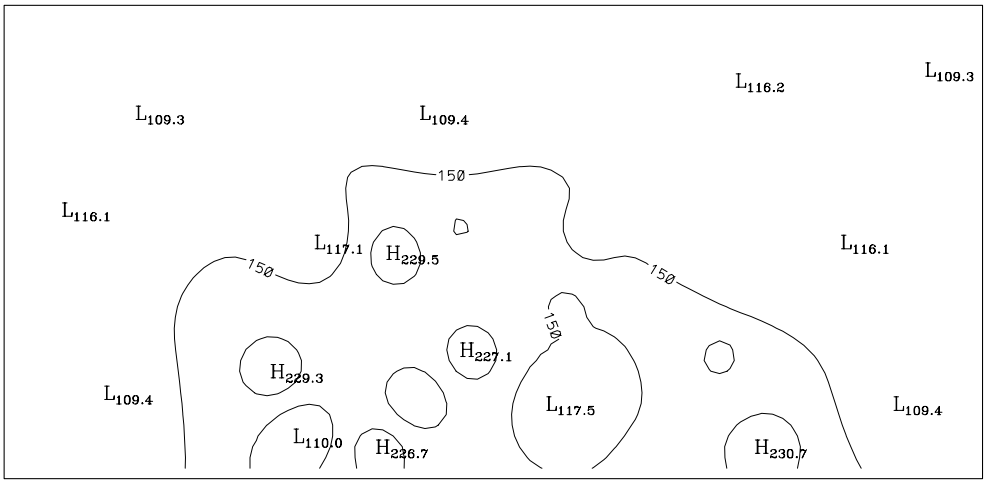
UAM DIFFUSION BREAK (M)
7/16/1998 0100-0200 MST




SIMULATED MAX 201.4 MIN 109.3 AVG 137.3

MAX AT (73,04)

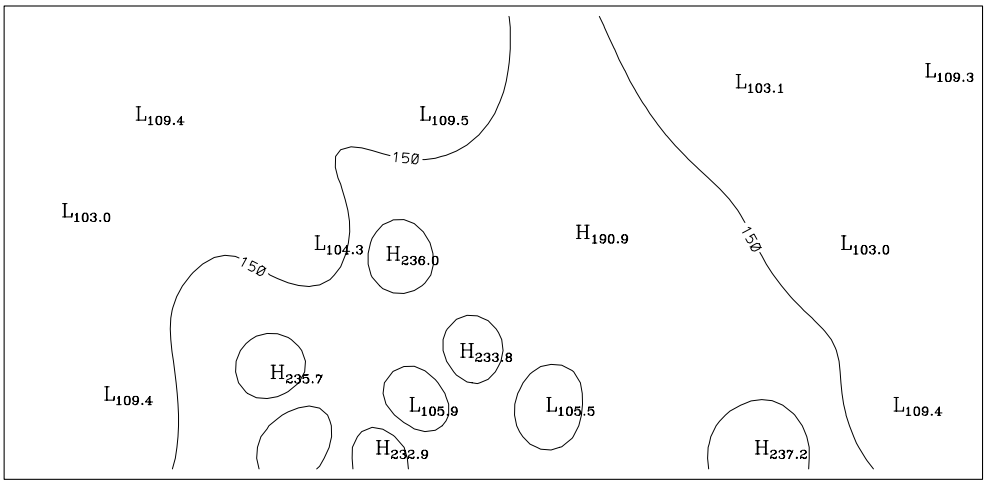
UAM DIFFUSION BREAK (M)
7/16/1998 0200-0300 MST




SIMULATED MAX 230.7 MIN 109.3 AVG 142.2

MAX AT (73,04)

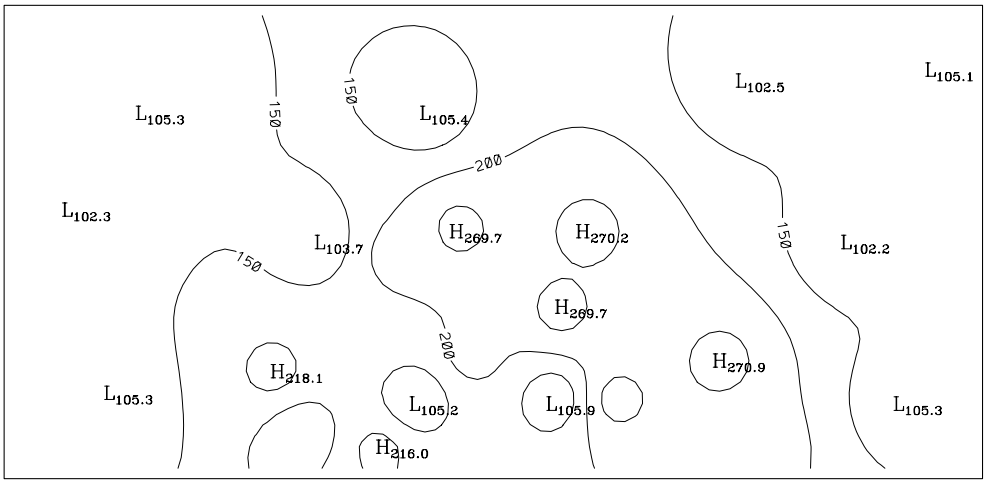
UAM DIFFUSION BREAK (M)
7/16/1998 0300-0400 MST




SIMULATED MAX 237.2 MIN 103.0 AVG 148.8

MAX AT (73,04)

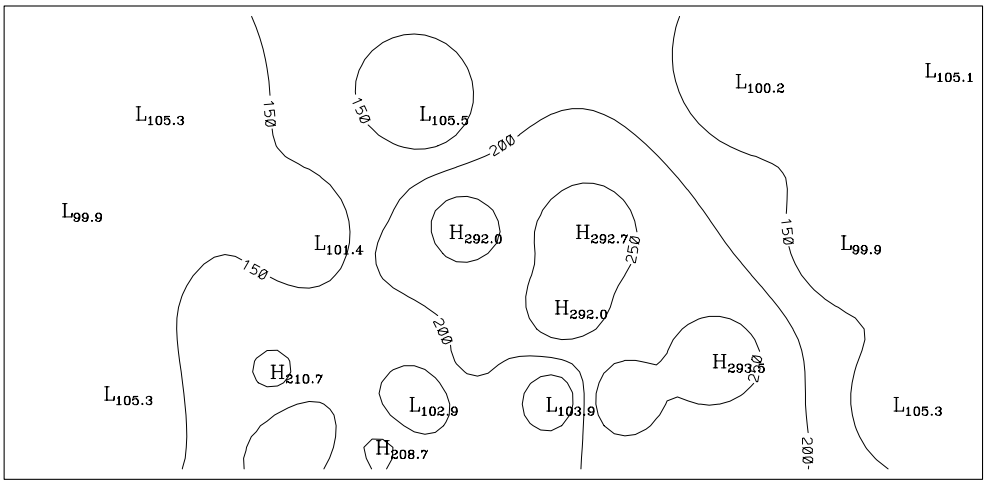
UAM DIFFUSION BREAK (M)
7/16/1998 0400-0500 MST




SIMULATED MAX 270.9 MIN 102.2 AVG 161.4

MAX AT (69,12)

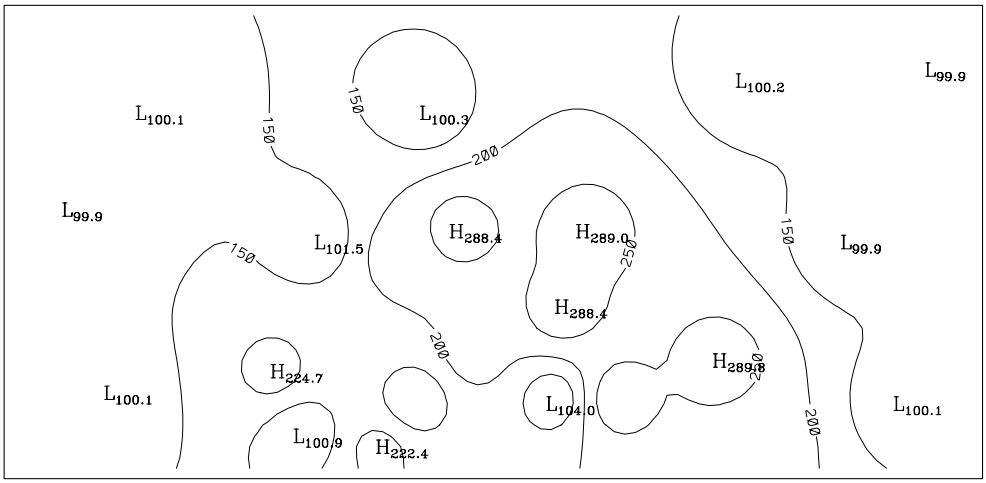
UAM DIFFUSION BREAK (M)
7/16/1998 0500-0600 MST




SIMULATED MAX 293.5 MIN 99.9 AVG 164.2

MAX AT (69,12)

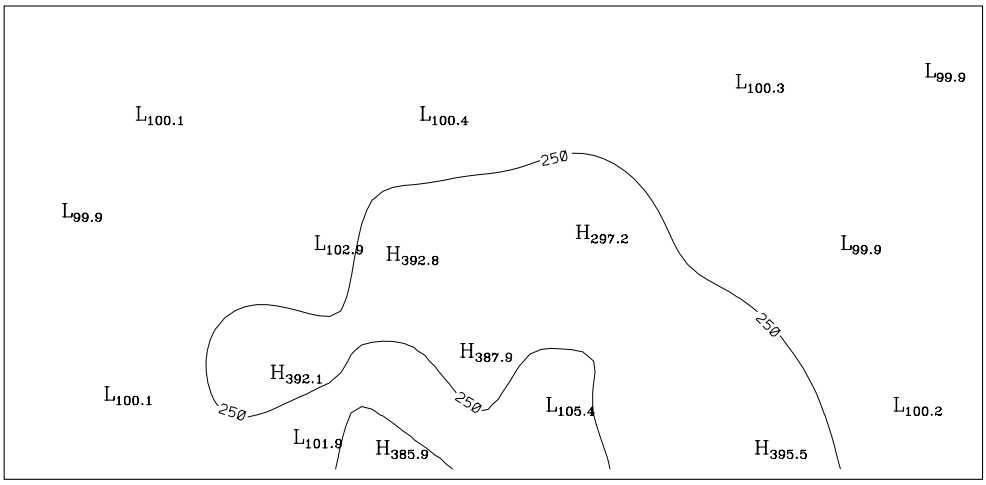
UAM DIFFUSION BREAK (M)
7/16/1998 0600-0700 MST




SIMULATED MAX 289.8 MIN 99.9 AVG 164.5

MAX AT (69,12)

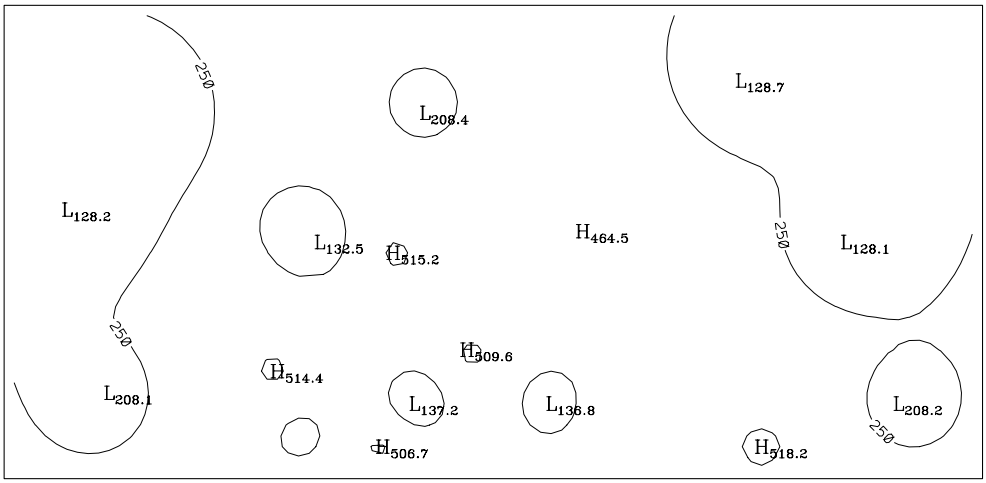
UAM DIFFUSION BREAK (M)
7/16/1998 0700-0800 MST




SIMULATED MAX 395.5 MIN 99.9 AVG 197.4

MAX AT (73,04)

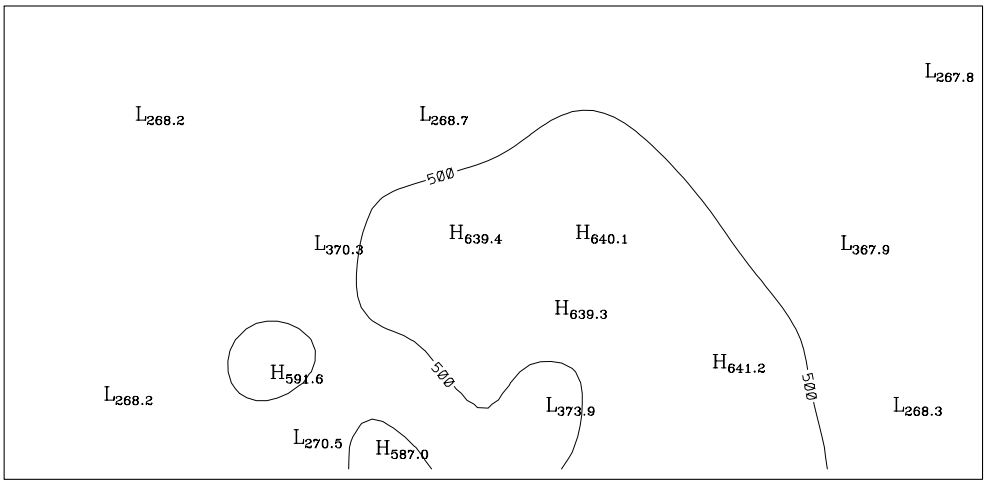
UAM DIFFUSION BREAK (M)
7/16/1998 0800-0900 MST




SIMULATED MAX 518.2 MIN 128.1 AVG 297.6

MAX AT (73,04)

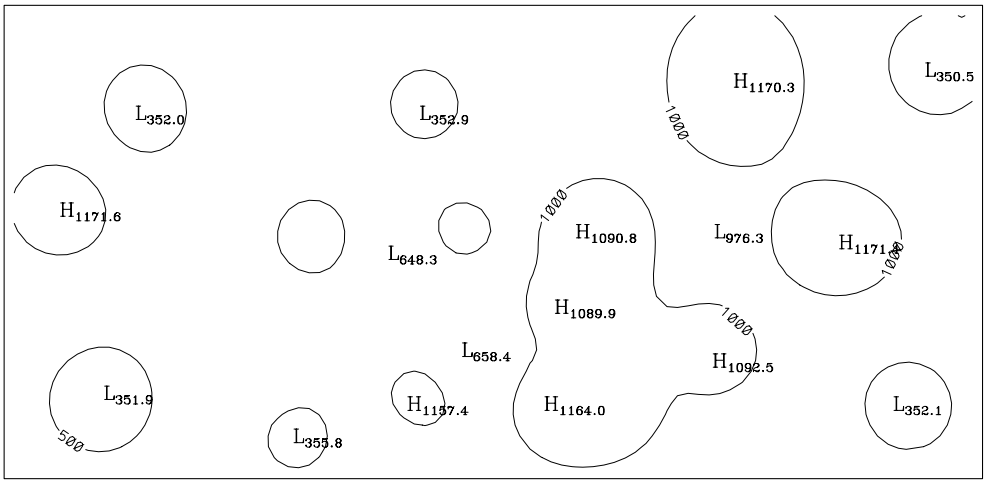
UAM DIFFUSION BREAK (M)
7/16/1998 0900-1000 MST




SIMULATED MAX 641.2 MIN 267.8 AVG 438.8

MAX AT (69,12)

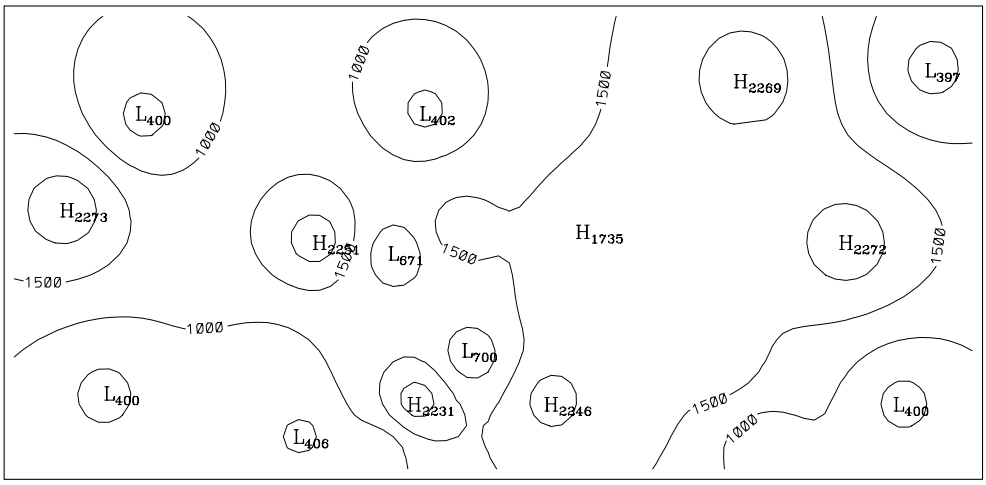
UAM DIFFUSION BREAK (M)
7/16/1998 1000–1100 MST




SIMULATED MAX 1172 MIN 351 AVG 808

MAX AT (07,26)

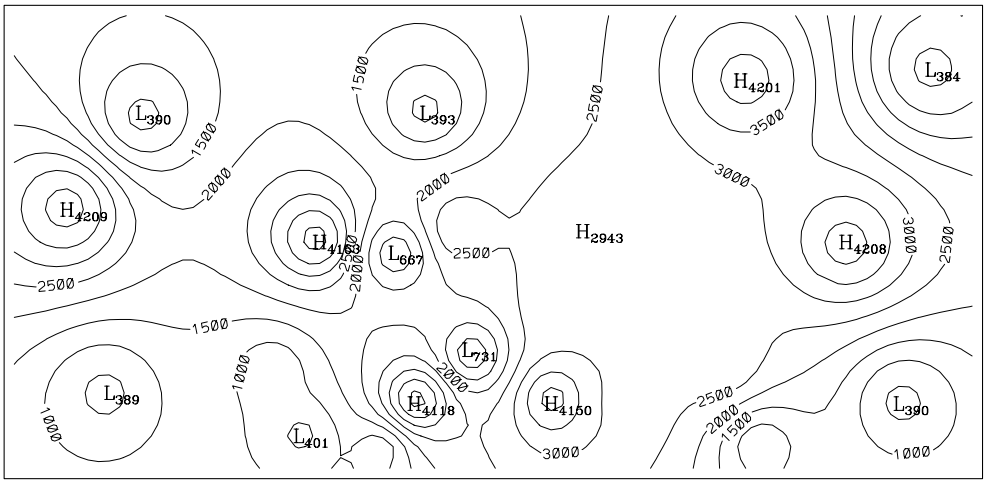
UAM DIFFUSION BREAK (M)
7/16/1998 1100–1200 MST




SIMULATED MAX 2273 MIN 398 AVG 1289

MAX AT (07,26)

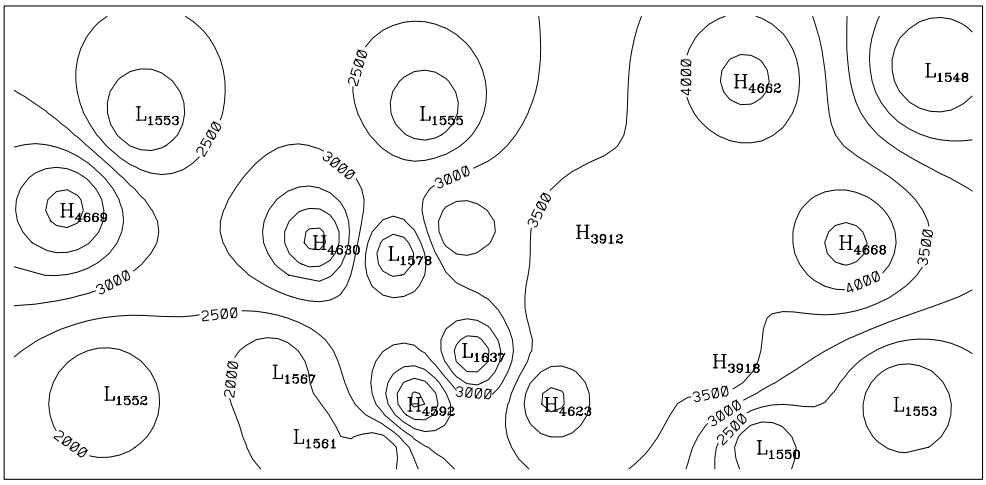
UAM DIFFUSION BREAK (M)
7/16/1998 1200–1300 MST




SIMULATED MAX 4209 MIN 385 AVG 2115

MAX AT (07,26)

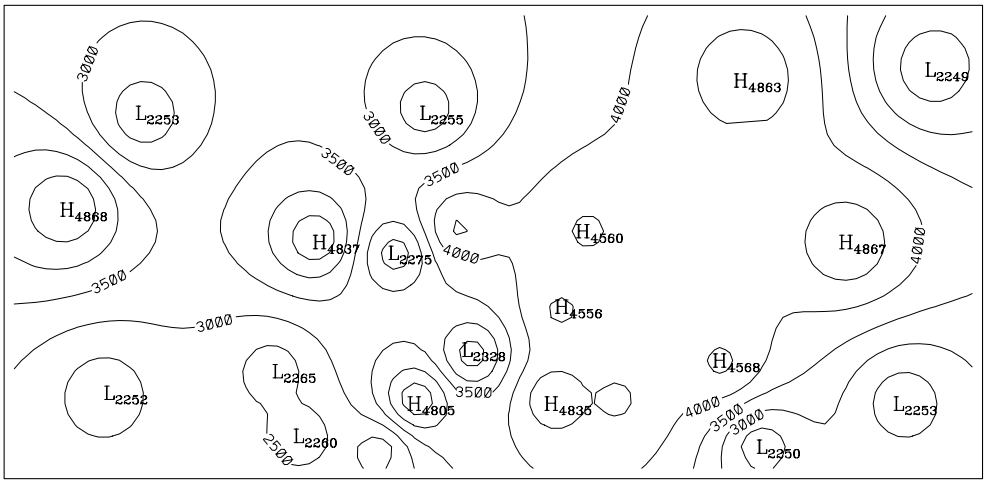
UAM DIFFUSION BREAK (M)
7/16/1998 1300–1400 MST




SIMULATED MAX 4669 MIN 1548 AVG 2983

MAX AT (07,26)

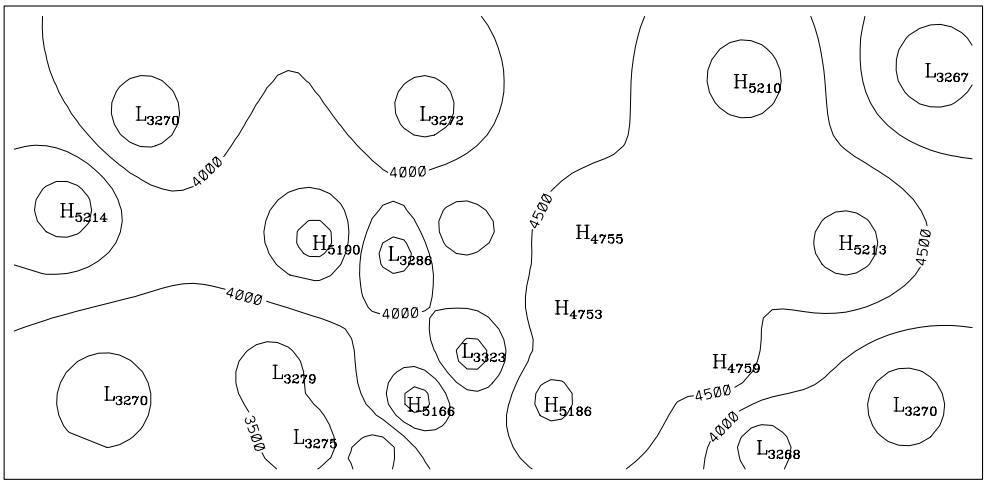
UAM DIFFUSION BREAK (M)
7/16/1998 1400–1500 MST




SIMULATED MAX 4868 MIN 2249 AVG 3525

MAX AT (07,26)

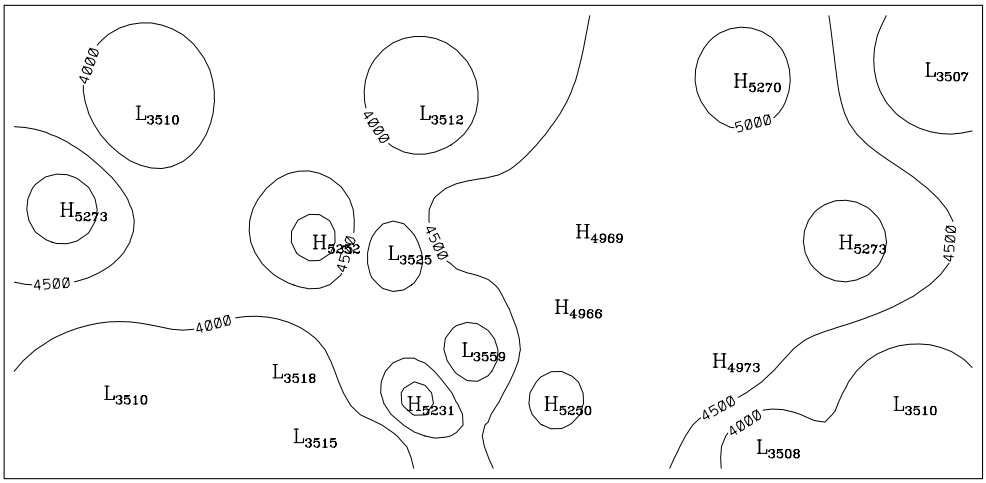
UAM DIFFUSION BREAK (M)
7/16/1998 1500–1600 MST




SIMULATED MAX 5214 MIN 3267 AVG 4165

MAX AT (07,26)

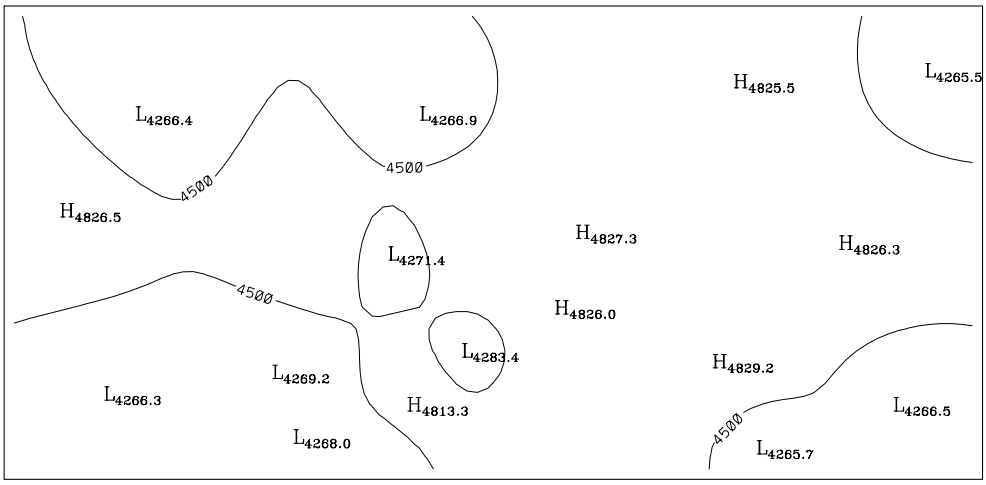
UAM DIFFUSION BREAK (M)
7/16/1998 1600–1700 MST




SIMULATED MAX 5273 MIN 3507 AVG 4347

MAX AT (07,26)

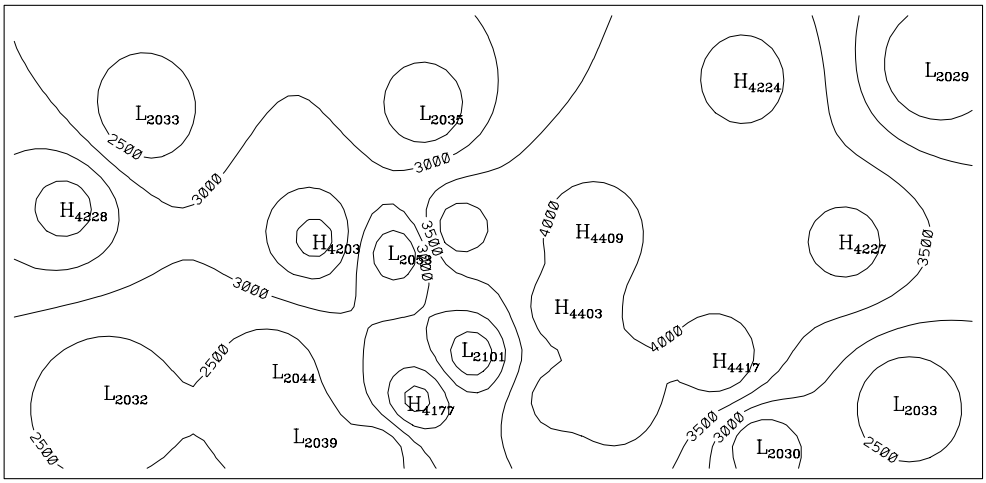
UAM DIFFUSION BREAK (M)
7/16/1998 1700–1800 MST




SIMULATED MAX 4829 MIN 4265 AVG 4553

MAX AT (69,12)

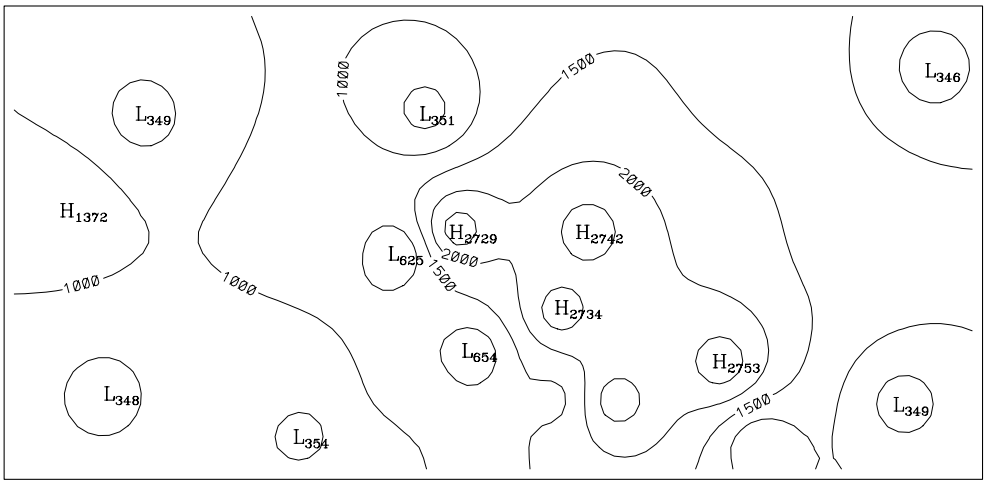
UAM DIFFUSION BREAK (M)
7/16/1998 1800-1900 MST




SIMULATED MAX 4417 MIN 2029 AVG 3196

MAX AT (69,12)

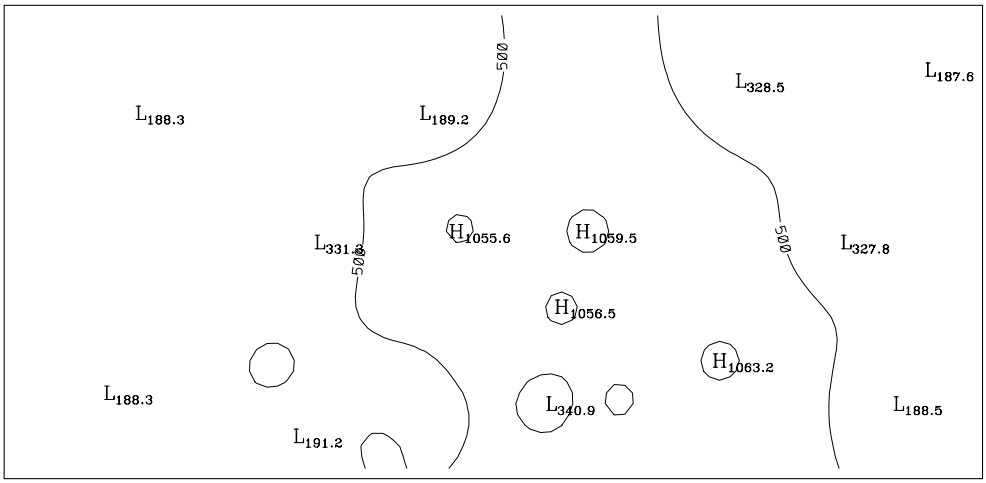
UAM DIFFUSION BREAK (M)
7/16/1998 1900-2000 MST




SIMULATED MAX 2753 MIN 347 AVG 1221

MAX AT (69,12)

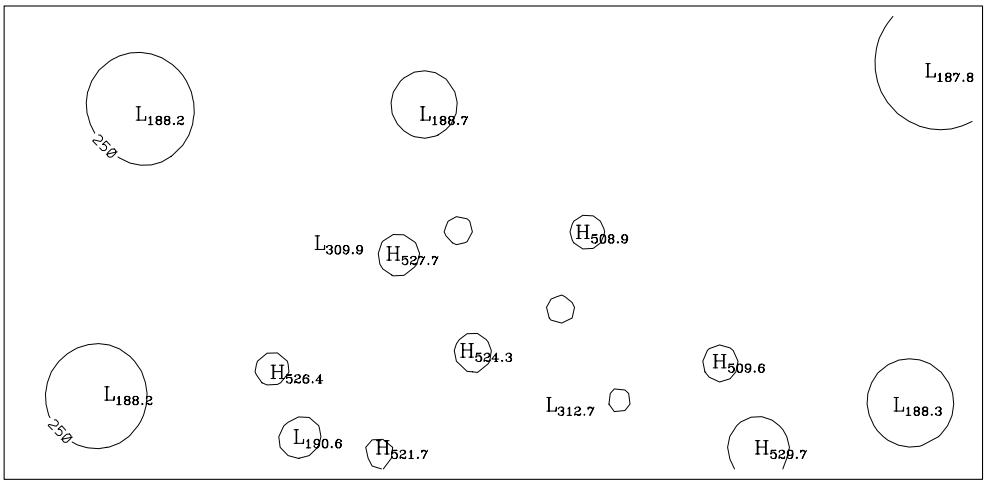
UAM DIFFUSION BREAK (M)
7/16/1998 2000-2100 MST




SIMULATED MAX 1063 MIN 188 AVG 483

MAX AT (69,12)

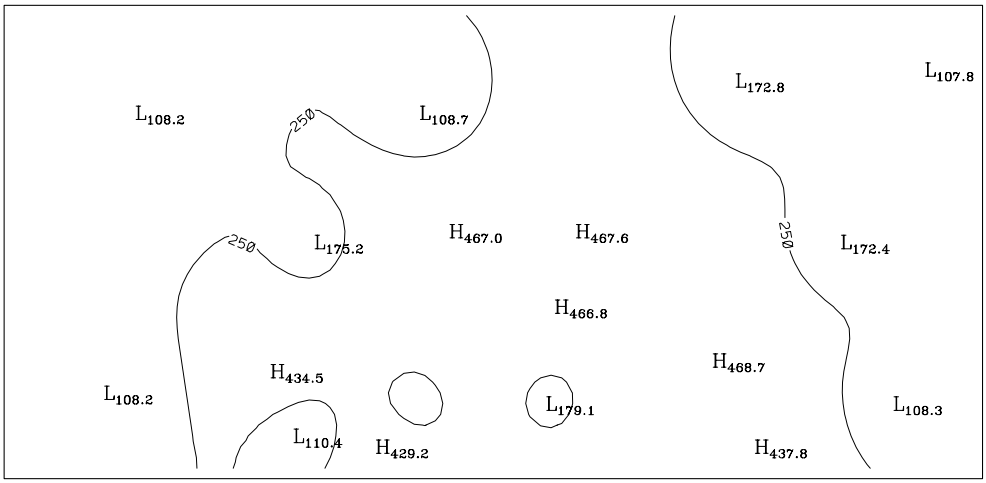
UAM DIFFUSION BREAK (M)
7/16/1998 2100-2200 MST




SIMULATED MAX 529.7 MIN 187.8 AVG 356.2

MAX AT (73,04)

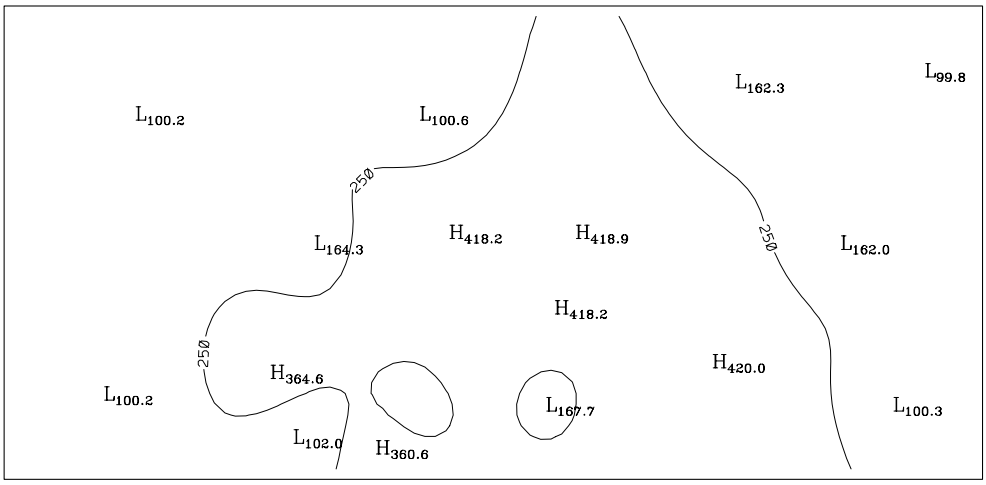
UAM DIFFUSION BREAK (M)
7/16/1998 2200-2300 MST




SIMULATED MAX 468.7 MIN 107.8 AVG 266.2

MAX AT (69,12)

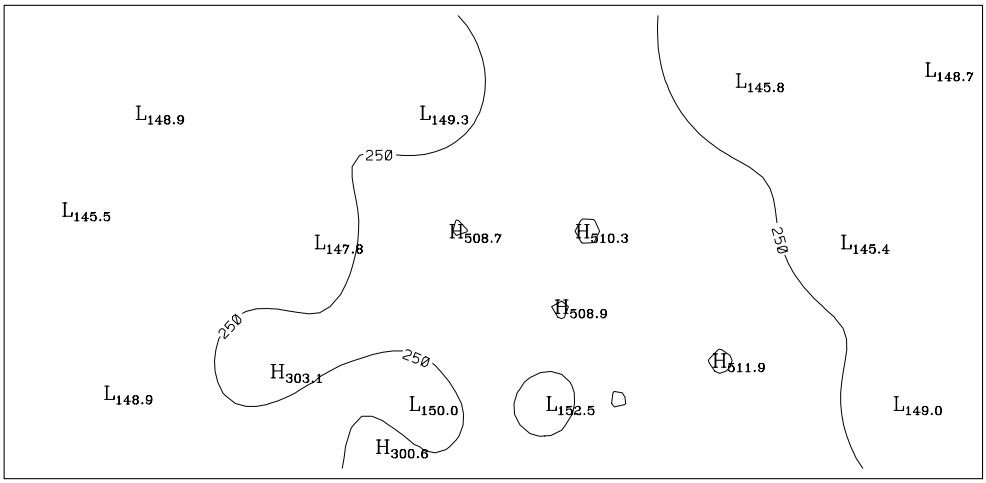
UAM DIFFUSION BREAK (M)
7/16/1998 2300-0000 MST




SIMULATED MAX 420.0 MIN 99.8 AVG 237.1

MAX AT (69,12)

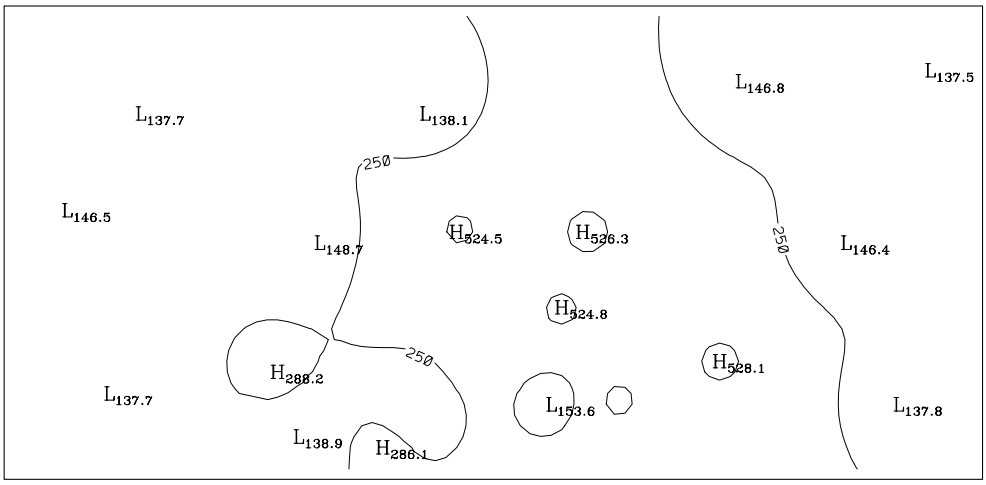
UAM DIFFUSION BREAK (M)
7/17/1998 0000-0100 MST




SIMULATED MAX 511.9 MIN 145.4 AVG 255.5

MAX AT (69,12)

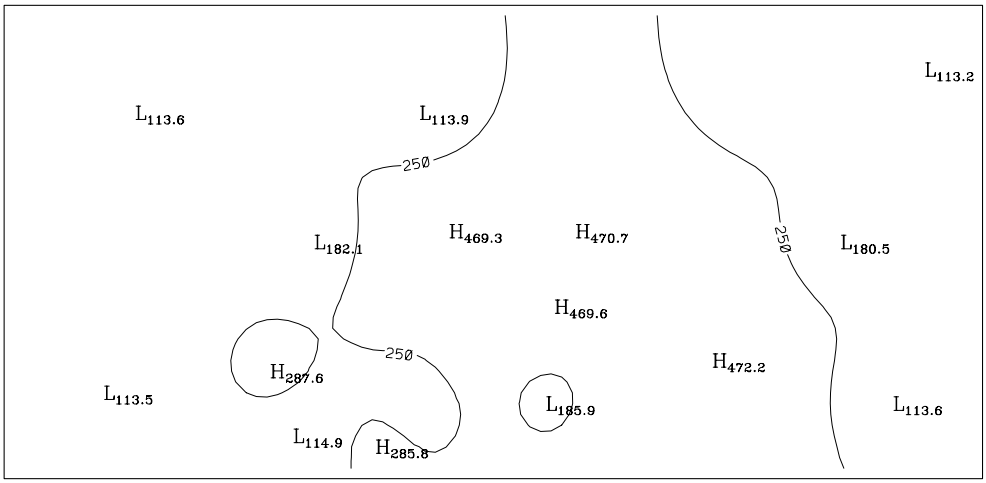
UAM DIFFUSION BREAK (M)
7/17/1998 0100-0200 MST




SIMULATED MAX 528.1 MIN 137.5 AVG 253.1

MAX AT (69,12)

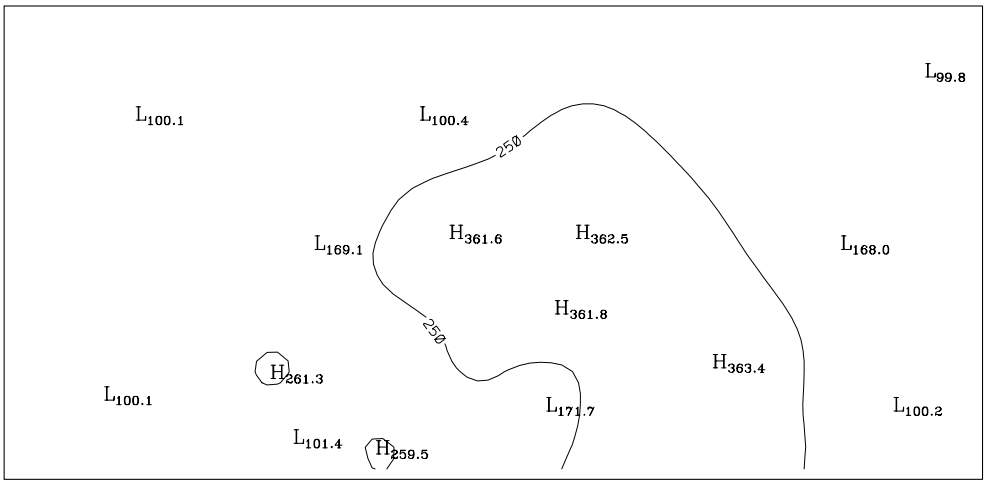
UAM DIFFUSION BREAK (M)
7/17/1998 0200-0300 MST




SIMULATED MAX 472.2 MIN 113.2 AVG 243.6

MAX AT (69,12)

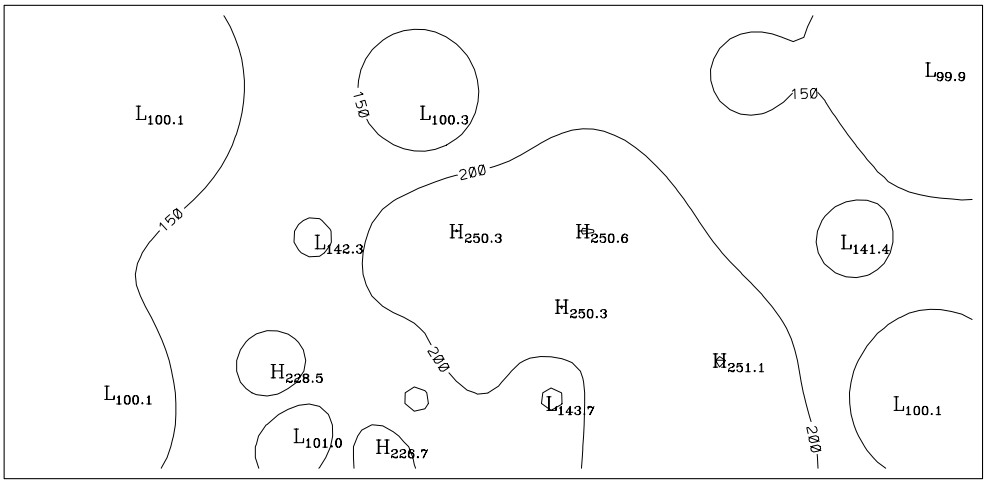
UAM DIFFUSION BREAK (M)
7/17/1998 0300-0400 MST




SIMULATED MAX 363.4 MIN 99.9 AVG 207.3

MAX AT (69,12)

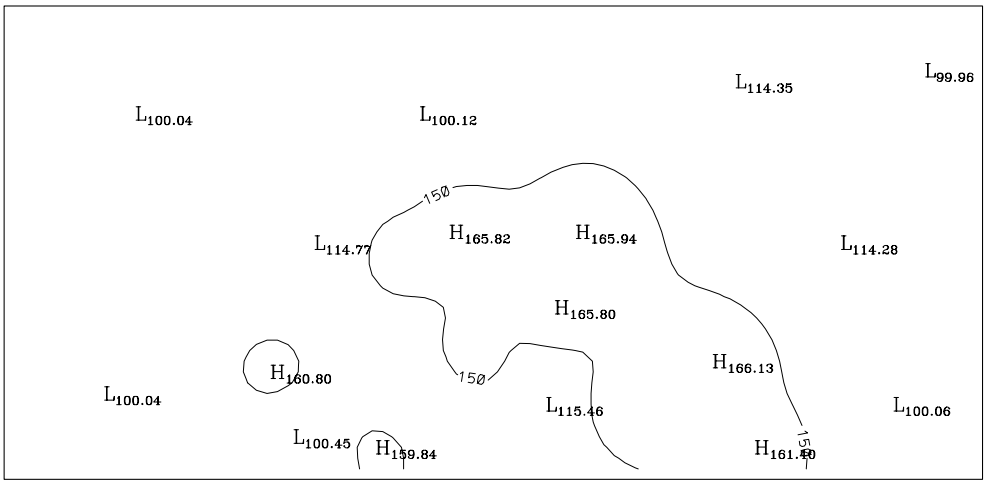
UAM DIFFUSION BREAK (M)
7/17/1998 0400-0500 MST




SIMULATED MAX 251.1 MIN 99.9 AVG 168.9

MAX AT (69,12)

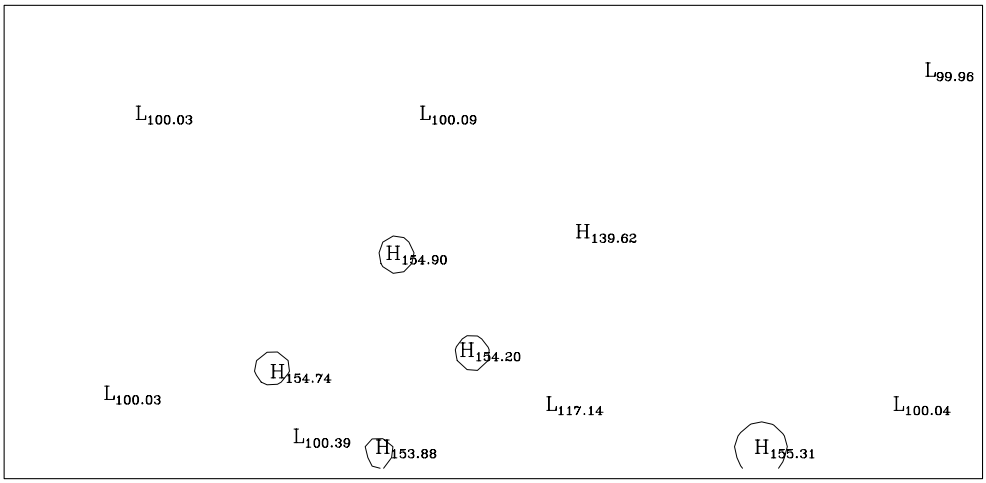
UAM DIFFUSION BREAK (M)
7/17/1998 0500-0600 MST




SIMULATED MAX 166.1 MIN 100.0 AVG 129.9

MAX AT (69,12)

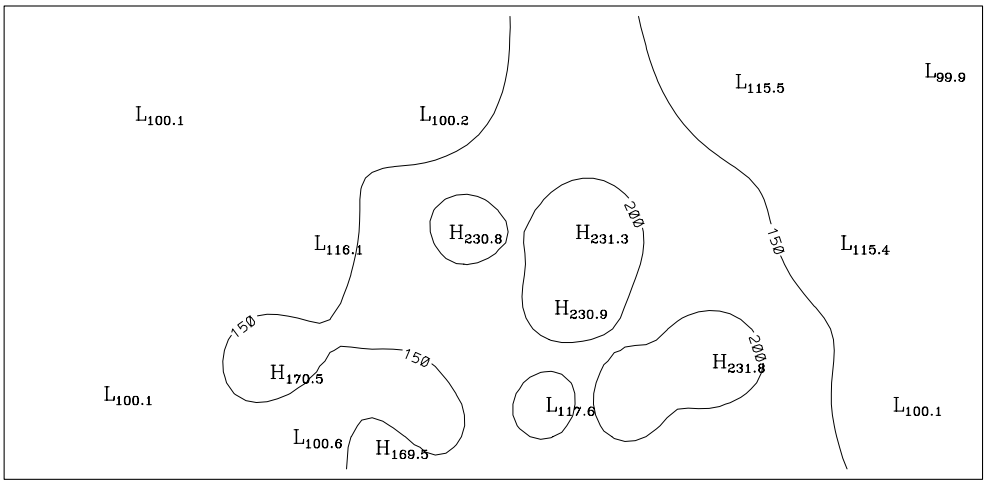
UAM DIFFUSION BREAK (M)
7/17/1998 0600-0700 MST




SIMULATED MAX 155.3 MIN 100.0 AVG 123.7

MAX AT (73,04)

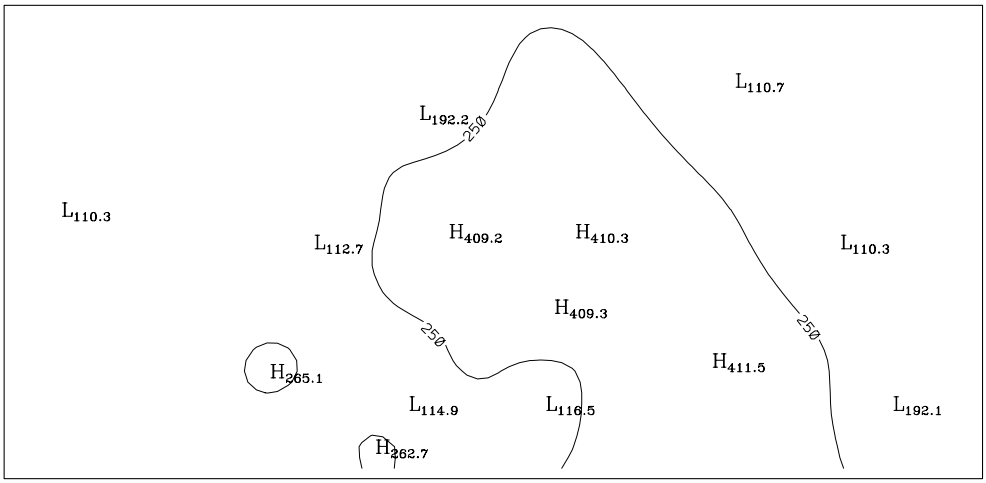
UAM DIFFUSION BREAK (M)
7/17/1998 0700-0800 MST




SIMULATED MAX 231.8 MIN 99.9 AVG 146.3

MAX AT (69,12)

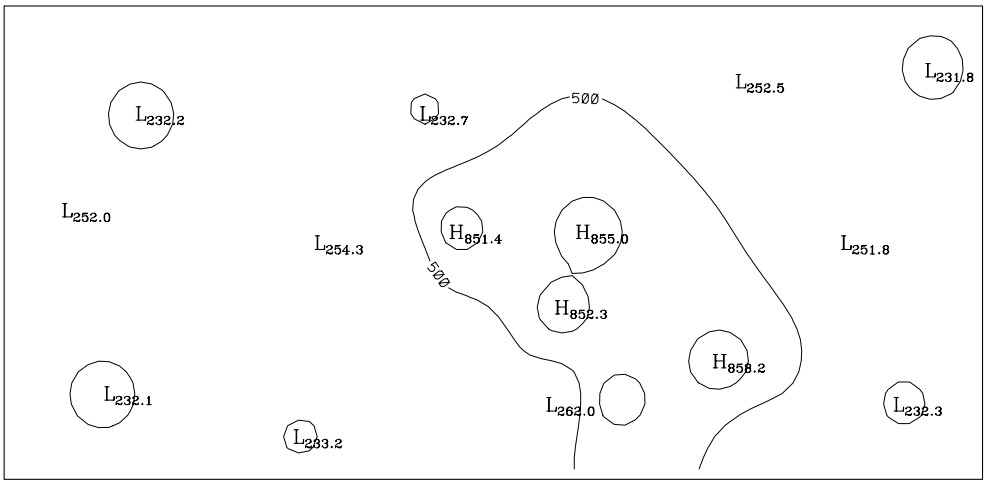
UAM DIFFUSION BREAK (M)
7/17/1998 0800-0900 MST




SIMULATED MAX 411.5 MIN 110.3 AVG 229.4

MAX AT (69,12)

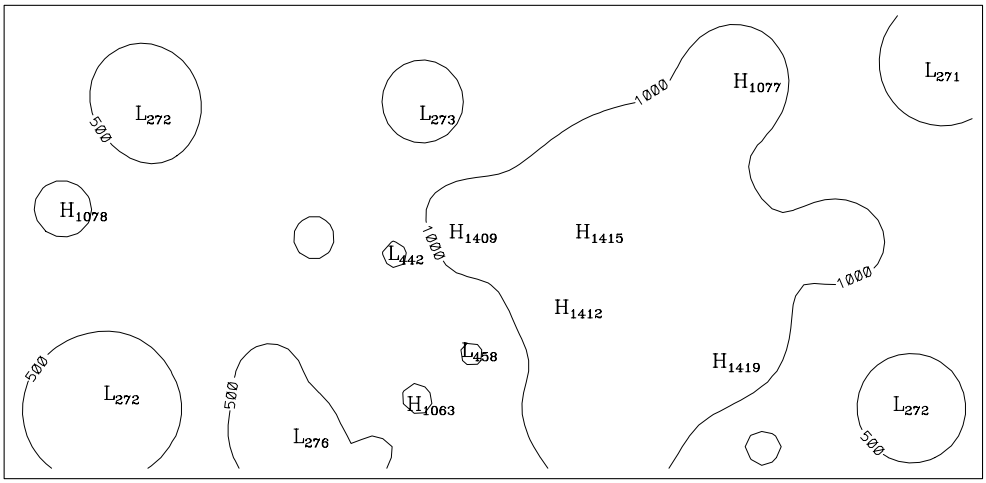
UAM DIFFUSION BREAK (M)
7/17/1998 0900-1000 MST




SIMULATED MAX 858.2 MIN 231.8 AVG 390.6

MAX AT (69,12)

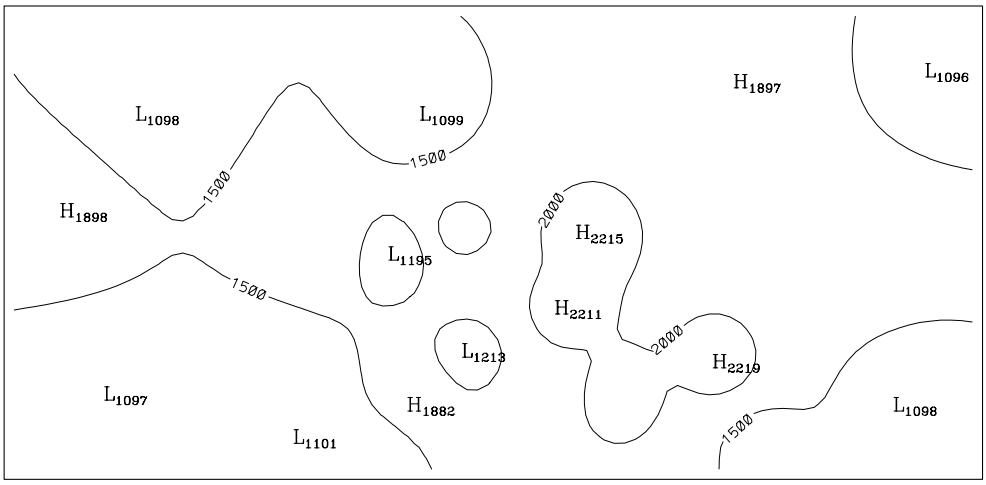
UAM DIFFUSION BREAK (M)
7/17/1998 1000–1100 MST




SIMULATED MAX 1419 MIN 271 AVG 789

MAX AT (69,12)

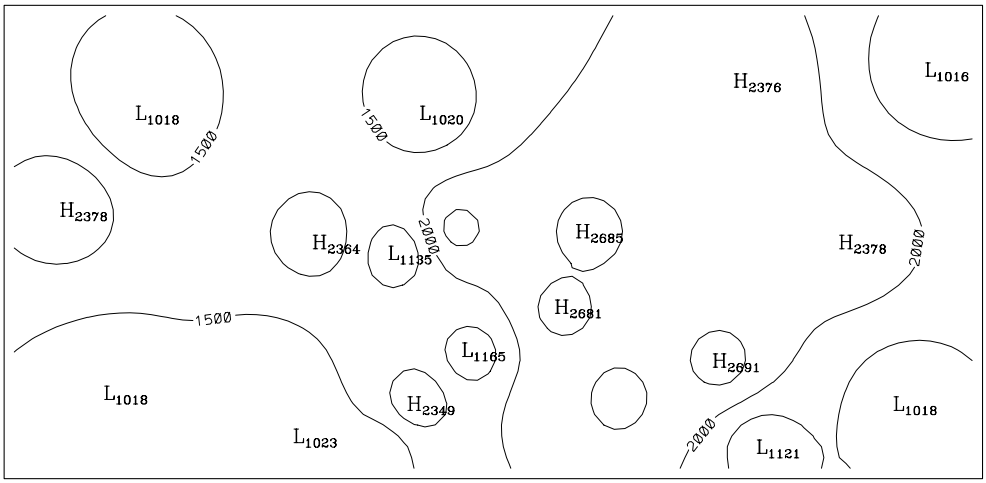
UAM DIFFUSION BREAK (M)
7/17/1998 1100–1200 MST




SIMULATED MAX 2219 MIN 1096 AVG 1593

MAX AT (69,12)

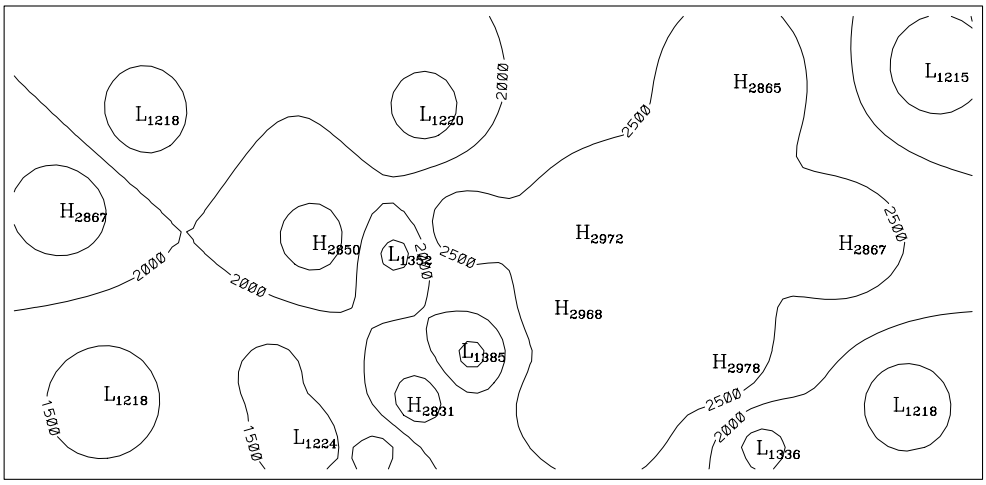
UAM DIFFUSION BREAK (M)
7/17/1998 1200-1300 MST




SIMULATED MAX 2691 MIN 1016 AVG 1801

MAX AT (69,12)

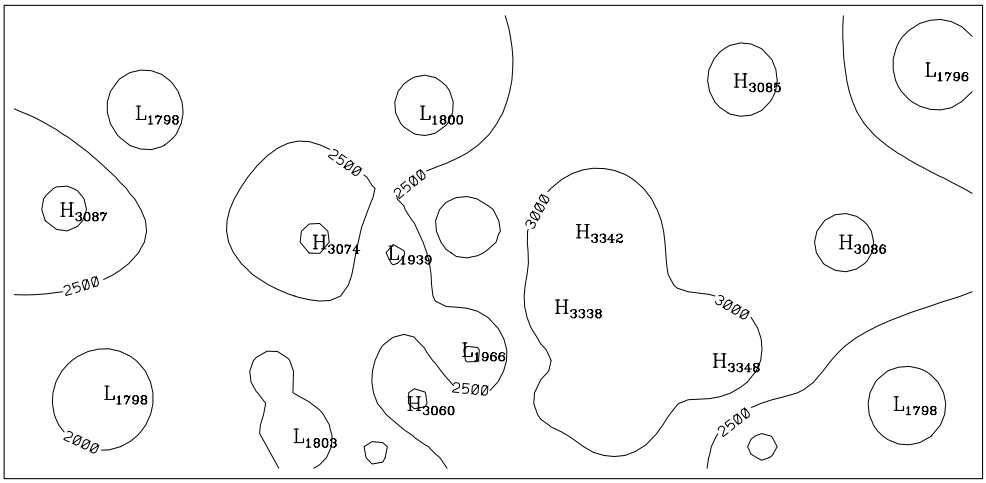
UAM DIFFUSION BREAK (M)
7/17/1998 1300-1400 MST




SIMULATED MAX 2978 MIN 1215 AVG 2108

MAX AT (69,12)

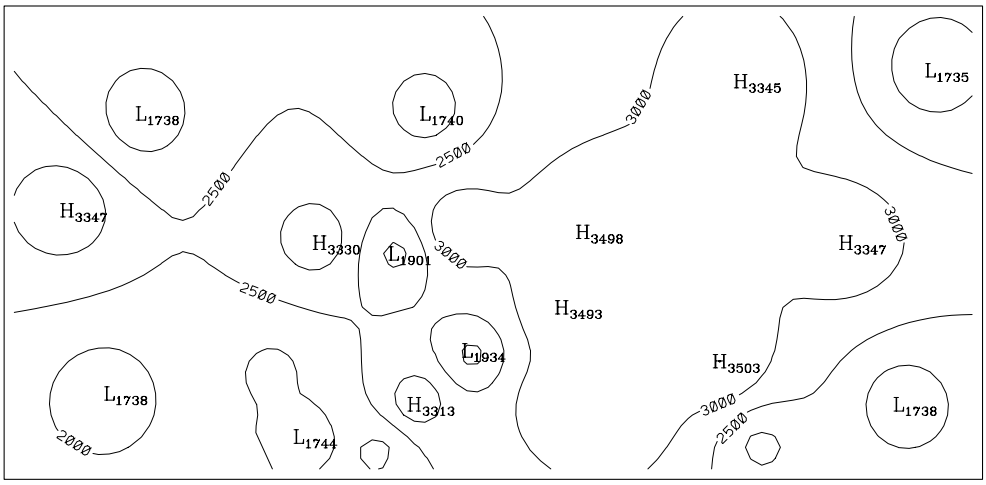
UAM DIFFUSION BREAK (M)
7/17/1998 1400–1500 MST




SIMULATED MAX 3348 MIN 1796 AVG 2538

MAX AT (69,12)

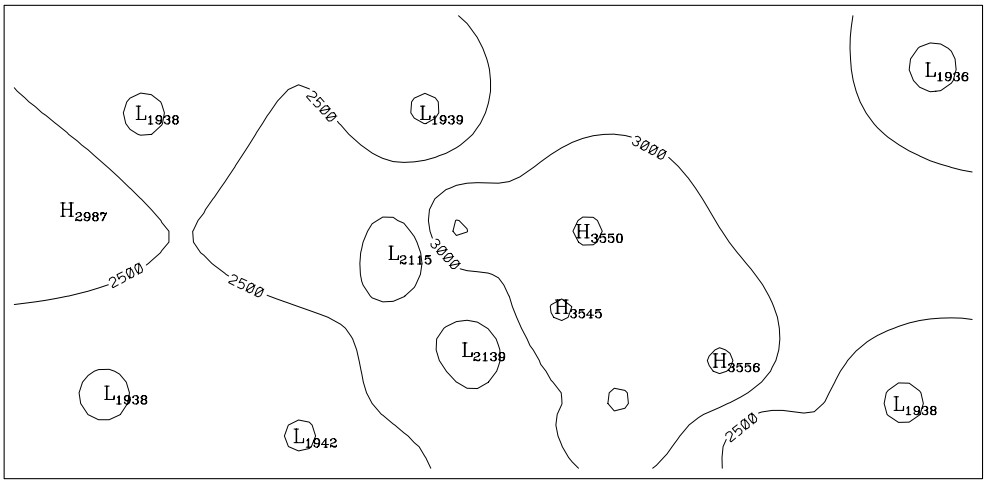
UAM DIFFUSION BREAK (M)
7/17/1998 1500–1600 MST




SIMULATED MAX 3503 MIN 1735 AVG 2623

MAX AT (69,12)

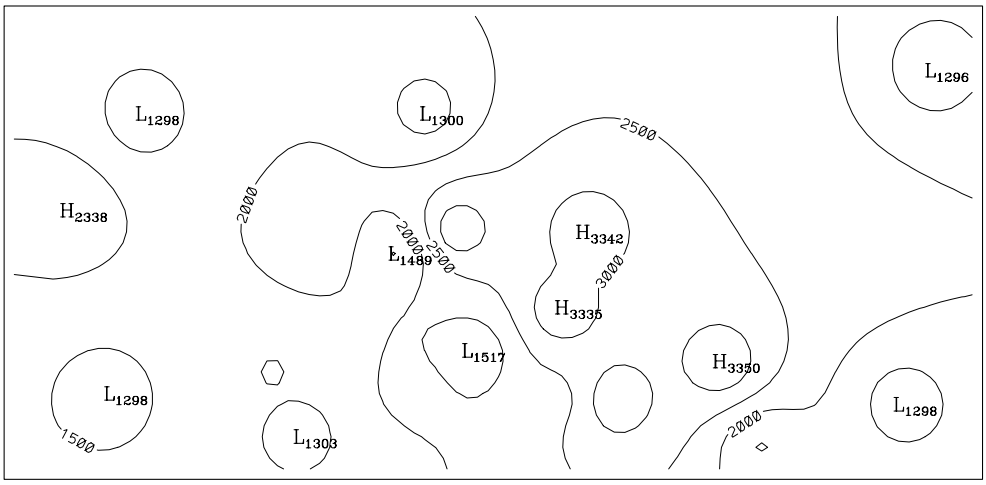
UAM DIFFUSION BREAK (M)
7/17/1998 1600–1700 MST




SIMULATED MAX 3556 MIN 1936 AVG 2629

MAX AT (69,12)

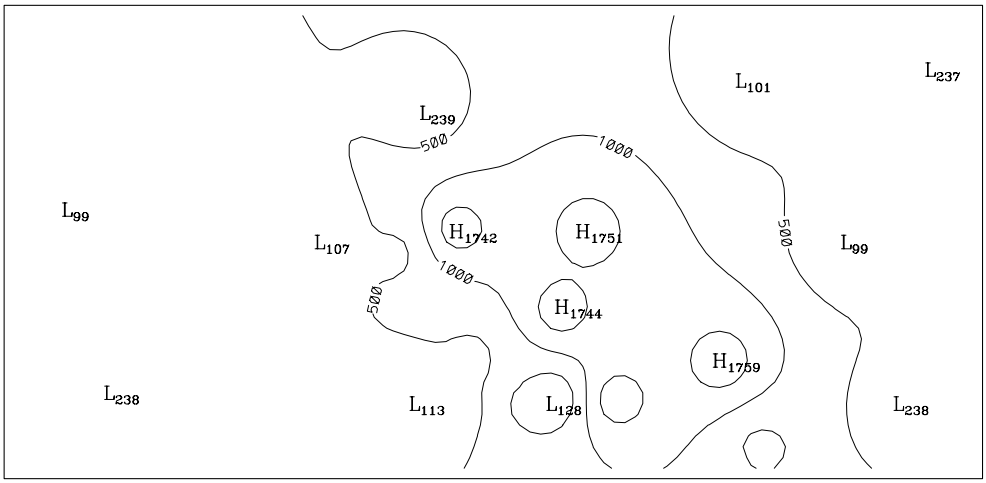
UAM DIFFUSION BREAK (M)
7/17/1998 1700–1800 MST




SIMULATED MAX 3350 MIN 1296 AVG 2083

MAX AT (69,12)

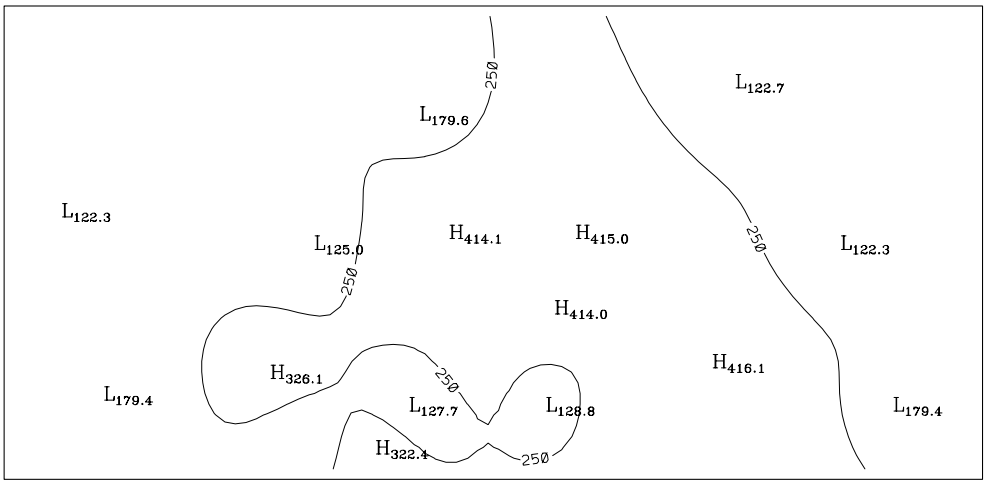
UAM DIFFUSION BREAK (M)
7/17/1998 1800-1900 MST




SIMULATED MAX 1759 MIN 99 AVG 561

MAX AT (69,12)

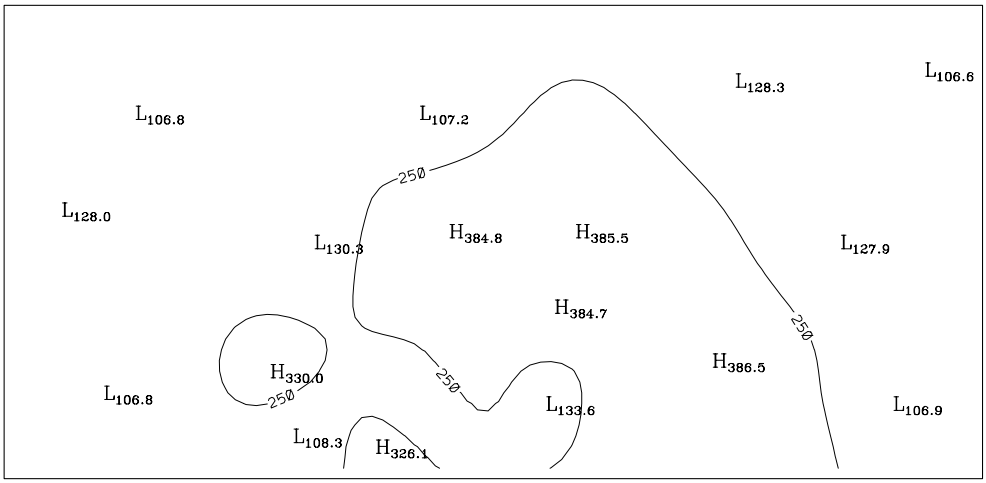
UAM DIFFUSION BREAK (M)
7/17/1998 1900-2000 MST




SIMULATED MAX 416.1 MIN 122.3 AVG 241.4

MAX AT (69,12)

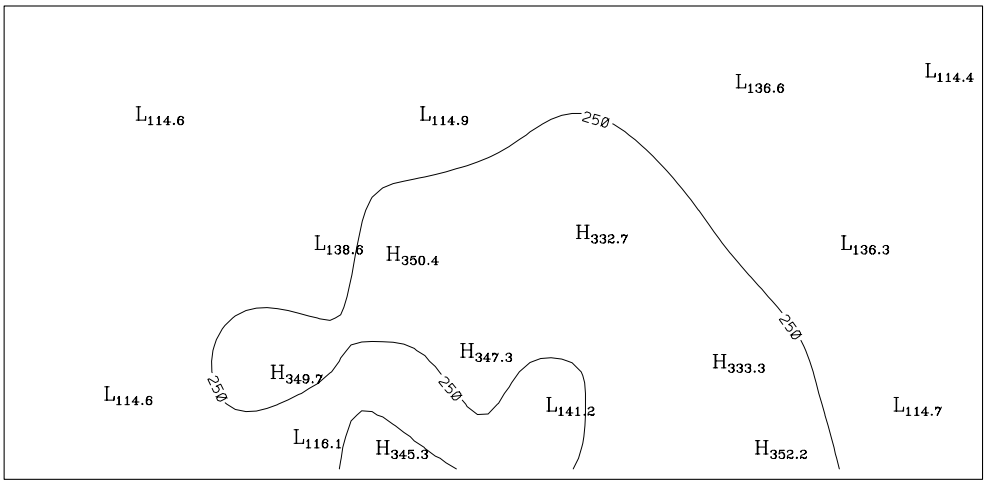
UAM DIFFUSION BREAK (M)
7/17/1998 2000-2100 MST




SIMULATED MAX 386.5 MIN 106.6 AVG 215.4

MAX AT (69,12)

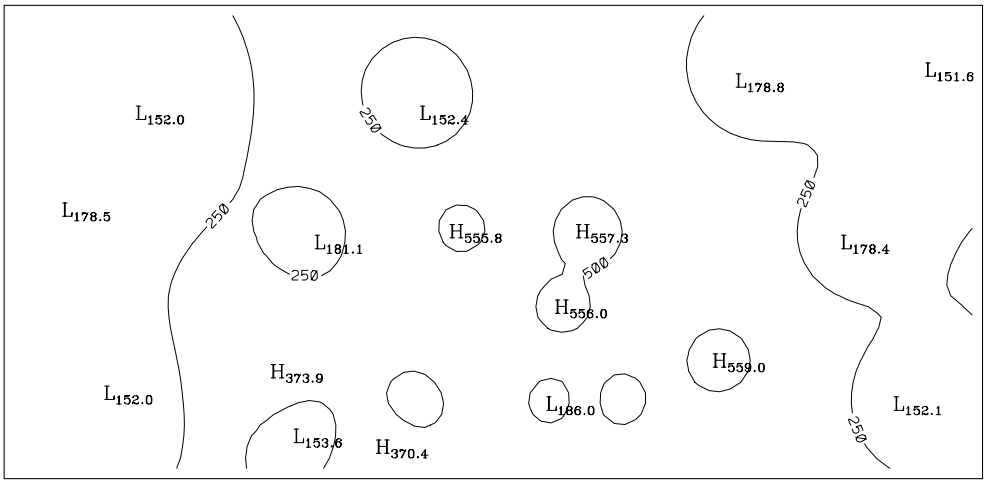
UAM DIFFUSION BREAK (M)
7/17/1998 2100-2200 MST




SIMULATED MAX 352.2 MIN 114.4 AVG 212.3

MAX AT (73,04)

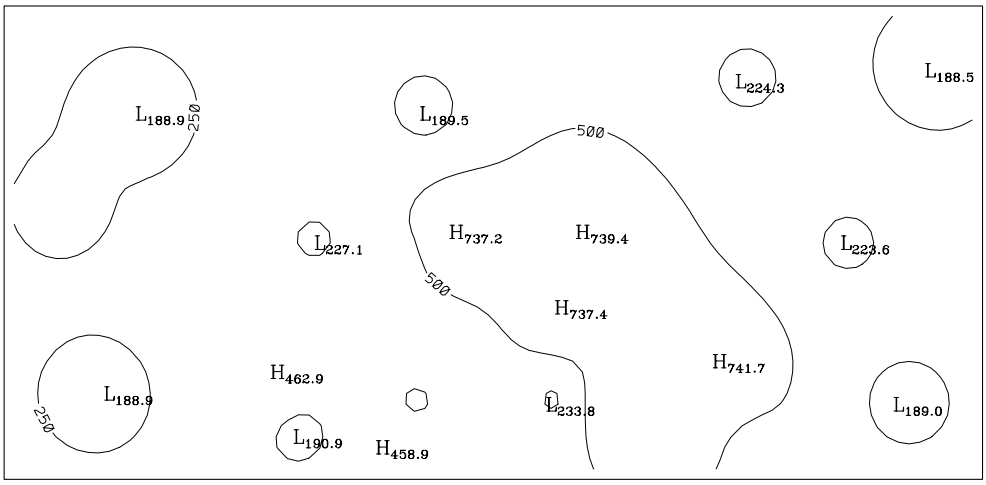
UAM DIFFUSION BREAK (M)
7/17/1998 2200-2300 MST




SIMULATED MAX 559.0 MIN 151.6 AVG 289.5

MAX AT (69,12)

UAM DIFFUSION BREAK (M)
7/17/1998 2300-0000 MST




SIMULATED MAX 741.7 MIN 188.5 AVG 370.3

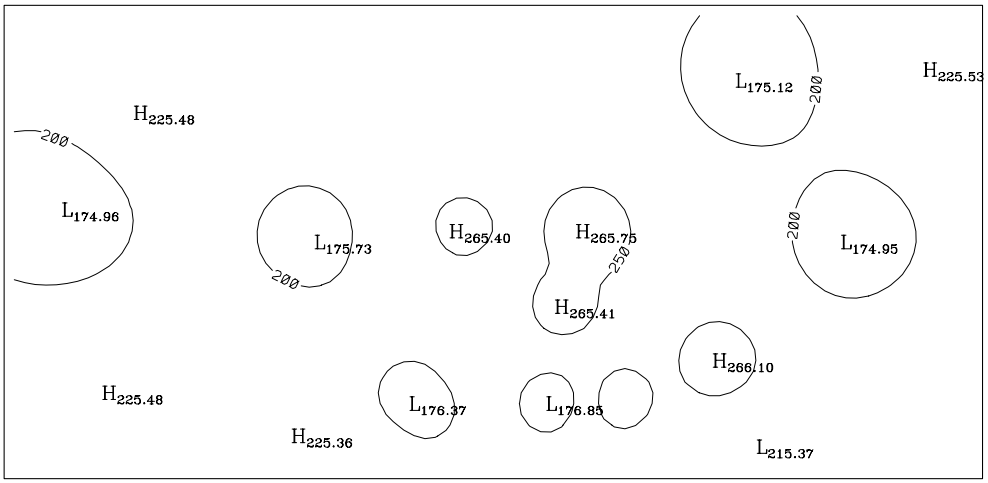
MAX AT (69,12)

Appendix IV-ii

# HOURLY MIXING HEIGHTS FIELDS FOR 1999 EPISODE

The isopleth plots shown here are the simulated mixing heights for each hour. These hourly plots are from hour 0 on August 23, 1999 to hour 2400 on August 24, 1999.

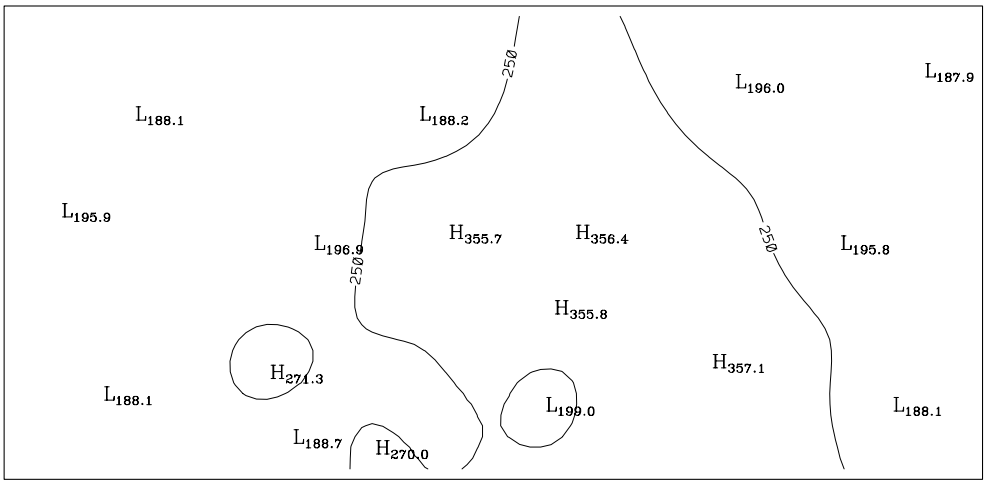
UAM DIFFUSION BREAK (M)
8/23/1999 0000-0100 MST




SIMULATED MAX 266.1 MIN 175.0 AVG 217.6

MAX AT (69,12)

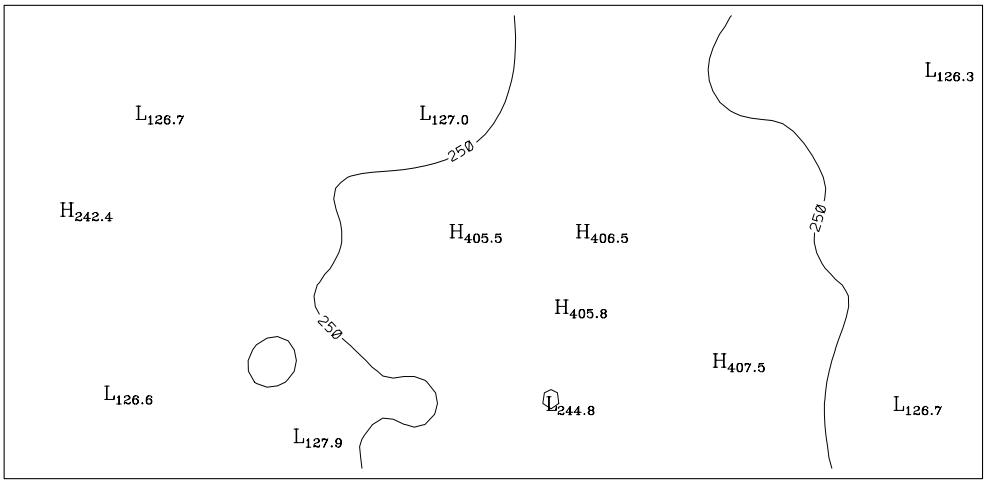
UAM DIFFUSION BREAK (M)
8/23/1999 0100-0200 MST




SIMULATED MAX 357.1 MIN 187.9 AVG 242.6

MAX AT (69,12)

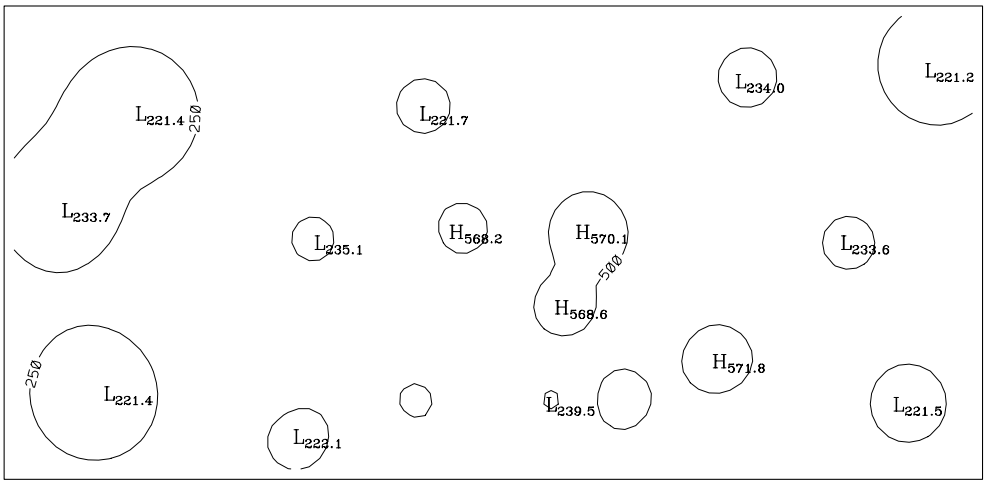
UAM DIFFUSION BREAK (M)
8/23/1999 0200-0300 MST




SIMULATED MAX 407.5 MIN 126.3 AVG 246.7

MAX AT (69,12)

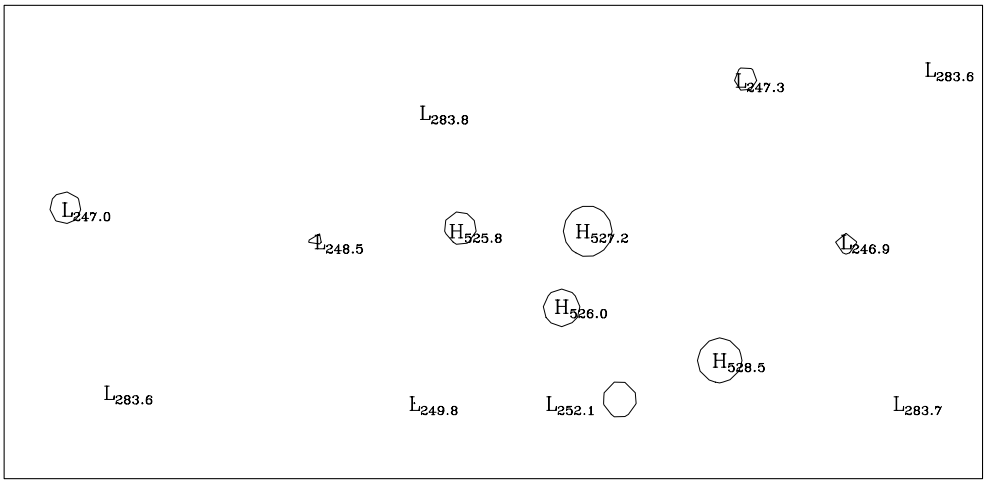
UAM DIFFUSION BREAK (M)
8/23/1999 0300-0400 MST




SIMULATED MAX 571.8 MIN 221.2 AVG 314.2

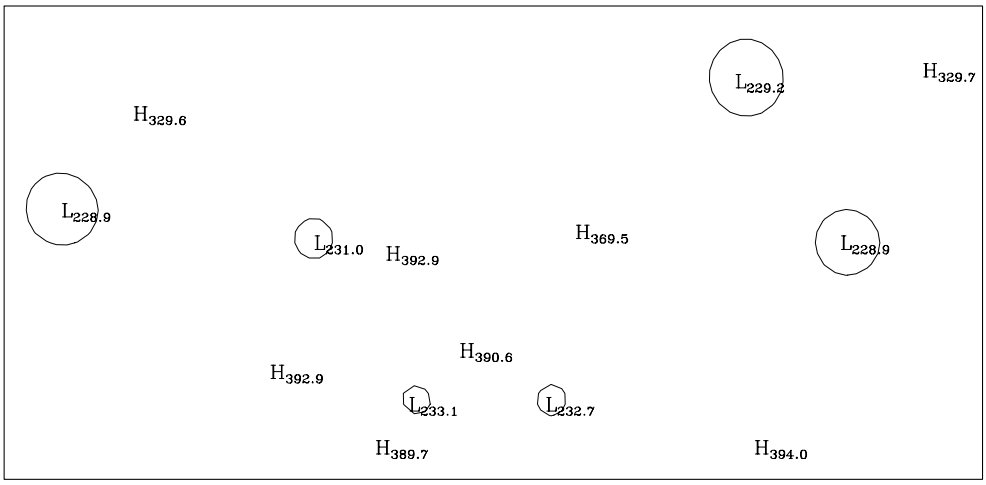
MAX AT (69,12)

UAM DIFFUSION BREAK (M)
8/23/1999 0400–0500 MST



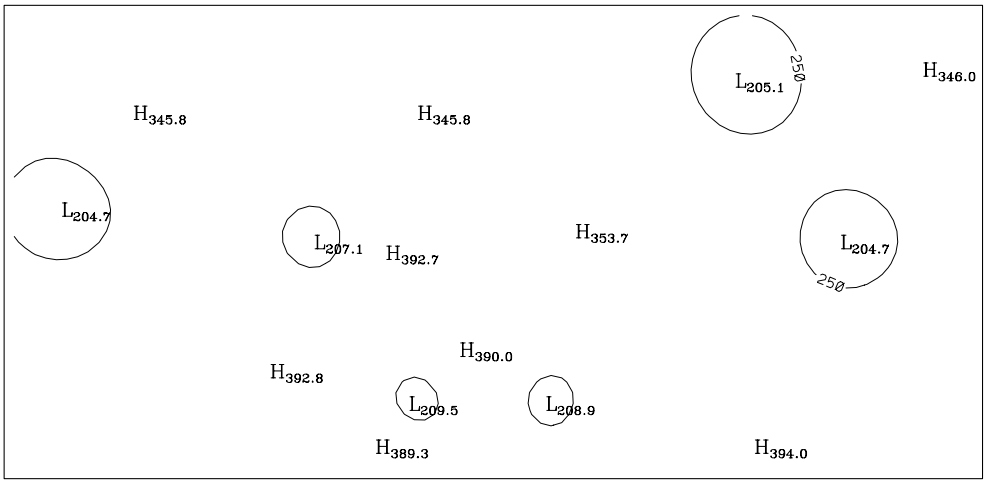

SIMULATED MAX 528.5 MIN 246.9 AVG 333.5 MAX AT (69,12)

UAM DIFFUSION BREAK (M)
8/23/1999 0500–0600 MST




SIMULATED MAX 394.0 MIN 228.9 AVG 320.6 MAX AT (73,04)

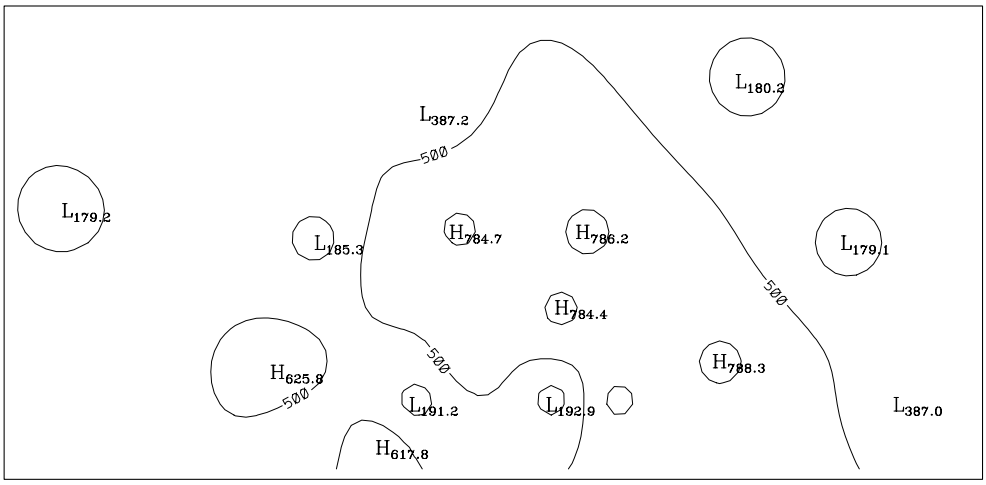
UAM DIFFUSION BREAK (M)
8/23/1999 0600-0700 MST




SIMULATED MAX 394.0 MIN 204.7 AVG 315.0

MAX AT (73,04)

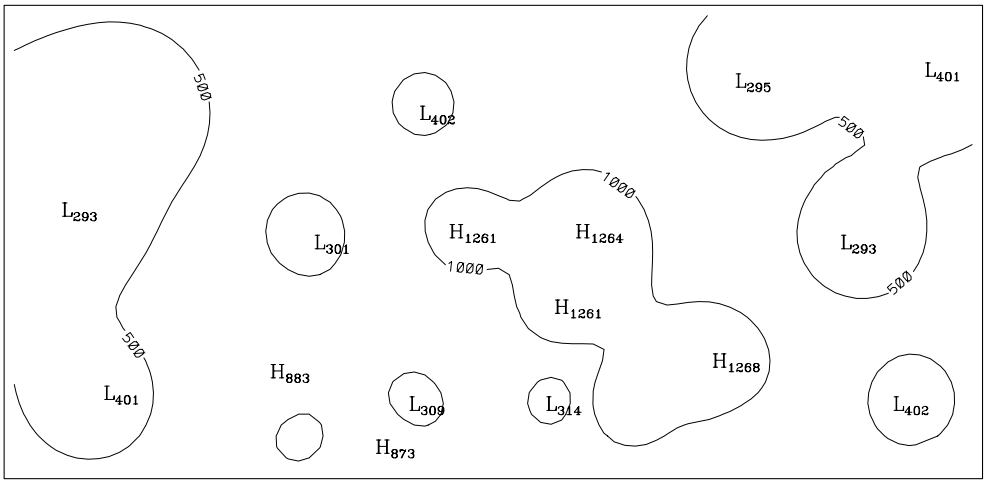
UAM DIFFUSION BREAK (M)
8/23/1999 0700-0800 MST




SIMULATED MAX 788.3 MIN 179.1 AVG 457.7

MAX AT (69,12)

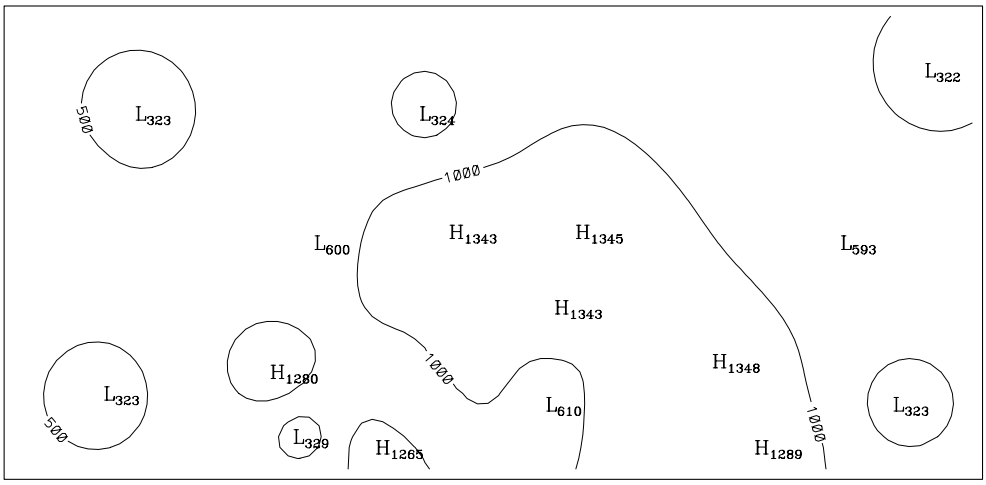
UAM DIFFUSION BREAK (M)
8/23/1999 0800–0900 MST




SIMULATED MAX 1268 MIN 294 AVG 648

MAX AT (69,12)

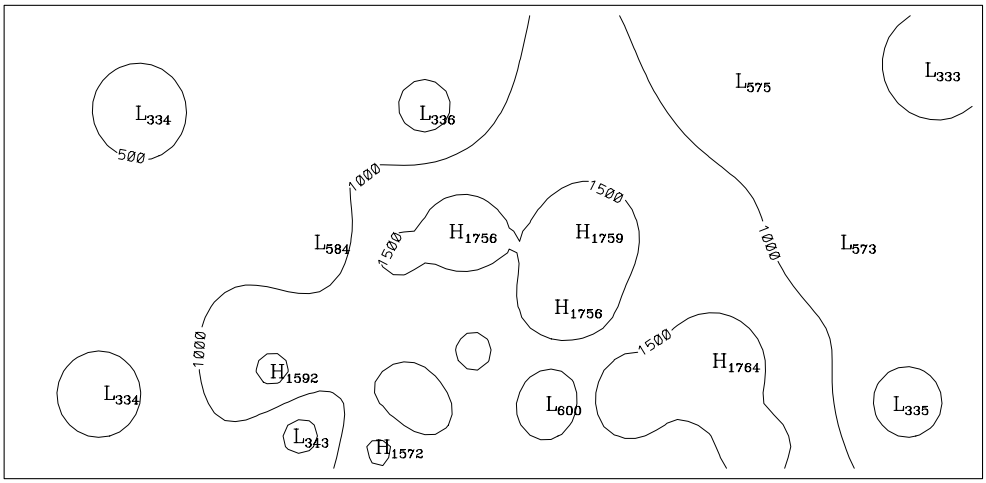
UAM DIFFUSION BREAK (M)
8/23/1999 0900–1000 MST




SIMULATED MAX 1348 MIN 322 AVG 804

MAX AT (69,12)

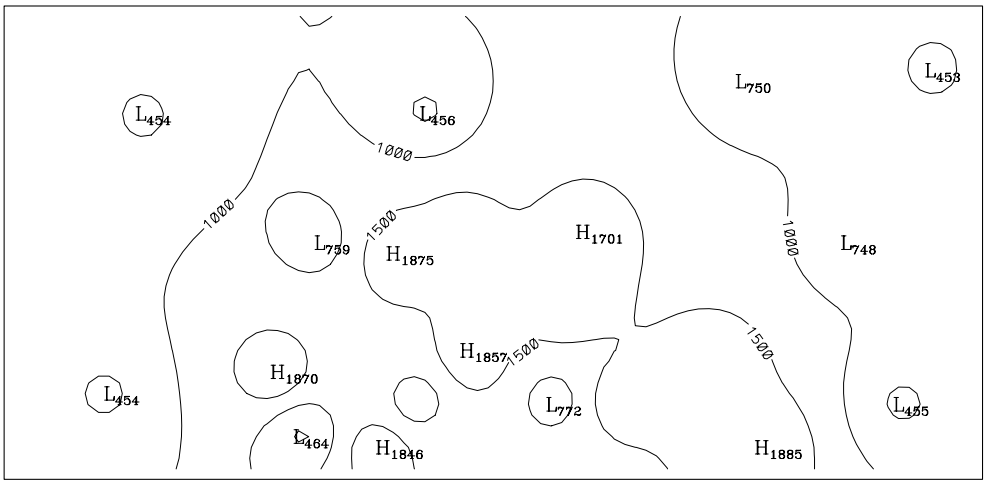
UAM DIFFUSION BREAK (M)
8/23/1999 1000–1100 MST




SIMULATED MAX 1764 MIN 333 AVG 950

MAX AT (69,12)

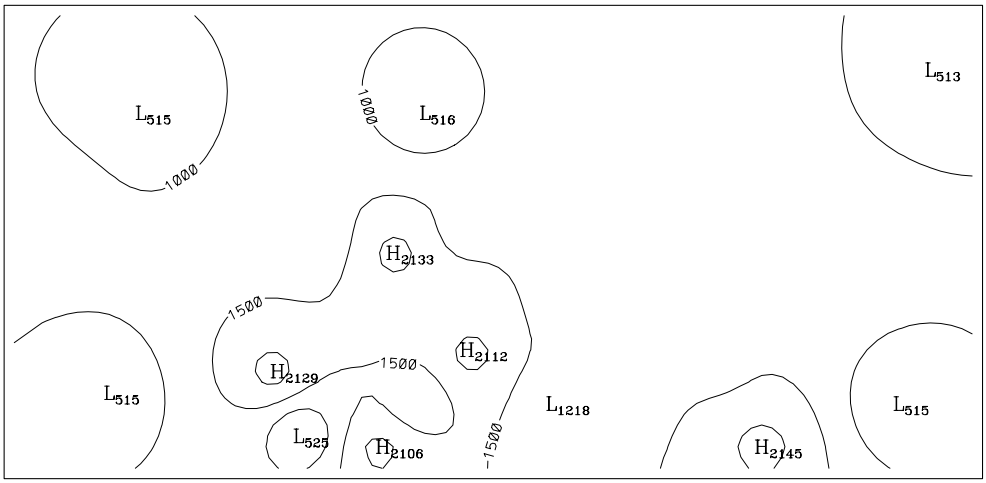
UAM DIFFUSION BREAK (M)
8/23/1999 1100–1200 MST




SIMULATED MAX 1885 MIN 453 AVG 1076

MAX AT (73,04)

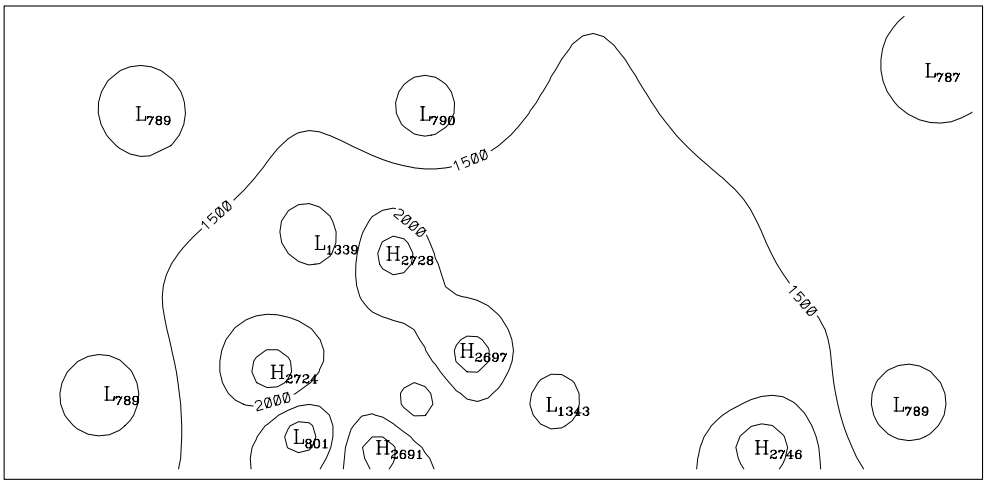
UAM DIFFUSION BREAK (M)
8/23/1999 1200–1300 MST




SIMULATED MAX 2145 MIN 513 AVG 1214

MAX AT (73,04)

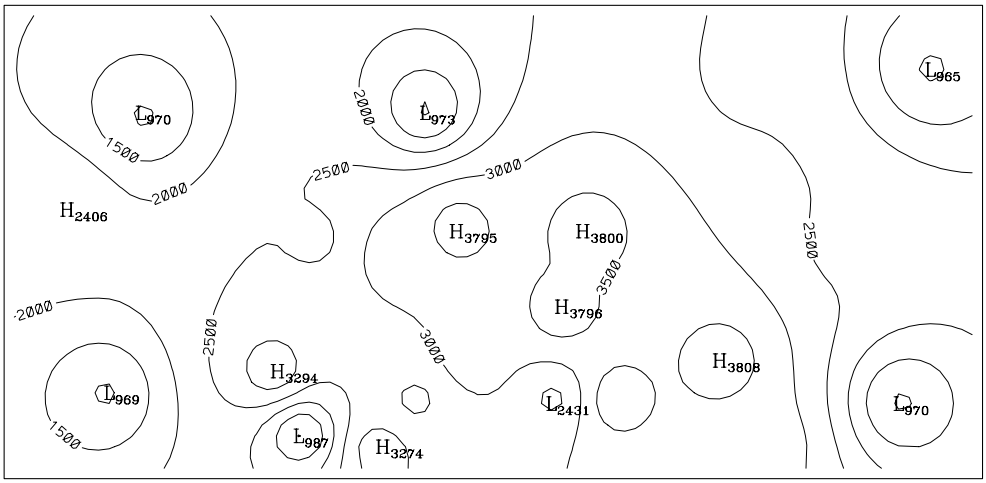
UAM DIFFUSION BREAK (M)
8/23/1999 1300–1400 MST




SIMULATED MAX 2746 MIN 787 AVG 1485

MAX AT (73,04)

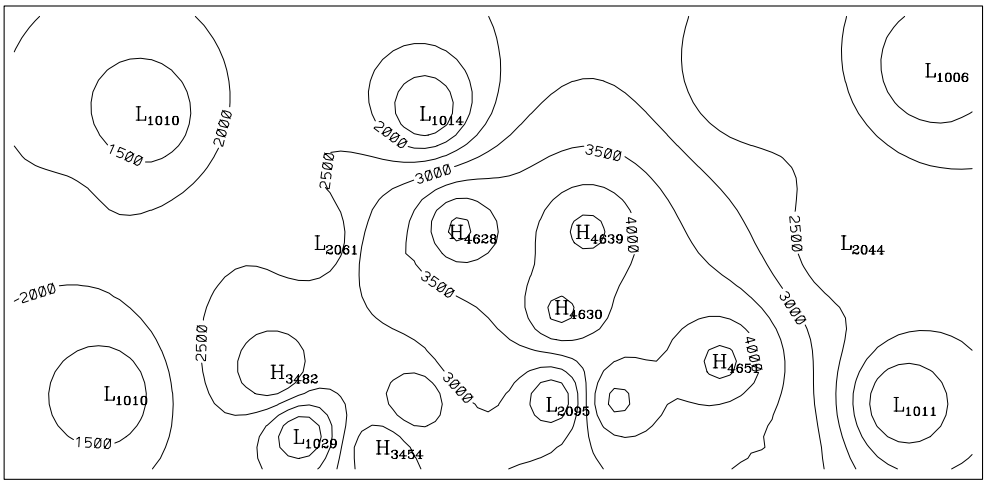
UAM DIFFUSION BREAK (M)
8/23/1999 1400–1500 MST




SIMULATED MAX 3808 MIN 966 AVG 2440

MAX AT (69,12)

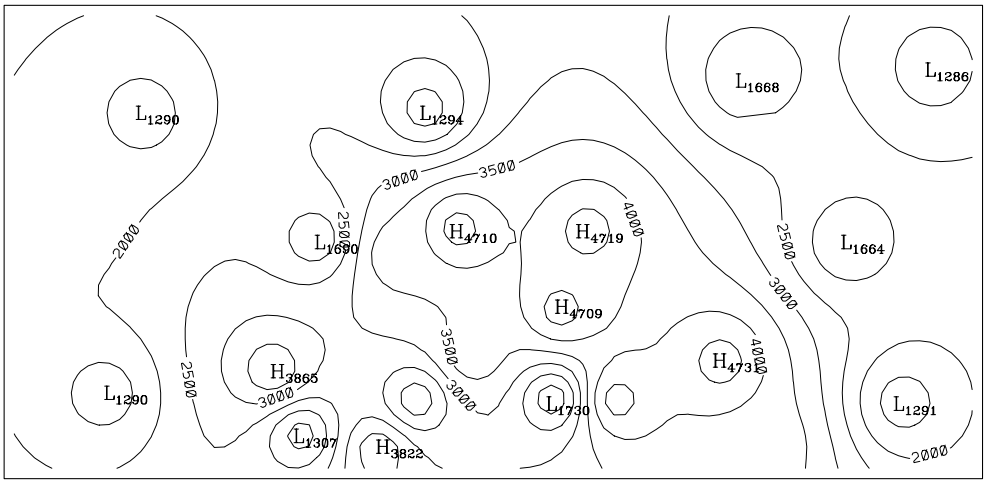
UAM DIFFUSION BREAK (M)
8/23/1999 1500–1600 MST




SIMULATED MAX 4651 MIN 1006 AVG 2565

MAX AT (69,12)

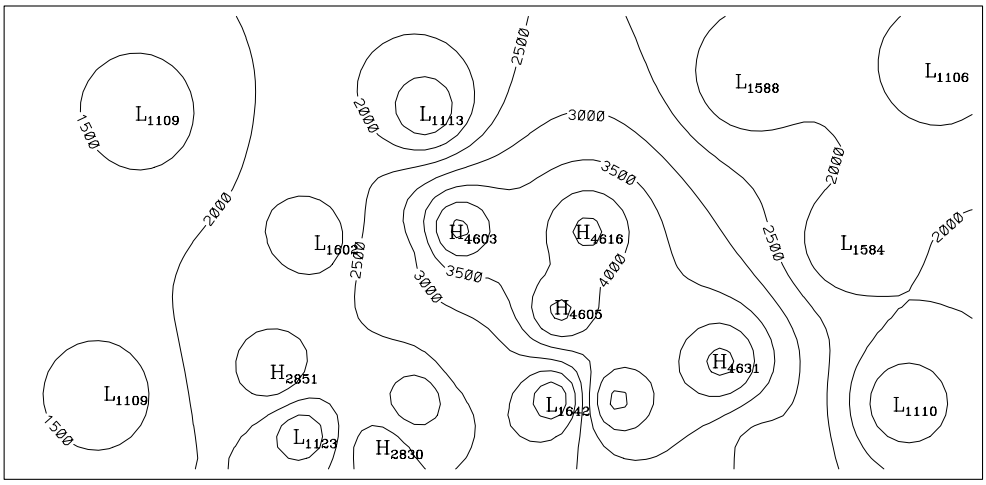
UAM DIFFUSION BREAK (M)
8/23/1999 1600–1700 MST




SIMULATED MAX 4731 MIN 1286 AVG 2627

MAX AT (69,12)

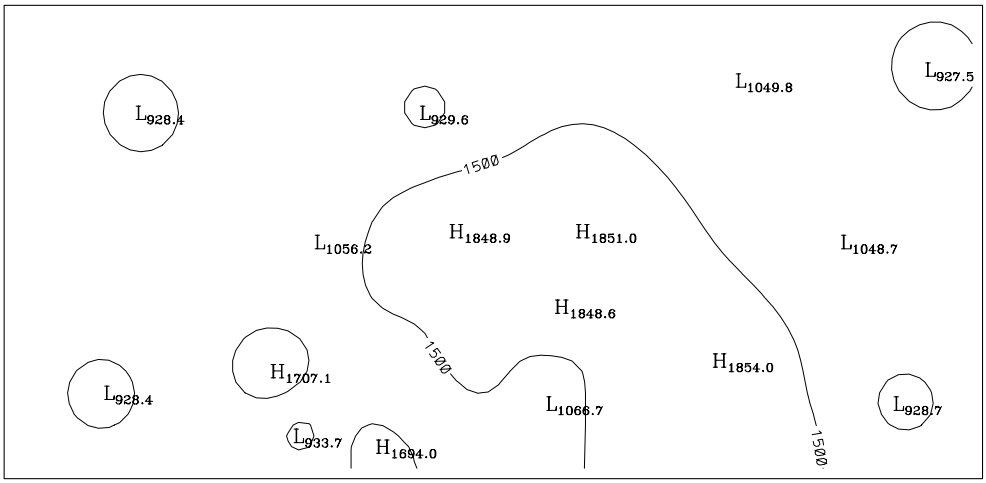
UAM DIFFUSION BREAK (M)
8/23/1999 1700–1800 MST




SIMULATED MAX 4631 MIN 1106 AVG 2338

MAX AT (69,12)

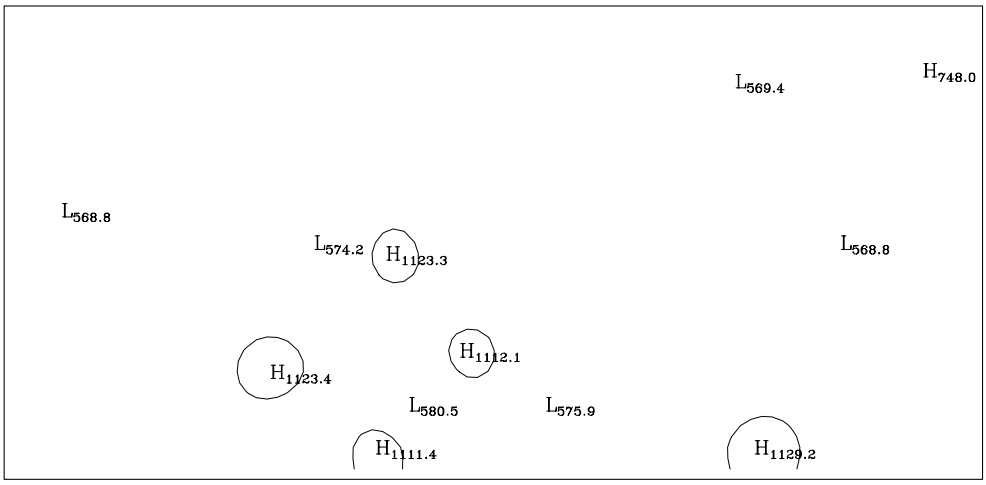
UAM DIFFUSION BREAK (M)
8/23/1999 1800-1900 MST




SIMULATED MAX 1854 MIN 928 AVG 1310

MAX AT (69,12)

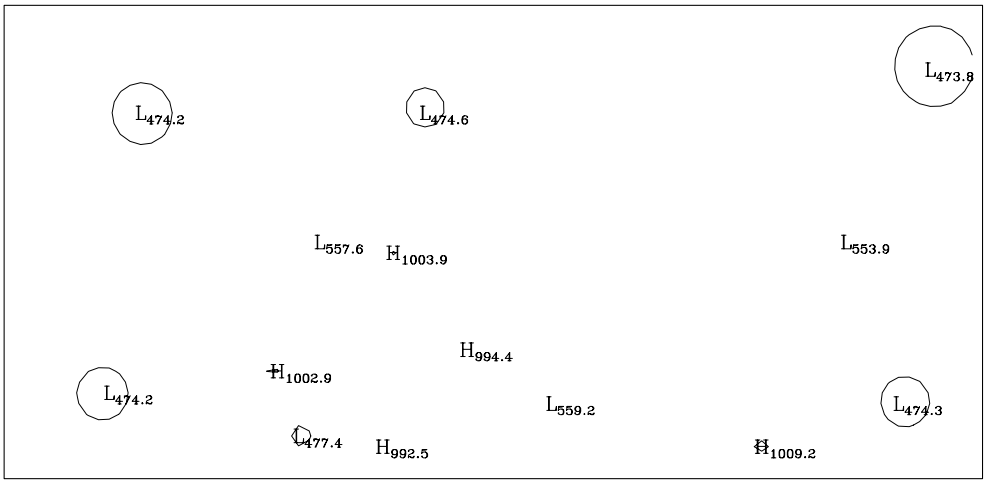
UAM DIFFUSION BREAK (M)
8/23/1999 1900-2000 MST




SIMULATED MAX 1129 MIN 569 AVG 757

MAX AT (73,04)

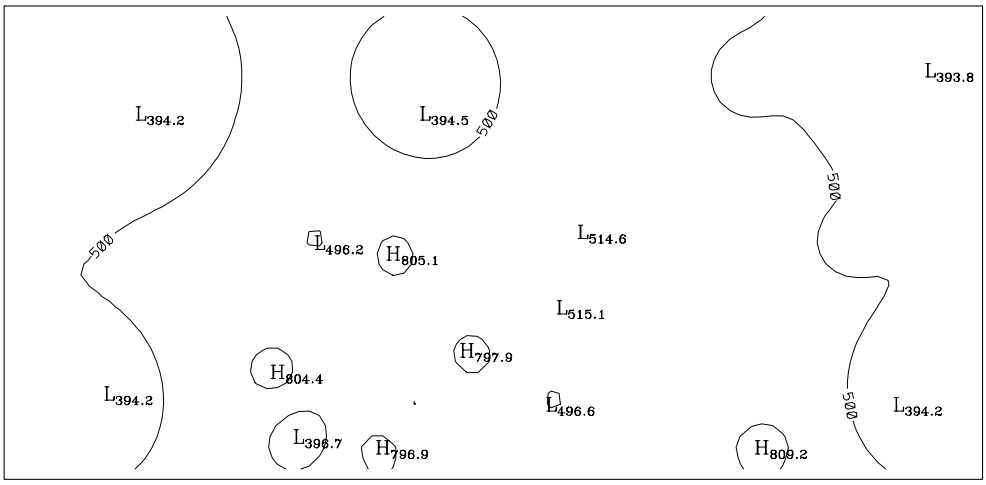
UAM DIFFUSION BREAK (M)
8/23/1999 2000-2100 MST




SIMULATED MAX 1009 MIN 474 AVG 638

MAX AT (73,04)

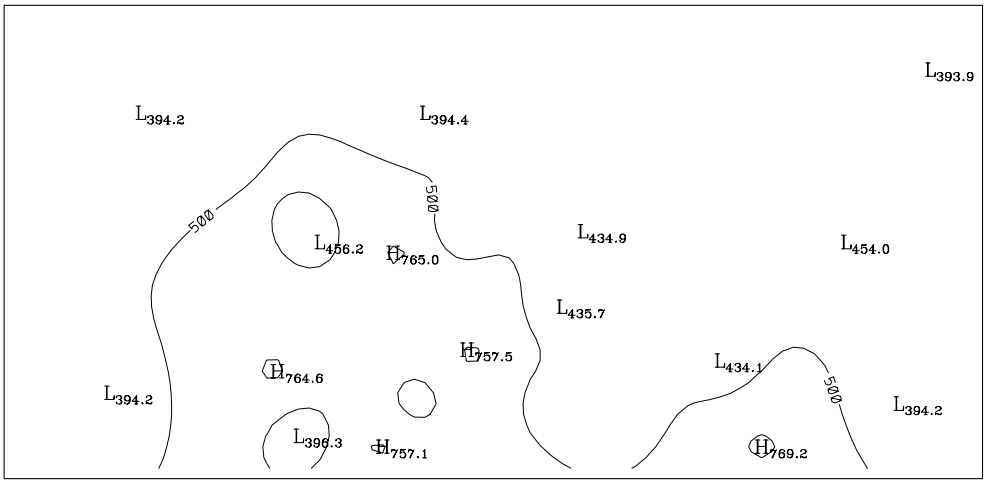
UAM DIFFUSION BREAK (M)
8/23/1999 2100-2200 MST




SIMULATED MAX 809.2 MIN 393.8 AVG 525.9

MAX AT (73,04)

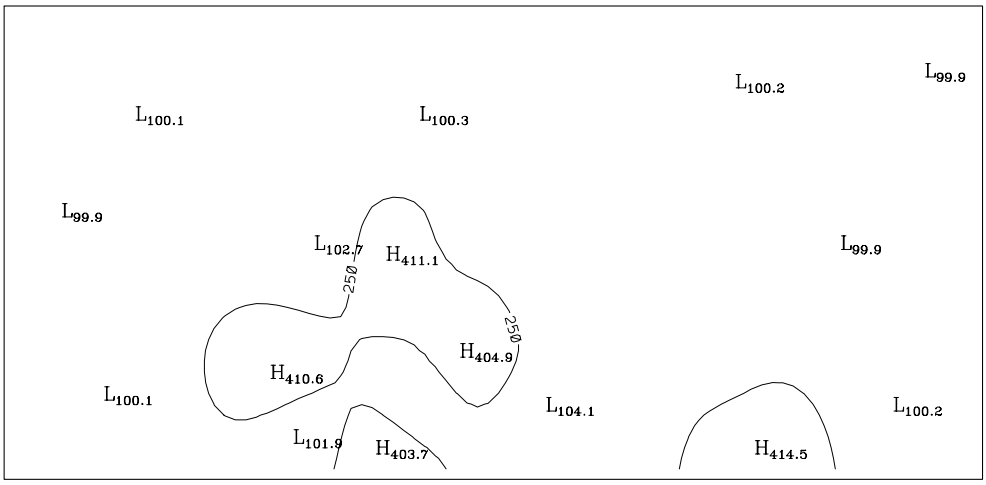
UAM DIFFUSION BREAK (M)
8/23/1999 2200-2300 MST




SIMULATED MAX 769.2 MIN 393.9 AVG 489.4

MAX AT (73,04)

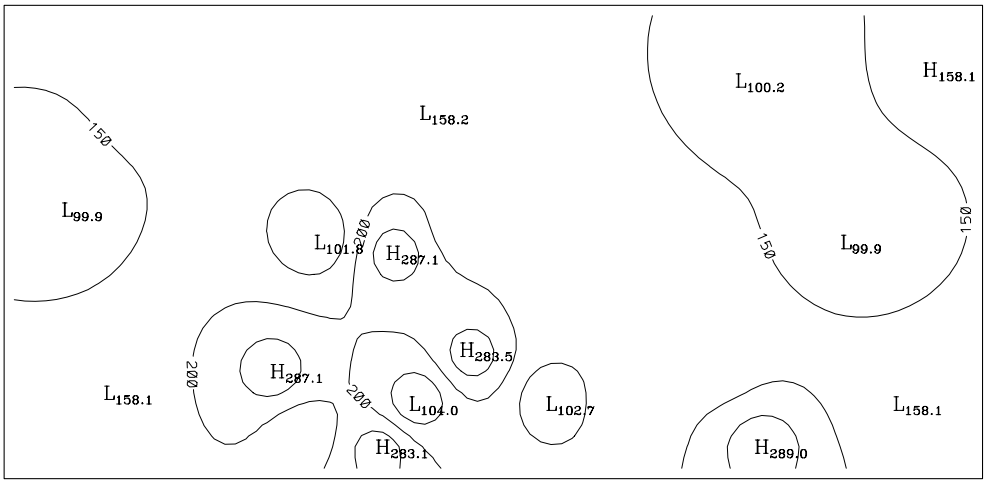
UAM DIFFUSION BREAK (M)
8/23/1999 2300-0000 MST




SIMULATED MAX 414.5 MIN 99.9 AVG 180.8

MAX AT (73,04)

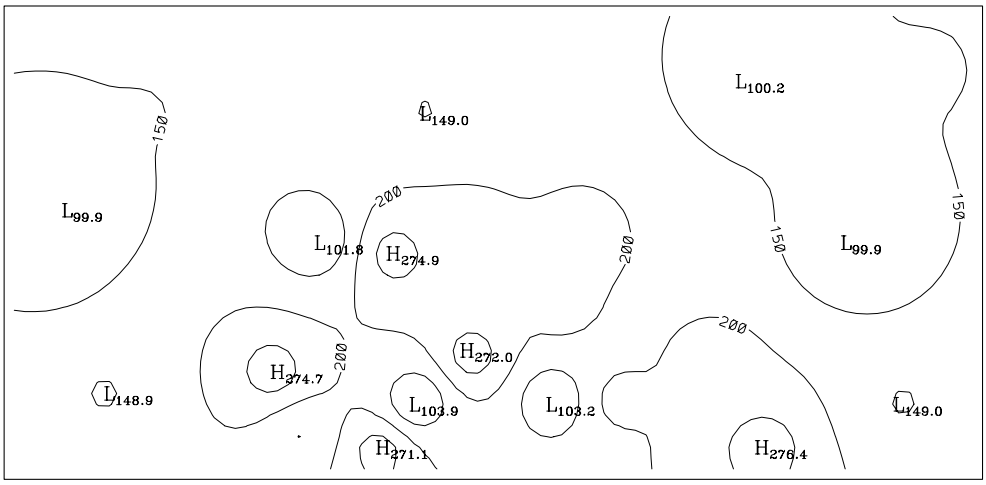
UAM DIFFUSION BREAK (M)
8/24/1999 0000-0100 MST




SIMULATED MAX 289.0 MIN 99.9 AVG 168.2

MAX AT (73,04)

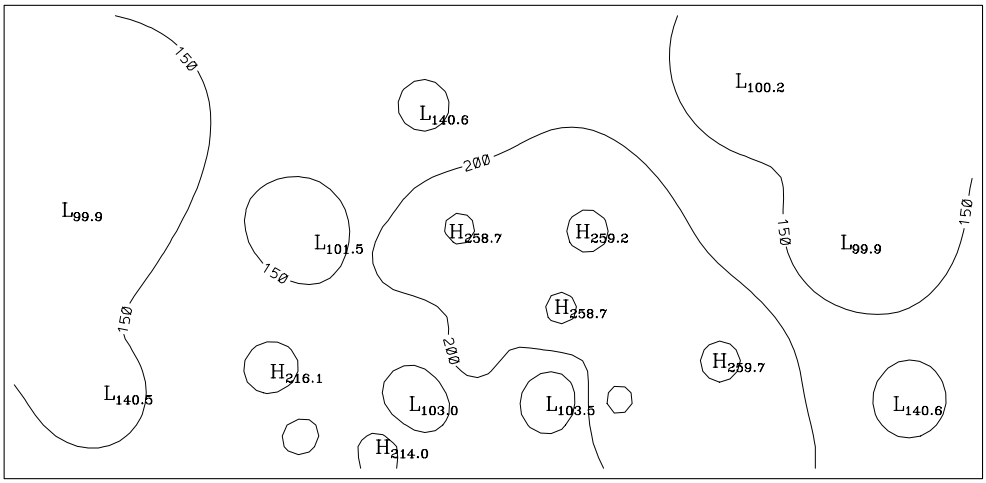
UAM DIFFUSION BREAK (M)
8/24/1999 0100-0200 MST




SIMULATED MAX 276.4 MIN 99.9 AVG 171.3

MAX AT (73,04)

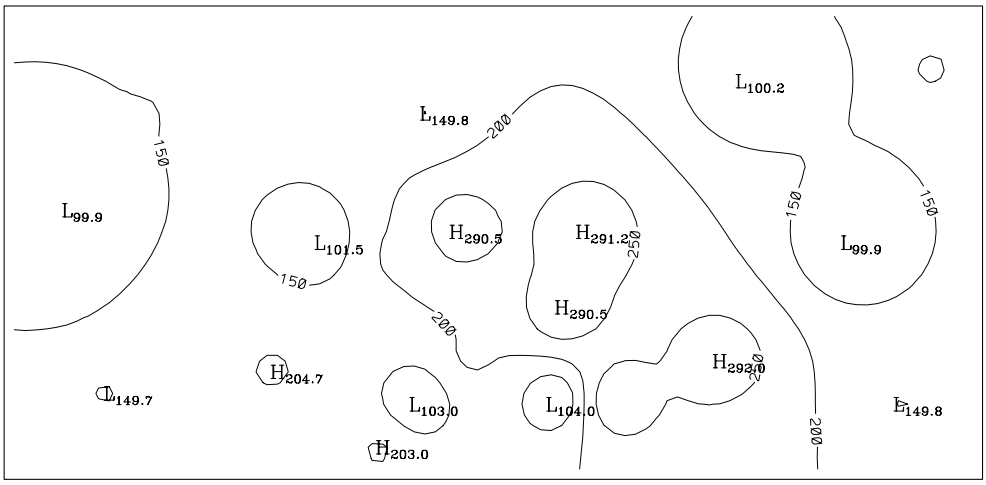
UAM DIFFUSION BREAK (M)
8/24/1999 0200-0300 MST




SIMULATED MAX 259.7 MIN 99.9 AVG 168.6

MAX AT (69,12)

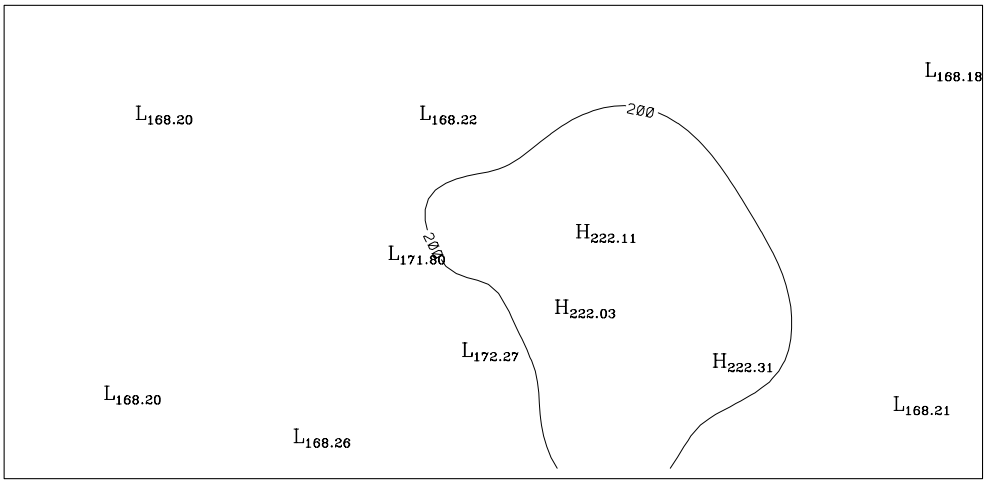
UAM DIFFUSION BREAK (M)
8/24/1999 0300-0400 MST




SIMULATED MAX 292.0 MIN 99.9 AVG 176.3

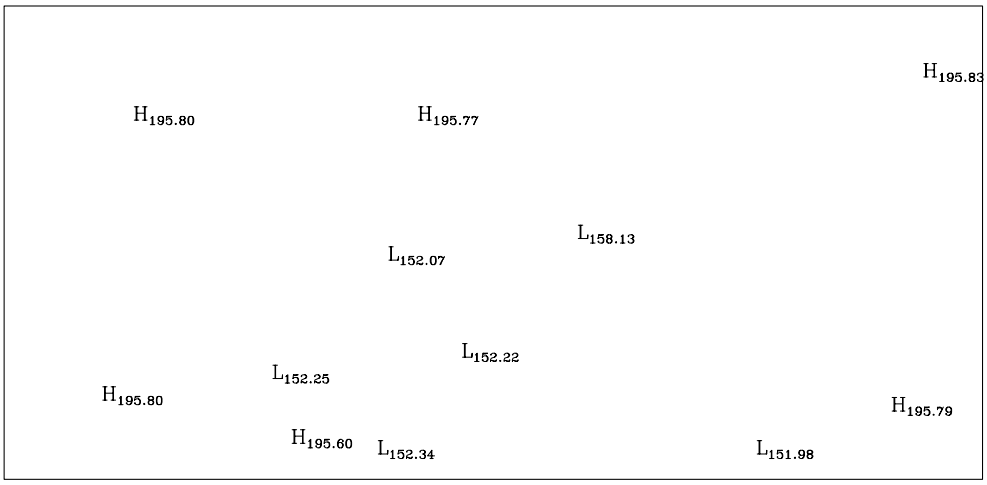
MAX AT (69,12)

UAM DIFFUSION BREAK (M)
8/24/1999 0400–0500 MST



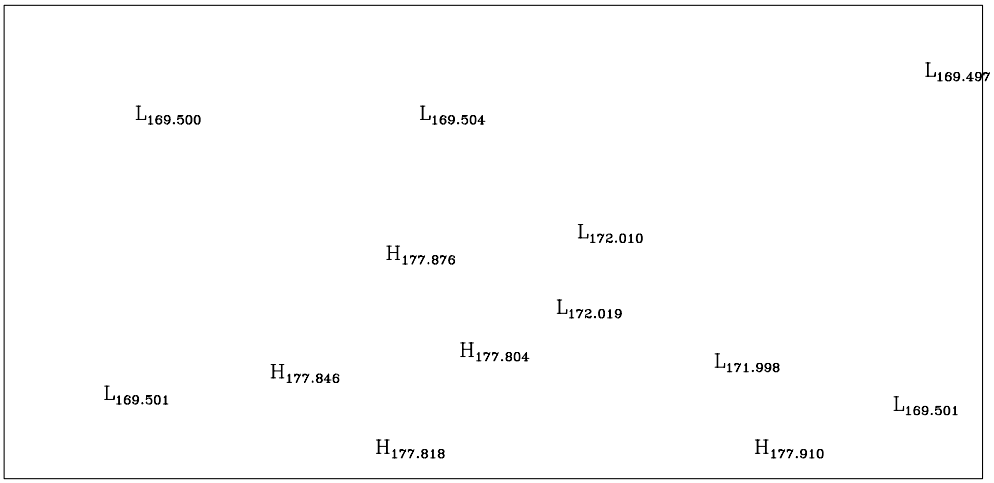

SIMULATED MAX 222.3 MIN 168.2 AVG 185.8 MAX AT (69,12)

UAM DIFFUSION BREAK (M)
8/24/1999 0500–0600 MST




SIMULATED MAX 195.8 MIN 152.0 AVG 172.6 MAX AT (89,39)

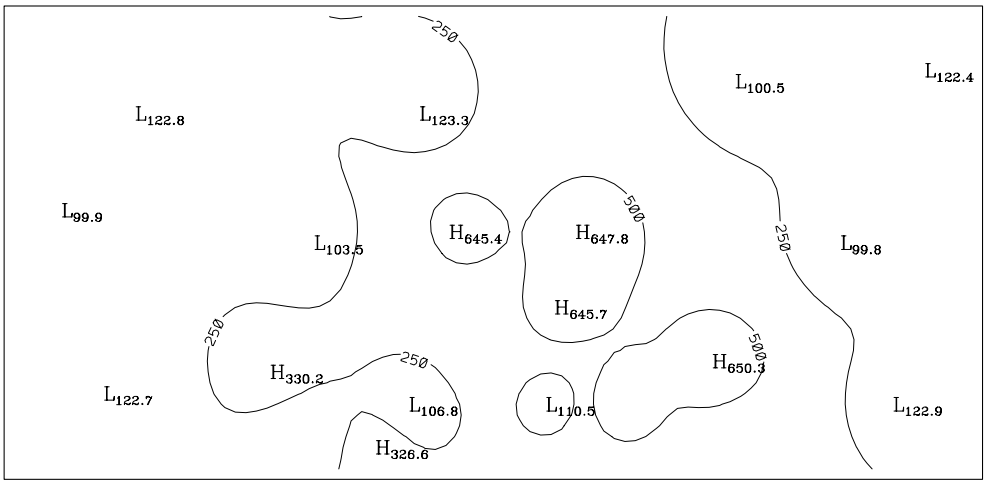
UAM DIFFUSION BREAK (M)
8/24/1999 0600–0700 MST




SIMULATED MAX 177.9 MIN 169.5 AVG 172.5

MAX AT (73,04)

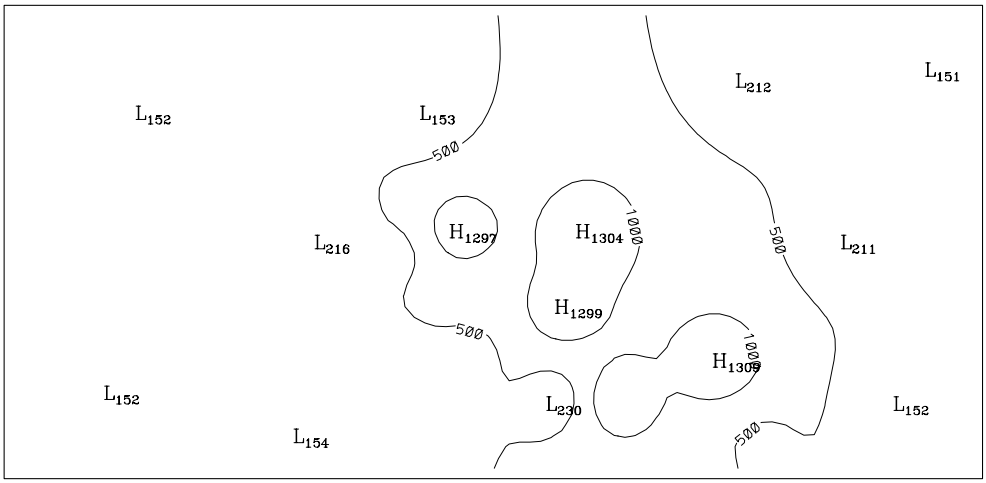
UAM DIFFUSION BREAK (M)
8/24/1999 0700–0800 MST




SIMULATED MAX 650.3 MIN 99.8 AVG 269.3

MAX AT (69,12)

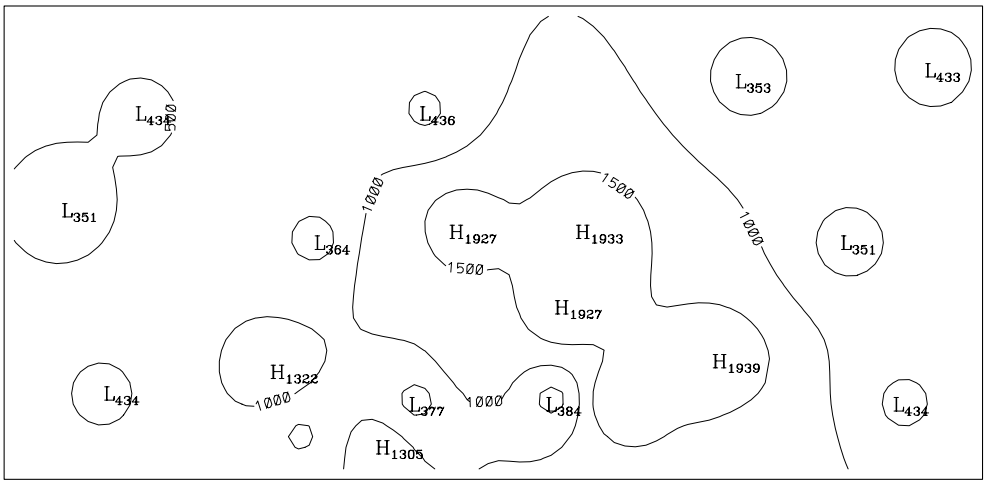
UAM DIFFUSION BREAK (M)
8/24/1999 0800–0900 MST




SIMULATED MAX 1309 MIN 152 AVG 466

MAX AT (69,12)

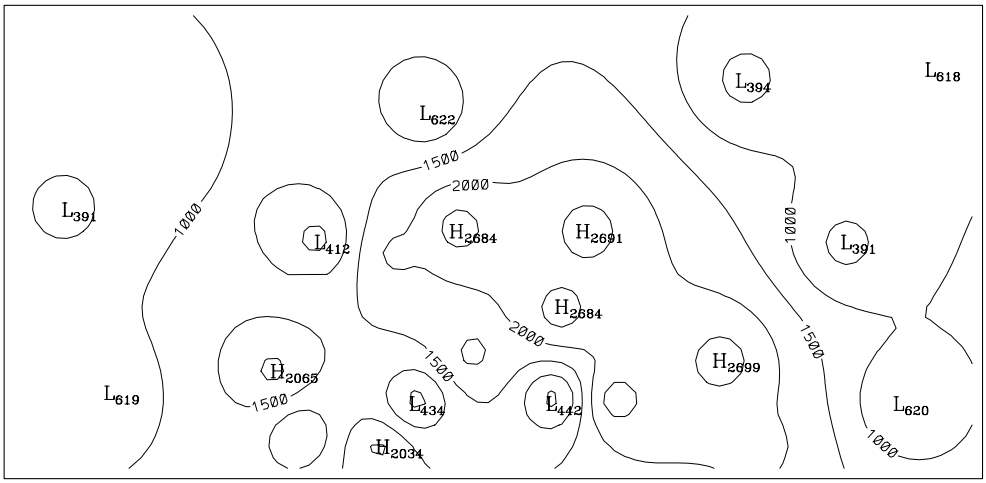
UAM DIFFUSION BREAK (M)
8/24/1999 0900–1000 MST




SIMULATED MAX 1939 MIN 351 AVG 903

MAX AT (69,12)

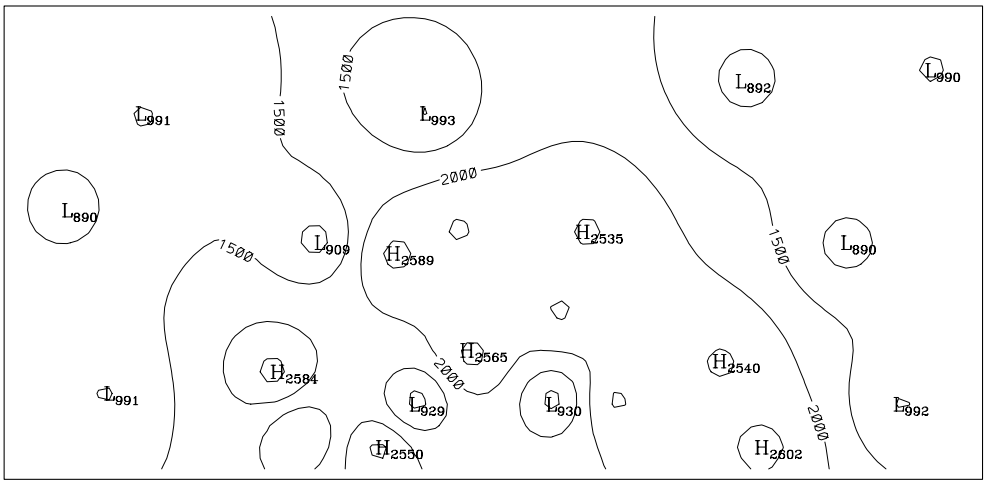
UAM DIFFUSION BREAK (M)
8/24/1999 1000–1100 MST




SIMULATED MAX 2699 MIN 391 AVG 1274

MAX AT (69,12)

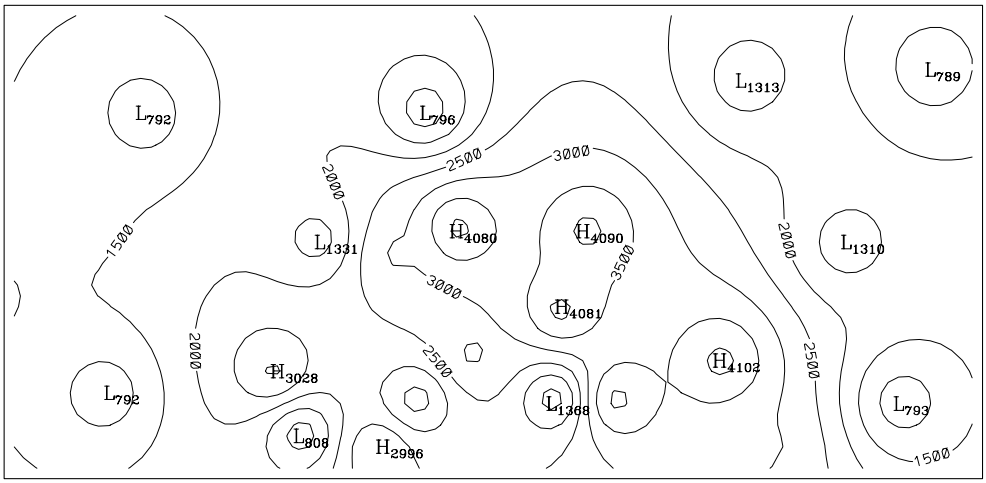
UAM DIFFUSION BREAK (M)
8/24/1999 1100–1200 MST




SIMULATED MAX 2602 MIN 890 AVG 1595

MAX AT (73,04)

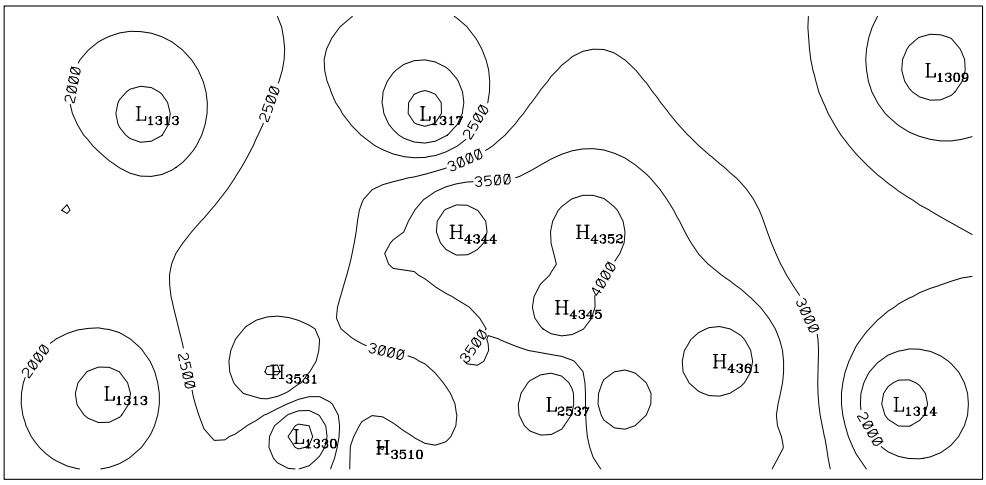
UAM DIFFUSION BREAK (M)
8/24/1999 1200–1300 MST




SIMULATED MAX 4102 MIN 789 AVG 2080

MAX AT (69,12)

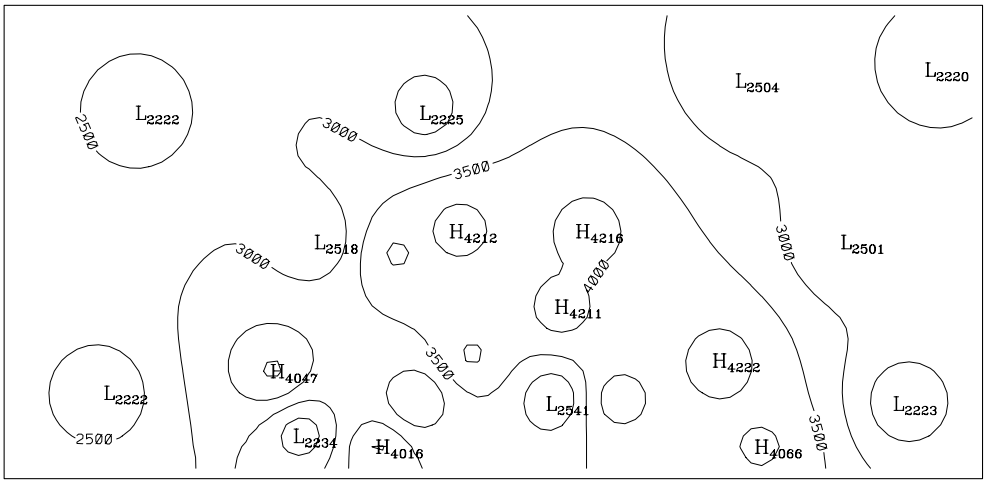
UAM DIFFUSION BREAK (M)
8/24/1999 1300–1400 MST




SIMULATED MAX 4361 MIN 1309 AVG 2737

MAX AT (69,12)

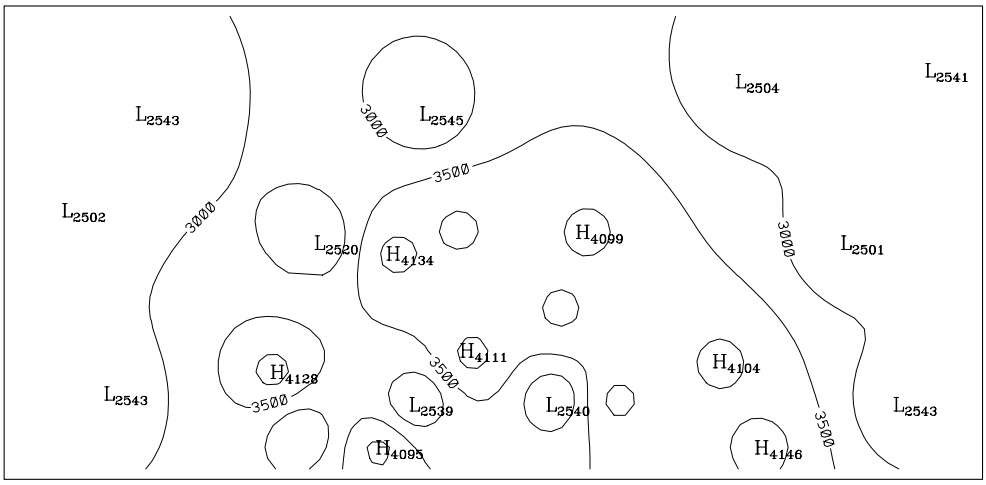
UAM DIFFUSION BREAK (M)
8/24/1999 1400–1500 MST




SIMULATED MAX 4222 MIN 2220 AVG 3079

MAX AT (69,12)

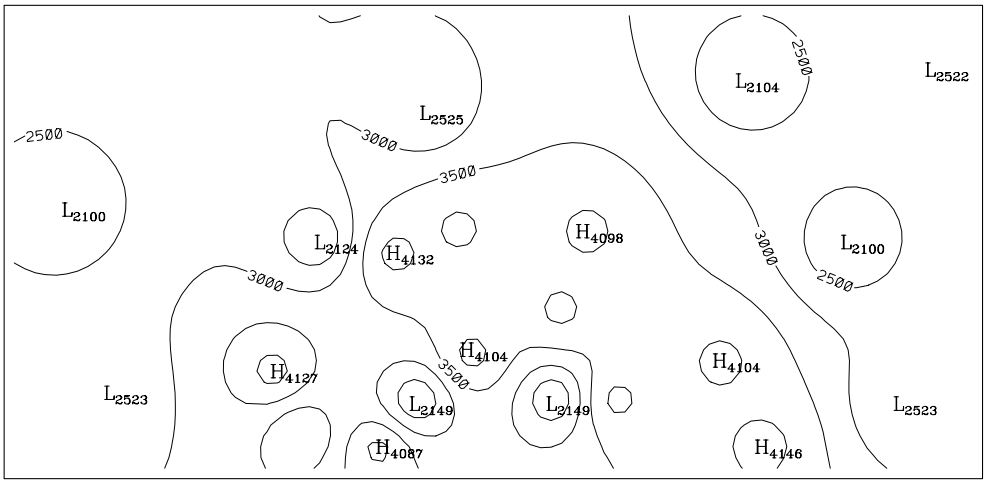
UAM DIFFUSION BREAK (M)
8/24/1999 1500–1600 MST




SIMULATED MAX 4146 MIN 2501 AVG 3165

MAX AT (73,04)

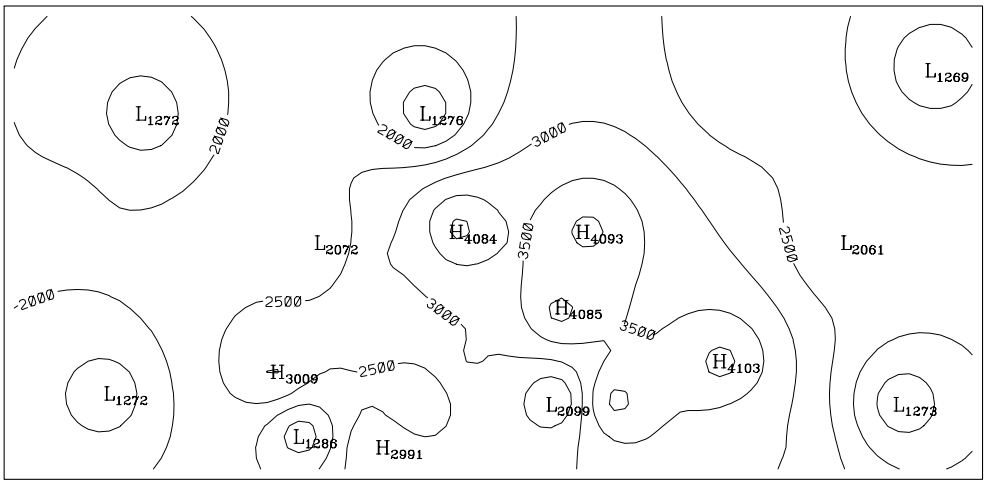
UAM DIFFUSION BREAK (M)
8/24/1999 1600–1700 MST




SIMULATED MAX 4146 MIN 2100 AVG 3041

MAX AT (73,04)

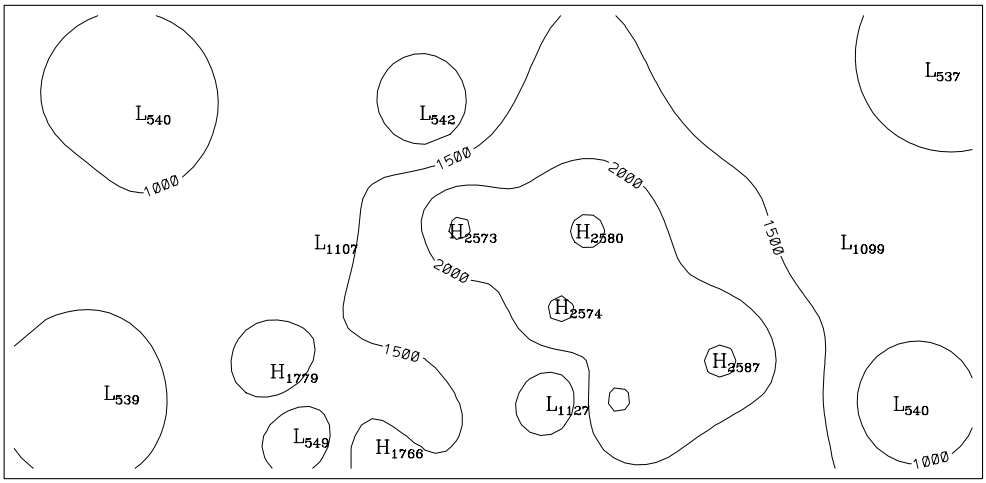
UAM DIFFUSION BREAK (M)
8/24/1999 1700–1800 MST




SIMULATED MAX 4103 MIN 1269 AVG 2442

MAX AT (69,12)

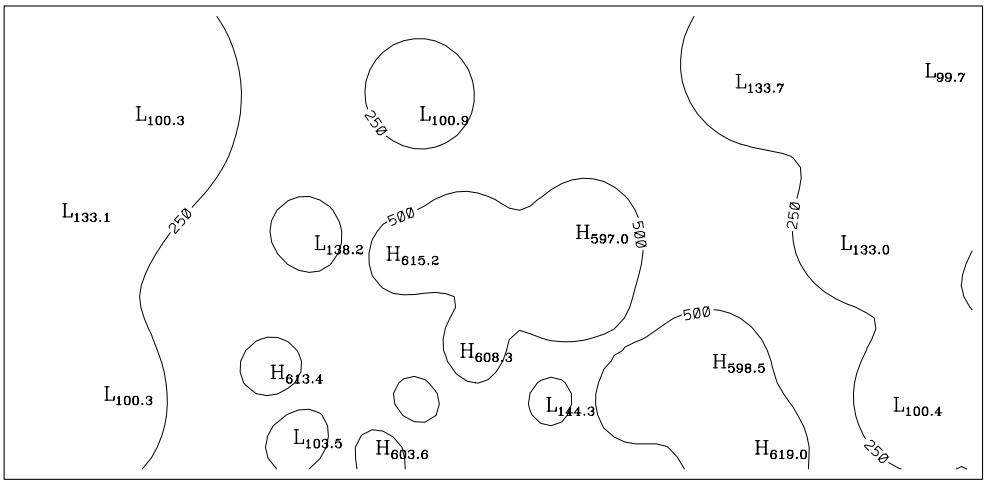
UAM DIFFUSION BREAK (M)
8/24/1999 1800–1900 MST




SIMULATED MAX 2587 MIN 538 AVG 1380

MAX AT (69,12)

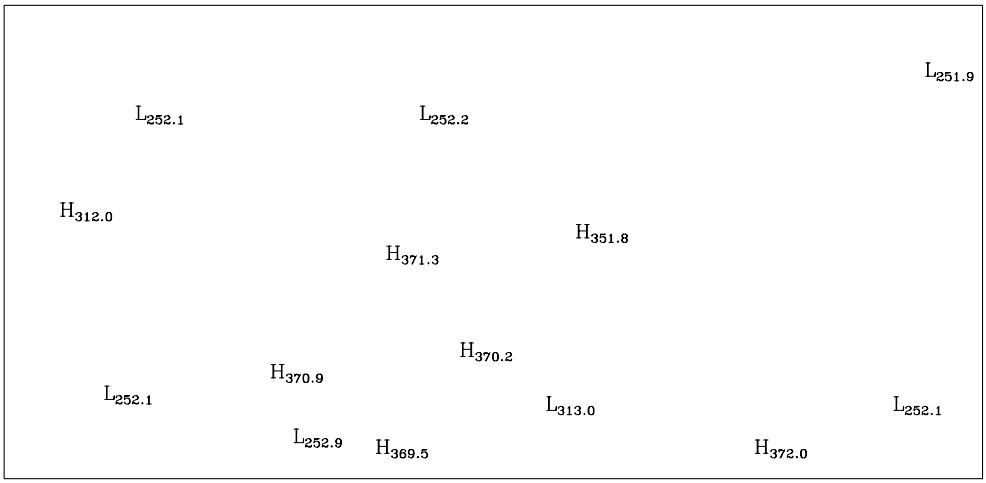
UAM DIFFUSION BREAK (M)
8/24/1999 1900–2000 MST




SIMULATED MAX 619.0 MIN 99.8 AVG 313.8

MAX AT (73,04)

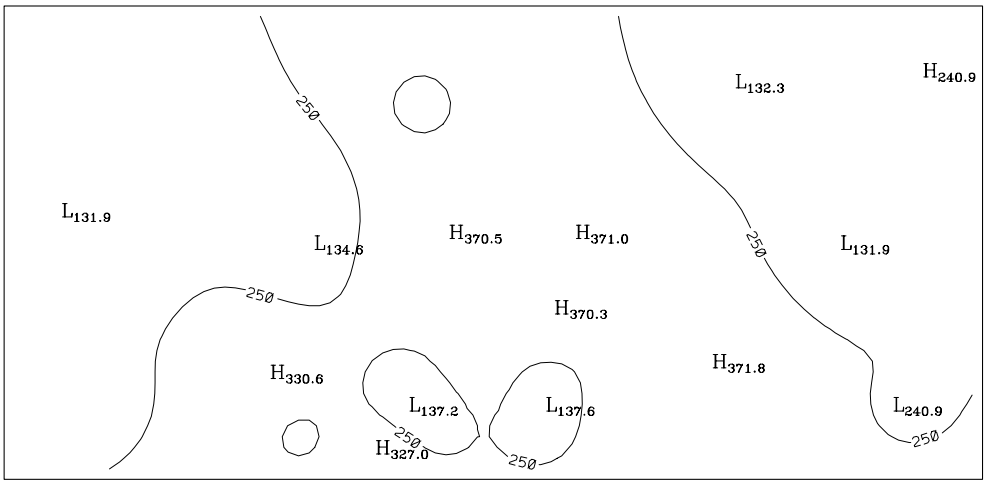
UAM DIFFUSION BREAK (M)
8/24/1999 2000-2100 MST




SIMULATED MAX 372.0 MIN 251.9 AVG 313.5

MAX AT (73,04)

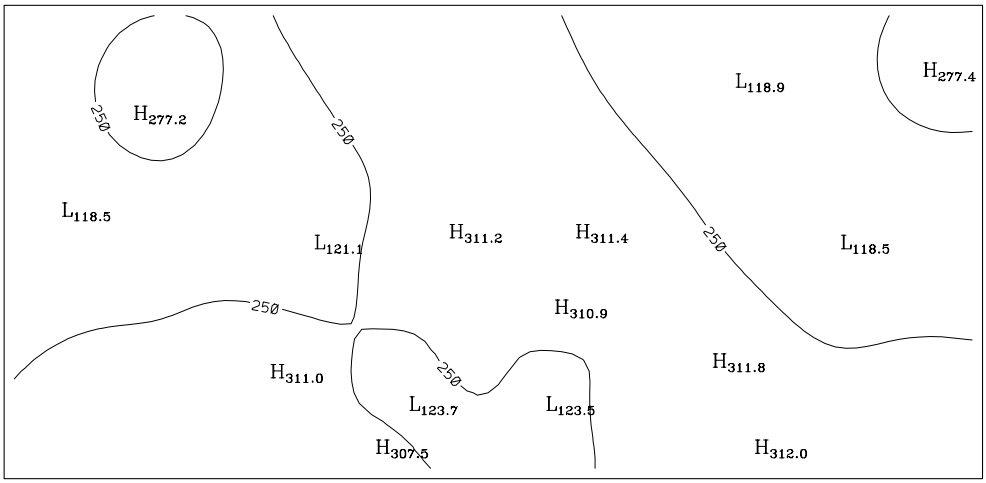
UAM DIFFUSION BREAK (M)
8/24/1999 2100-2200 MST




SIMULATED MAX 371.8 MIN 131.9 AVG 254.1

MAX AT (69,12)

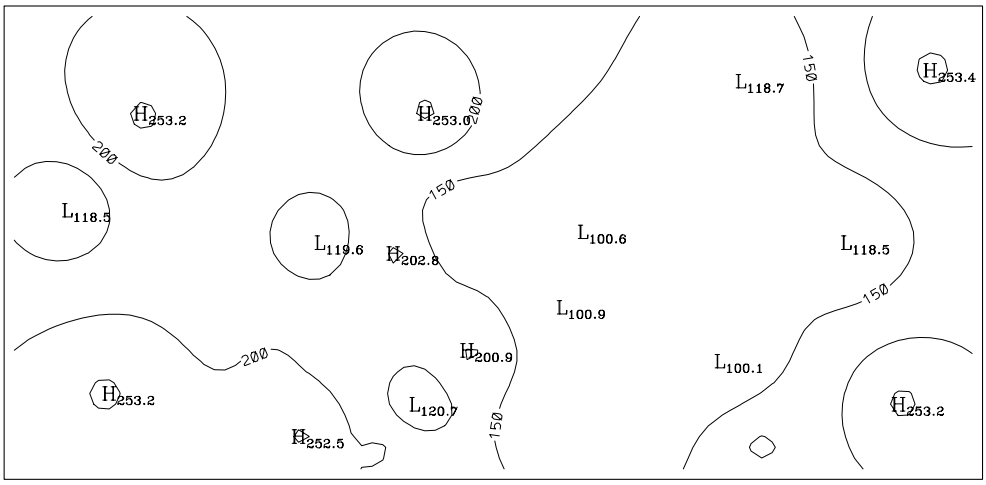
UAM DIFFUSION BREAK (M)
8/24/1999 2200-2300 MST




SIMULATED MAX 312.0 MIN 118.5 AVG 244.5

MAX AT (73,04)

UAM DIFFUSION BREAK (M)
8/24/1999 2300-0000 MST




SIMULATED MAX 253.4 MIN 100.1 AVG 171.2

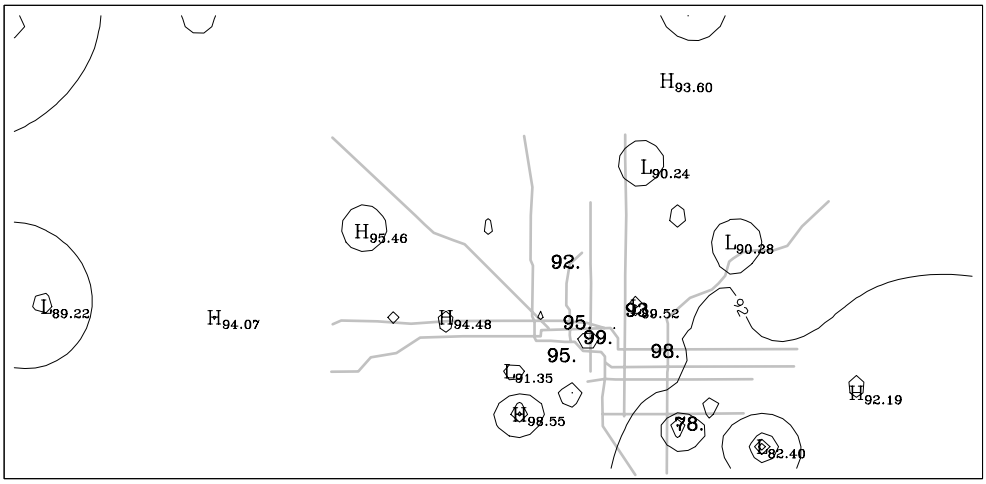
MAX AT (89,39)

Appendix IV-iii

# SURFACE TEMPERATURE FIELDS FOR 1998 EPISODE

The isopleth plots shown here are the simulated UAM and observed surface temperatures. The bold numbers indicate the observed surface temperatures. These hourly plots are from hour 0 on July 16, 1998 to hour 2400 on July 17, 1998.

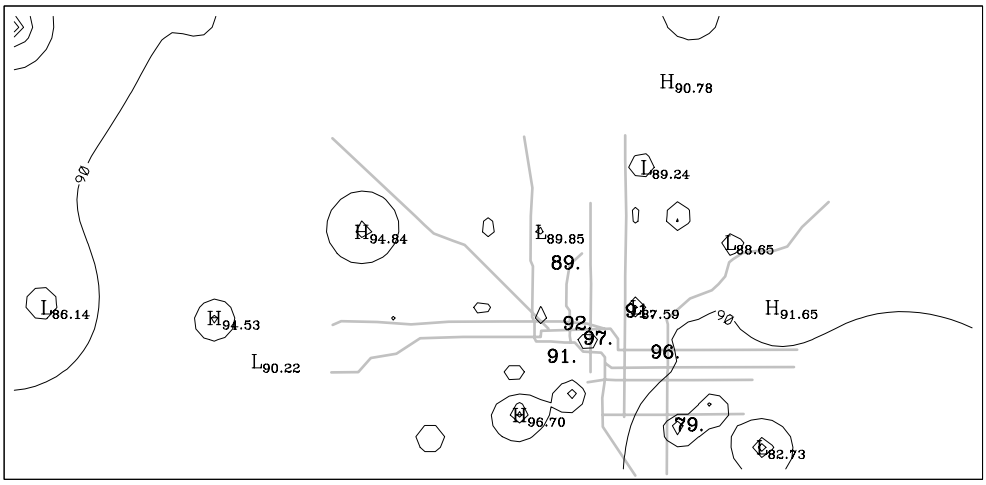
UAM SURFACE TEMPERATURE (F)
7/16/1998 0000-0100 MST




SIMULATED MAX 98.6 MIN 82.4 AVG 92.4
OBSERVED MAX 99.0 MIN 78.0 AVG 92.9

MAX AT (50,07)

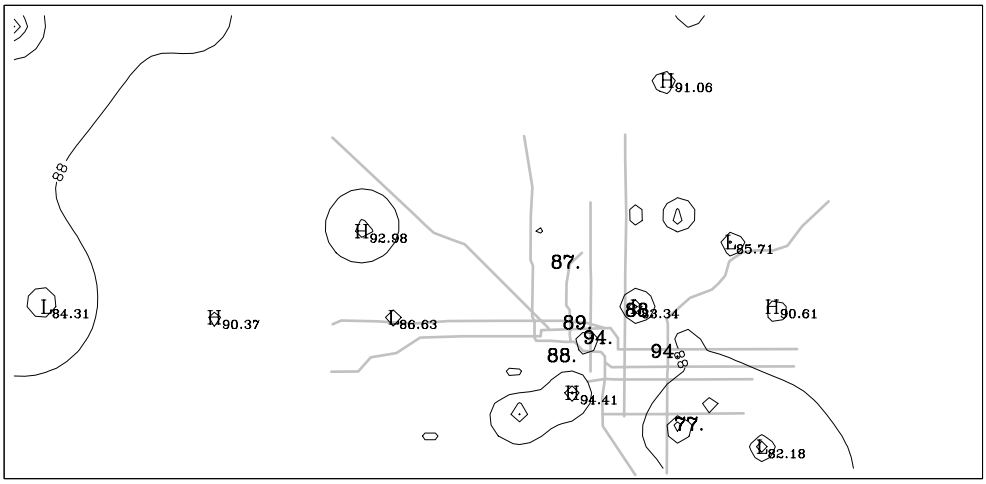
UAM SURFACE TEMPERATURE (F)
7/16/1998 0100-0200 MST




SIMULATED MAX 96.7 MIN 80.1 AVG 90.5
OBSERVED MAX 97.0 MIN 79.0 AVG 90.7

MAX AT (50,07)

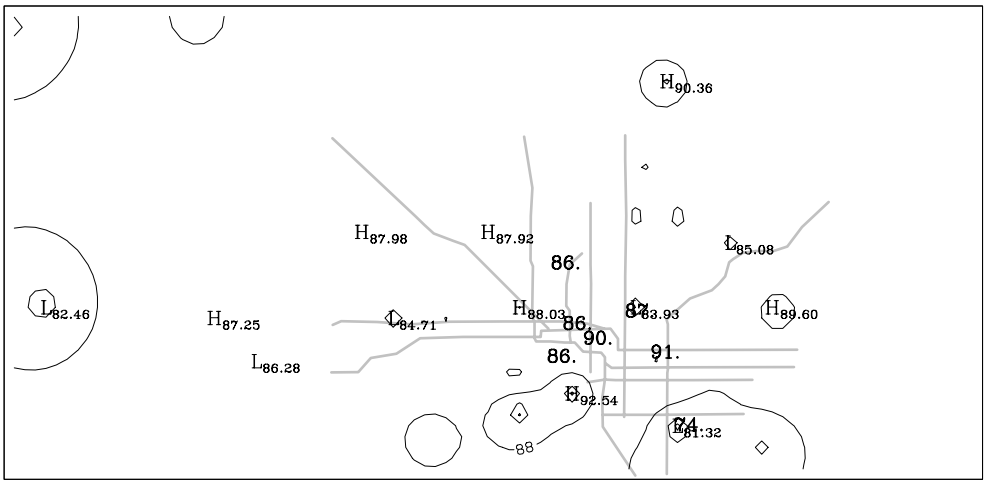
UAM SURFACE TEMPERATURE (F)
7/16/1998 0200-0300 MST




SIMULATED MAX 94.4 MIN 79.8 AVG 88.7
OBSERVED MAX 94.0 MIN 77.0 AVG 88.1

MAX AT (55,09)

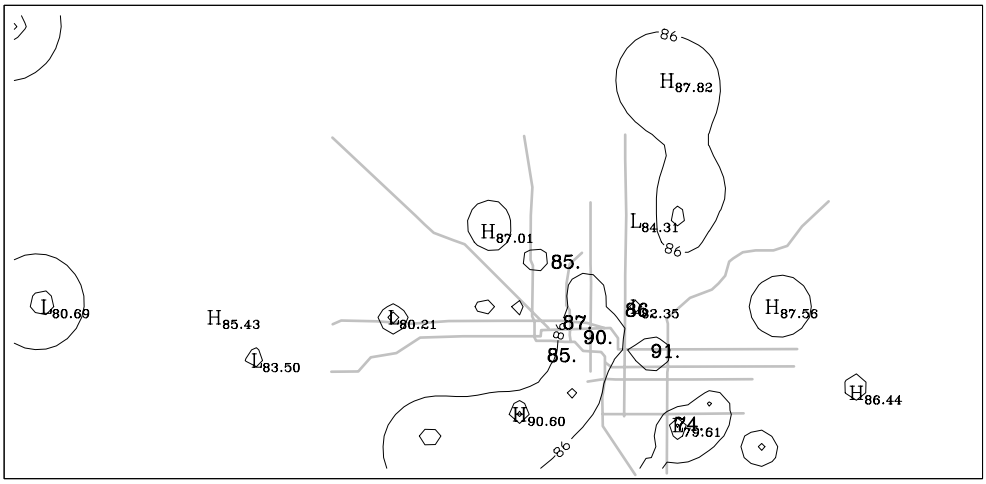
UAM SURFACE TEMPERATURE (F)
7/16/1998 0300-0400 MST




SIMULATED MAX 92.5 MIN 81.3 AVG 86.9
OBSERVED MAX 91.0 MIN 74.0 AVG 85.7

MAX AT (55,09)

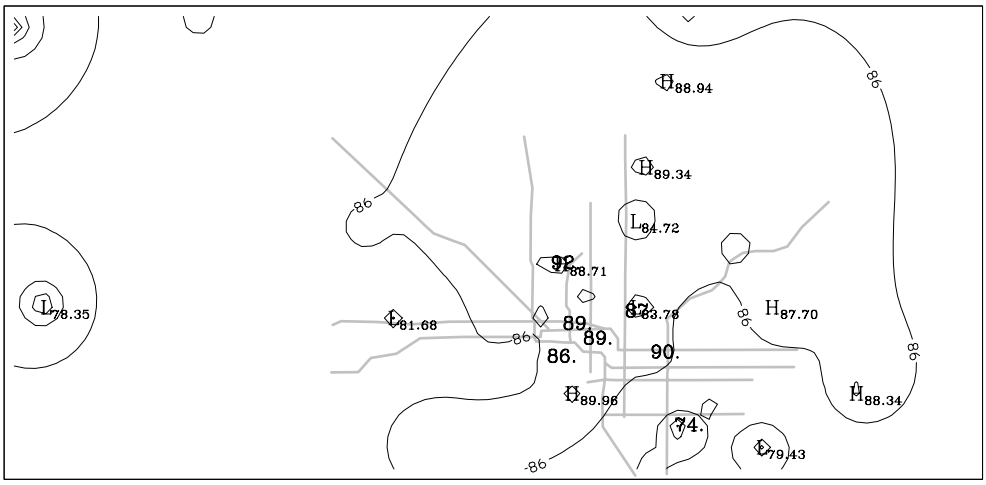
UAM SURFACE TEMPERATURE (F)
7/16/1998 0400-0500 MST




SIMULATED MAX 90.6 MIN 79.4 AVG 85.4
OBSERVED MAX 91.0 MIN 74.0 AVG 85.4

MAX AT (50,07)

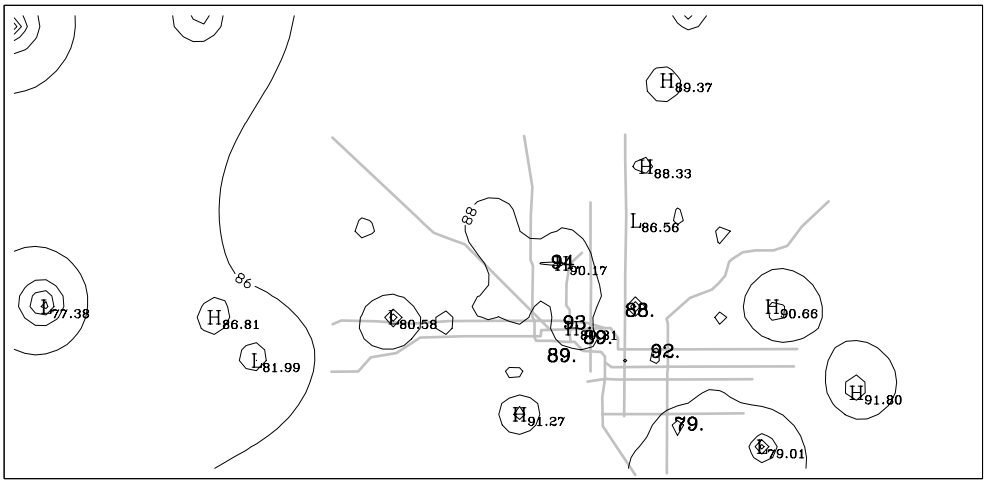
UAM SURFACE TEMPERATURE (F)
7/16/1998 0500-0600 MST




SIMULATED MAX 90.0 MIN 74.7 AVG 85.6
OBSERVED MAX 92.0 MIN 74.0 AVG 86.7

MAX AT (55,09)

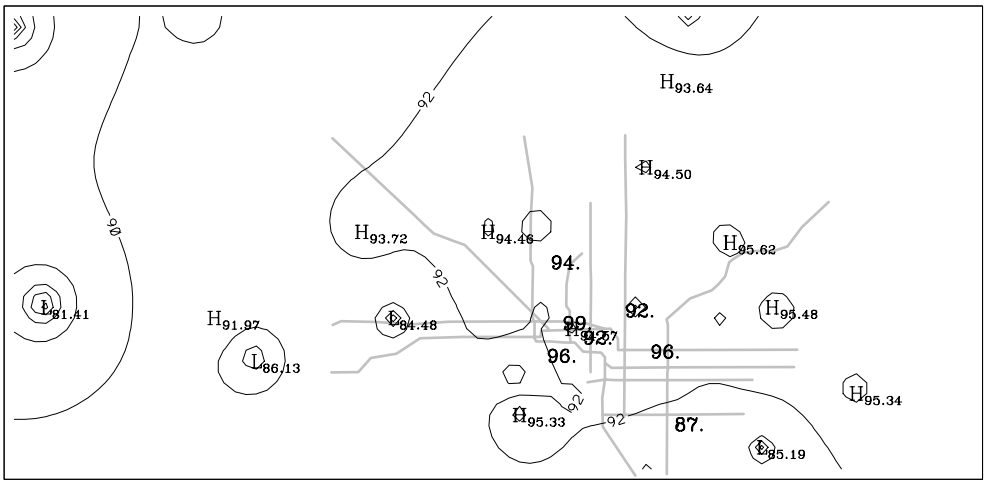
UAM SURFACE TEMPERATURE (F)
7/16/1998 0600-0700 MST




SIMULATED MAX 91.8 MIN 74.8 AVG 86.6
OBSERVED MAX 94.0 MIN 79.0 AVG 89.1

MAX AT (82,09)

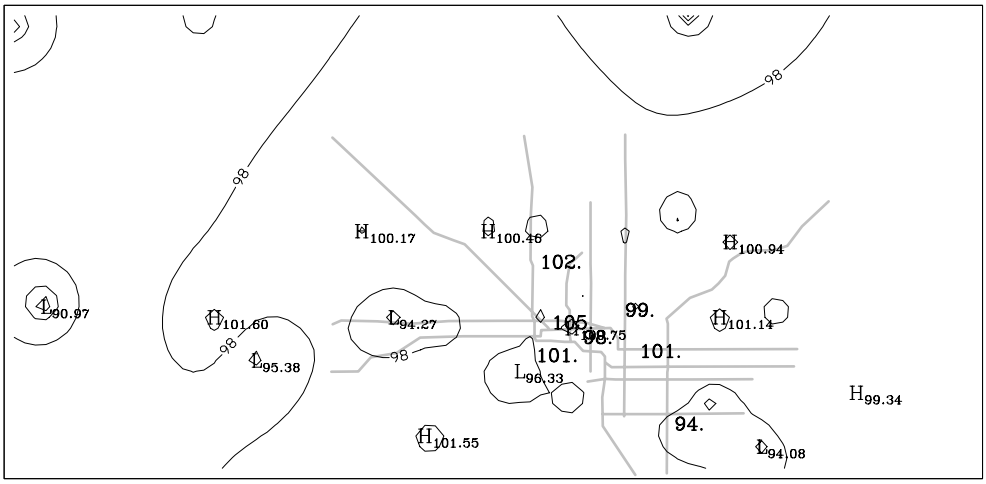
UAM SURFACE TEMPERATURE (F)
7/16/1998 0700-0800 MST




SIMULATED MAX 95.6 MIN 78.6 AVG 91.6
OBSERVED MAX 99.0 MIN 87.0 AVG 93.7

MAX AT (70,23)

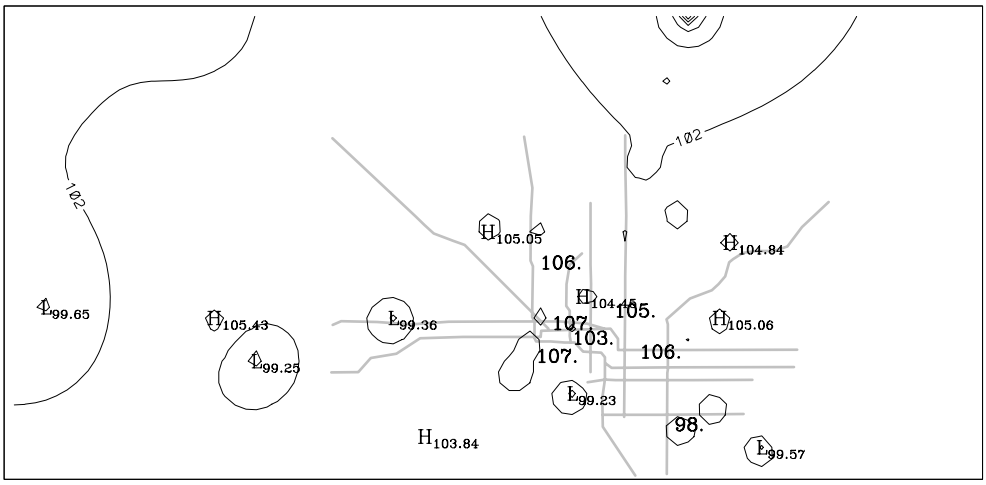
UAM SURFACE TEMPERATURE (F)
7/16/1998 0800-0900 MST




SIMULATED MAX 101.6 MIN 89.7 AVG 98.1
OBSERVED MAX 105.0 MIN 94.0 AVG 100.0

MAX AT (21,16)

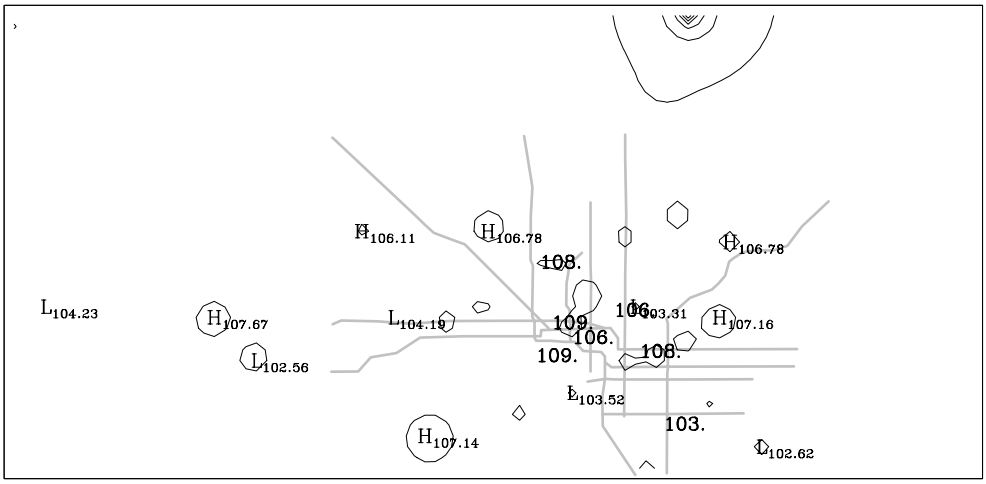
UAM SURFACE TEMPERATURE (F)
7/16/1998 0900-1000 MST




SIMULATED MAX 105.4 MIN 90.5 AVG 102.3
OBSERVED MAX 107.0 MIN 98.0 AVG 104.6

MAX AT (21,16)

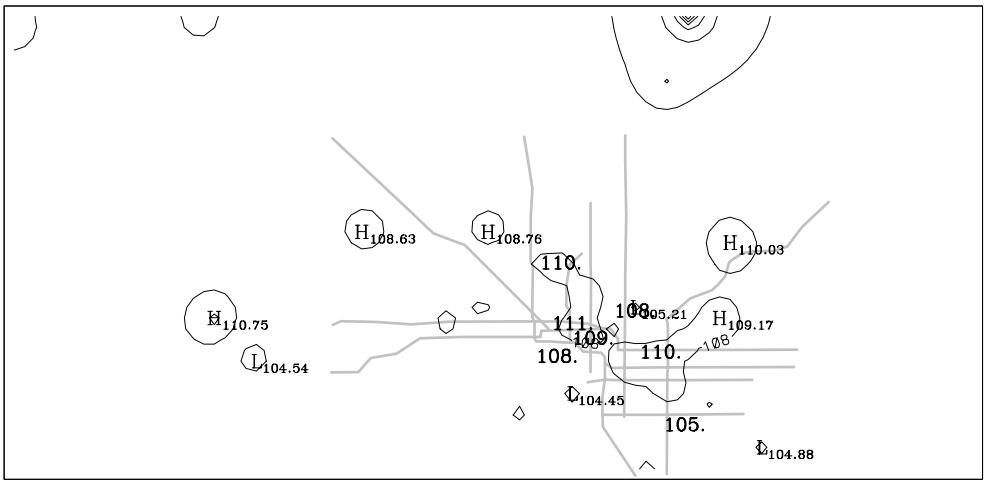
UAM SURFACE TEMPERATURE (F)
7/16/1998 1000–1100 MST




SIMULATED MAX 107.7 MIN 92.4 AVG 105.1
OBSERVED MAX 109.0 MIN 103.0 AVG 107.0

MAX AT (21,16)

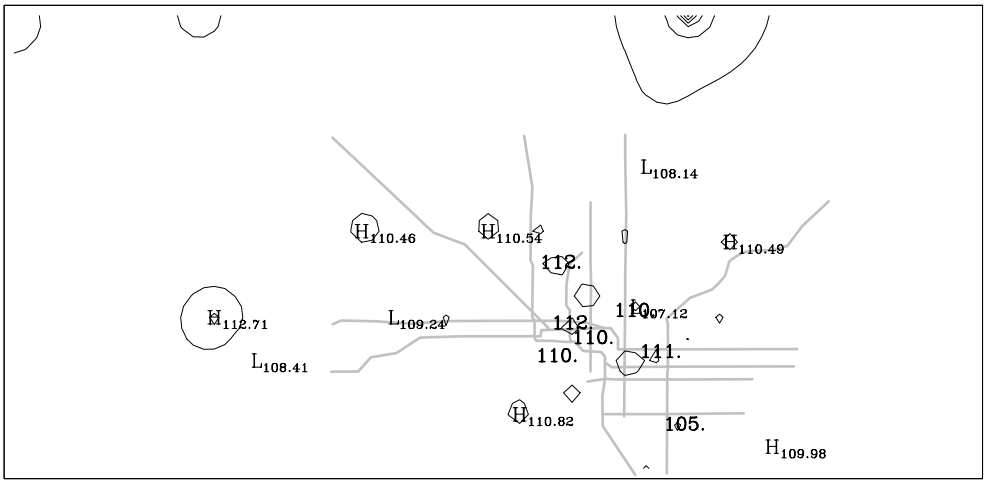
UAM SURFACE TEMPERATURE (F)
7/16/1998 1100–1200 MST




SIMULATED MAX 110.8 MIN 94.3 AVG 107.2
OBSERVED MAX 111.0 MIN 105.0 AVG 108.7

MAX AT (21,16)

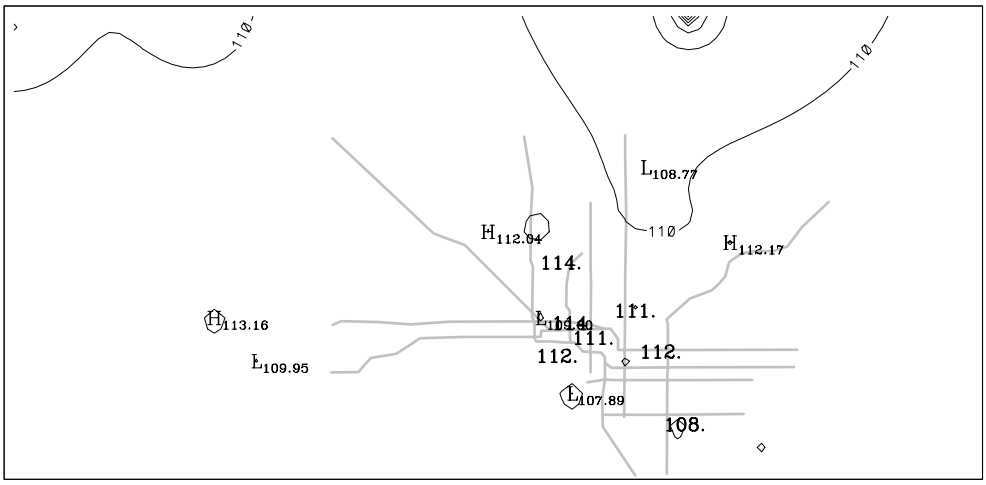
UAM SURFACE TEMPERATURE (F)
7/16/1998 1200–1300 MST




SIMULATED MAX 112.7 MIN 97.5 AVG 109.2
OBSERVED MAX 112.0 MIN 105.0 AVG 110.0

MAX AT (21,16)

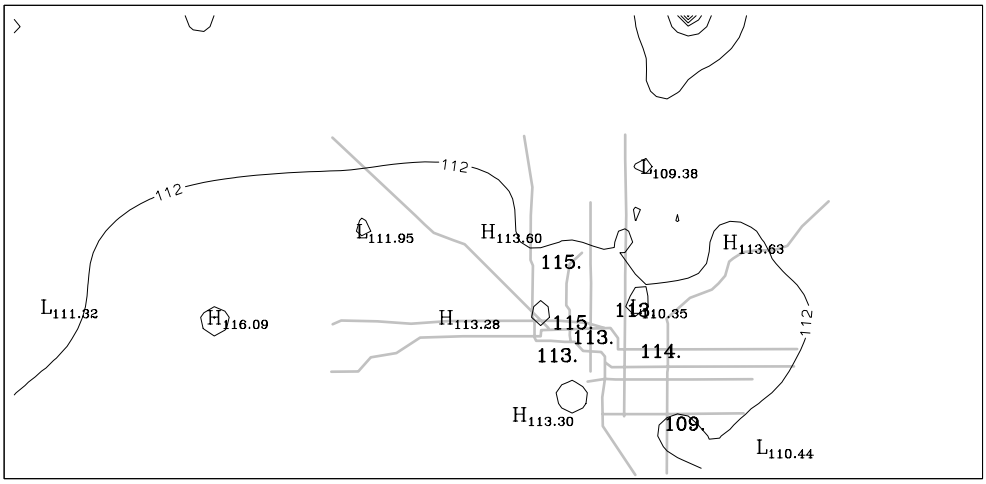
UAM SURFACE TEMPERATURE (F)
7/16/1998 1300–1400 MST




SIMULATED MAX 113.2 MIN 97.8 AVG 110.5
OBSERVED MAX 114.0 MIN 108.0 AVG 111.7

MAX AT (21,16)

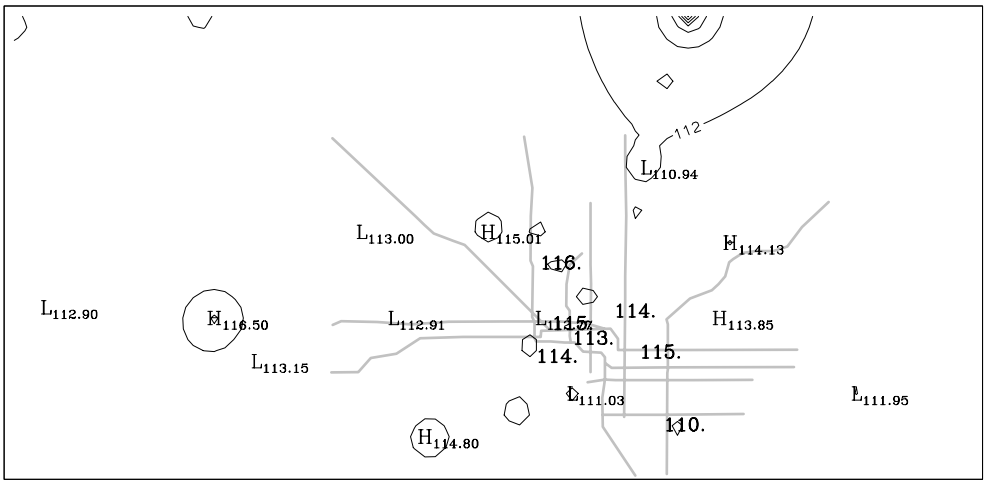
UAM SURFACE TEMPERATURE (F)
7/16/1998 1400–1500 MST




SIMULATED MAX 116.1 MIN 99.5 AVG 111.8
OBSERVED MAX 115.0 MIN 109.0 AVG 113.1

MAX AT (21,16)

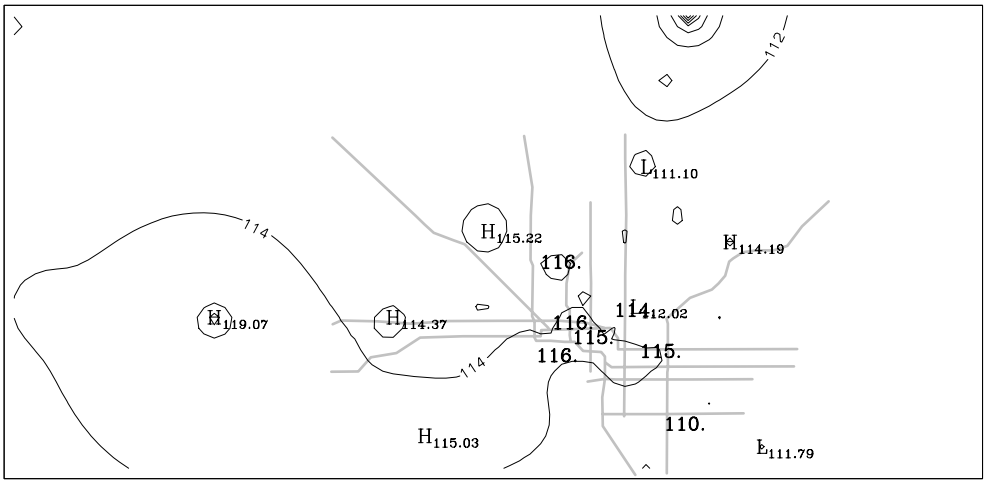
UAM SURFACE TEMPERATURE (F)
7/16/1998 1500–1600 MST




SIMULATED MAX 116.5 MIN 99.7 AVG 113.0
OBSERVED MAX 116.0 MIN 110.0 AVG 113.9

MAX AT (21,16)

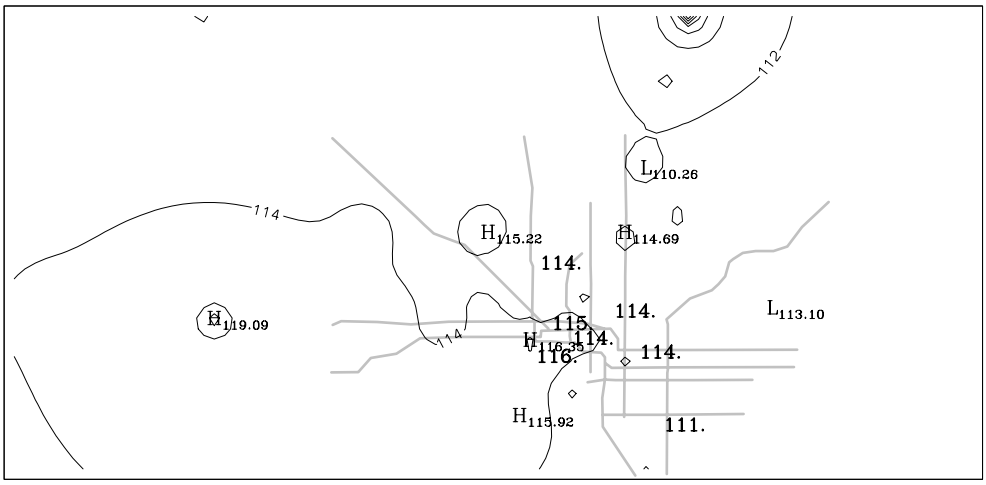
UAM SURFACE TEMPERATURE (F)
7/16/1998 1600-1700 MST




SIMULATED MAX 119.1 MIN 98.3 AVG 113.5
OBSERVED MAX 116.0 MIN 110.0 AVG 114.6

MAX AT (21,16)

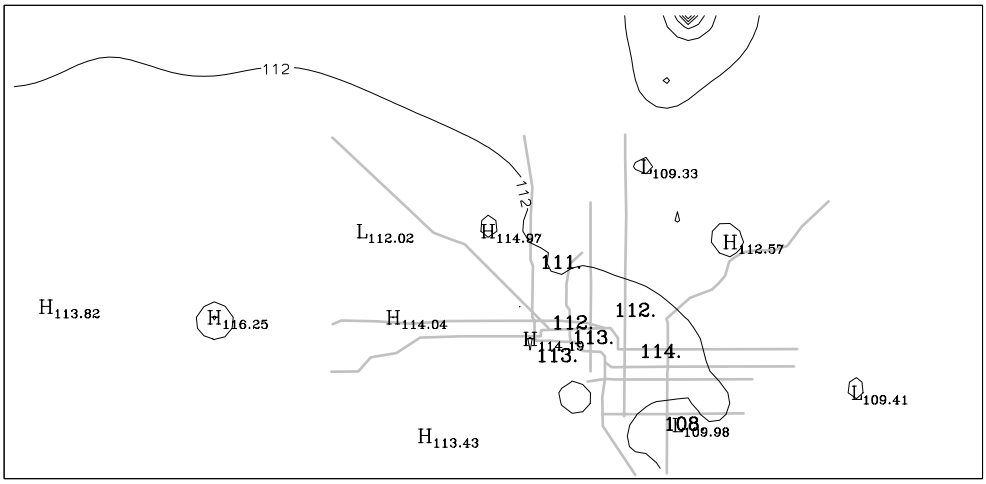
UAM SURFACE TEMPERATURE (F)
7/16/1998 1700-1800 MST




SIMULATED MAX 119.1 MIN 98.3 AVG 113.5
OBSERVED MAX 116.0 MIN 111.0 AVG 114.0

MAX AT (21,16)

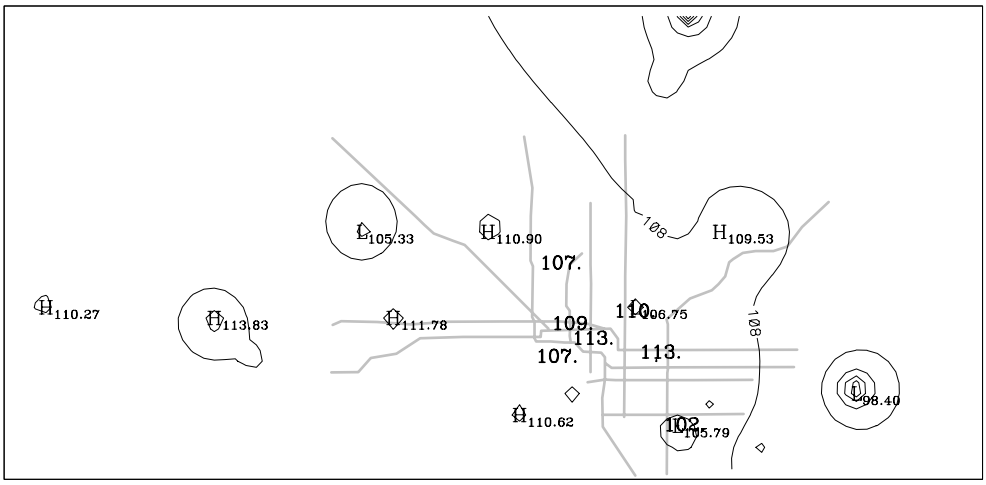
UAM SURFACE TEMPERATURE (F)
7/16/1998 1800-1900 MST




SIMULATED MAX 116.2 MIN 98.0 AVG 111.9
OBSERVED MAX 114.0 MIN 108.0 AVG 111.9

MAX AT (21,16)

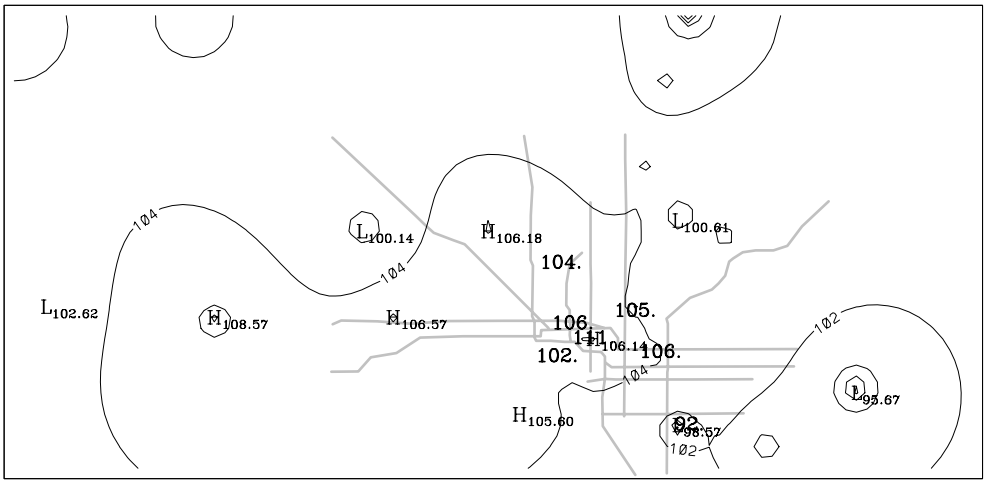
UAM SURFACE TEMPERATURE (F)
7/16/1998 1900-2000 MST




SIMULATED MAX 113.8 MIN 94.4 AVG 108.3
OBSERVED MAX 113.0 MIN 102.0 AVG 108.7

MAX AT (21,16)

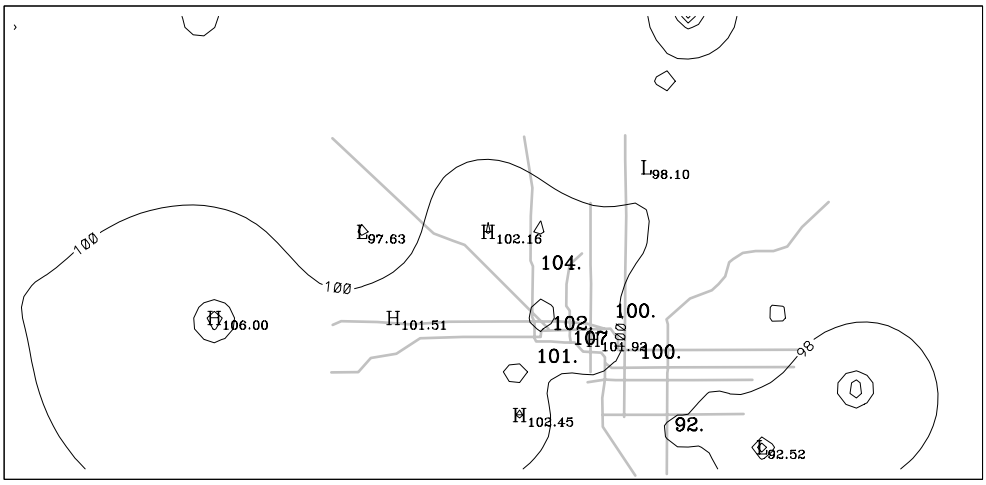
UAM SURFACE TEMPERATURE (F)
7/16/1998 2000-2100 MST




SIMULATED MAX 108.6 MIN 92.0 AVG 103.3
OBSERVED MAX 111.0 MIN 92.0 AVG 103.7

MAX AT (21,16)

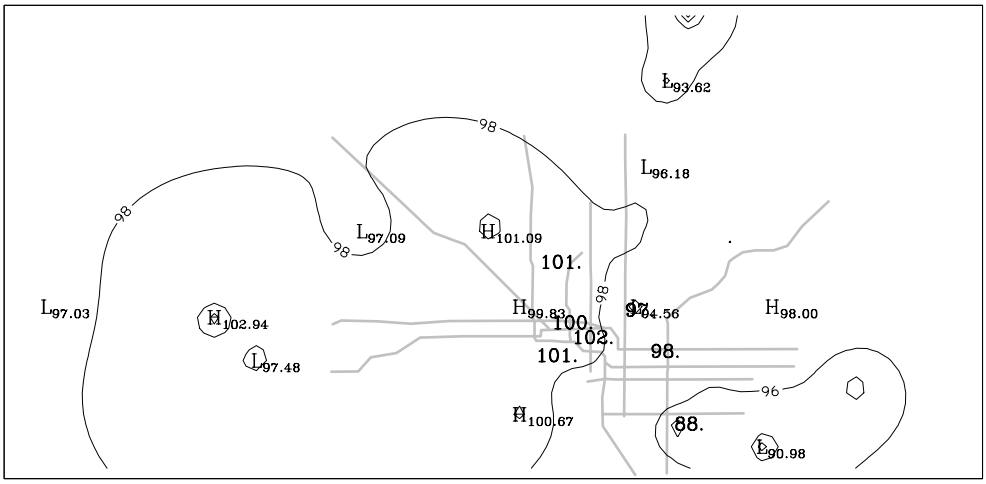
UAM SURFACE TEMPERATURE (F)
7/16/1998 2100-2200 MST




SIMULATED MAX 106.0 MIN 91.3 AVG 99.4
OBSERVED MAX 107.0 MIN 92.0 AVG 100.9

MAX AT (21,16)

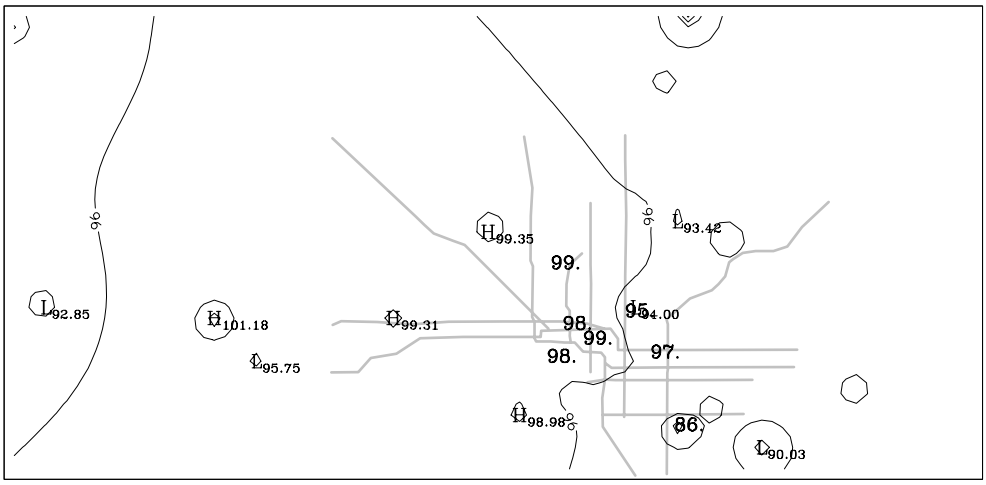
UAM SURFACE TEMPERATURE (F)
7/16/1998 2200-2300 MST




SIMULATED MAX 102.9 MIN 89.4 AVG 97.5
OBSERVED MAX 102.0 MIN 88.0 AVG 98.1

MAX AT (21,16)

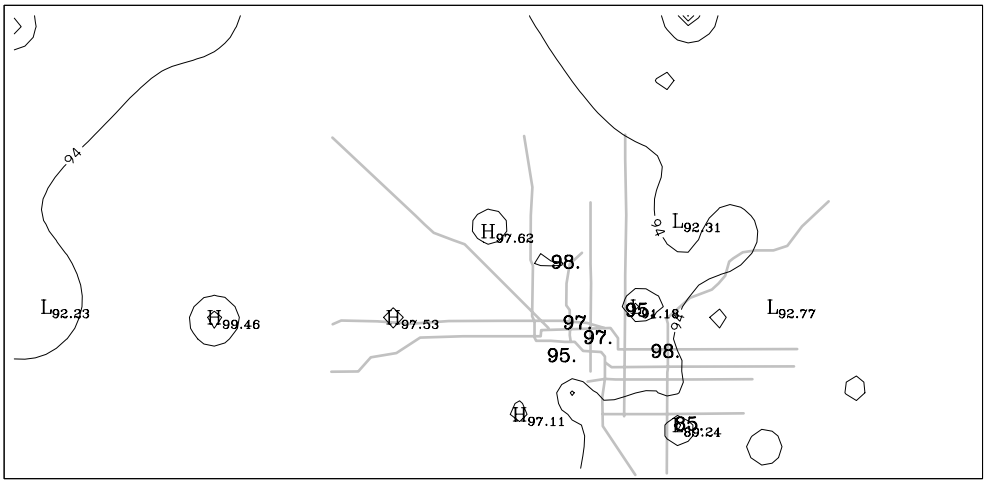
UAM SURFACE TEMPERATURE (F)
7/16/1998 2300-2400 MST




SIMULATED MAX 101.2 MIN 87.7 AVG 95.9
OBSERVED MAX 99.0 MIN 86.0 AVG 96.0

MAX AT (21,16)

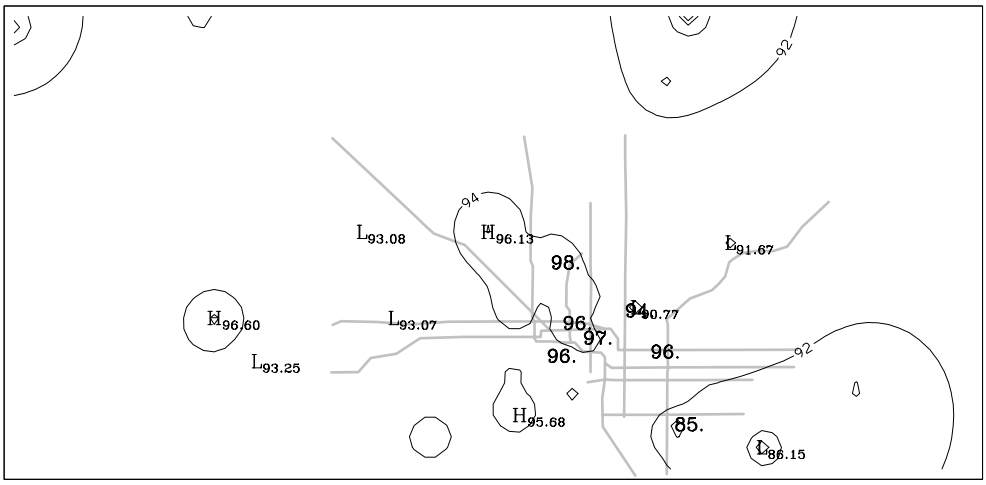
UAM SURFACE TEMPERATURE (F)
7/17/1998 0000-0100 MST




SIMULATED MAX 99.5 MIN 85.9 AVG 94.1
OBSERVED MAX 98.0 MIN 85.0 AVG 95.0

MAX AT (21,16)

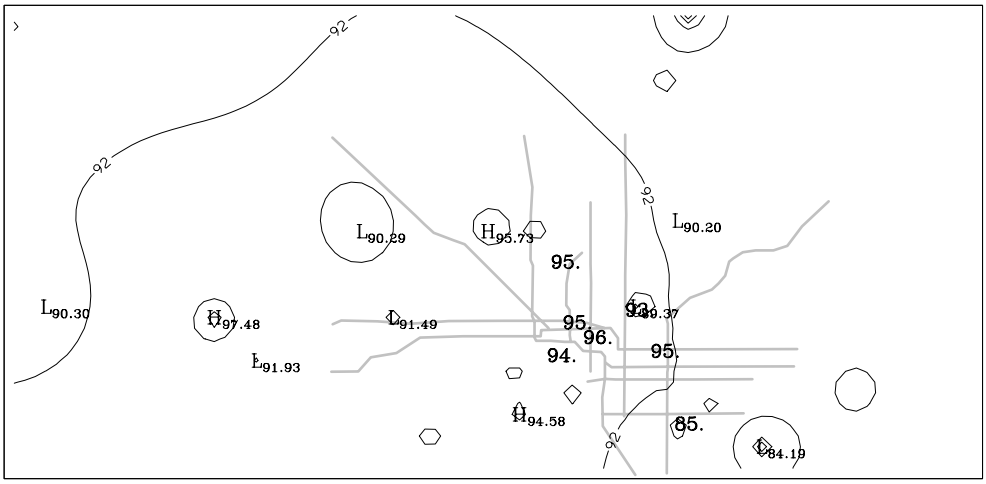
UAM SURFACE TEMPERATURE (F)
7/17/1998 0100-0200 MST




SIMULATED MAX 96.6 MIN 84.2 AVG 92.8
OBSERVED MAX 98.0 MIN 85.0 AVG 94.6

MAX AT (21,16)

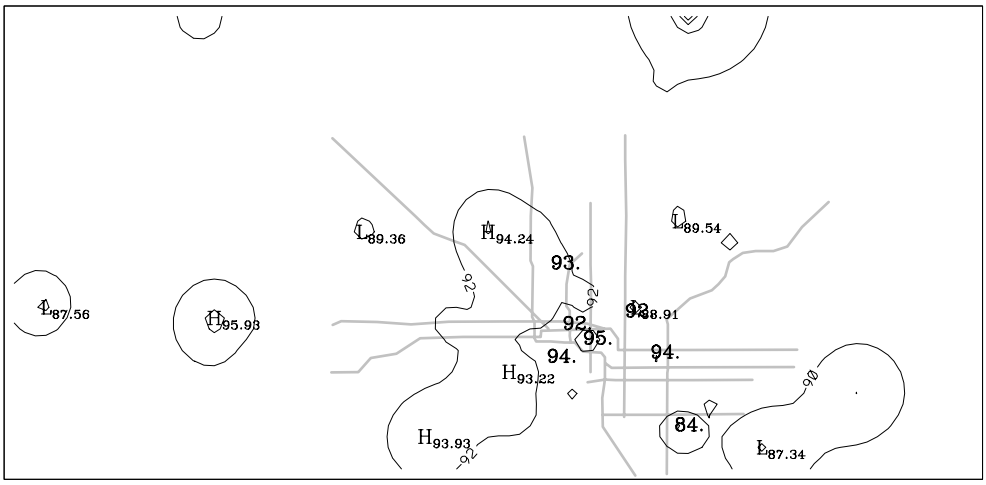
UAM SURFACE TEMPERATURE (F)
7/17/1998 0200-0300 MST




SIMULATED MAX 97.5 MIN 82.5 AVG 91.9
OBSERVED MAX 96.0 MIN 85.0 AVG 93.3

MAX AT (21,16)

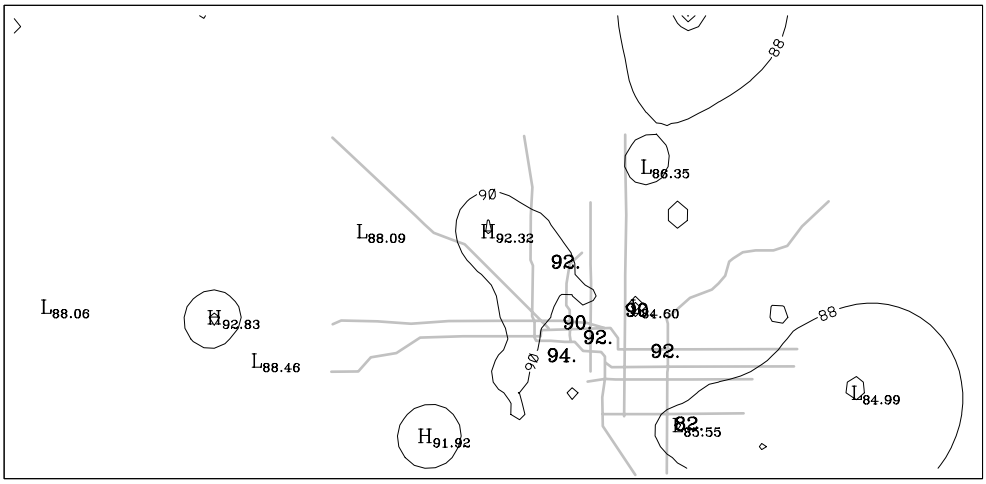
UAM SURFACE TEMPERATURE (F)
7/17/1998 0300-0400 MST




SIMULATED MAX 95.9 MIN 82.4 AVG 90.9
OBSERVED MAX 95.0 MIN 84.0 AVG 92.0

MAX AT (21,16)

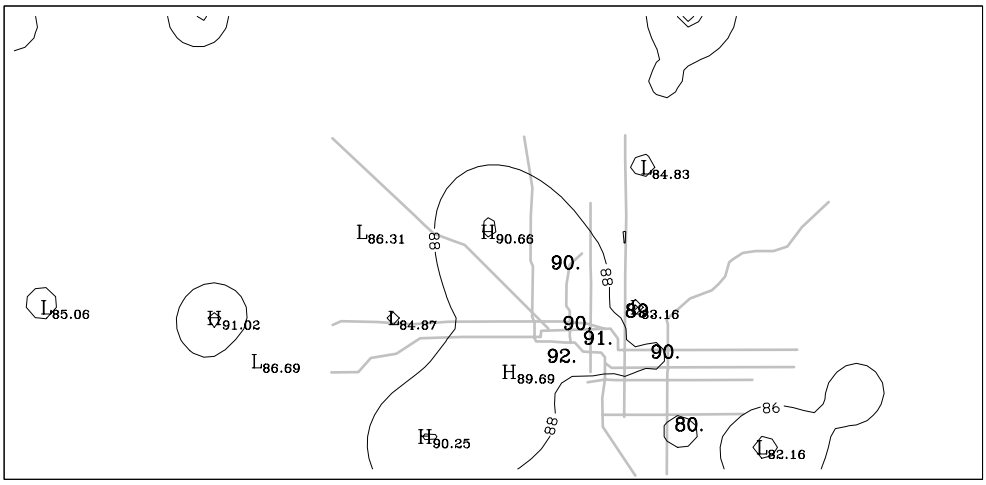
UAM SURFACE TEMPERATURE (F)
7/17/1998 0400-0500 MST




SIMULATED MAX 92.8 MIN 81.9 AVG 88.8
OBSERVED MAX 94.0 MIN 82.0 AVG 90.3

MAX AT (21,16)

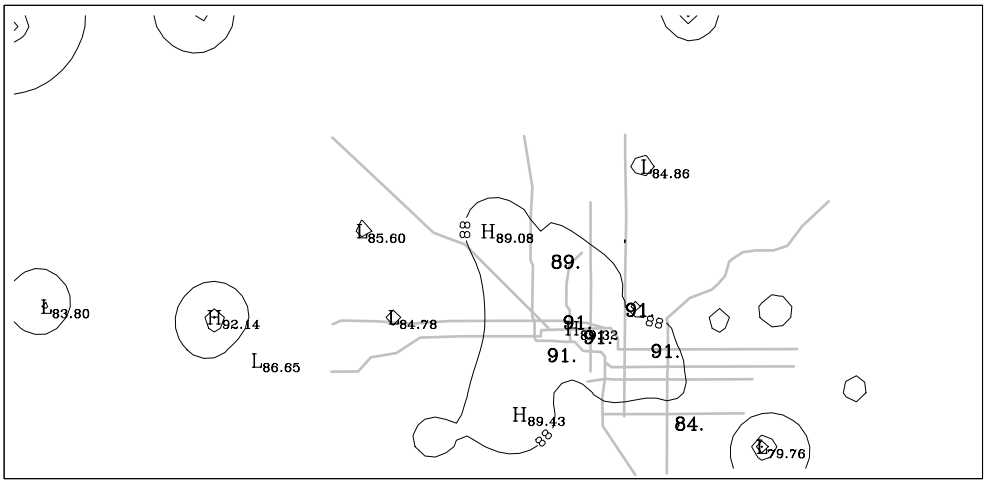
UAM SURFACE TEMPERATURE (F)
7/17/1998 0500-0600 MST




SIMULATED MAX 91.0 MIN 80.2 AVG 87.2
OBSERVED MAX 92.0 MIN 80.0 AVG 88.9

MAX AT (21,16)

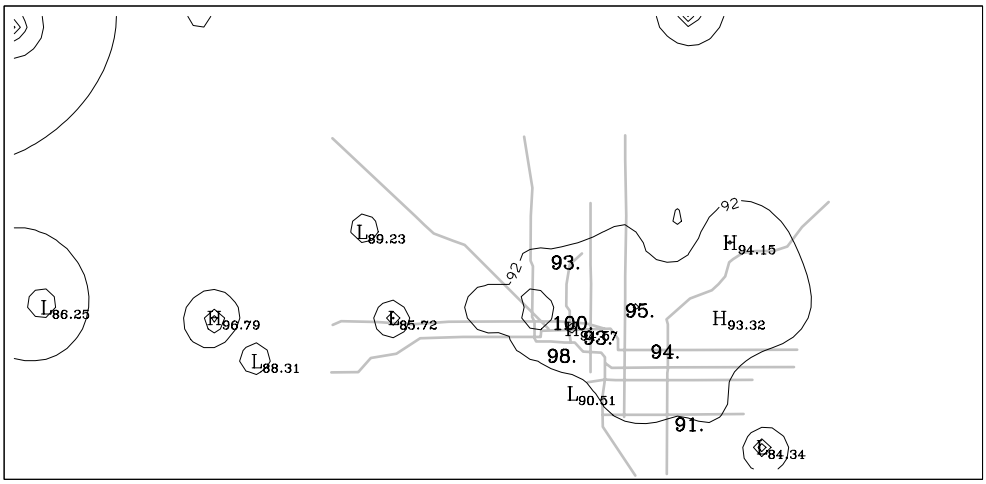
UAM SURFACE TEMPERATURE (F)
7/17/1998 0600-0700 MST




SIMULATED MAX 92.1 MIN 79.8 AVG 87.2
OBSERVED MAX 91.0 MIN 84.0 AVG 89.7

MAX AT (21,16)

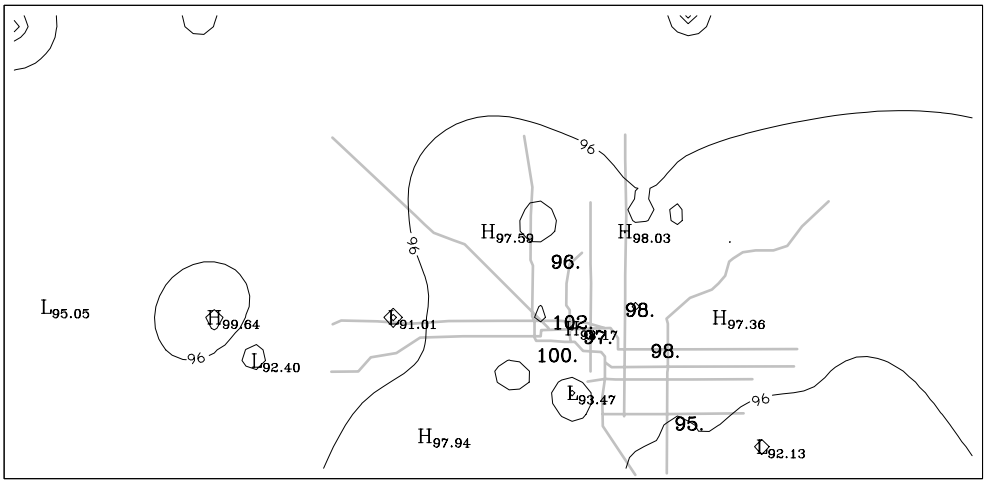
UAM SURFACE TEMPERATURE (F)
7/17/1998 0700-0800 MST




SIMULATED MAX 96.8 MIN 81.7 AVG 91.1
OBSERVED MAX 100.0 MIN 91.0 AVG 94.9

MAX AT (21,16)

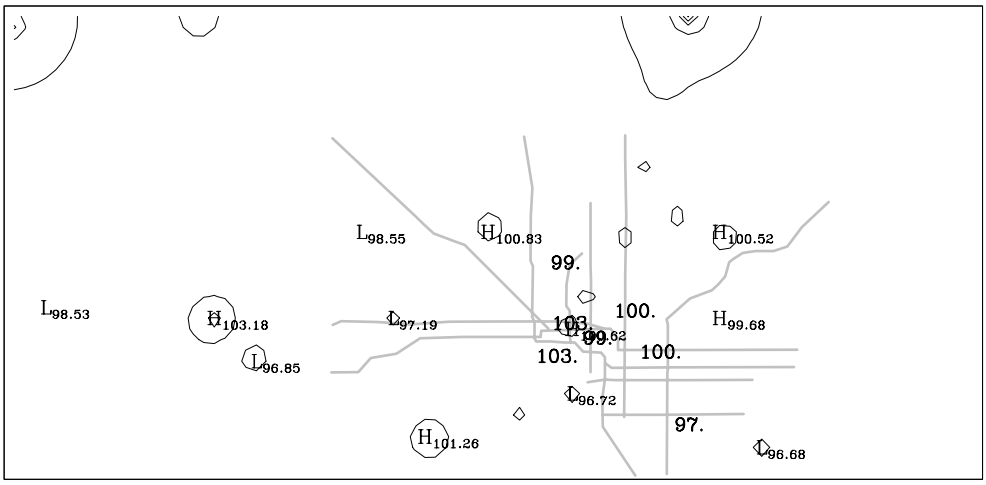
UAM SURFACE TEMPERATURE (F)
7/17/1998 0800–0900 MST




SIMULATED MAX 99.6 MIN 88.6 AVG 95.9
OBSERVED MAX 102.0 MIN 95.0 AVG 98.0

MAX AT (21,16)

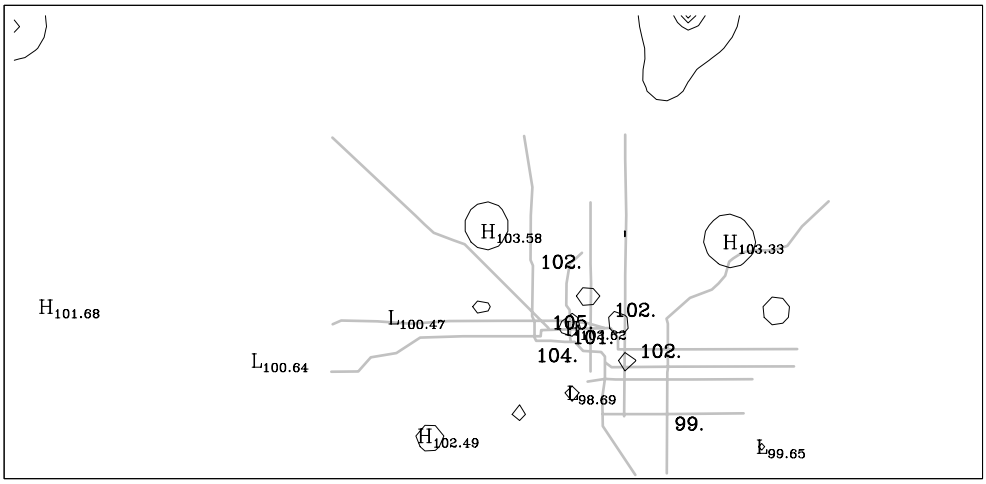
UAM SURFACE TEMPERATURE (F)
7/17/1998 0900–1000 MST




SIMULATED MAX 103.2 MIN 89.8 AVG 98.9
OBSERVED MAX 103.0 MIN 97.0 AVG 100.1

MAX AT (21,16)

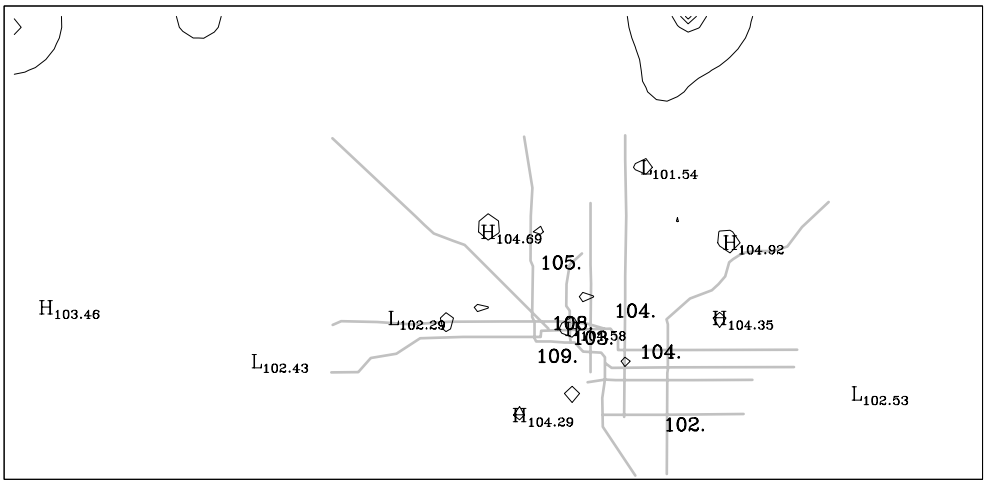
UAM SURFACE TEMPERATURE (F)
7/17/1998 1000–1100 MST




SIMULATED MAX 103.6 MIN 93.1 AVG 101.2
OBSERVED MAX 105.0 MIN 99.0 AVG 102.1

MAX AT (47,24)

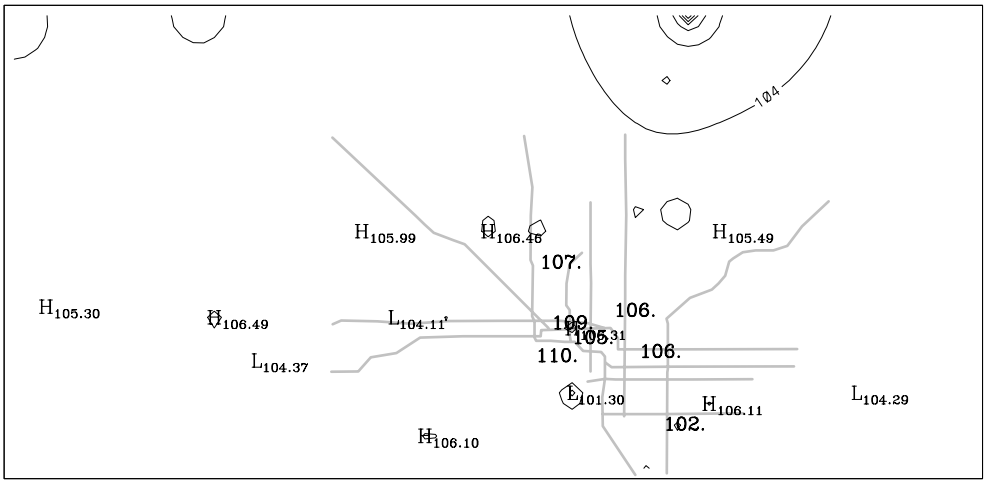
UAM SURFACE TEMPERATURE (F)
7/17/1998 1100–1200 MST




SIMULATED MAX 104.9 MIN 94.9 AVG 103.0
OBSERVED MAX 109.0 MIN 102.0 AVG 105.0

MAX AT (70,23)

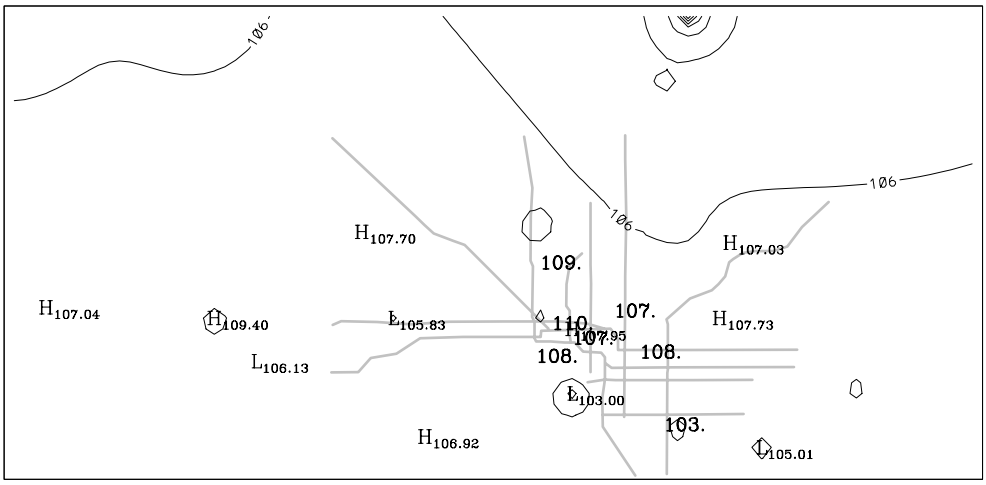
UAM SURFACE TEMPERATURE (F)
7/17/1998 1200–1300 MST




SIMULATED MAX 106.5 MIN 92.3 AVG 104.7
OBSERVED MAX 110.0 MIN 102.0 AVG 106.4

MAX AT (21,16)

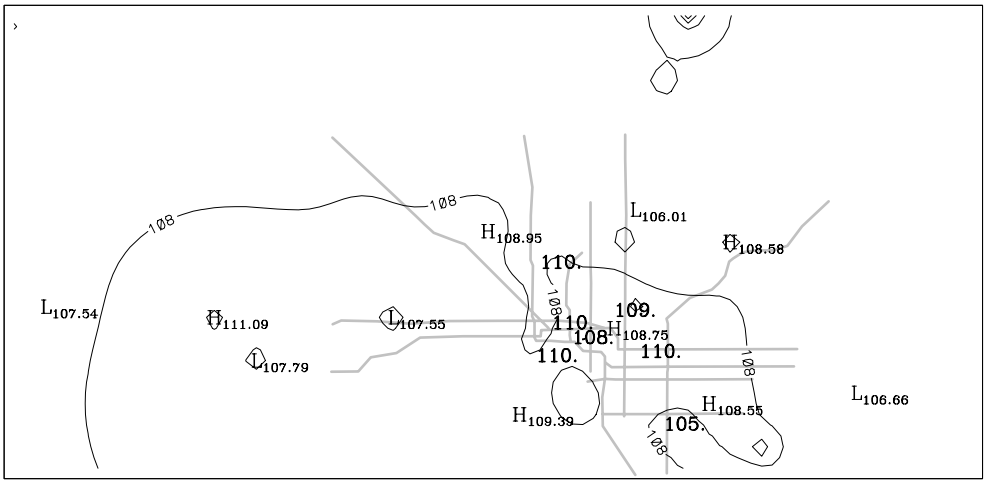
UAM SURFACE TEMPERATURE (F)
7/17/1998 1300–1400 MST




SIMULATED MAX 109.4 MIN 92.6 AVG 106.2
OBSERVED MAX 110.0 MIN 103.0 AVG 107.4

MAX AT (21,16)

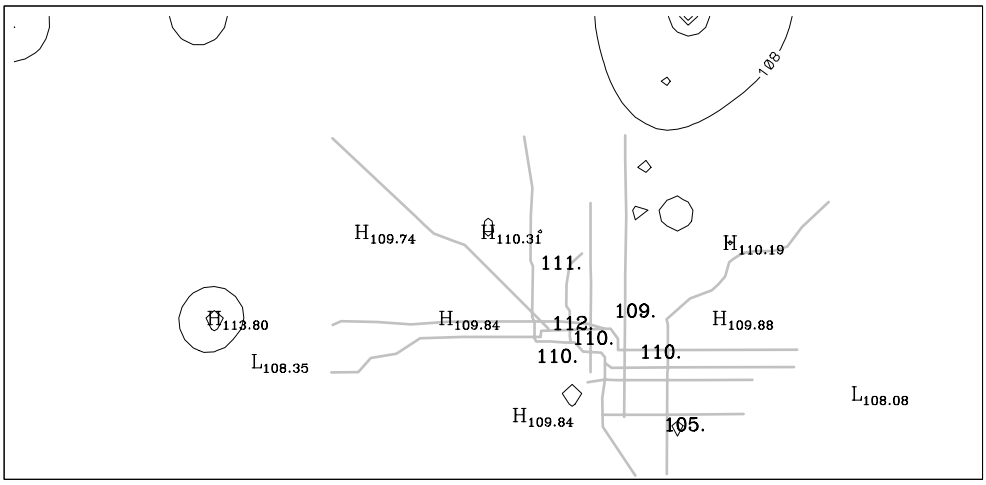
UAM SURFACE TEMPERATURE (F)
7/17/1998 1400-1500 MST




SIMULATED MAX 111.1 MIN 98.7 AVG 107.7
OBSERVED MAX 110.0 MIN 105.0 AVG 108.9

MAX AT (21,16)

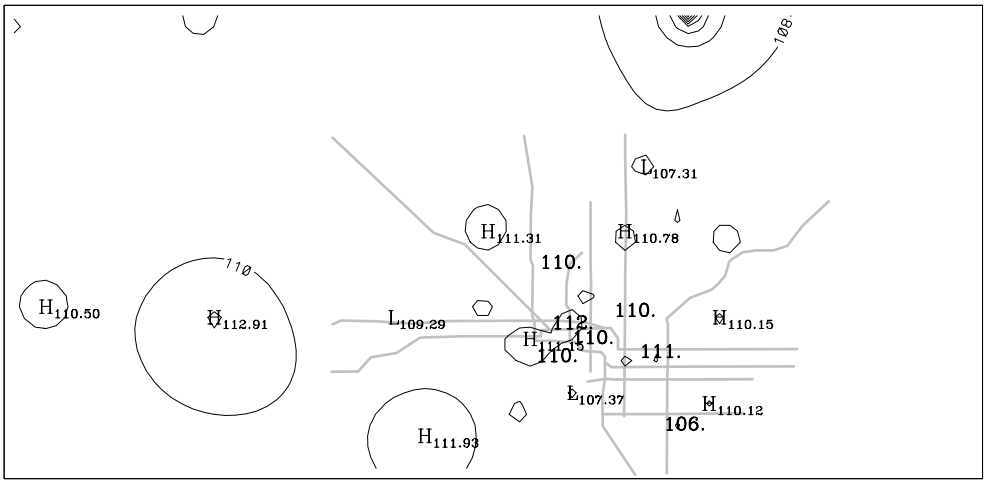
UAM SURFACE TEMPERATURE (F)
7/17/1998 1500-1600 MST




SIMULATED MAX 113.8 MIN 100.3 AVG 108.8
OBSERVED MAX 112.0 MIN 105.0 AVG 109.6

MAX AT (21,16)

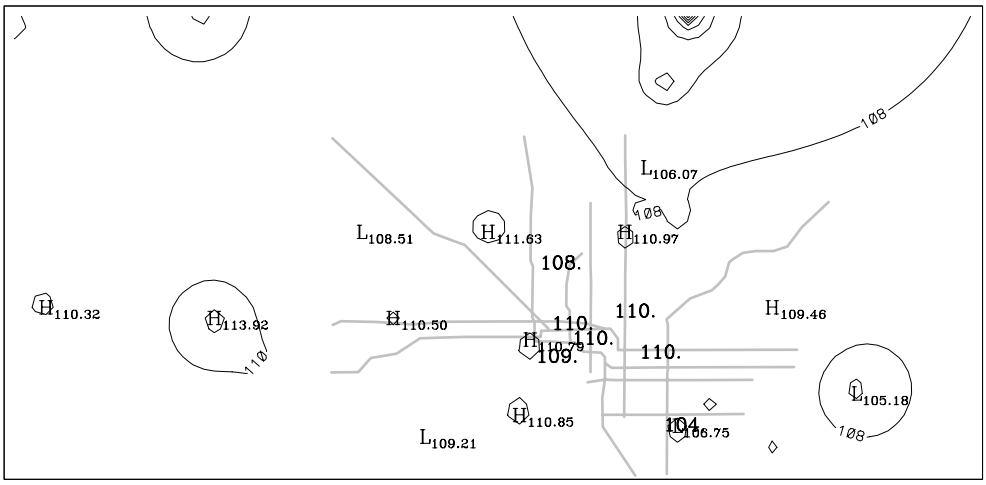
UAM SURFACE TEMPERATURE (F)
7/17/1998 1600–1700 MST




SIMULATED MAX 112.9 MIN 93.2 AVG 109.3
OBSERVED MAX 112.0 MIN 106.0 AVG 109.9

MAX AT (21,16)

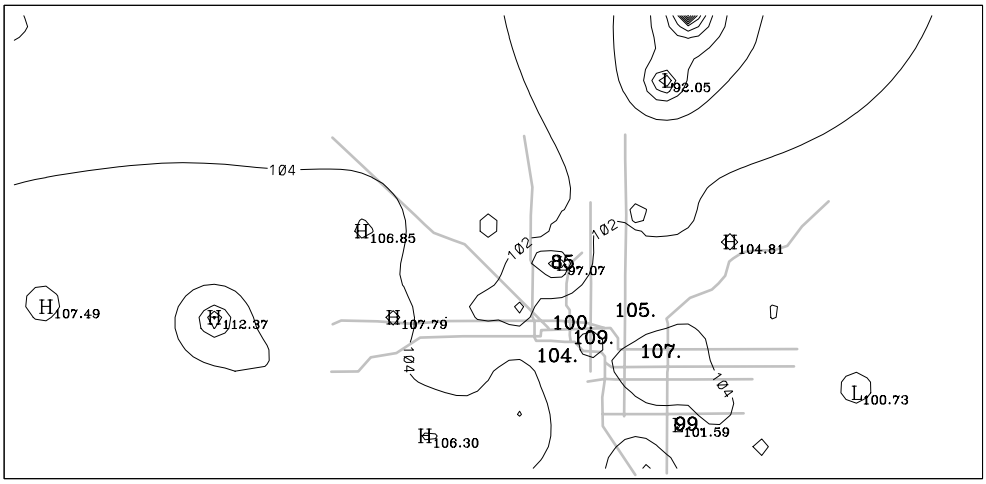
UAM SURFACE TEMPERATURE (F)
7/17/1998 1700–1800 MST




SIMULATED MAX 113.9 MIN 93.0 AVG 108.6
OBSERVED MAX 110.0 MIN 104.0 AVG 108.7

MAX AT (21,16)

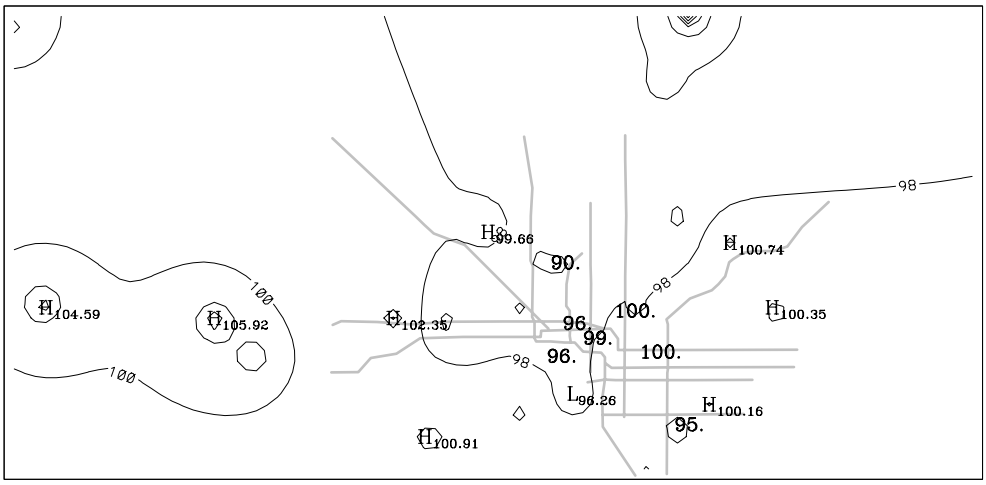
UAM SURFACE TEMPERATURE (F)
7/17/1998 1800-1900 MST




SIMULATED MAX 112.4 MIN 81.5 AVG 103.2
OBSERVED MAX 109.0 MIN 85.0 AVG 101.3

MAX AT (21,16)

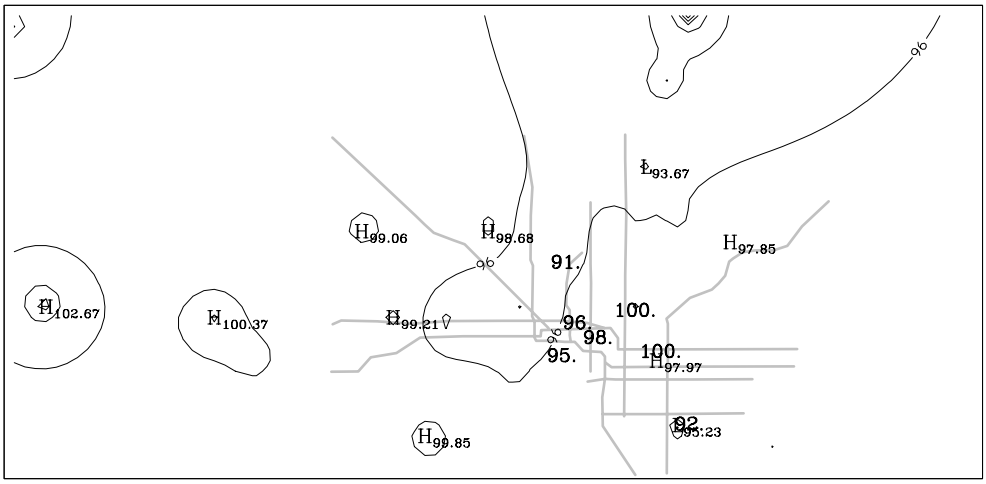
UAM SURFACE TEMPERATURE (F)
7/17/1998 1900-2000 MST




SIMULATED MAX 105.9 MIN 85.2 AVG 98.4
OBSERVED MAX 100.0 MIN 90.0 AVG 96.6

MAX AT (21,16)

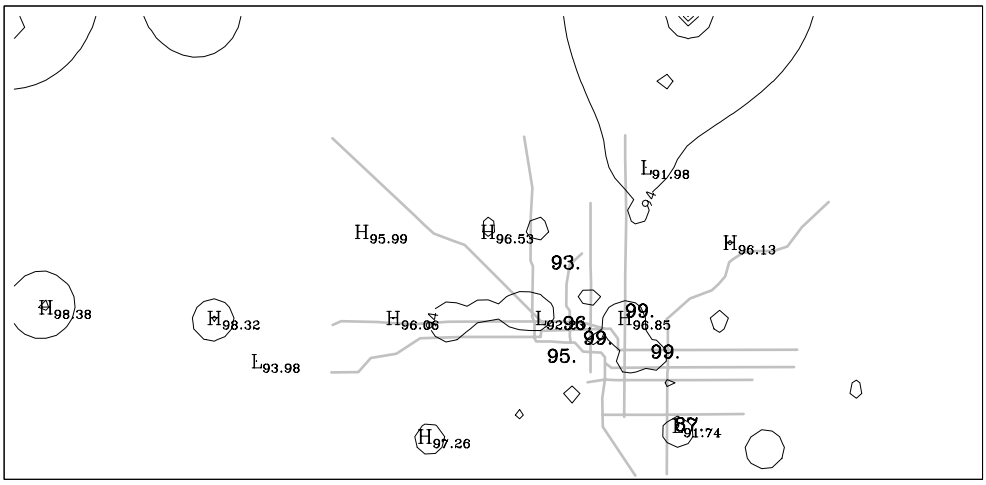
UAM SURFACE TEMPERATURE (F)
7/17/1998 2000-2100 MST




SIMULATED MAX 102.7 MIN 84.8 AVG 96.6
OBSERVED MAX 100.0 MIN 91.0 AVG 96.0

MAX AT (05,17)

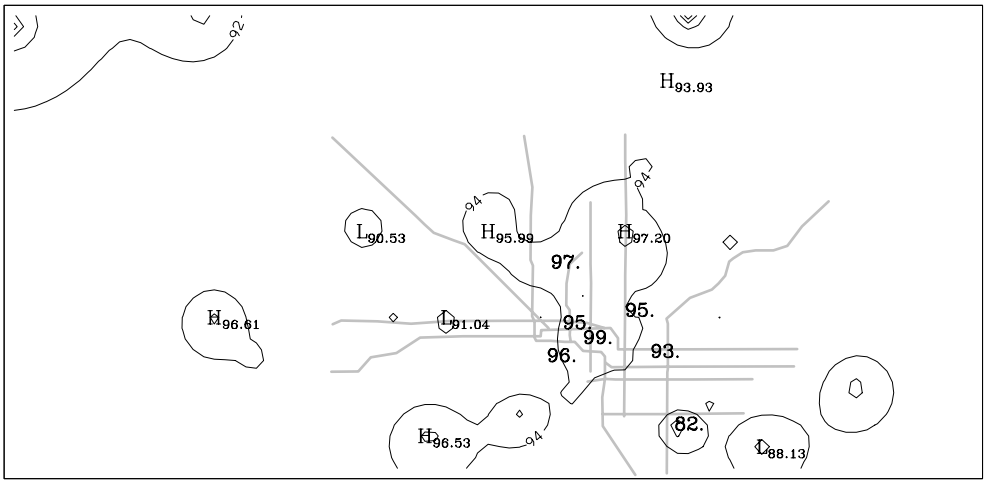
UAM SURFACE TEMPERATURE (F)
7/17/1998 2100-2200 MST




SIMULATED MAX 98.4 MIN 85.9 AVG 94.7
OBSERVED MAX 99.0 MIN 87.0 AVG 95.4

MAX AT (05,17)

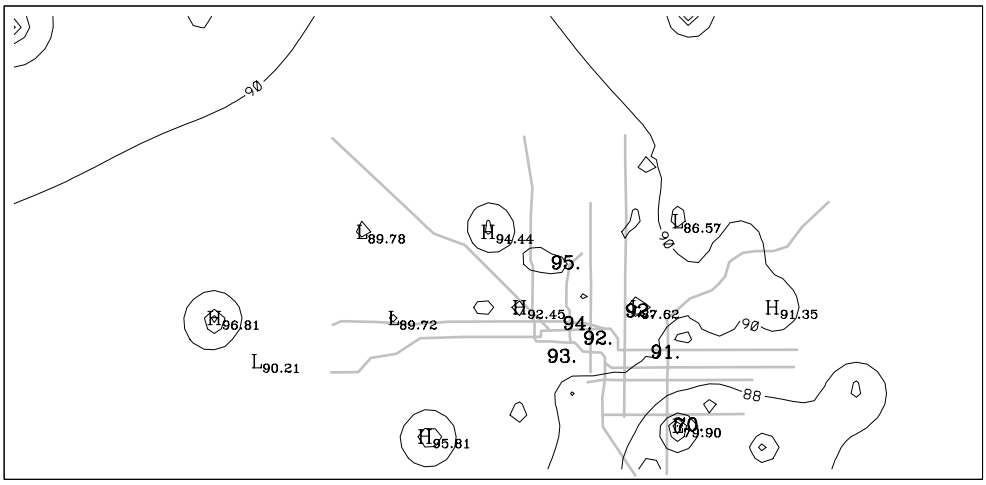
UAM SURFACE TEMPERATURE (F)
7/17/1998 2200-2300 MST




SIMULATED MAX 97.2 MIN 84.3 AVG 93.1
OBSERVED MAX 99.0 MIN 82.0 AVG 93.9

MAX AT (60,24)

UAM SURFACE TEMPERATURE (F)
7/17/1998 2300-2400 MST




SIMULATED MAX 96.8 MIN 79.9 AVG 90.0
OBSERVED MAX 95.0 MIN 70.0 AVG 89.6

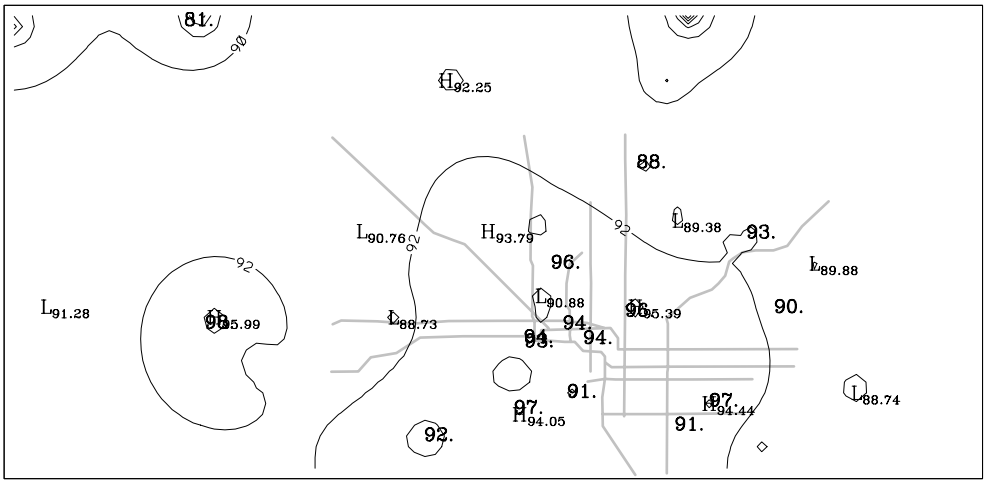
MAX AT (21,16)

Appendix IV-iv

# SURFACE TEMPERATURE FIELDS FOR 1999 EPISODE

The isopleth plots shown here are the simulated UAM and observed surface temperatures. The bold numbers indicate the observed surface temperatures. These hourly plots are from hour 0 on August 23, 1999 to hour 2400 on August 24, 1999.

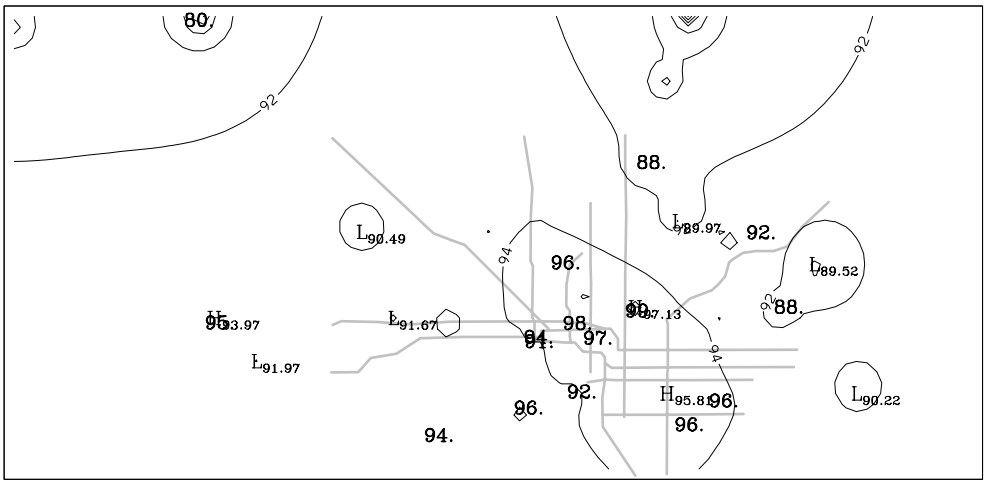
UAM SURFACE TEMPERATURE (F)
8/23/1999 0000-0100 MST




SIMULATED MAX 96.0 MIN 78.3 AVG 91.5
OBSERVED MAX 98.0 MIN 81.0 AVG 92.8

MAX AT (21,16)

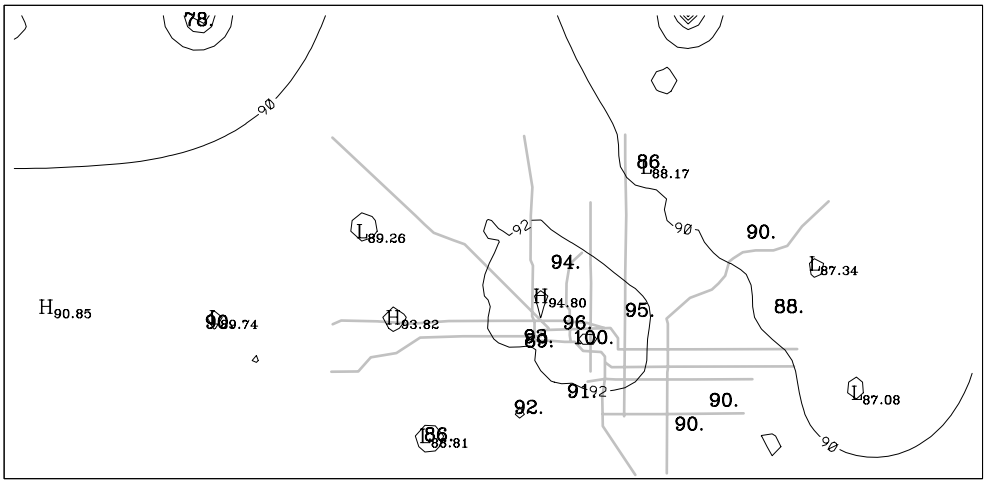
UAM SURFACE TEMPERATURE (F)
8/23/1999 0100-0200 MST




SIMULATED MAX 97.1 MIN 79.9 AVG 92.6
OBSERVED MAX 99.0 MIN 80.0 AVG 93.2

MAX AT (61,17)

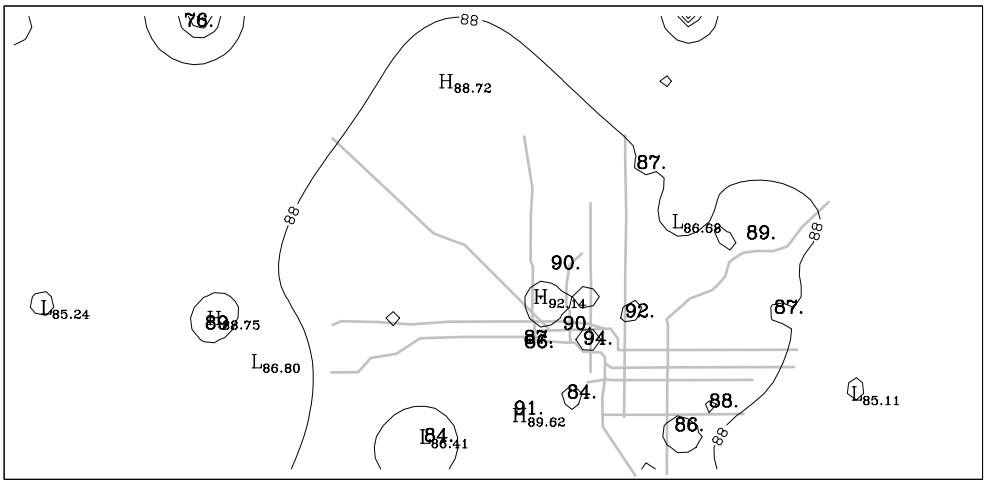
UAM SURFACE TEMPERATURE (F)
8/23/1999 0200-0300 MST




SIMULATED MAX 94.8 MIN 79.4 AVG 90.3
OBSERVED MAX 100.0 MIN 78.0 AVG 90.5

MAX AT (52,18)

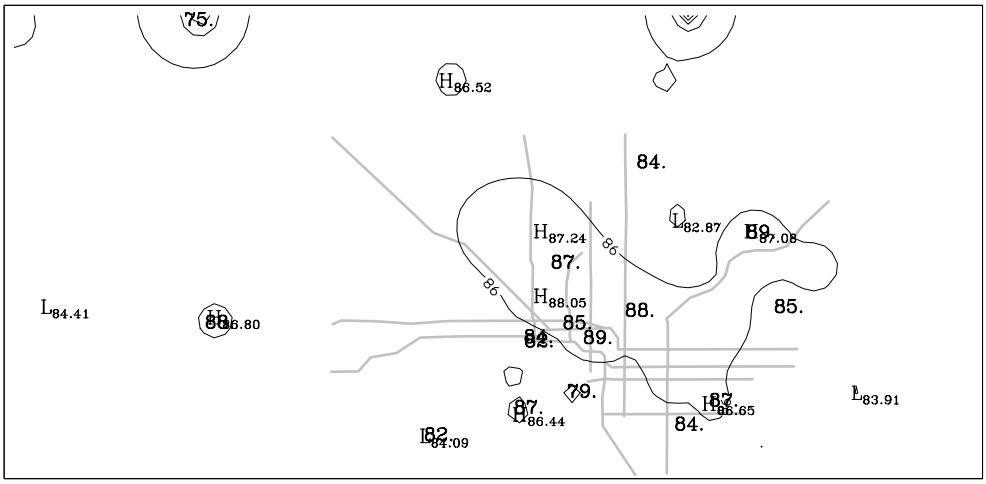
UAM SURFACE TEMPERATURE (F)
8/23/1999 0300-0400 MST




SIMULATED MAX 92.1 MIN 78.9 AVG 87.9
OBSERVED MAX 94.0 MIN 76.0 AVG 87.5

MAX AT (52,18)

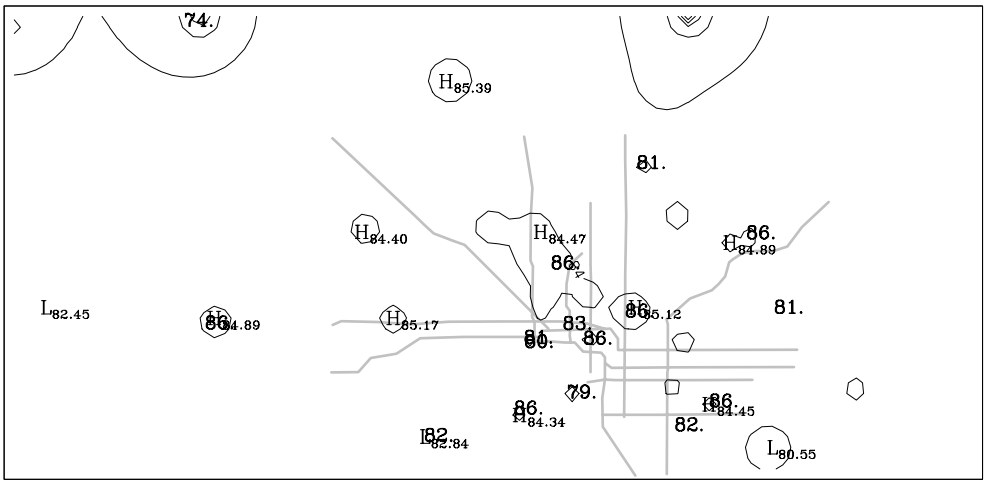
UAM SURFACE TEMPERATURE (F)
8/23/1999 0400-0500 MST




SIMULATED MAX 88.1 MIN 75.6 AVG 85.4
OBSERVED MAX 89.0 MIN 75.0 AVG 84.7

MAX AT (52,18)

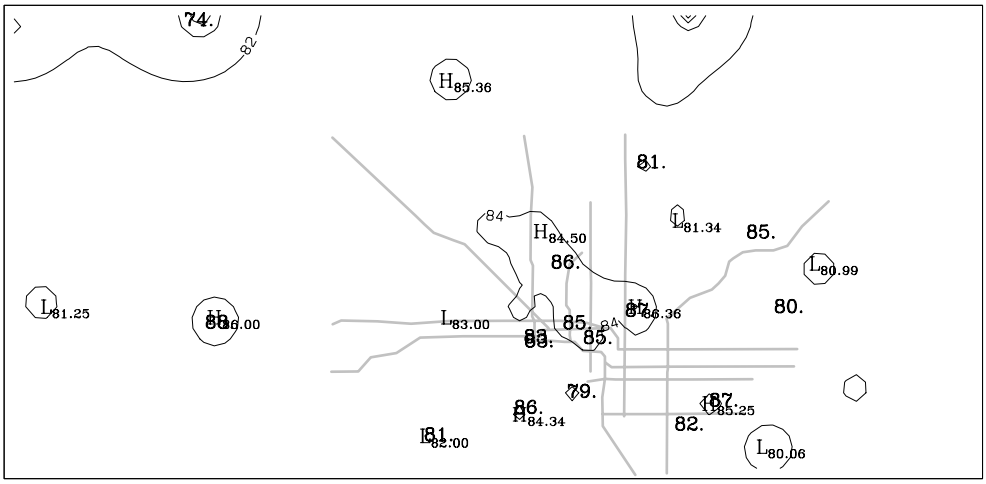
UAM SURFACE TEMPERATURE (F)
8/23/1999 0500-0600 MST




SIMULATED MAX 85.4 MIN 72.3 AVG 83.0
OBSERVED MAX 86.0 MIN 74.0 AVG 82.8

MAX AT (43,38)

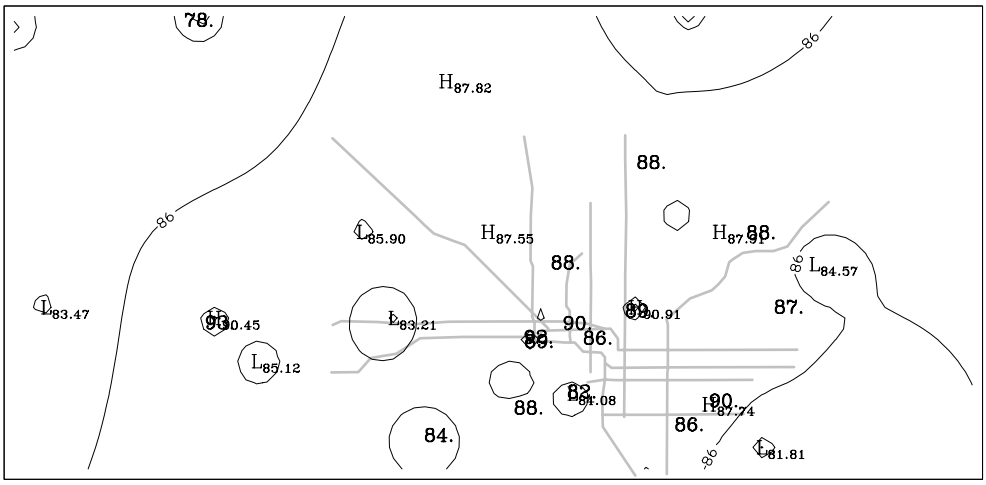
UAM SURFACE TEMPERATURE (F)
8/23/1999 0600-0700 MST




SIMULATED MAX 86.4 MIN 75.1 AVG 82.9
OBSERVED MAX 88.0 MIN 74.0 AVG 83.2

MAX AT (61,17)

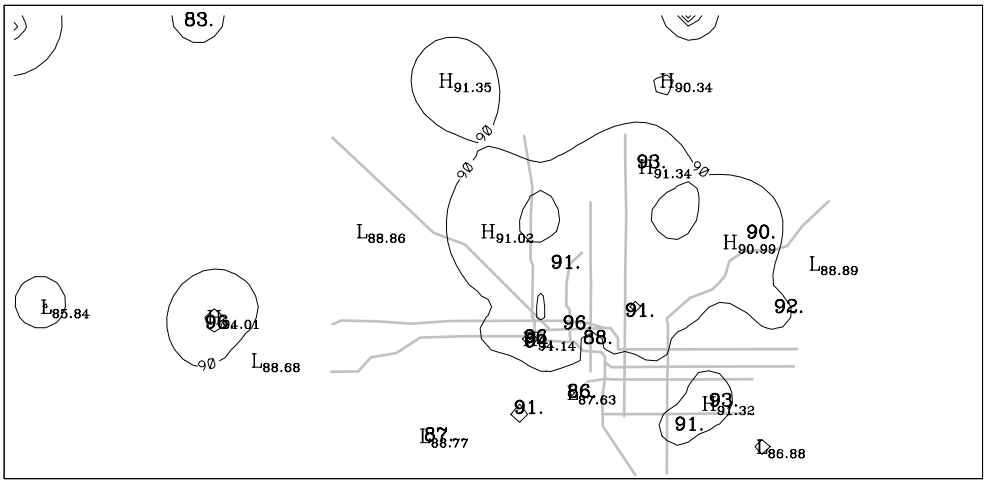
UAM SURFACE TEMPERATURE (F)
8/23/1999 0700-0800 MST




SIMULATED MAX 90.9 MIN 80.1 AVG 86.1
OBSERVED MAX 93.0 MIN 78.0 AVG 87.4

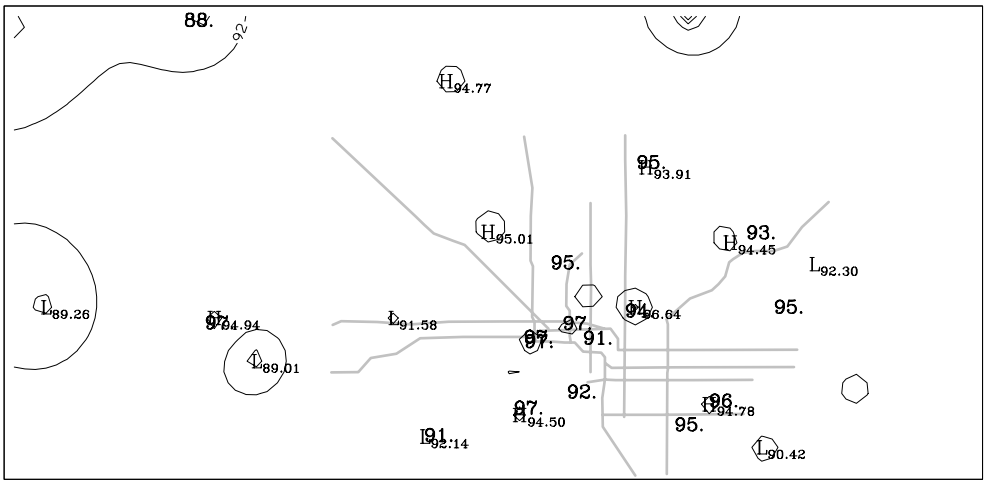
MAX AT (61,17)

UAM SURFACE TEMPERATURE (F)
8/23/1999 0800-0900 MST



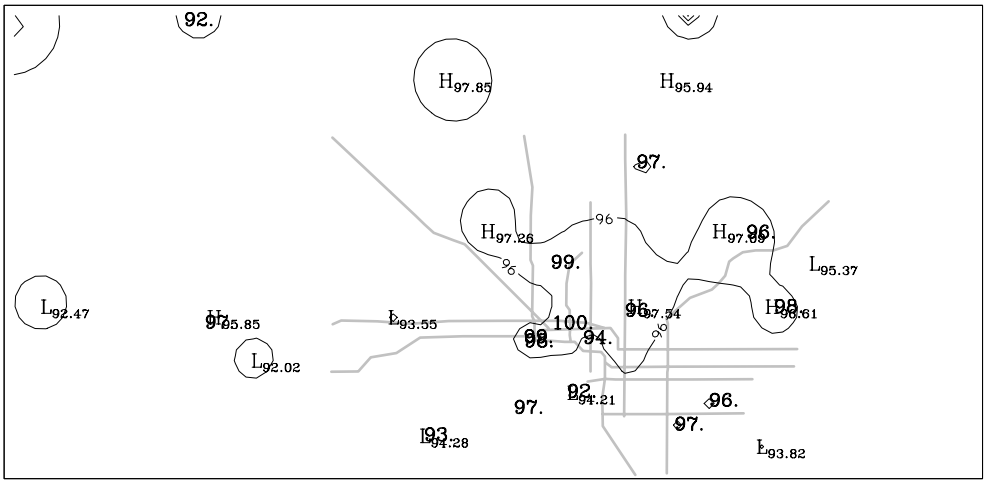

SIMULATED MAX 94.1 MIN 80.9 AVG 89.6 MAX AT (51,14)
OBSERVED MAX 96.0 MIN 83.0 AVG 91.1

UAM SURFACE TEMPERATURE (F)
8/23/1999 0900-1000 MST




SIMULATED MAX 96.6 MIN 84.4 AVG 92.8 MAX AT (61,17)
OBSERVED MAX 97.0 MIN 88.0 AVG 94.4

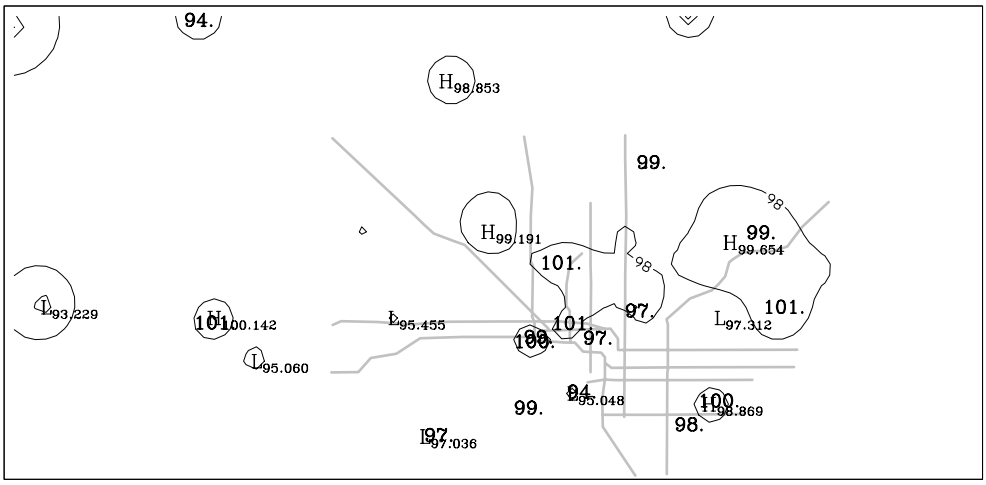
UAM SURFACE TEMPERATURE (F)
8/23/1999 1000–1100 MST




SIMULATED MAX 97.9 MIN 87.8 AVG 95.3
OBSERVED MAX 100.0 MIN 92.0 AVG 96.3

MAX AT (43,38)

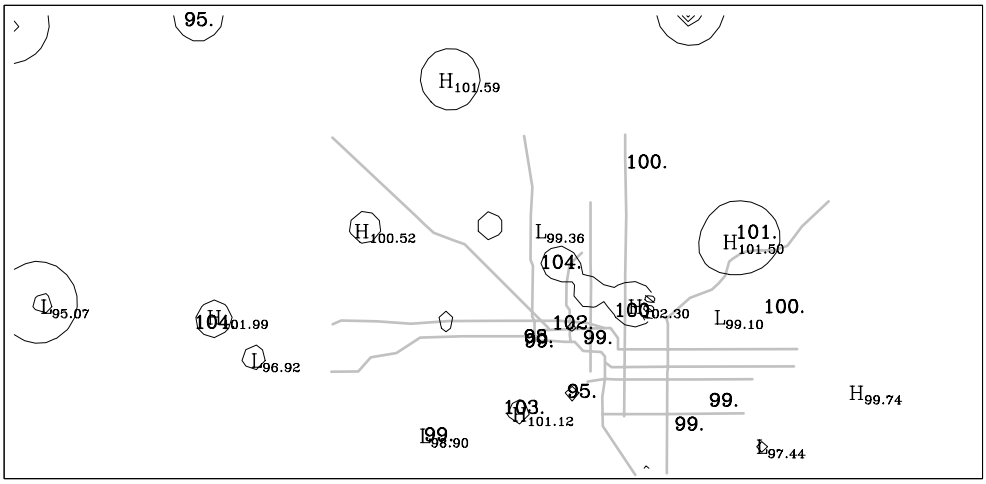
UAM SURFACE TEMPERATURE (F)
8/23/1999 1100–1200 MST




SIMULATED MAX 100.3 MIN 91.1 AVG 97.4
OBSERVED MAX 101.0 MIN 94.0 AVG 98.6

MAX AT (61,17)

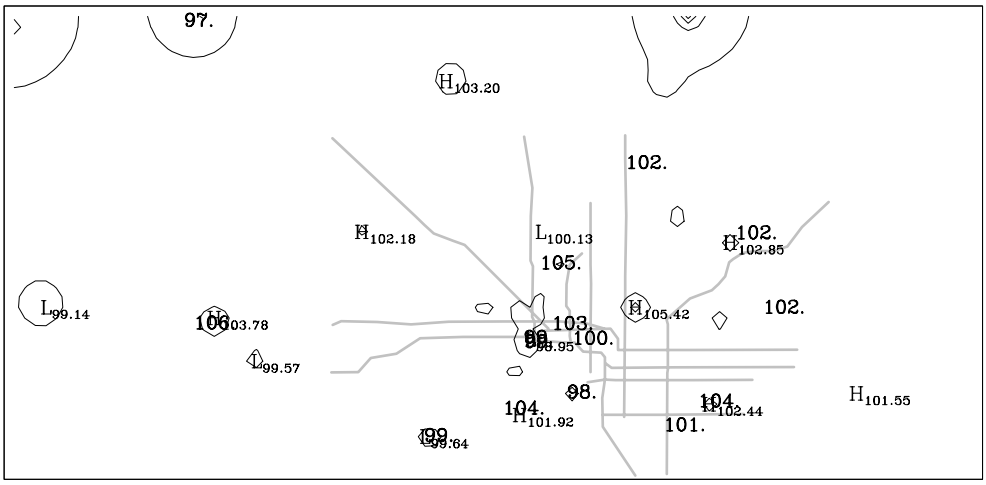
UAM SURFACE TEMPERATURE (F)
8/23/1999 1200–1300 MST




SIMULATED MAX 102.3 MIN 91.5 AVG 99.3
OBSERVED MAX 104.0 MIN 95.0 AVG 99.8

MAX AT (61,17)

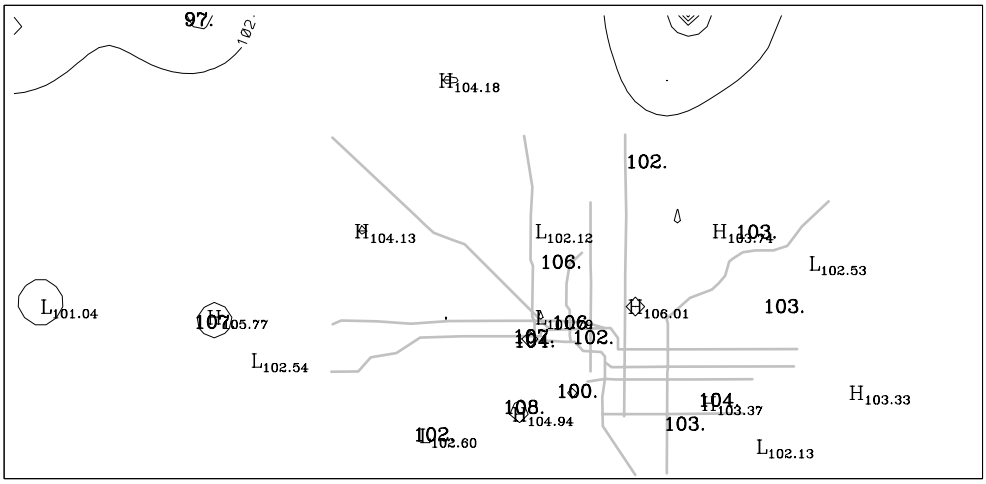
UAM SURFACE TEMPERATURE (F)
8/23/1999 1300–1400 MST




SIMULATED MAX 105.4 MIN 93.1 AVG 100.8
OBSERVED MAX 106.0 MIN 97.0 AVG 101.4

MAX AT (61,17)

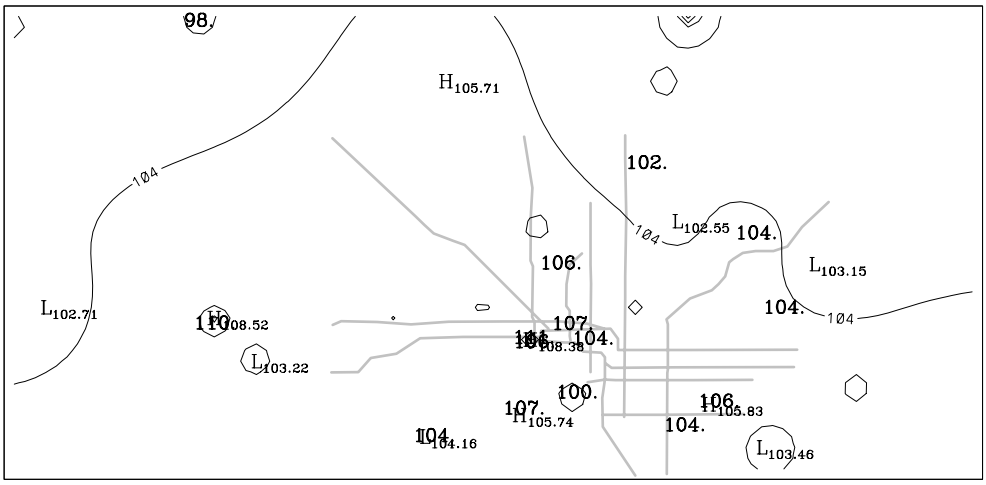
UAM SURFACE TEMPERATURE (F)
8/23/1999 1400–1500 MST




SIMULATED MAX 106.0 MIN 93.4 AVG 102.8
OBSERVED MAX 108.0 MIN 97.0 AVG 103.6

MAX AT (61,17)

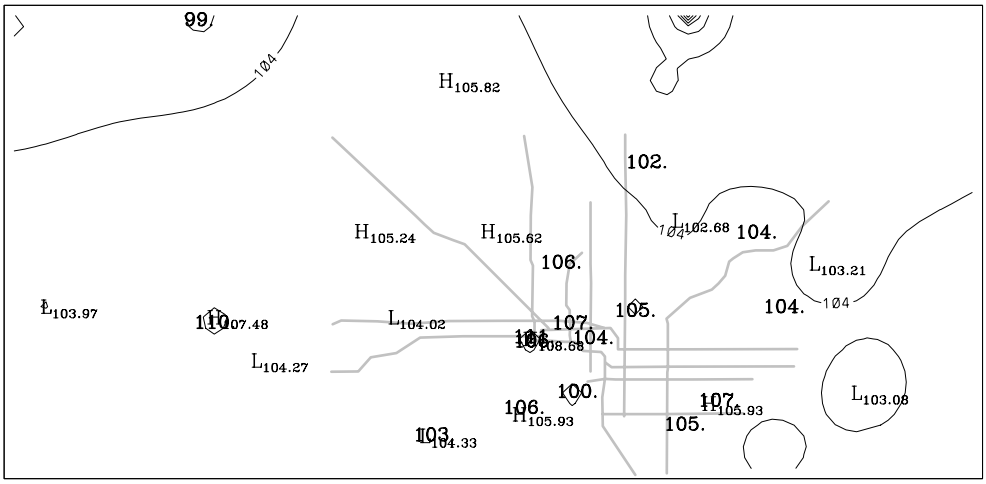
UAM SURFACE TEMPERATURE (F)
8/23/1999 1500–1600 MST




SIMULATED MAX 108.5 MIN 95.1 AVG 104.1
OBSERVED MAX 111.0 MIN 98.0 AVG 104.9

MAX AT (21,16)

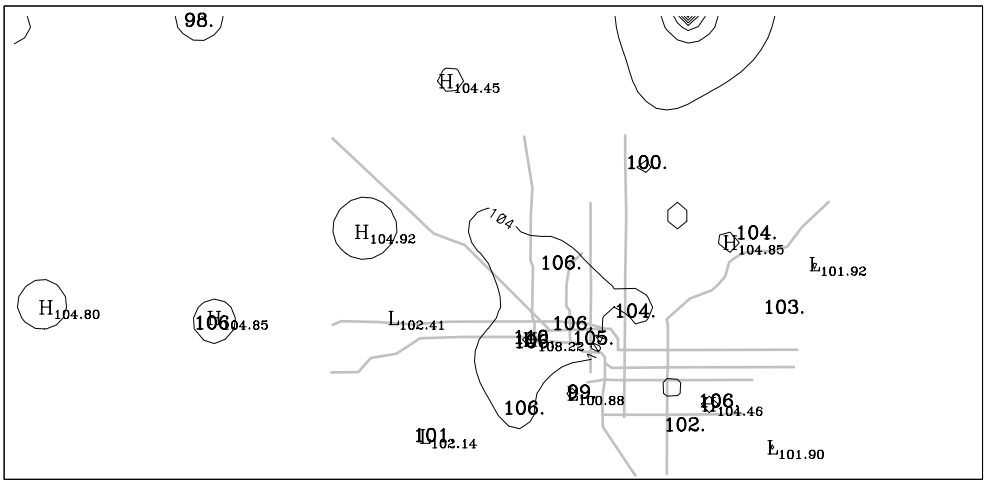
UAM SURFACE TEMPERATURE (F)
8/23/1999 1600–1700 MST




SIMULATED MAX 108.7 MIN 91.0 AVG 104.3
OBSERVED MAX 111.0 MIN 99.0 AVG 104.9

MAX AT (51,14)

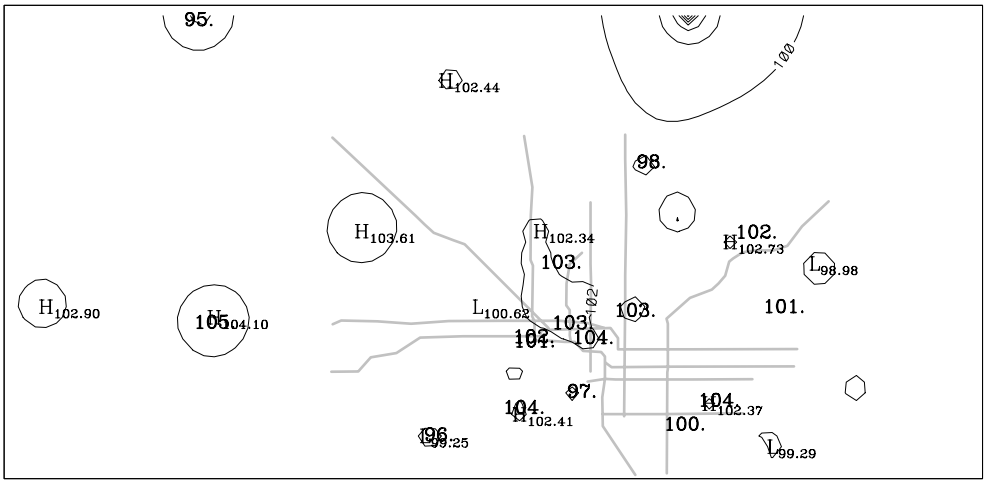
UAM SURFACE TEMPERATURE (F)
8/23/1999 1700–1800 MST




SIMULATED MAX 108.2 MIN 89.3 AVG 103.3
OBSERVED MAX 110.0 MIN 98.0 AVG 103.9

MAX AT (51,14)

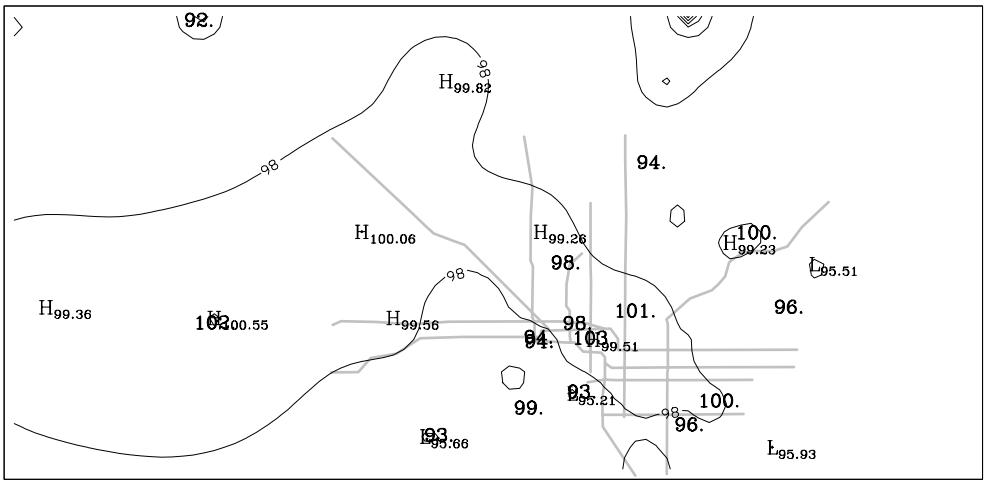
UAM SURFACE TEMPERATURE (F)
8/23/1999 1800-1900 MST




SIMULATED MAX 104.1 MIN 87.4 AVG 101.1
OBSERVED MAX 105.0 MIN 95.0 AVG 101.1

MAX AT (21,16)

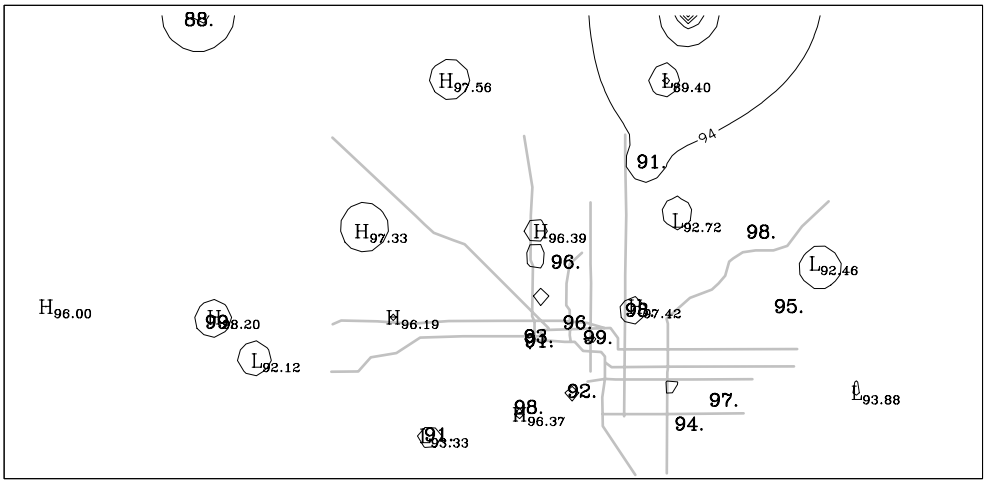
UAM SURFACE TEMPERATURE (F)
8/23/1999 1900-2000 MST




SIMULATED MAX 100.6 MIN 85.3 AVG 97.6
OBSERVED MAX 103.0 MIN 92.0 AVG 97.1

MAX AT (21,16)

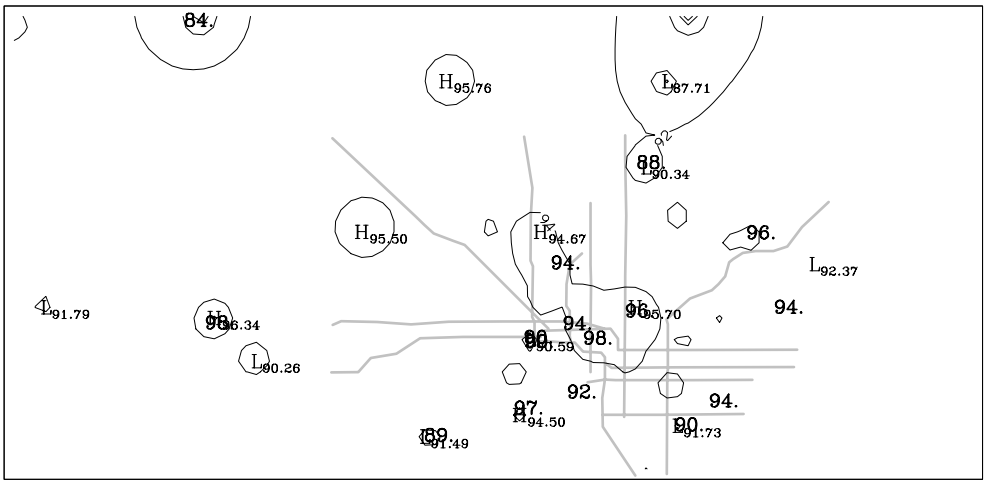
UAM SURFACE TEMPERATURE (F)
8/23/1999 2000-2100 MST




SIMULATED MAX 98.2 MIN 83.2 AVG 94.9
OBSERVED MAX 99.0 MIN 88.0 AVG 94.8

MAX AT (21,16)

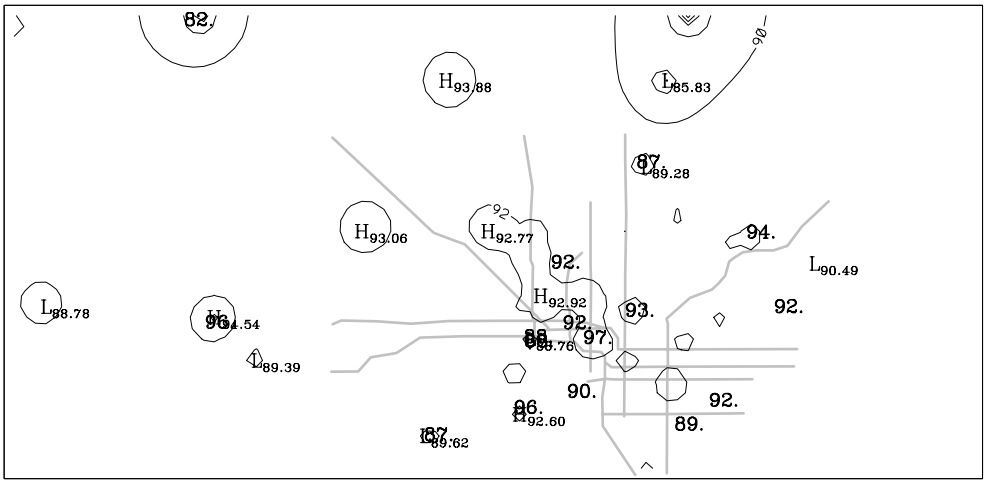
UAM SURFACE TEMPERATURE (F)
8/23/1999 2100-2200 MST




SIMULATED MAX 96.3 MIN 84.3 AVG 93.0
OBSERVED MAX 98.0 MIN 84.0 AVG 92.8

MAX AT (21,16)

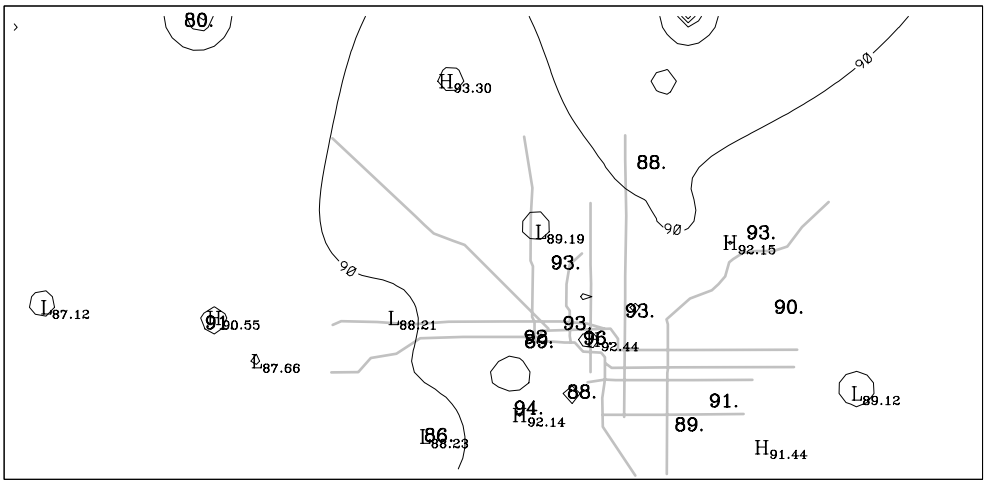
UAM SURFACE TEMPERATURE (F)
8/23/1999 2200-2300 MST




SIMULATED MAX 94.5 MIN 81.1 AVG 91.1
OBSERVED MAX 97.0 MIN 82.0 AVG 90.9

MAX AT (21,16)

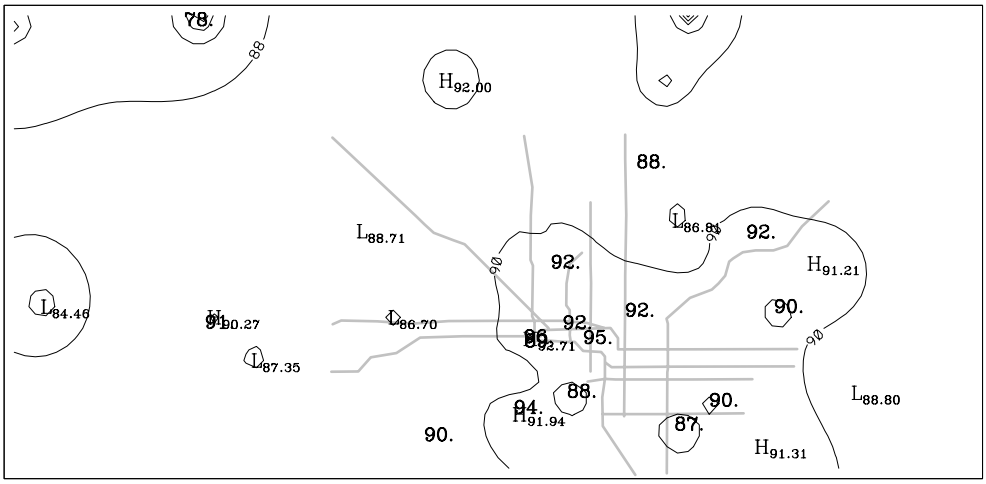
UAM SURFACE TEMPERATURE (F)
8/23/1999 2300-2400 MST




SIMULATED MAX 93.3 MIN 80.9 AVG 90.0
OBSERVED MAX 96.0 MIN 80.0 AVG 90.4

MAX AT (43,38)

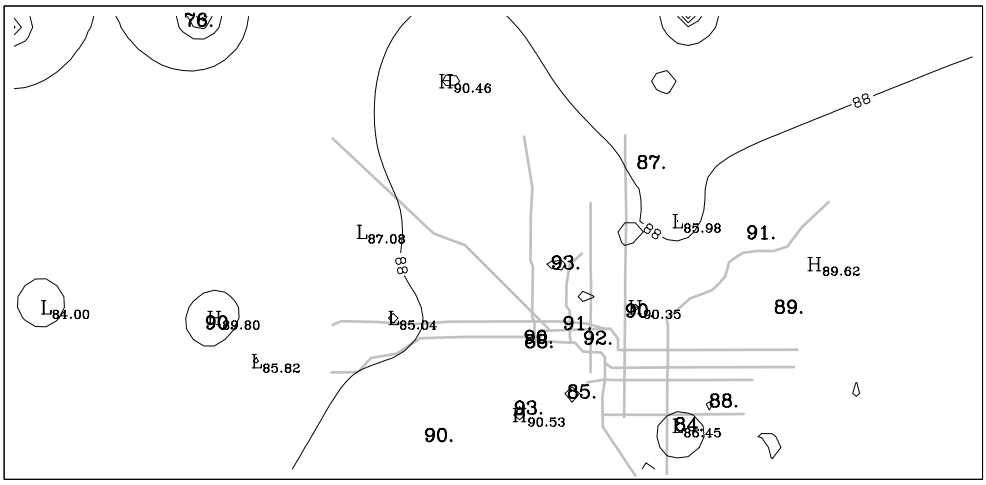
UAM SURFACE TEMPERATURE (F)
8/24/1999 0000-0100 MST




SIMULATED MAX 92.7 MIN 79.3 AVG 89.2
OBSERVED MAX 96.0 MIN 78.0 AVG 90.2

MAX AT (51,14)

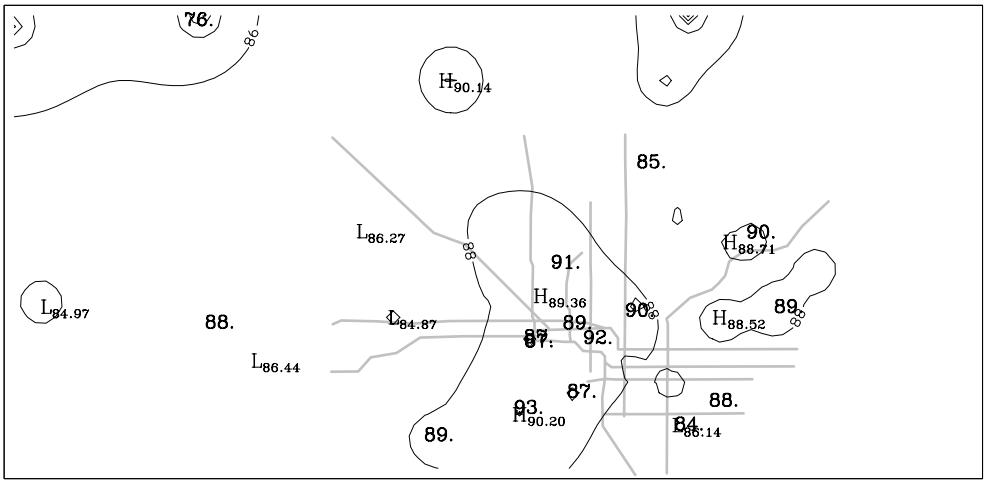
UAM SURFACE TEMPERATURE (F)
8/24/1999 0100-0200 MST




SIMULATED MAX 90.5 MIN 78.8 AVG 87.9
OBSERVED MAX 93.0 MIN 76.0 AVG 88.6

MAX AT (50,07)

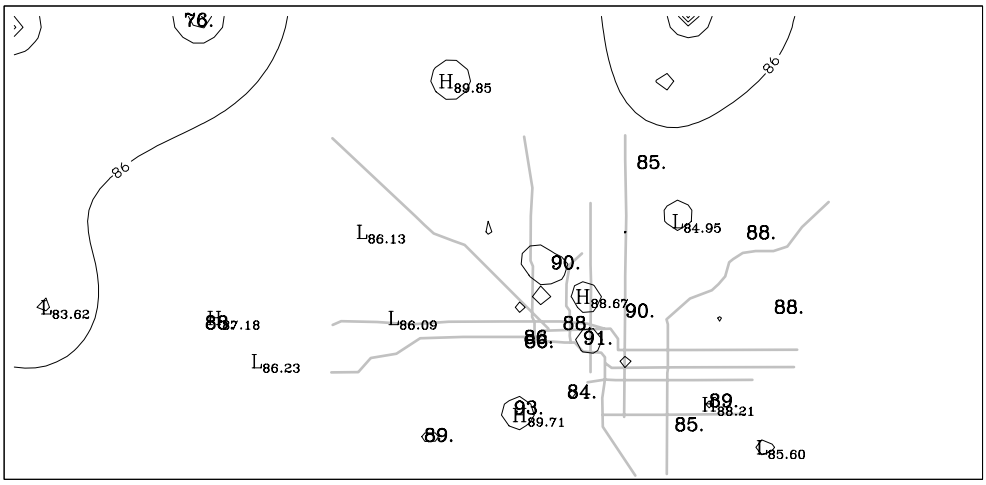
UAM SURFACE TEMPERATURE (F)
8/24/1999 0200-0300 MST




SIMULATED MAX 90.2 MIN 77.5 AVG 87.2
OBSERVED MAX 93.0 MIN 76.0 AVG 87.8

MAX AT (50,07)

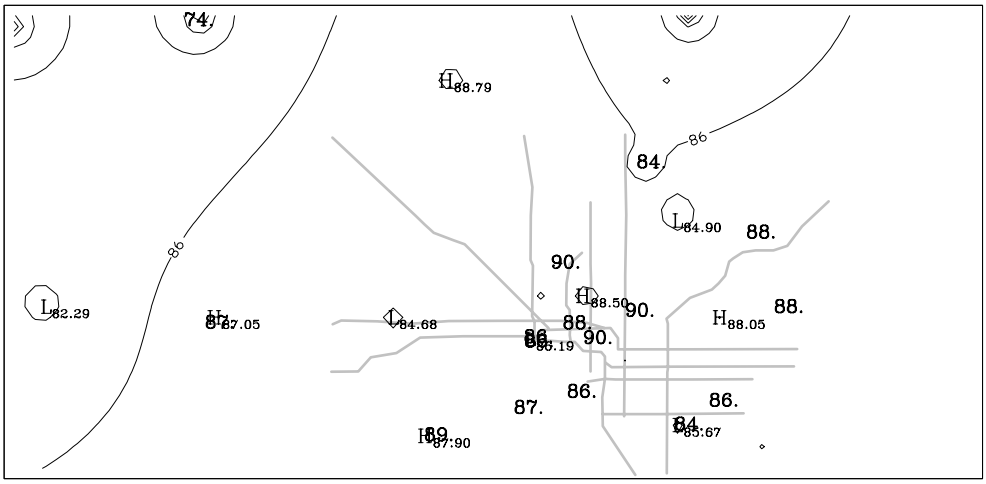
UAM SURFACE TEMPERATURE (F)
8/24/1999 0300-0400 MST




SIMULATED MAX 89.9 MIN 77.3 AVG 86.6
OBSERVED MAX 93.0 MIN 76.0 AVG 87.2

MAX AT (43,38)

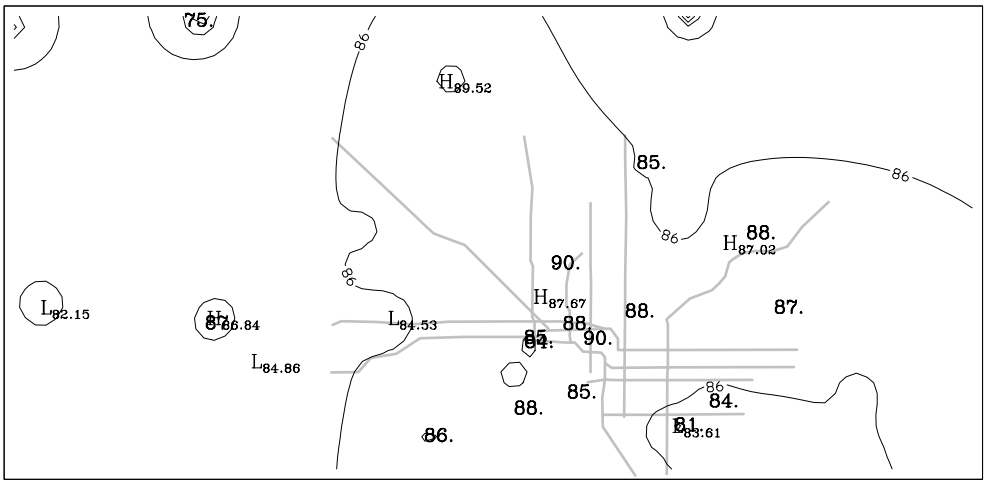
UAM SURFACE TEMPERATURE (F)
8/24/1999 0400–0500 MST




SIMULATED MAX 88.8 MIN 75.9 AVG 86.3
OBSERVED MAX 90.0 MIN 74.0 AVG 86.4

MAX AT (43,38)

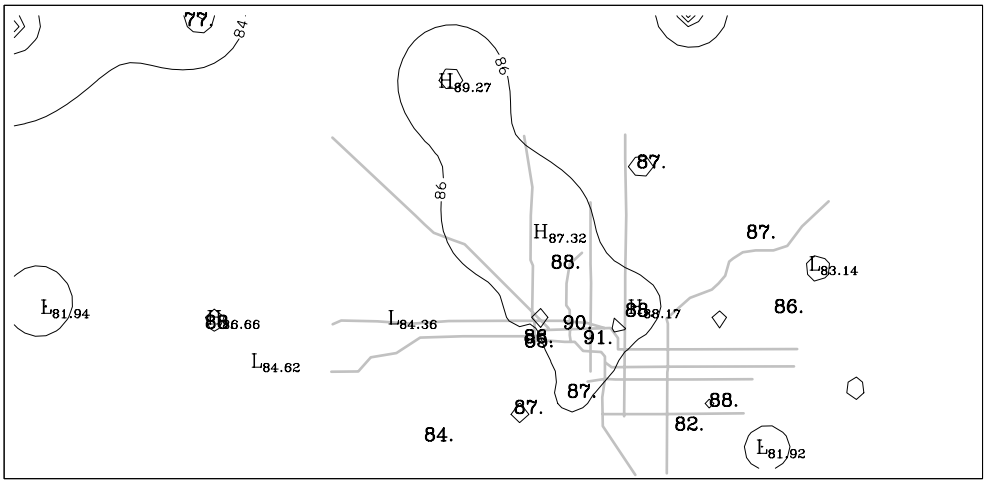
UAM SURFACE TEMPERATURE (F)
8/24/1999 0500–0600 MST




SIMULATED MAX 89.5 MIN 77.3 AVG 85.8
OBSERVED MAX 90.0 MIN 75.0 AVG 85.7

MAX AT (43,38)

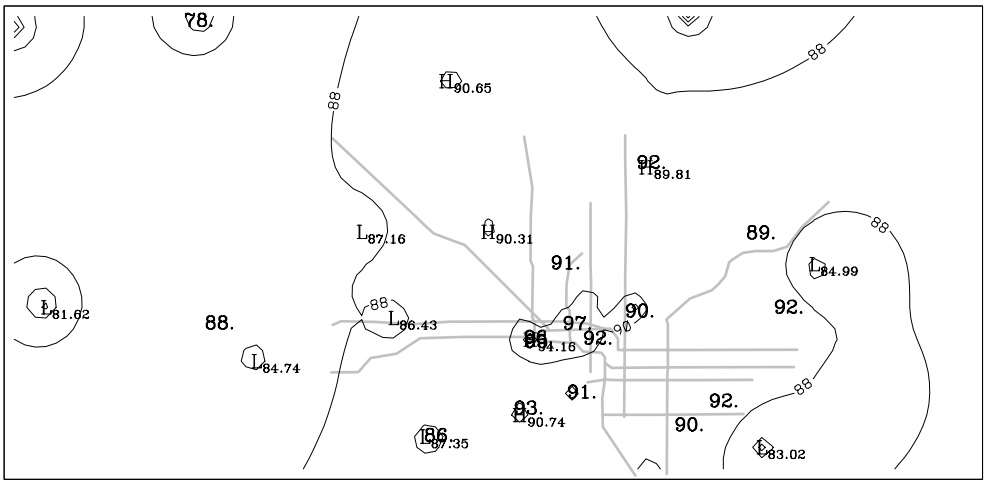
UAM SURFACE TEMPERATURE (F)
8/24/1999 0600-0700 MST




SIMULATED MAX 89.3 MIN 76.3 AVG 85.2
OBSERVED MAX 91.0 MIN 77.0 AVG 86.3

MAX AT (43,38)

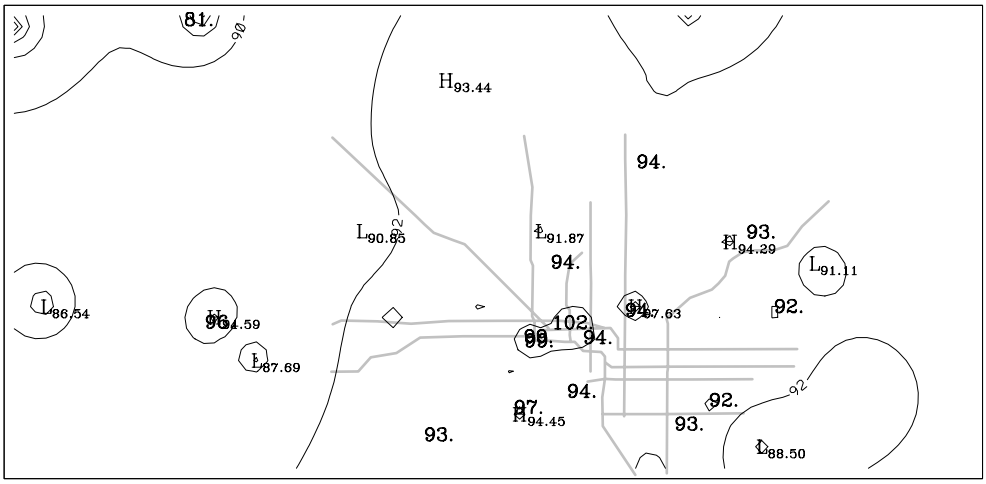
UAM SURFACE TEMPERATURE (F)
8/24/1999 0700-0800 MST




SIMULATED MAX 94.2 MIN 78.2 AVG 87.9
OBSERVED MAX 97.0 MIN 78.0 AVG 90.8

MAX AT (51,14)

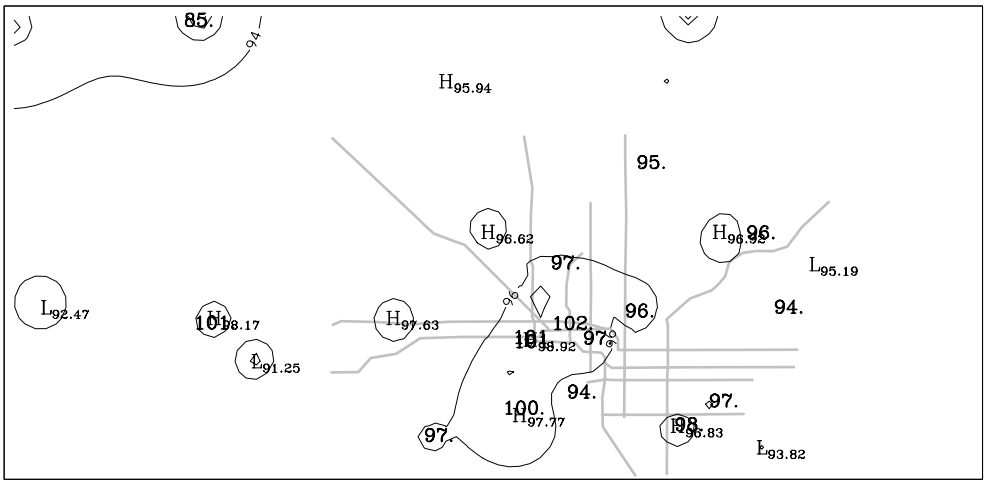
UAM SURFACE TEMPERATURE (F)
8/24/1999 0800-0900 MST




SIMULATED MAX 97.6 MIN 80.3 AVG 91.9
OBSERVED MAX 102.0 MIN 81.0 AVG 94.2

MAX AT (61,17)

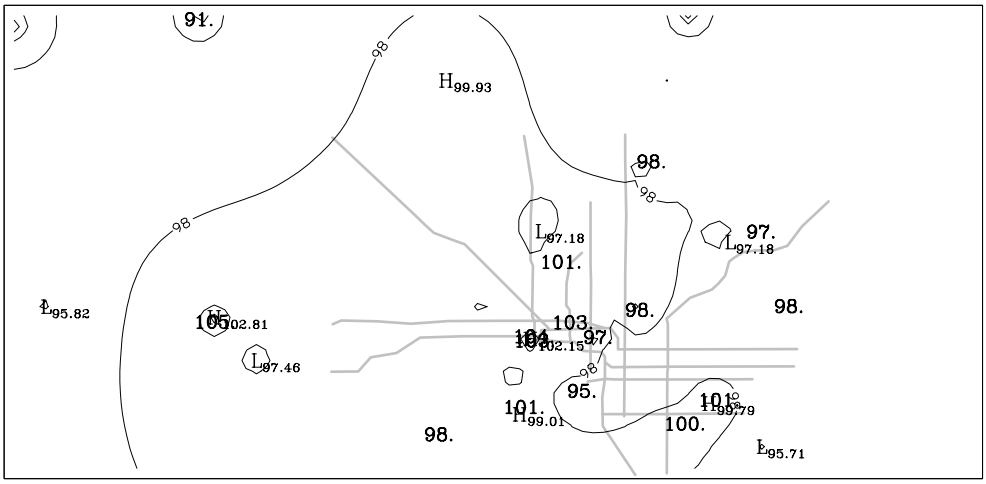
UAM SURFACE TEMPERATURE (F)
8/24/1999 0900-1000 MST




SIMULATED MAX 98.9 MIN 87.3 AVG 95.2
OBSERVED MAX 102.0 MIN 85.0 AVG 96.9

MAX AT (51,14)

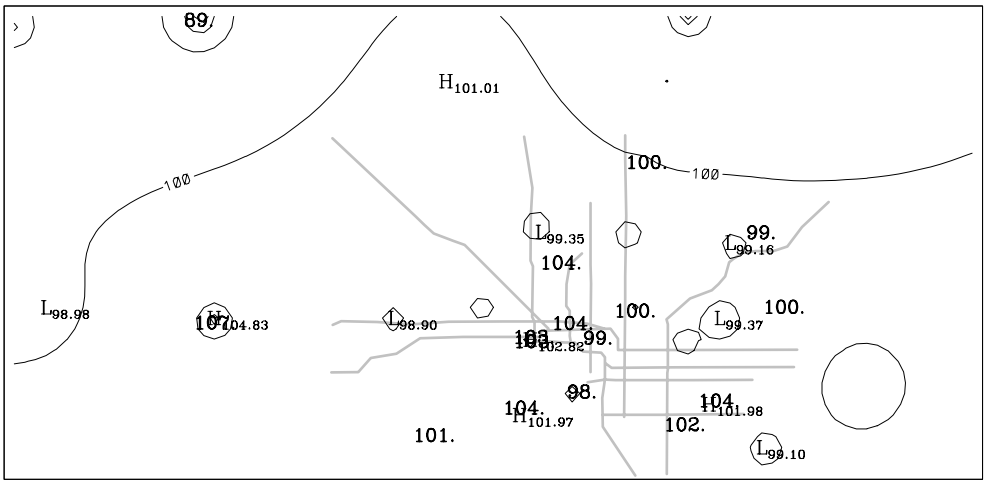
UAM SURFACE TEMPERATURE (F)
8/24/1999 1000–1100 MST




SIMULATED MAX 102.8 MIN 90.5 AVG 97.8
OBSERVED MAX 105.0 MIN 91.0 AVG 99.4

MAX AT (21,16)

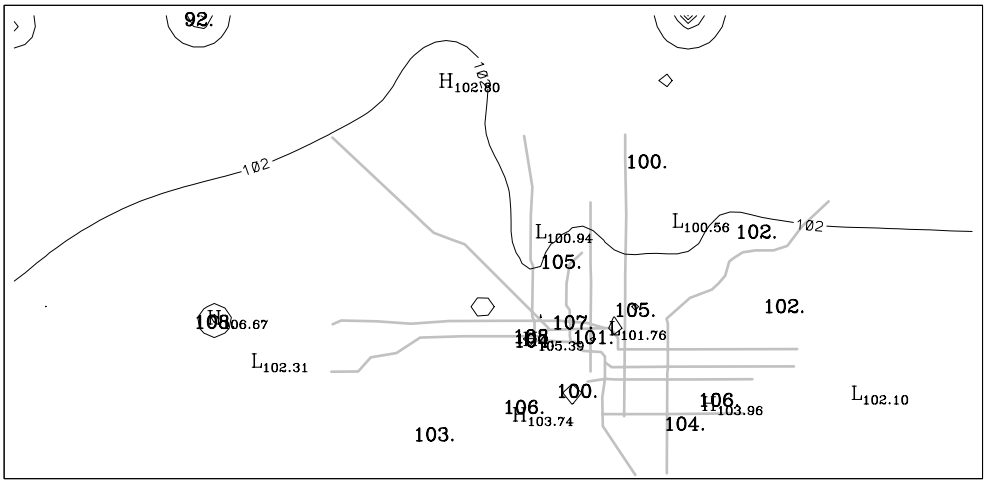
UAM SURFACE TEMPERATURE (F)
8/24/1999 1100–1200 MST




SIMULATED MAX 104.8 MIN 92.6 AVG 100.1
OBSERVED MAX 107.0 MIN 89.0 AVG 101.1

MAX AT (21,16)

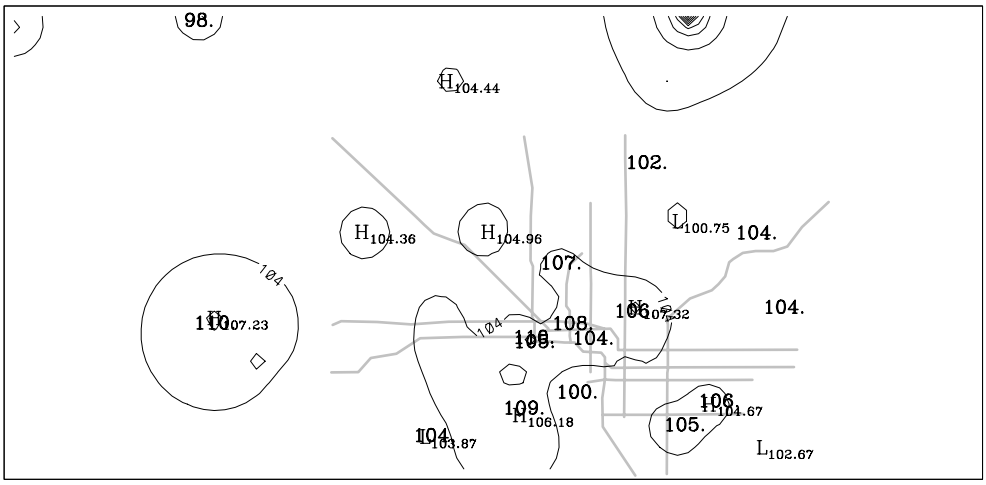
UAM SURFACE TEMPERATURE (F)
8/24/1999 1200–1300 MST




SIMULATED MAX 106.7 MIN 91.9 AVG 102.0
OBSERVED MAX 108.0 MIN 92.0 AVG 103.3

MAX AT (21,16)

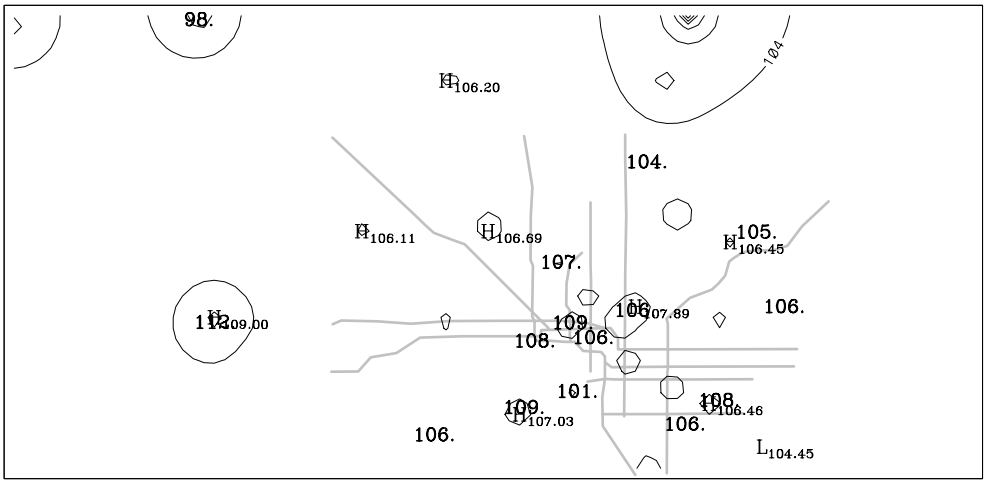
UAM SURFACE TEMPERATURE (F)
8/24/1999 1300–1400 MST




SIMULATED MAX 107.3 MIN 85.1 AVG 103.4
OBSERVED MAX 110.0 MIN 98.0 AVG 105.1

MAX AT (61,17)

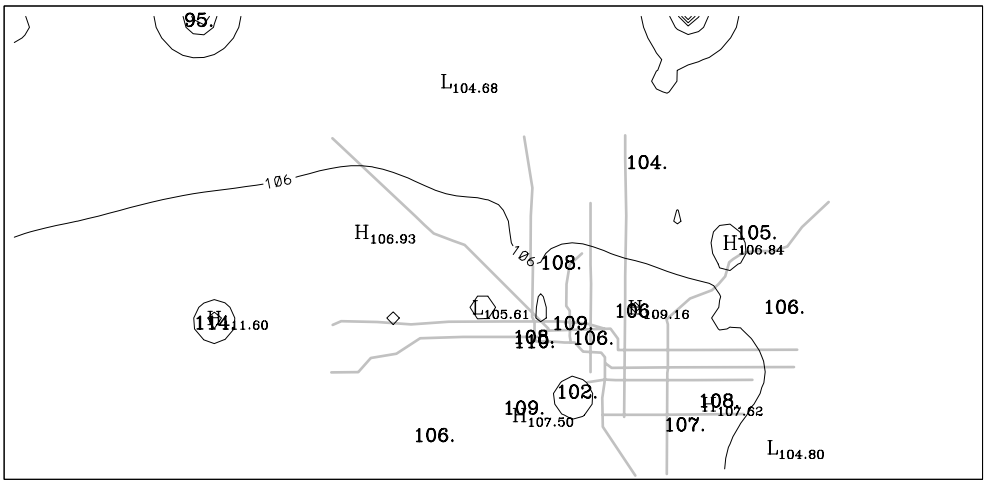
UAM SURFACE TEMPERATURE (F)
8/24/1999 1400–1500 MST




SIMULATED MAX 109.0 MIN 92.5 AVG 105.1
OBSERVED MAX 112.0 MIN 98.0 AVG 106.1

MAX AT (21,16)

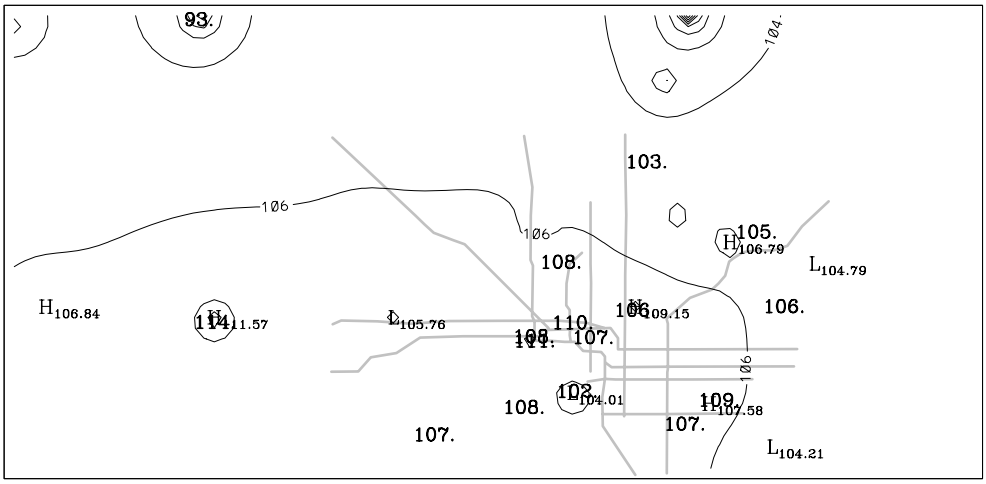
UAM SURFACE TEMPERATURE (F)
8/24/1999 1500–1600 MST




SIMULATED MAX 111.6 MIN 94.1 AVG 105.8
OBSERVED MAX 114.0 MIN 95.0 AVG 106.4

MAX AT (21,16)

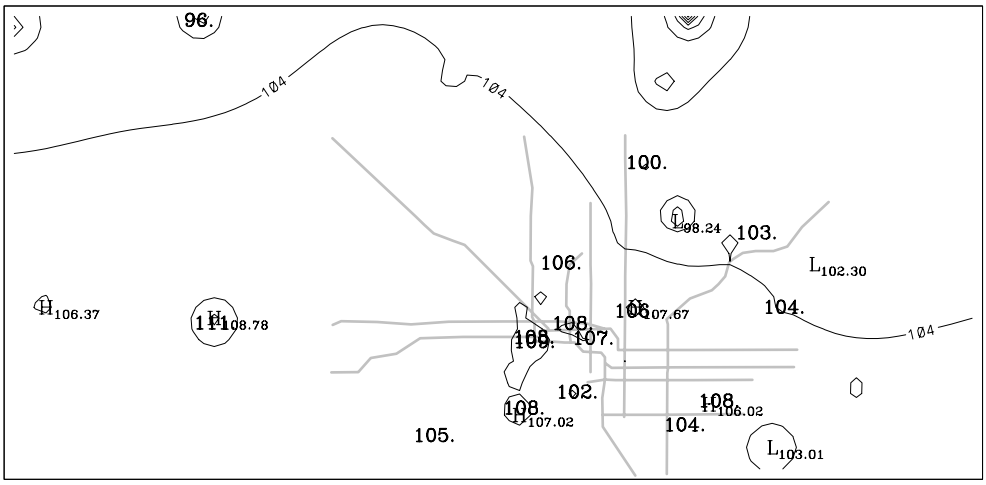
UAM SURFACE TEMPERATURE (F)
8/24/1999 1600–1700 MST




SIMULATED MAX 111.6 MIN 88.3 AVG 105.6
OBSERVED MAX 114.0 MIN 93.0 AVG 106.5

MAX AT (21,16)

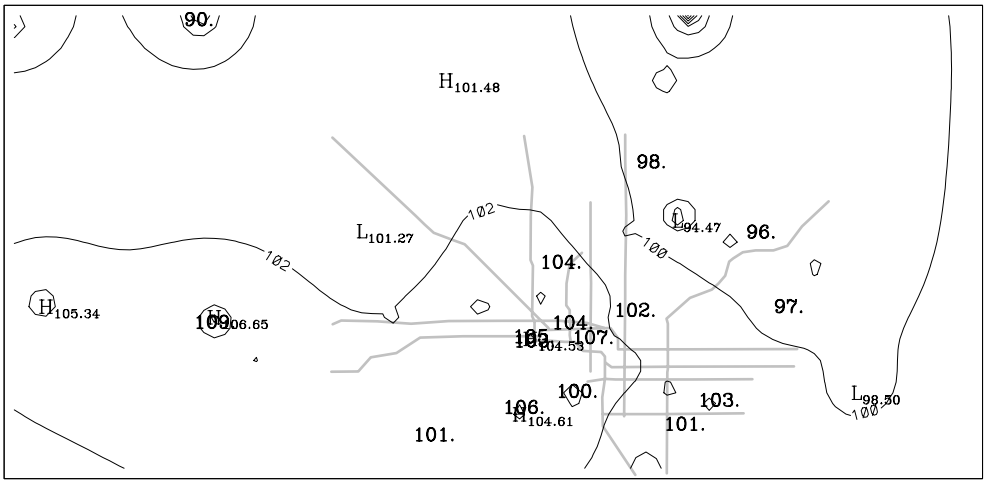
UAM SURFACE TEMPERATURE (F)
8/24/1999 1700–1800 MST




SIMULATED MAX 108.8 MIN 89.4 AVG 104.3
OBSERVED MAX 111.0 MIN 96.0 AVG 105.3

MAX AT (21,16)

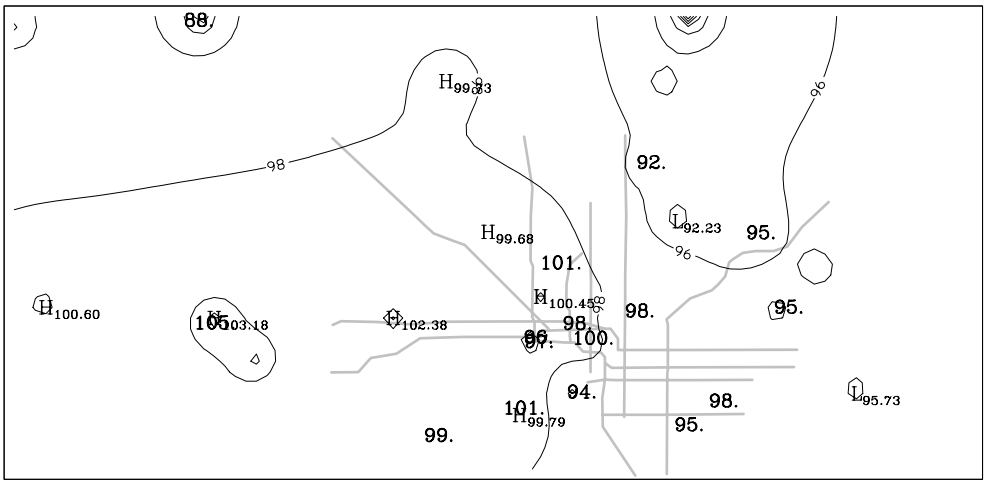
UAM SURFACE TEMPERATURE (F)
8/24/1999 1800–1900 MST




SIMULATED MAX 106.6 MIN 85.9 AVG 101.0
OBSERVED MAX 109.0 MIN 90.0 AVG 101.6

MAX AT (21,16)

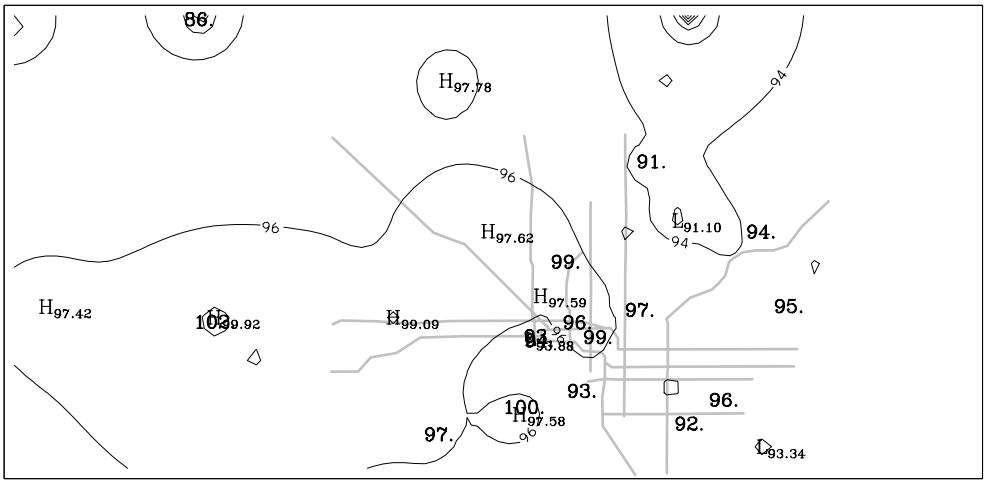
UAM SURFACE TEMPERATURE (F)
8/24/1999 1900–2000 MST




SIMULATED MAX 103.2 MIN 82.3 AVG 97.4
OBSERVED MAX 105.0 MIN 88.0 AVG 97.0

MAX AT (21,16)

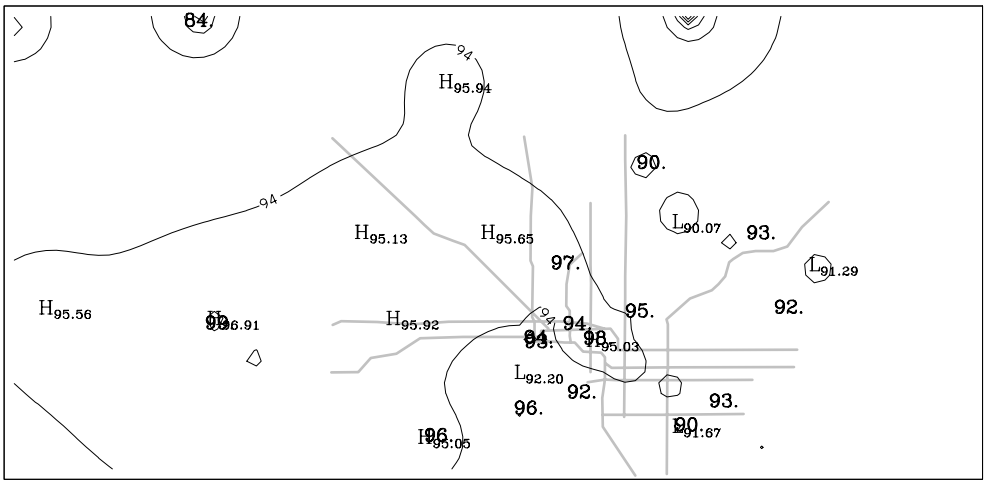
UAM SURFACE TEMPERATURE (F)
8/24/1999 2000-2100 MST




SIMULATED MAX 99.9 MIN 81.9 AVG 95.3
OBSERVED MAX 102.0 MIN 86.0 AVG 95.2

MAX AT (21,16)

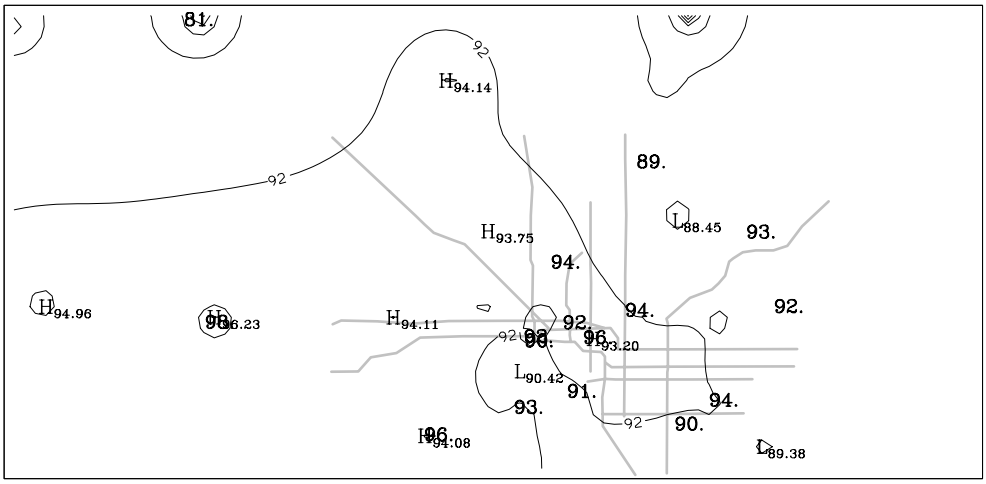
UAM SURFACE TEMPERATURE (F)
8/24/1999 2100-2200 MST




SIMULATED MAX 96.9 MIN 80.1 AVG 93.4
OBSERVED MAX 99.0 MIN 84.0 AVG 93.5

MAX AT (21,16)

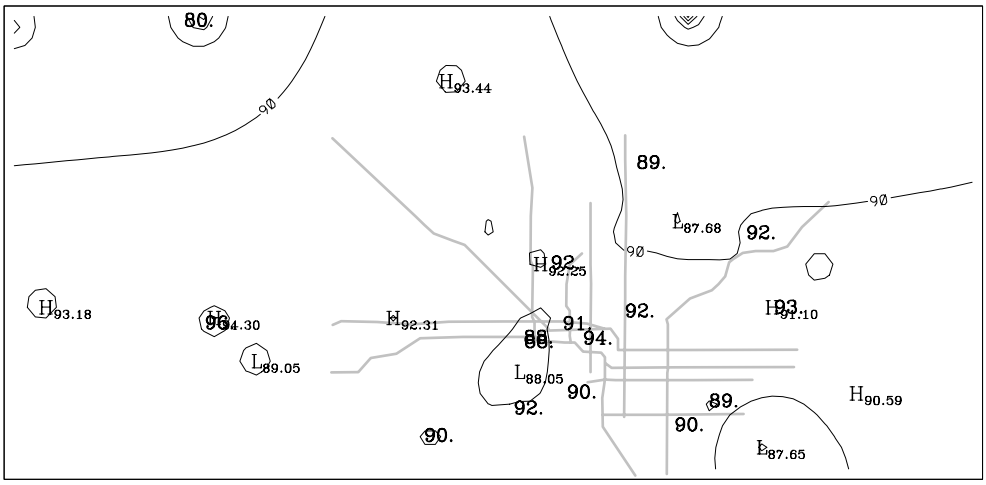
UAM SURFACE TEMPERATURE (F)
8/24/1999 2200-2300 MST




SIMULATED MAX 96.2 MIN 79.8 AVG 91.7
OBSERVED MAX 98.0 MIN 81.0 AVG 92.2

MAX AT (21,16)

UAM SURFACE TEMPERATURE (F)
8/24/1999 2300-2400 MST




SIMULATED MAX 94.3 MIN 79.5 AVG 90.2
OBSERVED MAX 96.0 MIN 80.0 AVG 90.4

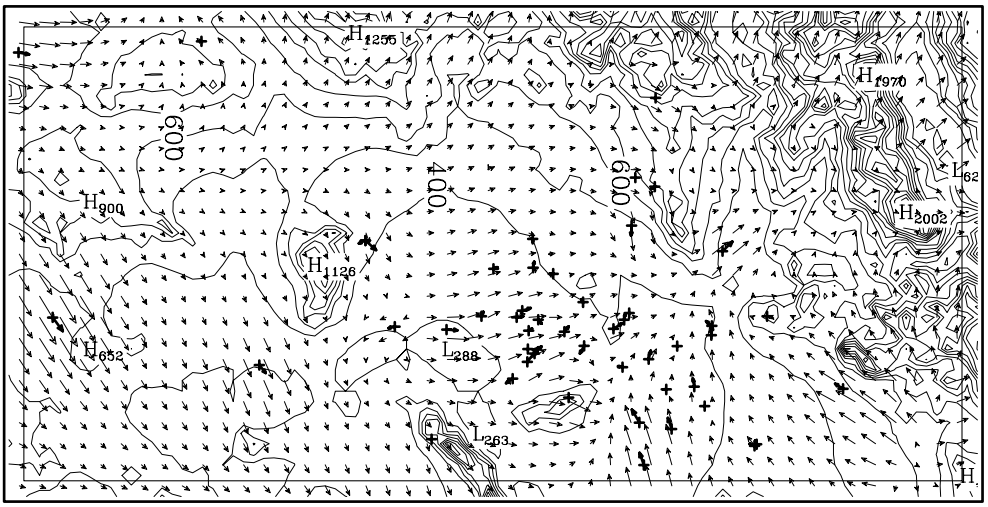
MAX AT (21,16)

Appendix IV-v

# MODELED WIND FIELDS FOR 1998 EPISODE

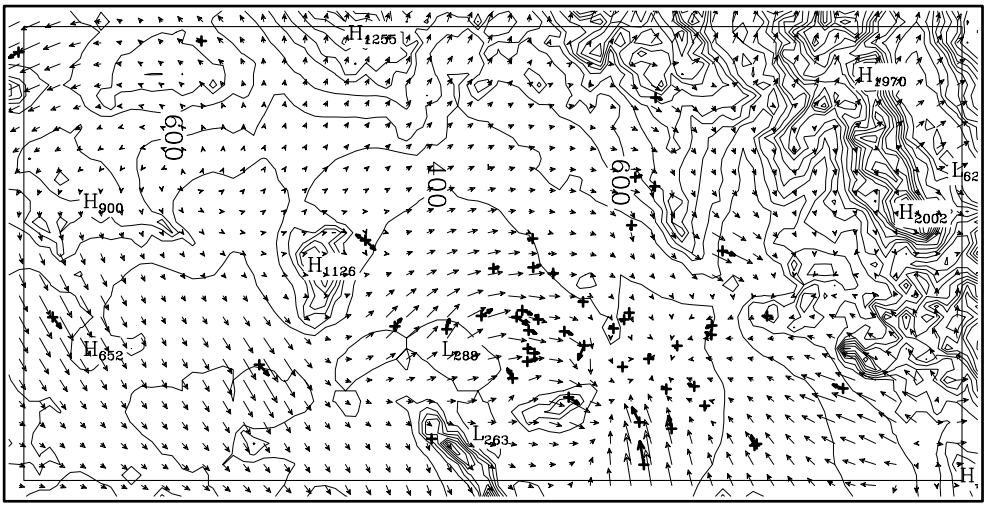
The plots shown here are the simulated DWM winds overlaid with observed wind vectors extended from the plus signs indicating the locations of the monitoring sites. These hourly wind fields are from hour 0 on July 16, 1998 to hour 2400 on July 17, 1998.

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 0 - 1 MST
MAG OZONE UAM AIRSHED



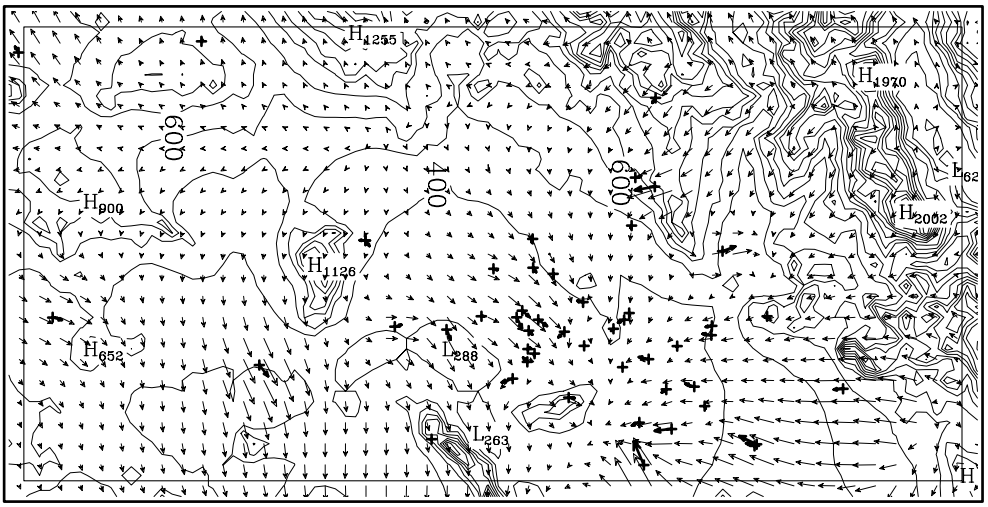

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 1 - 2 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



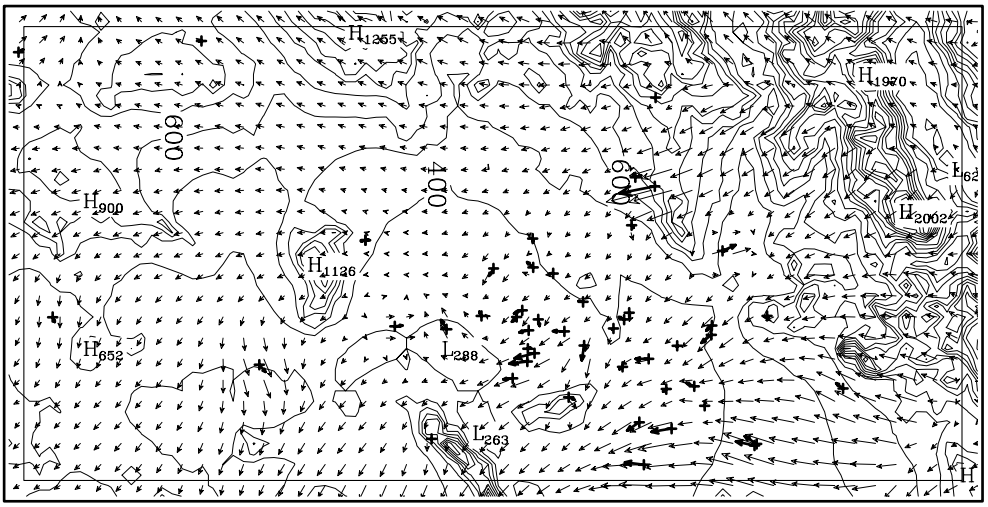

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 2 - 3 MST
MAG OZONE UAM AIRSHED



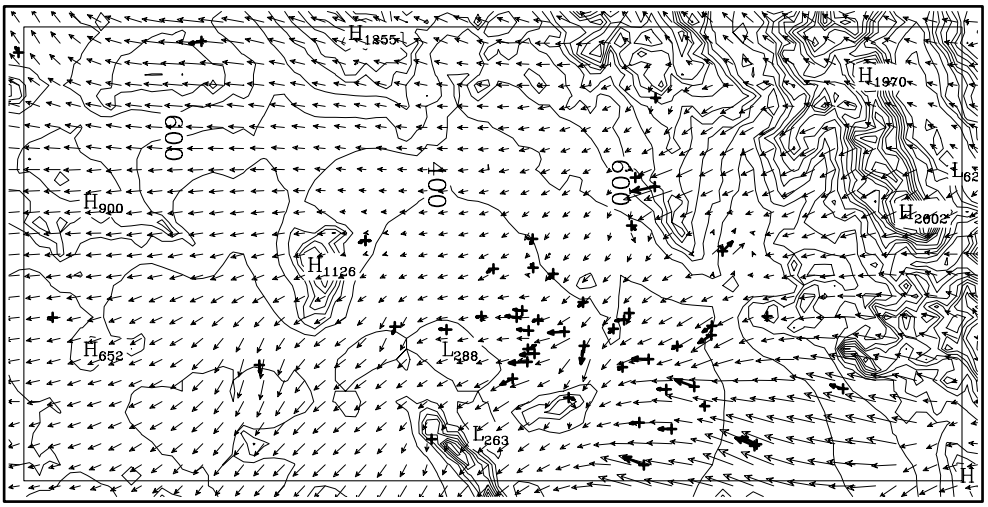

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 3 - 4 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



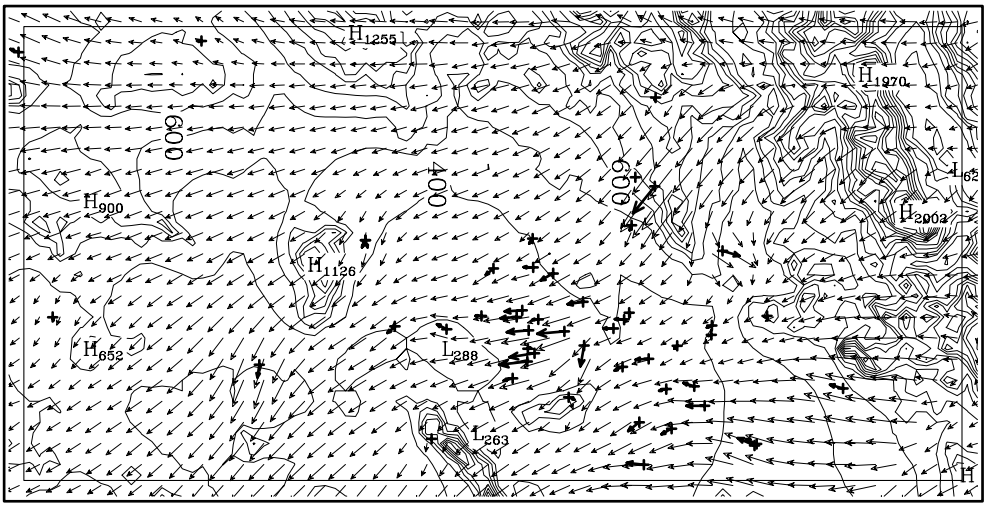

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 4 - 5 MST
MAG OZONE UAM AIRSHED



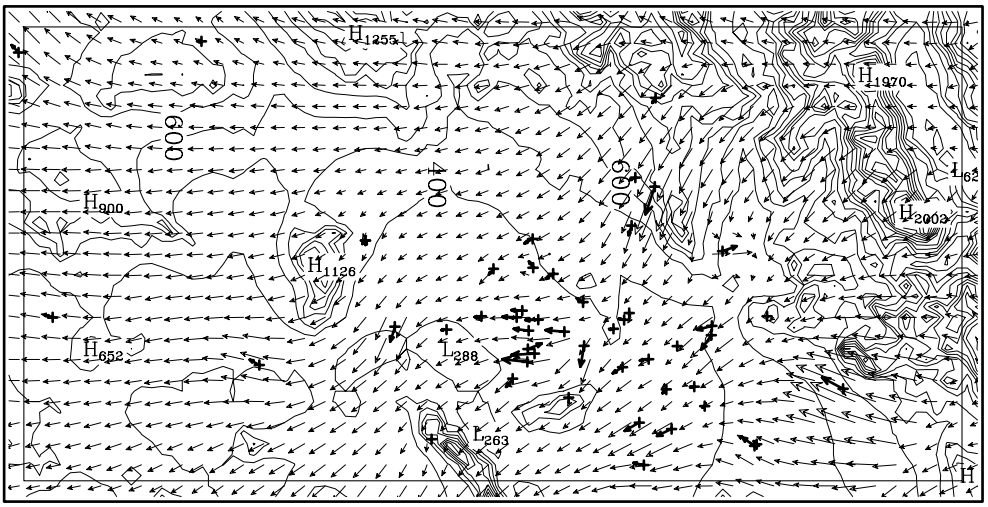

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 5 - 6 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



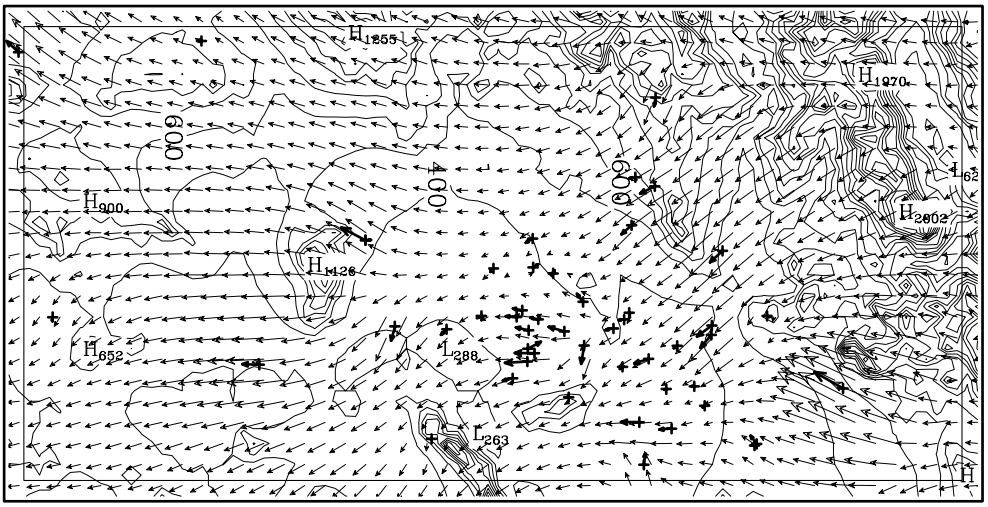

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 6 - 7 MST
MAG OZONE UAM AIRSHED



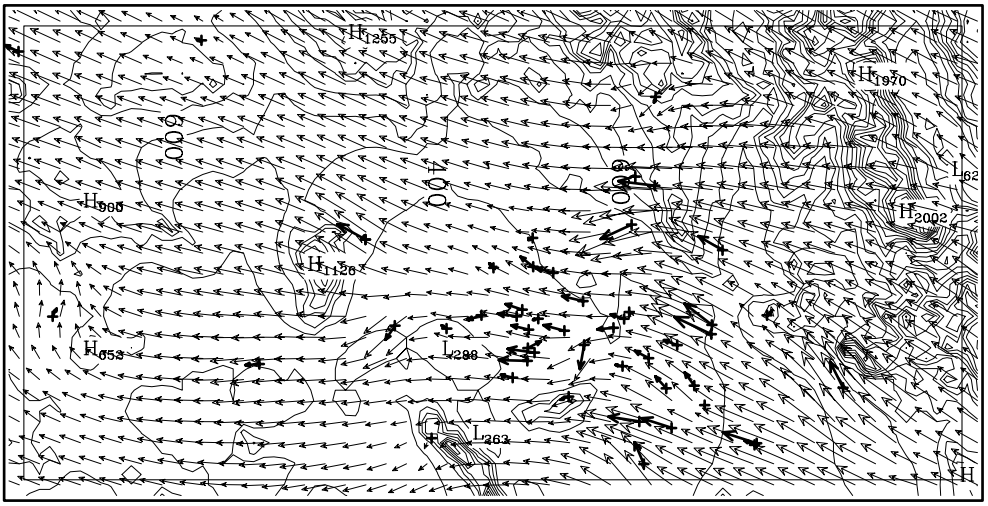

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 7 - 8 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



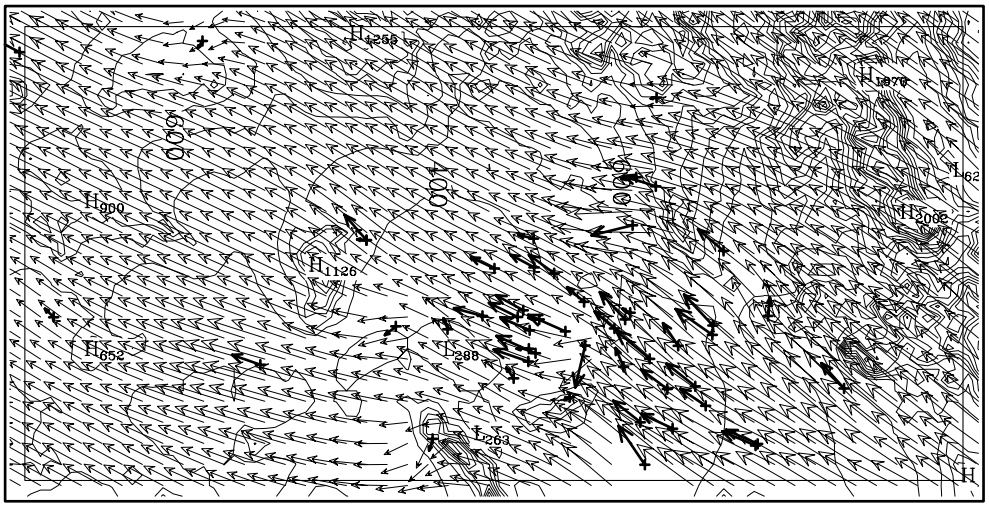

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 8 – 9 MST
MAG OZONE UAM AIRSHED



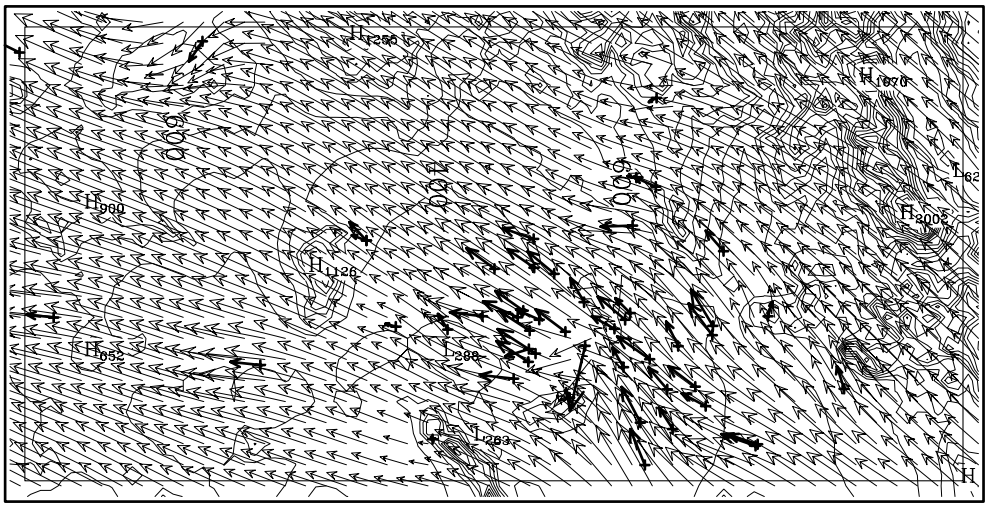

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 9 – 10 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



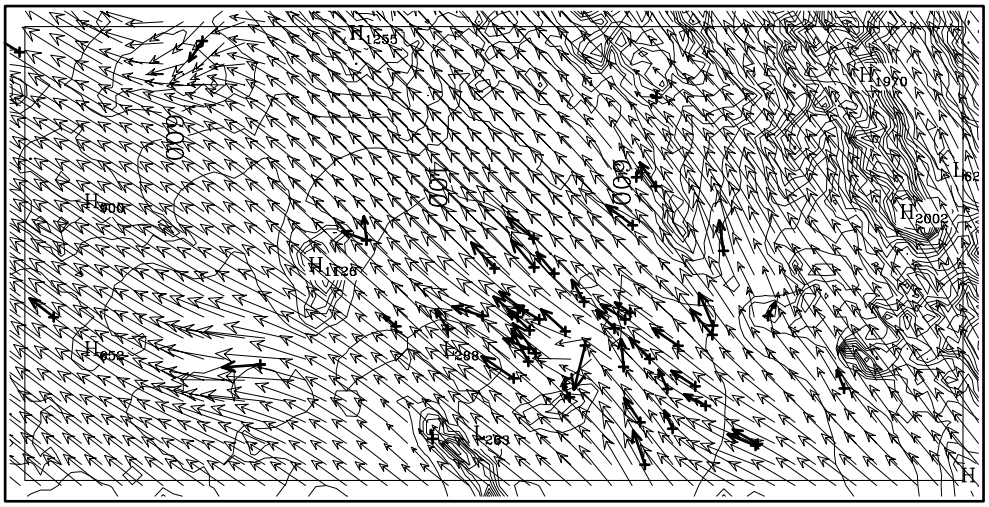

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 10 – 11 MST
MAG OZONE UAM AIRSHED



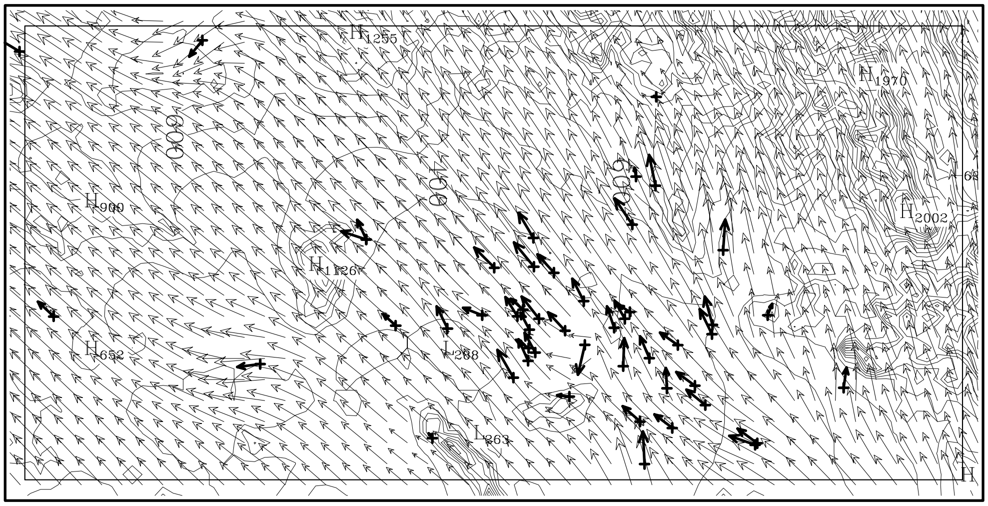

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 11 – 12 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



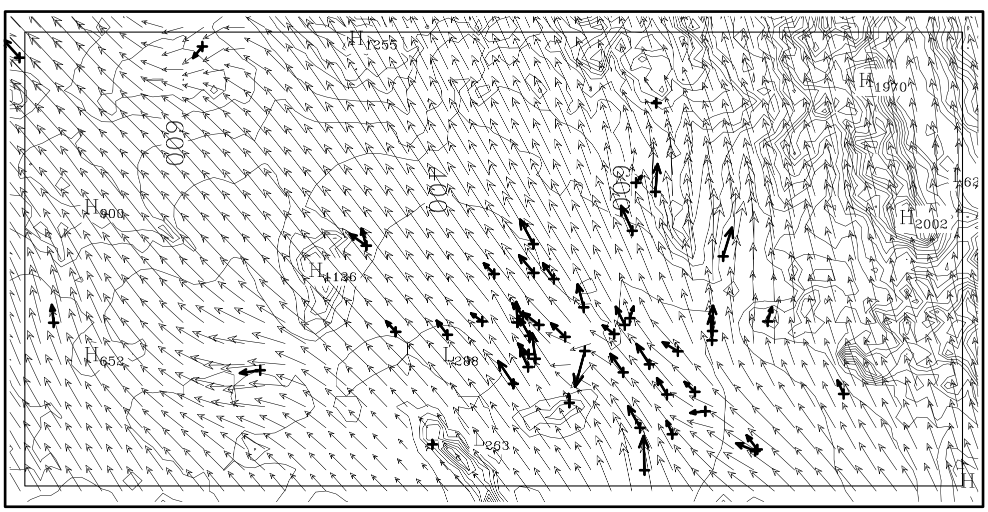

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 12 – 13 MST
MAG OZONE UAM AIRSHED



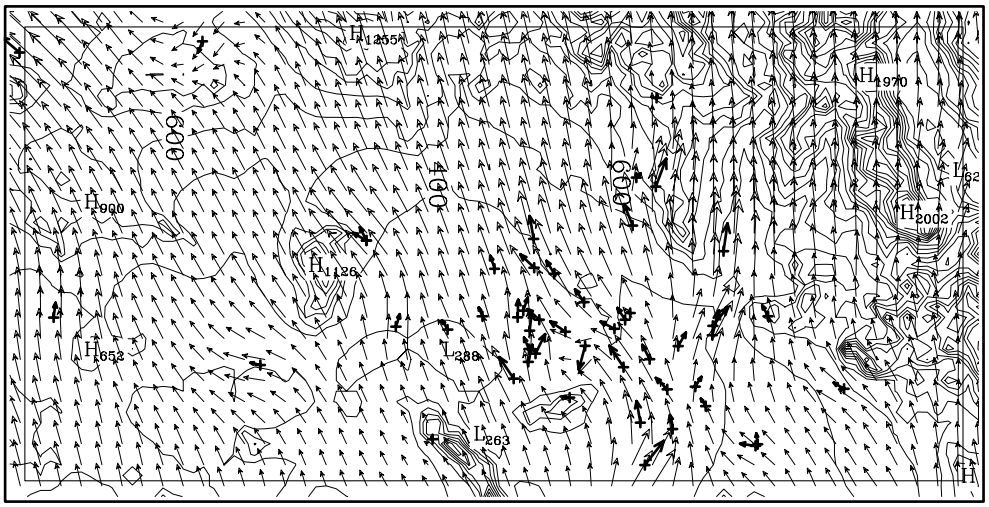

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 13 – 14 MST
MAG OZONE UAM AIRSHED



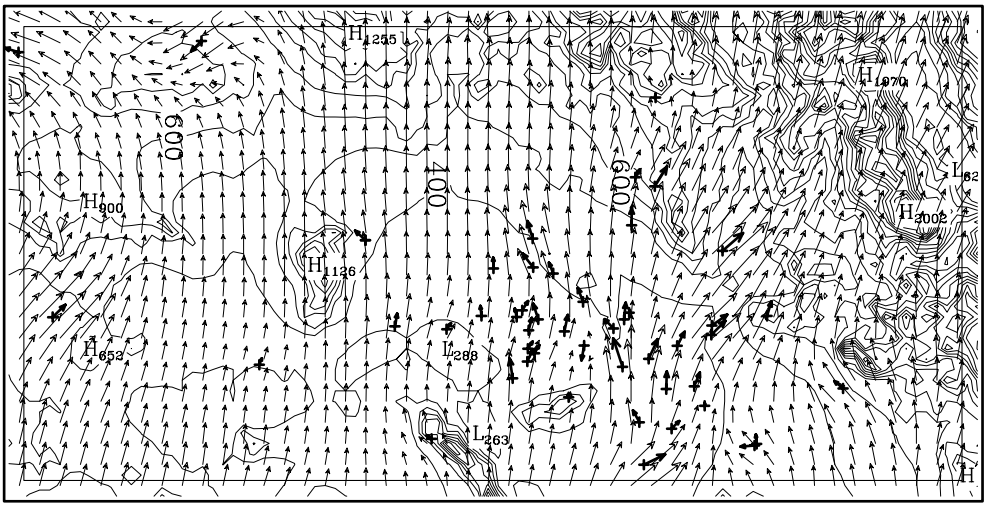

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 14 – 15 MST
MAG OZONE UAM AIRSHED



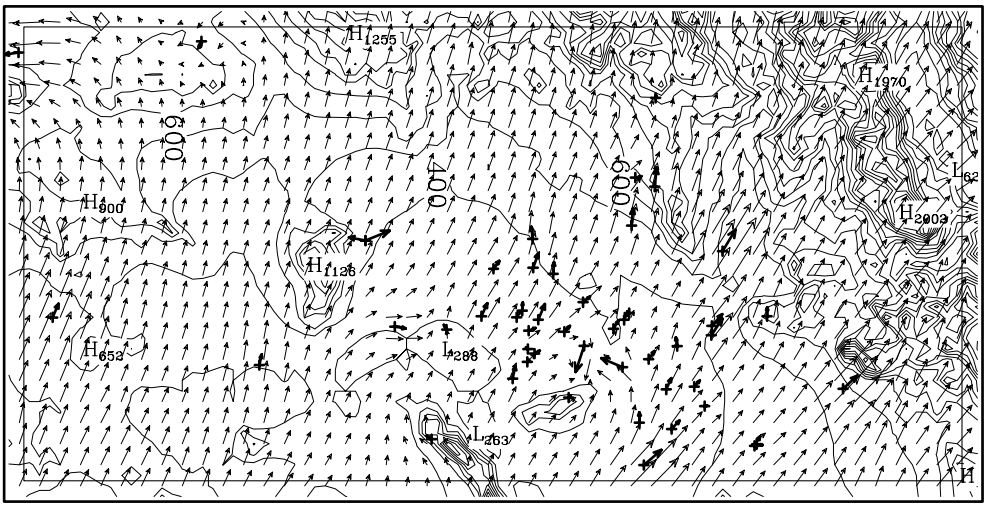

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 15 – 16 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



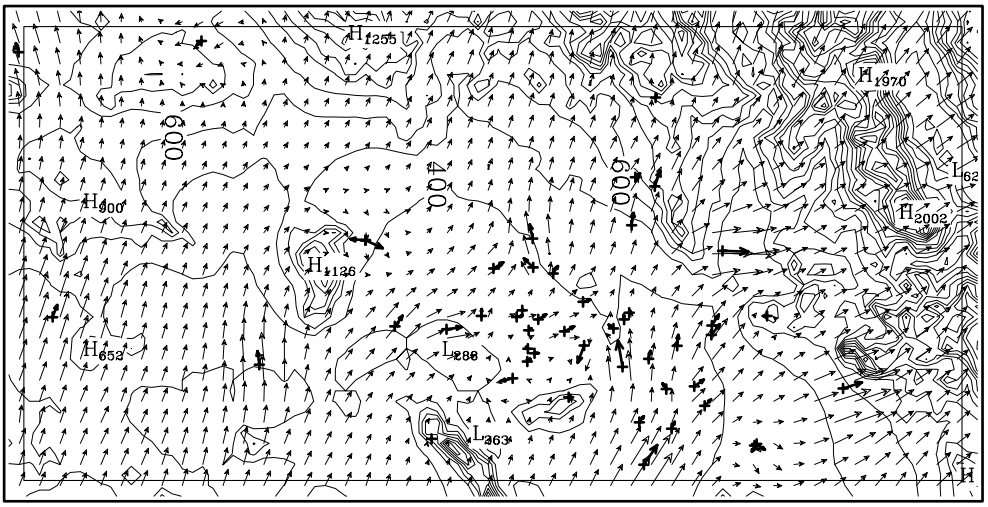

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 16 – 17 MST
MAG OZONE UAM AIRSHED



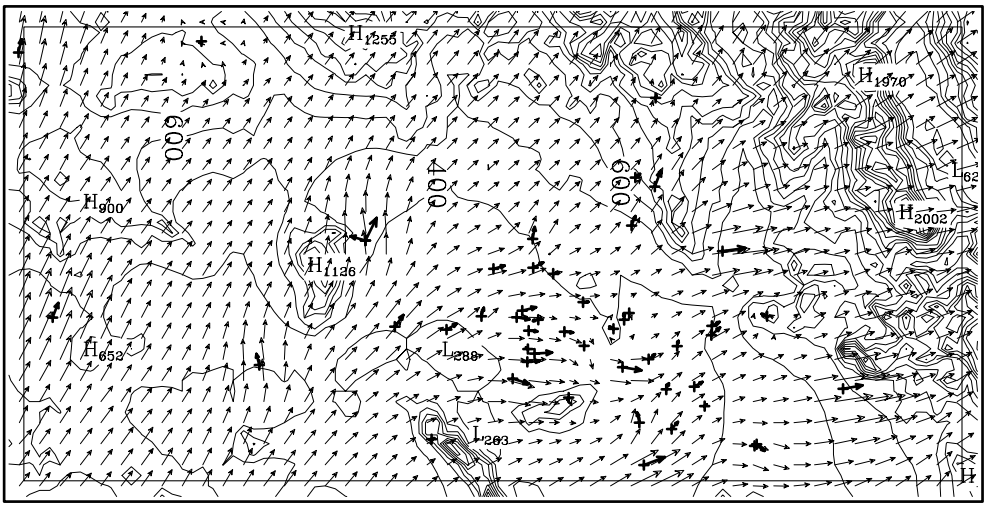

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 17 – 18 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



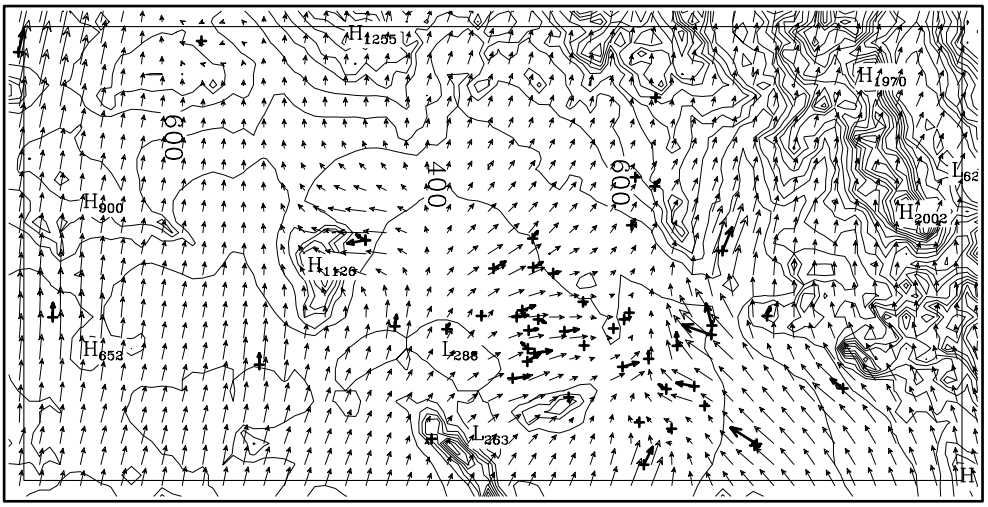

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 18 – 19 MST
MAG OZONE UAM AIRSHED



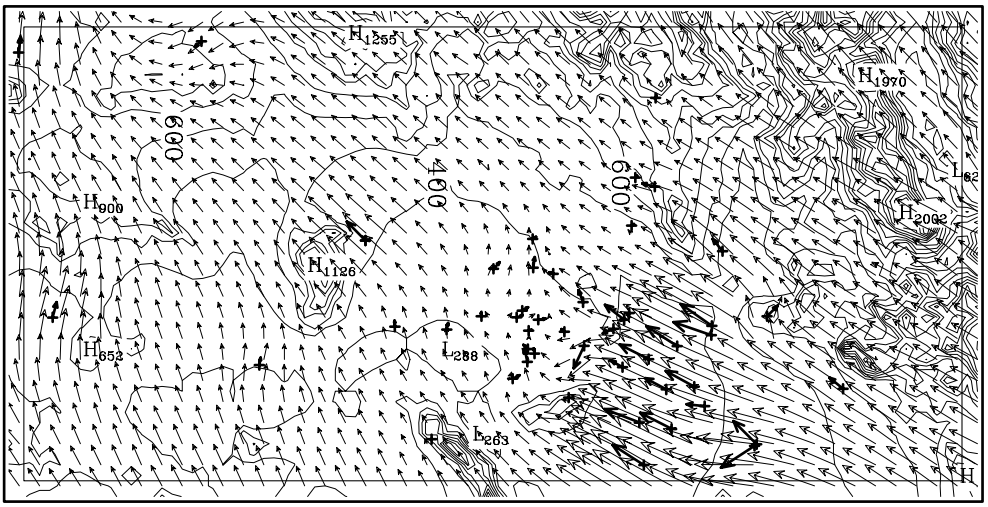

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 19 – 20 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



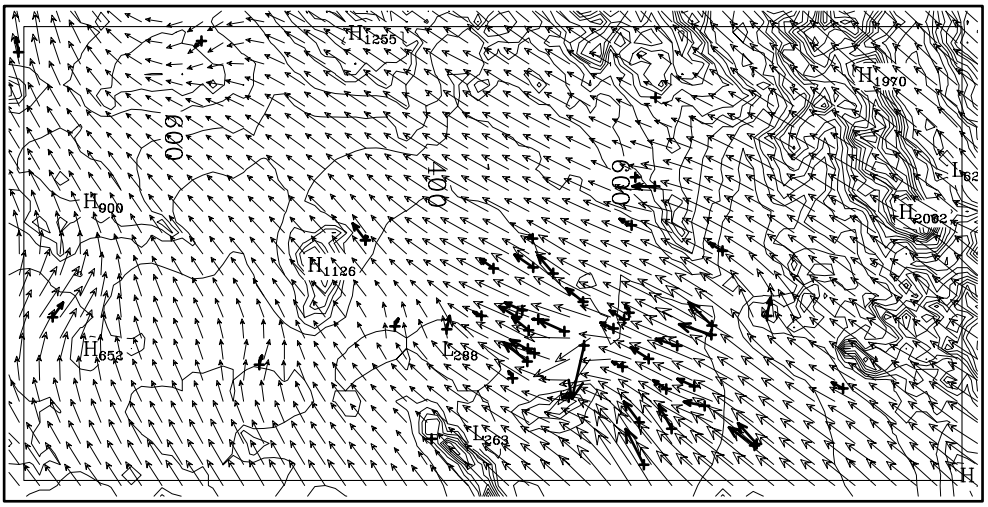

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 20 – 21 MST
MAG OZONE UAM AIRSHED



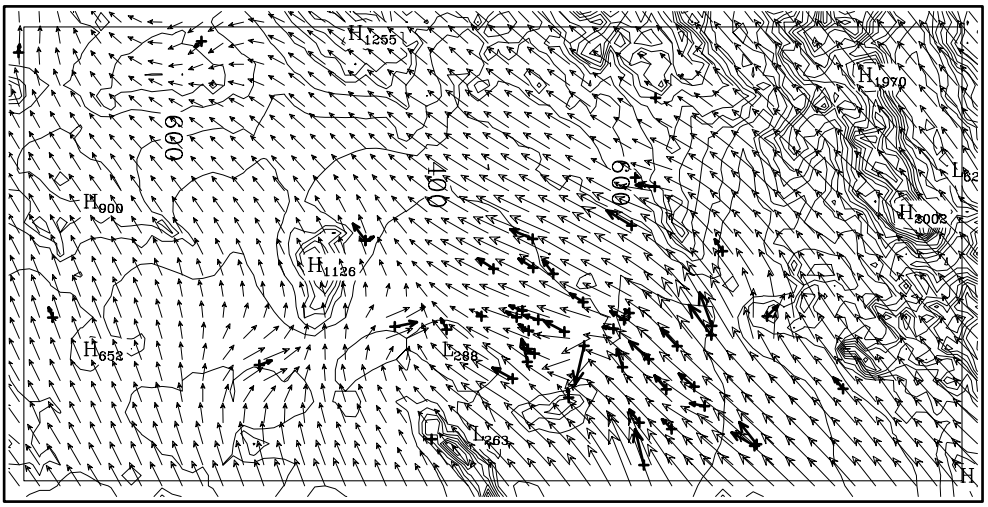

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 21 – 22 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



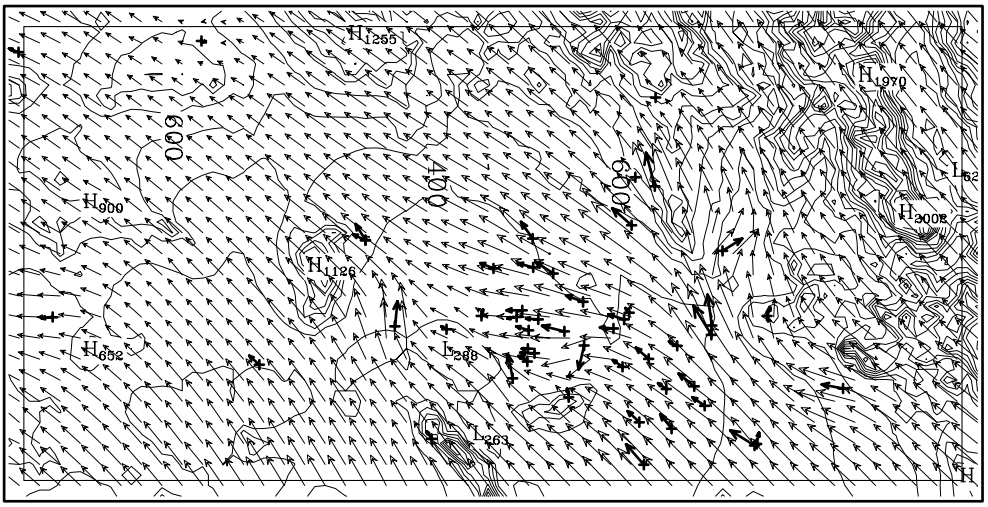

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 22 – 23 MST
MAG OZONE UAM AIRSHED



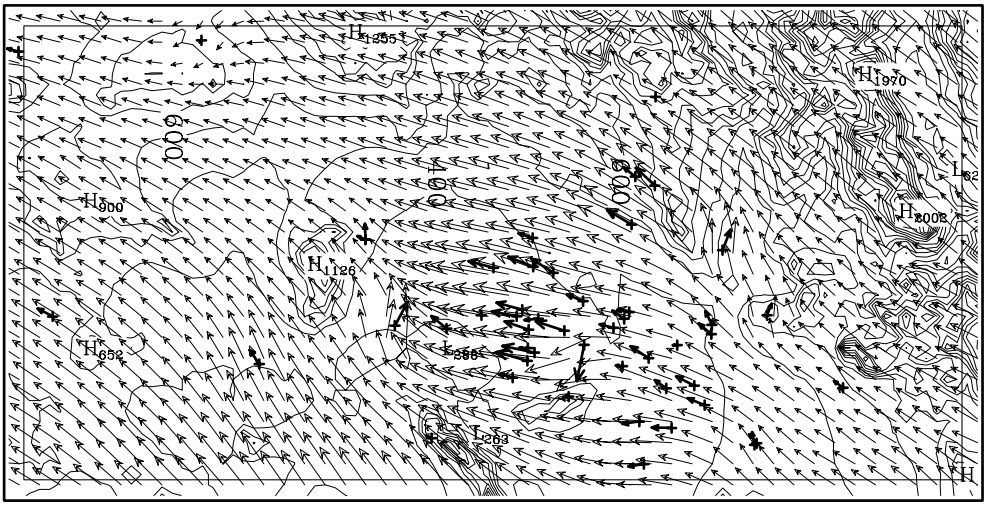

LAYER 1 DWM WIND FIELD (m/s) JUL 16, 1998 23 – 24 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



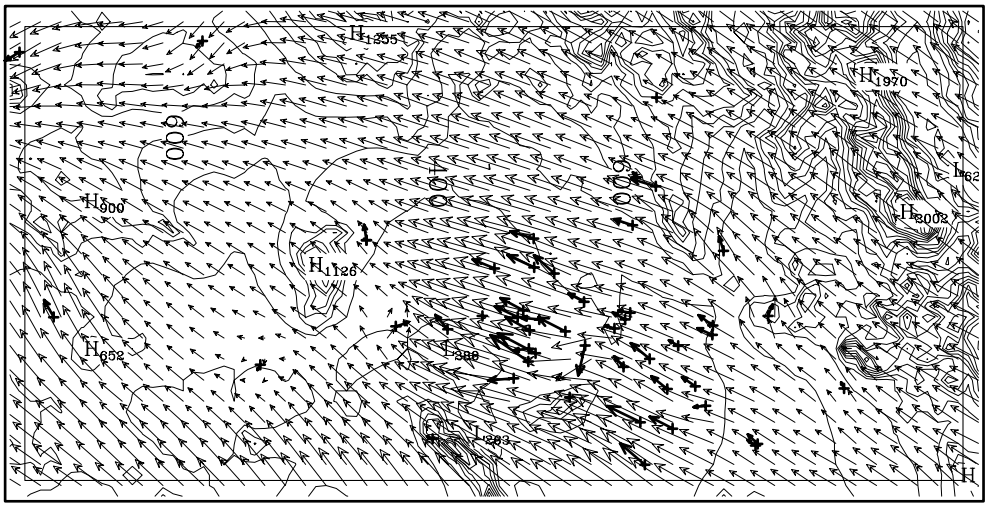

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 0 - 1 MST
MAG OZONE UAM AIRSHED



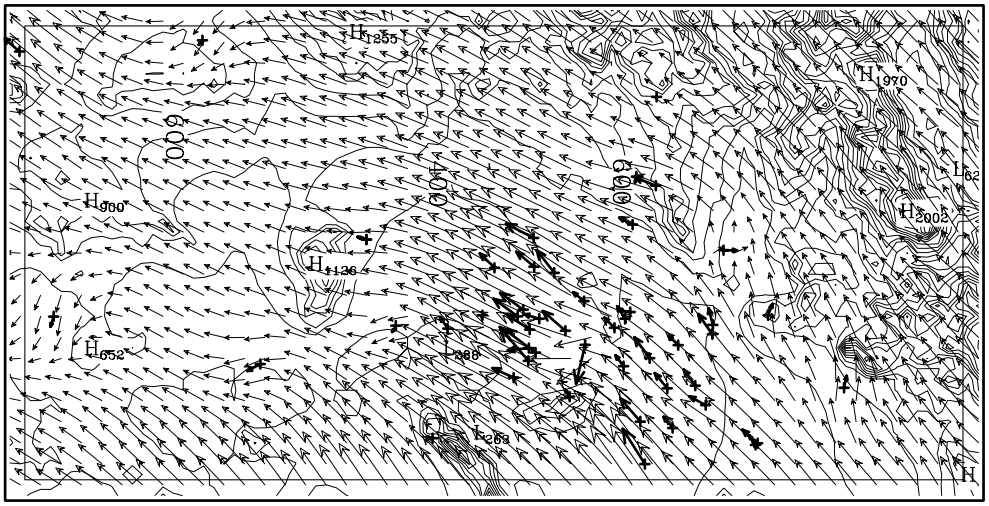

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 1 - 2 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



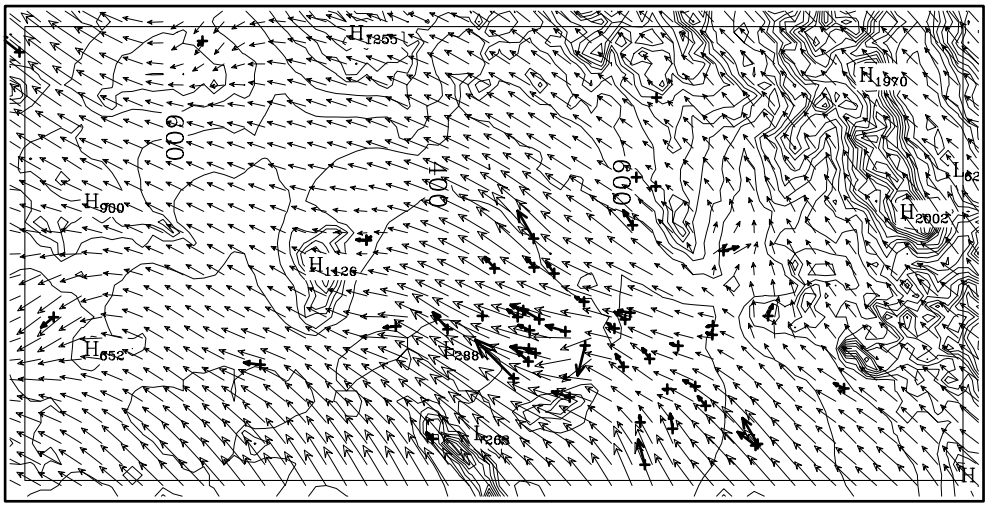

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 2 - 3 MST
MAG OZONE UAM AIRSHED



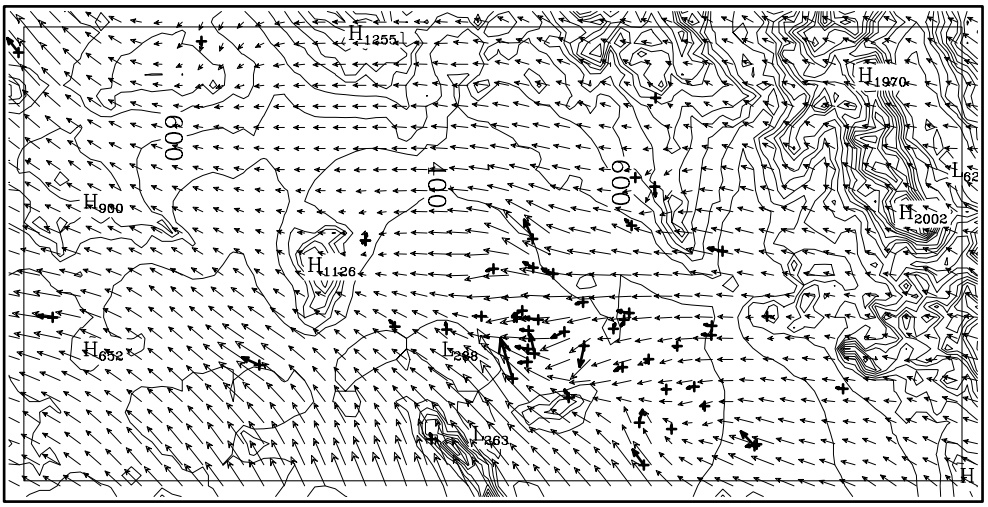

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 3 - 4 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



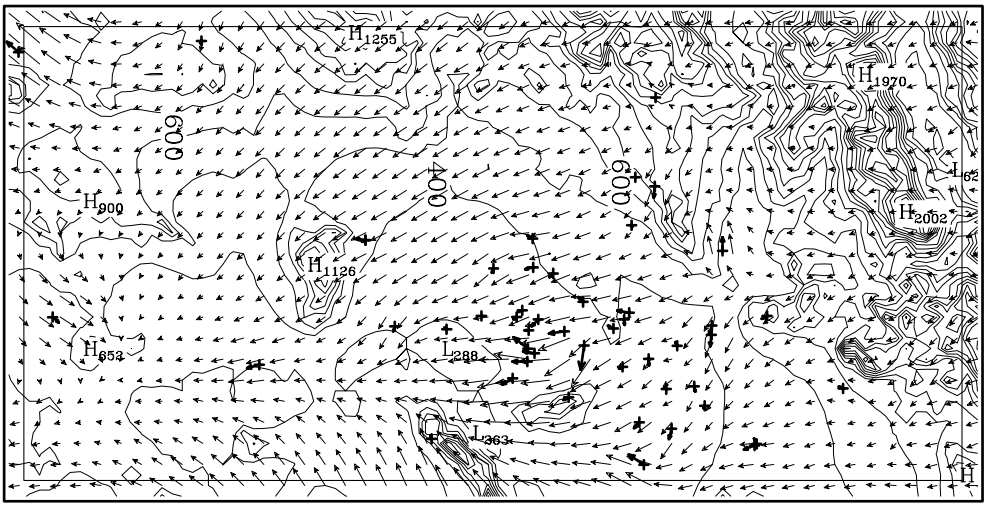

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 4 - 5 MST
MAG OZONE UAM AIRSHED



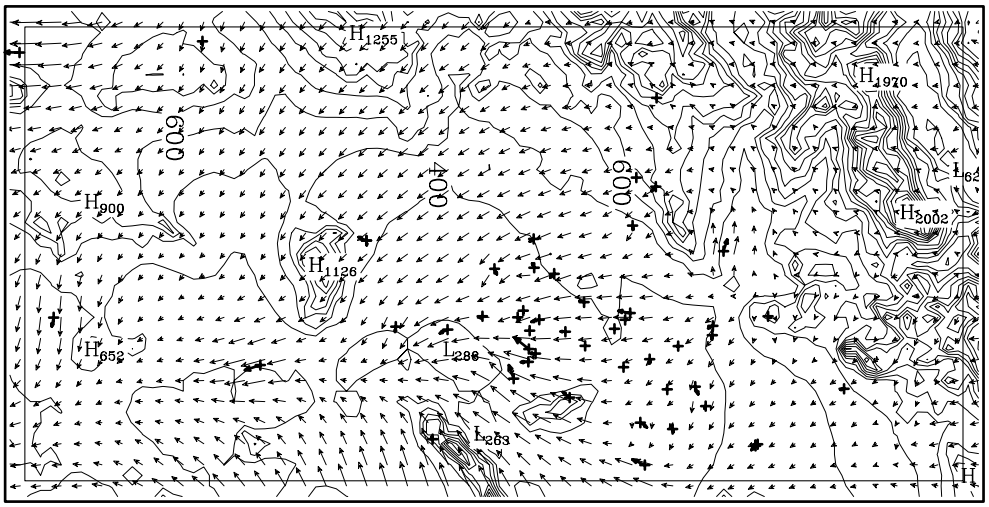

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 5 - 6 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



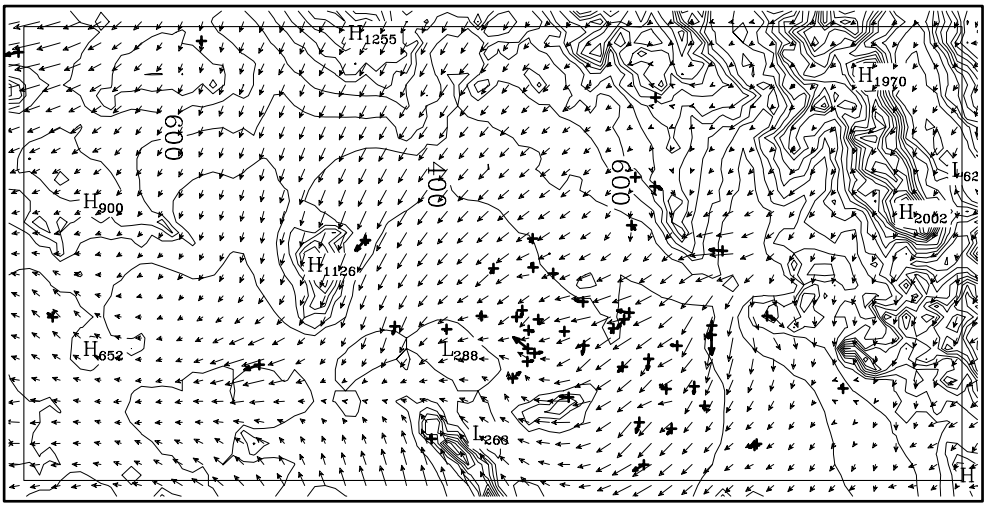

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 6 - 7 MST
MAG OZONE UAM AIRSHED



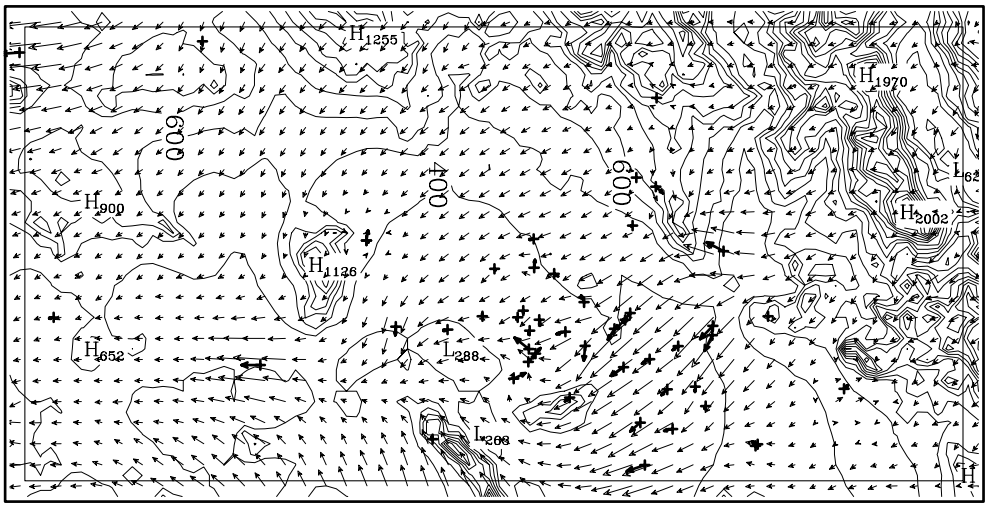

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 7 - 8 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



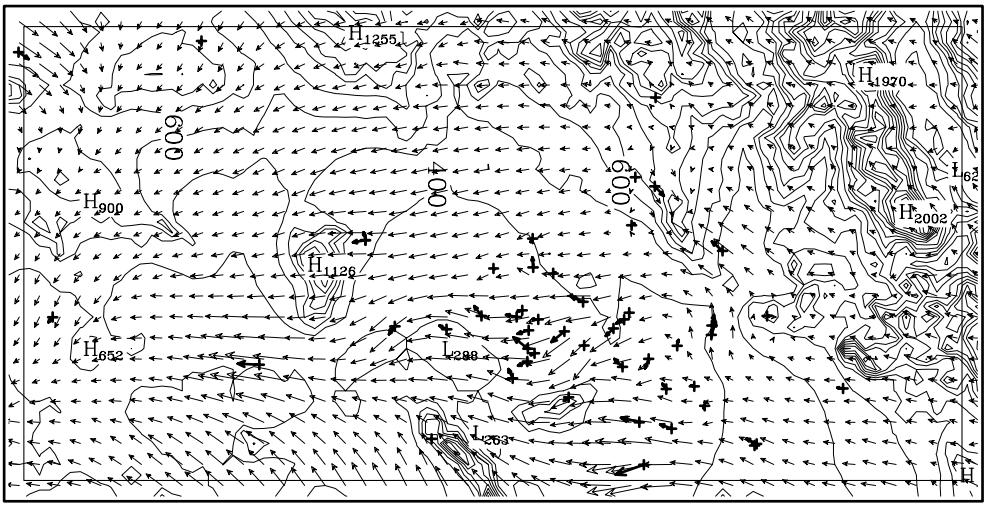

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 8 – 9 MST
MAG OZONE UAM AIRSHED



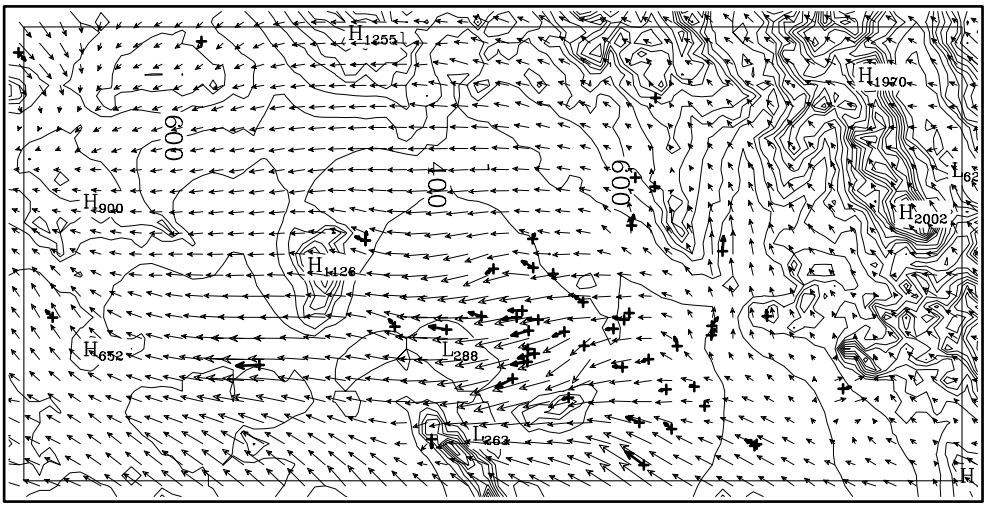

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 9 – 10 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



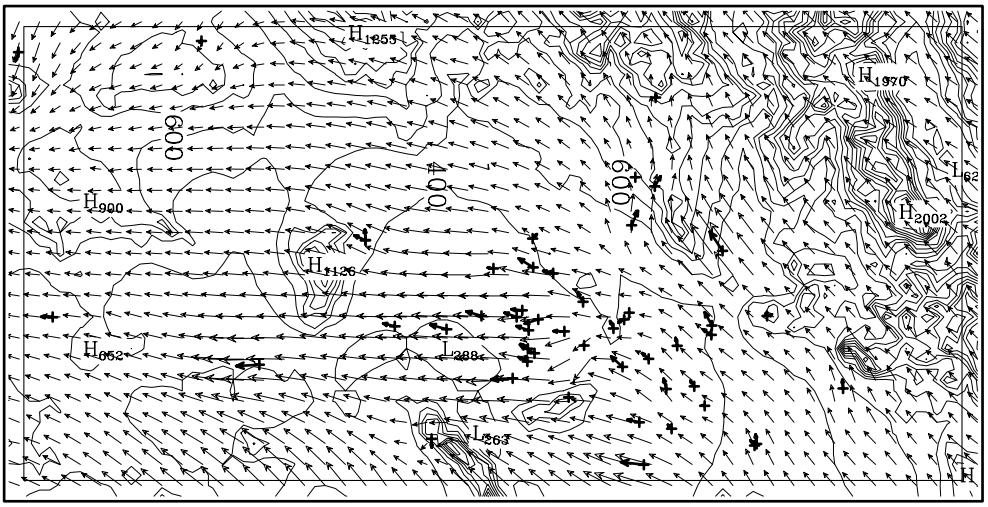

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 10 – 11 MST
MAG OZONE UAM AIRSHED



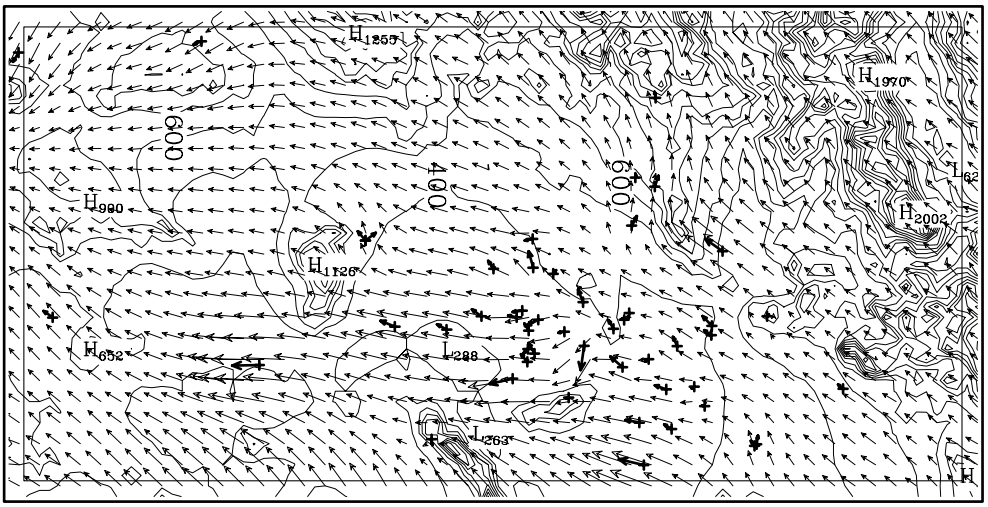

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 11 – 12 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



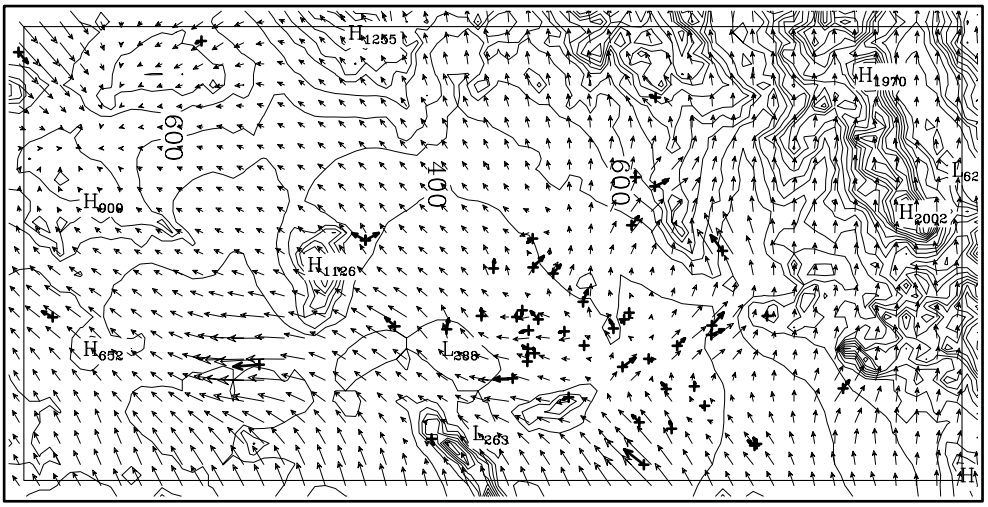

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 12 – 13 MST
MAG OZONE UAM AIRSHED



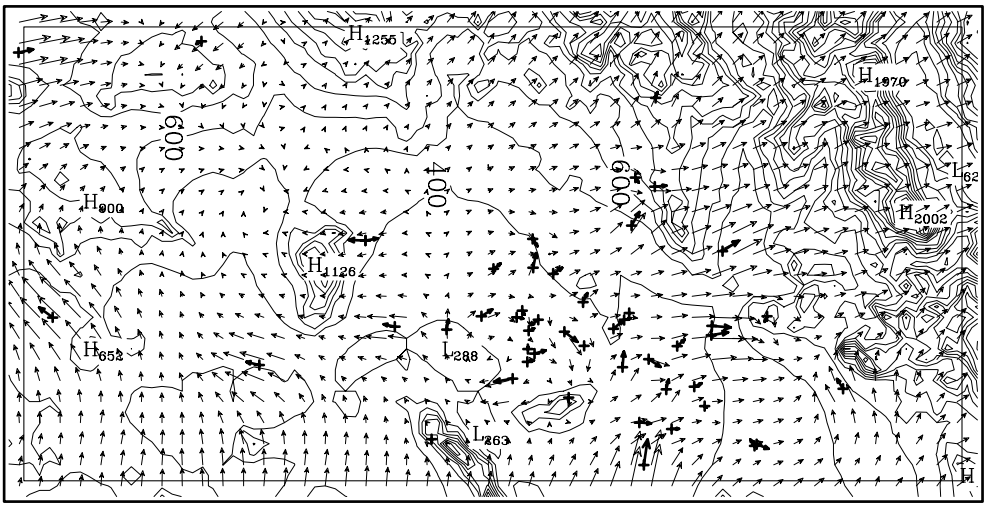

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 13 – 14 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



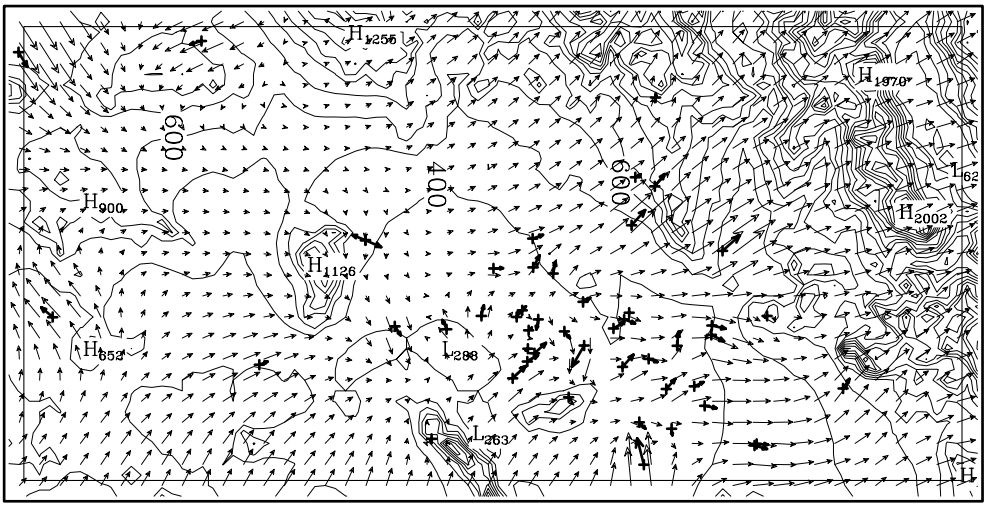

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 14 – 15 MST
MAG OZONE UAM AIRSHED



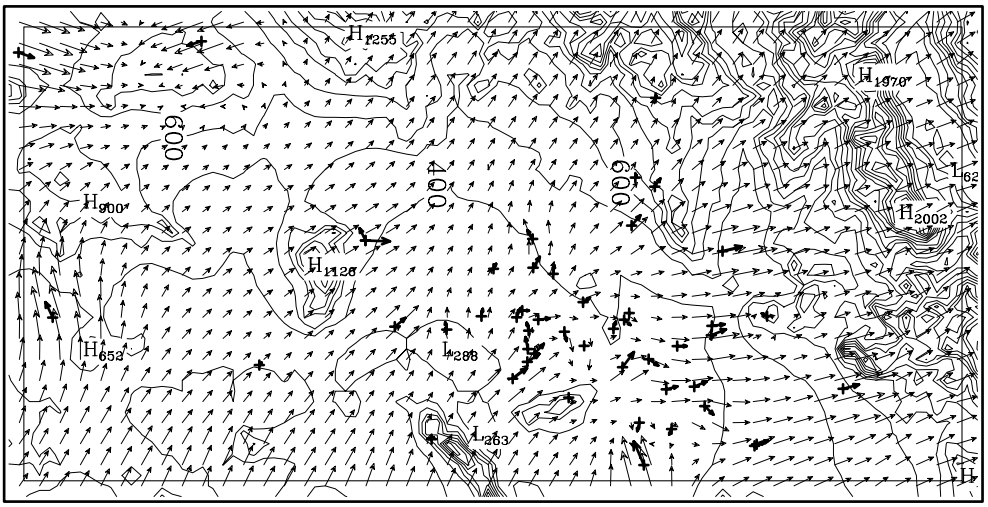

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 15 – 16 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



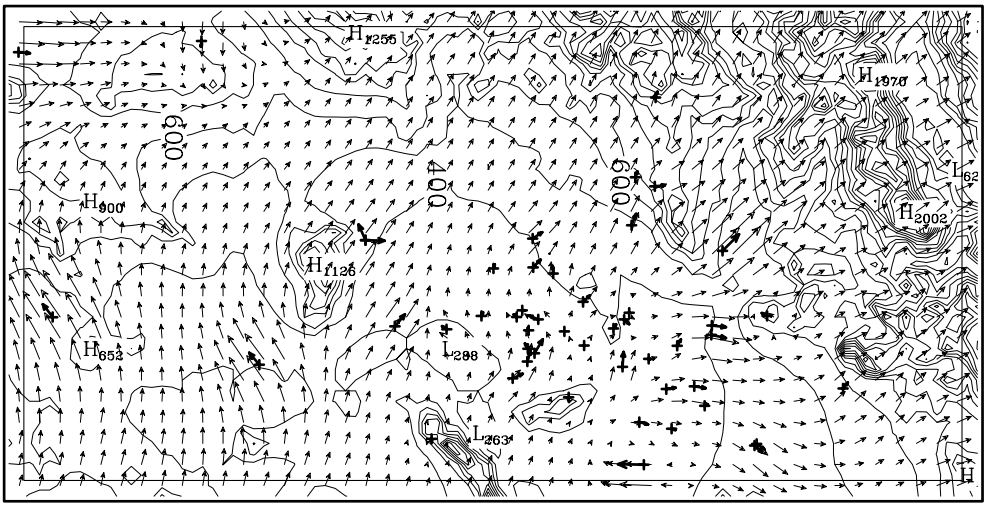

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 16 – 17 MST
MAG OZONE UAM AIRSHED



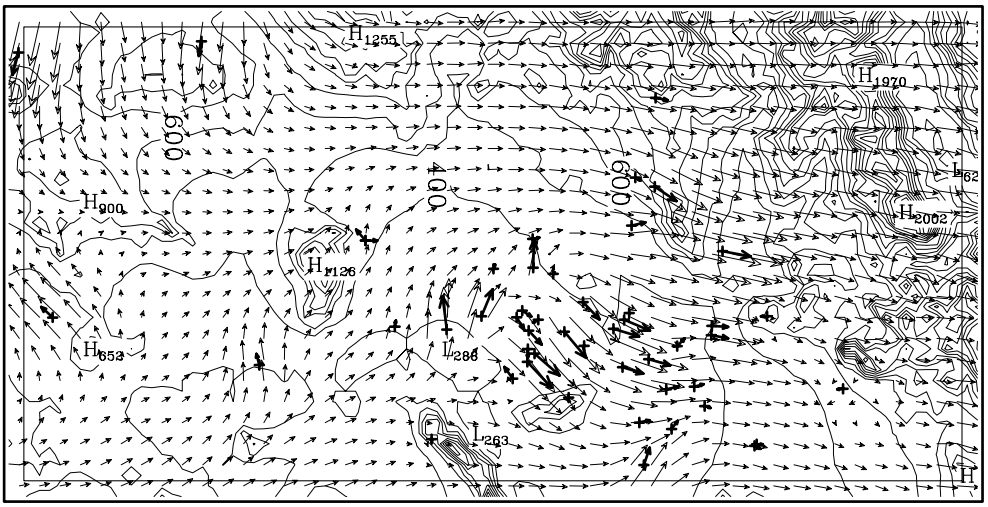

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 17 – 18 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



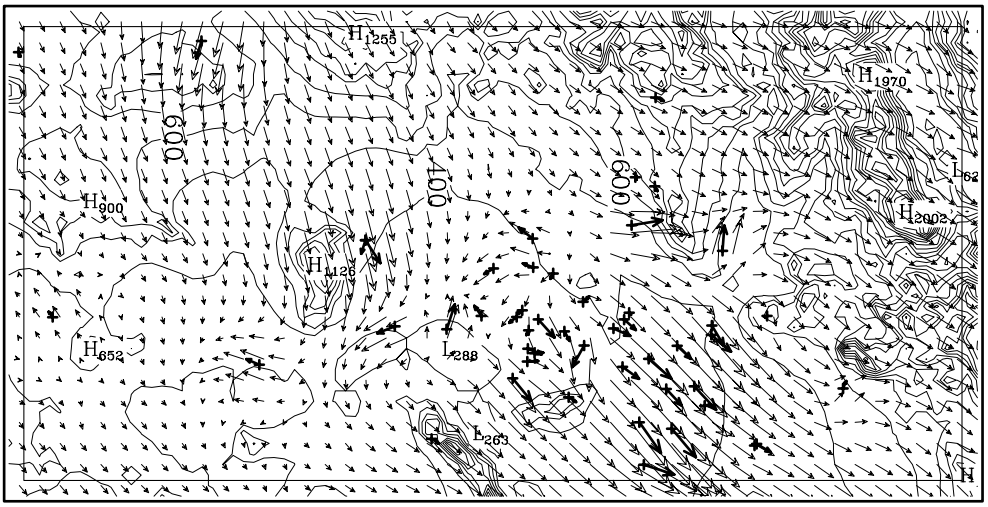

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 18 – 19 MST
MAG OZONE UAM AIRSHED



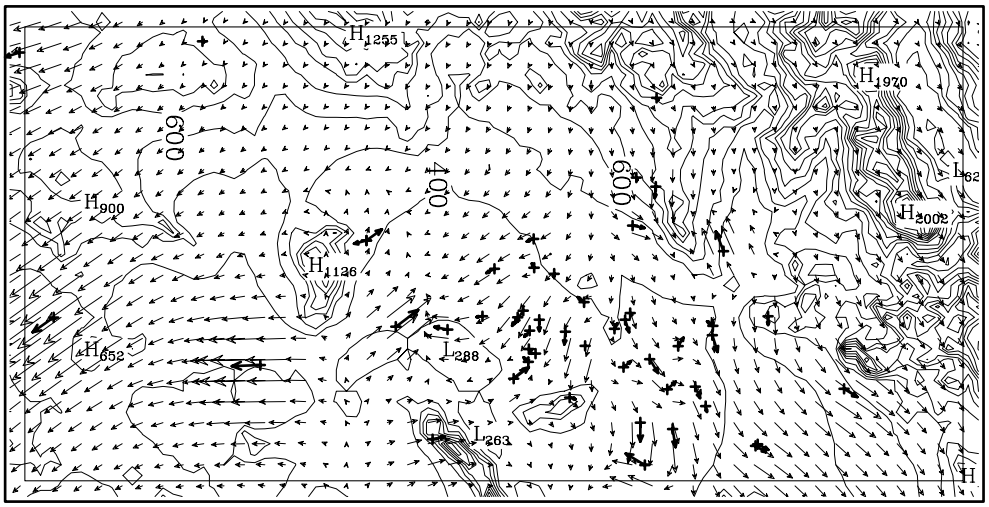

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 19 – 20 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



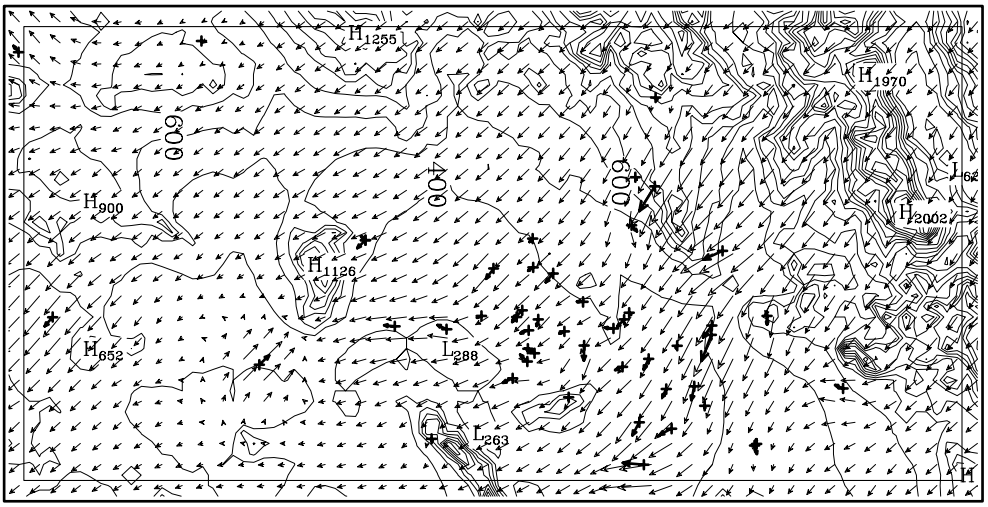

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 20 – 21 MST
MAG OZONE UAM AIRSHED



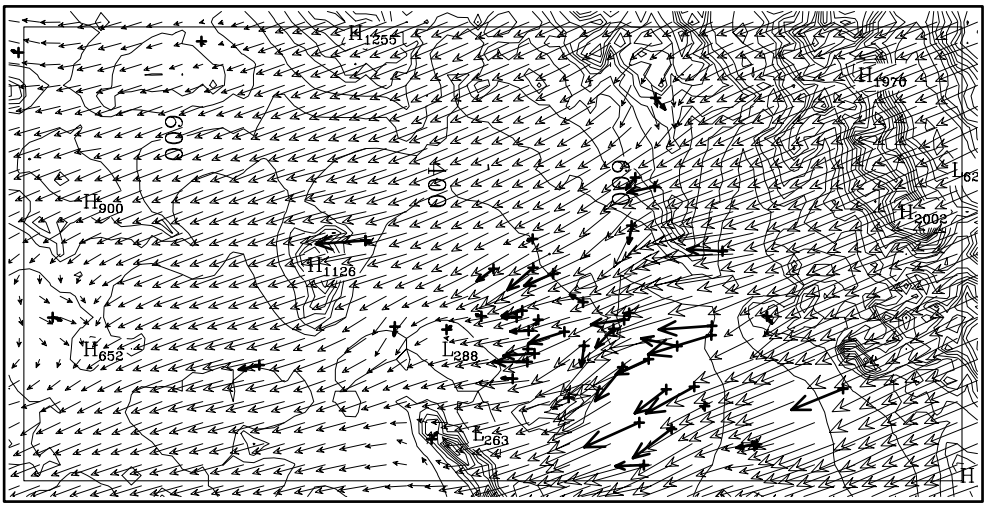

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 21 – 22 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



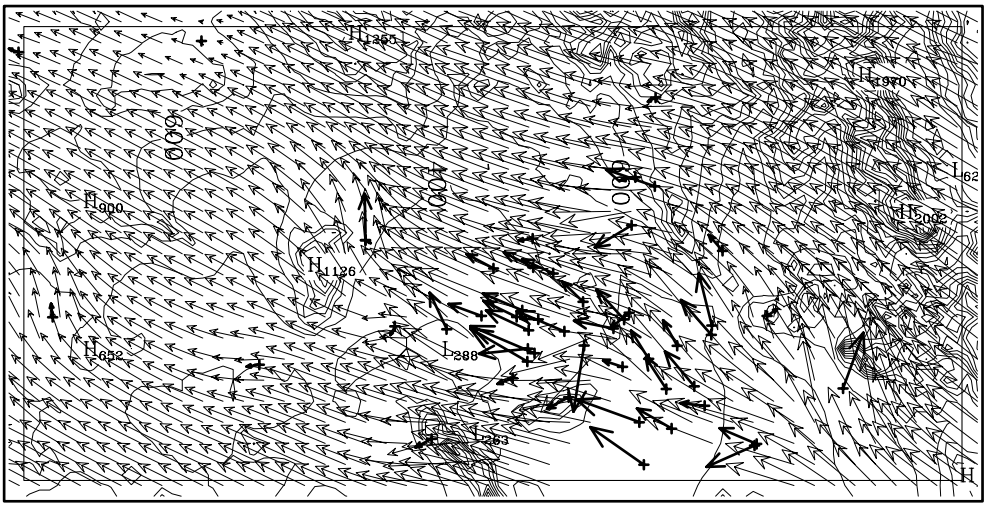

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 22 – 23 MST
MAG OZONE UAM AIRSHED




LAYER 1 DWM WIND FIELD (m/s) JUL 17, 1998 23 – 24 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



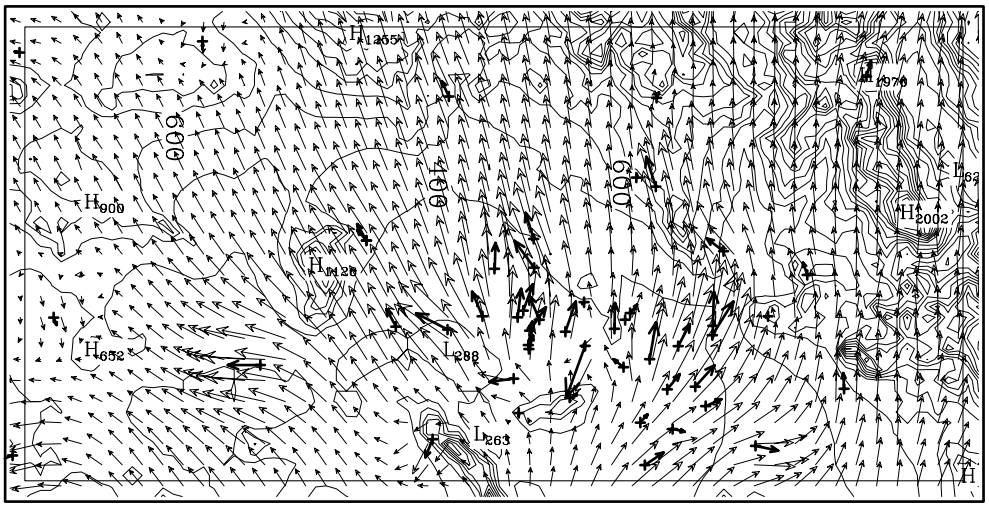

0.500E+01
MAXIMUM VECTOR

Appendix IV-vi

# MODELED WIND FIELDS FOR 1999 EPISODE

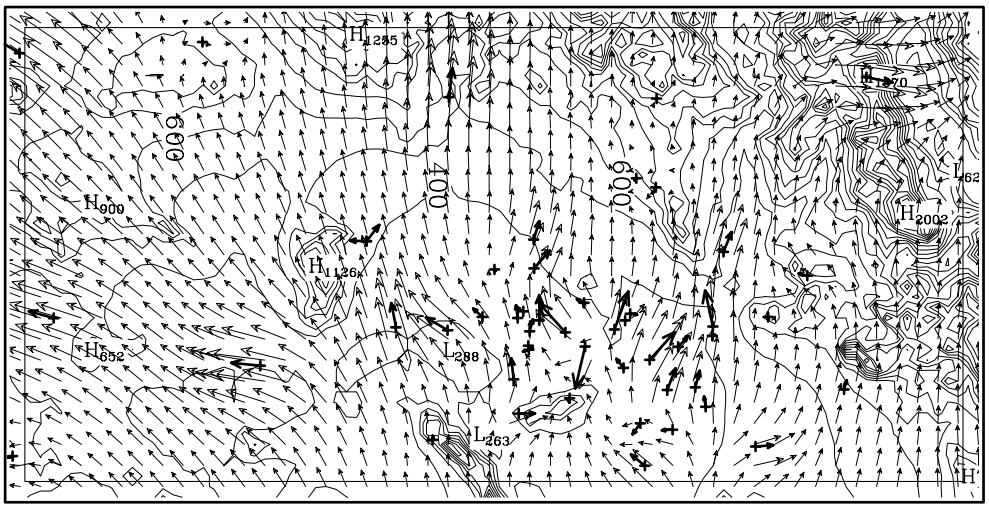
The plots shown here are the simulated DWM winds overlaid with observed wind vectors extended from the plus signs indicating the locations of the monitoring sites. These hourly wind fields are from hour 0 on August 23, 1999 and to hour 2400 on August 24, 1999.

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 0 - 1 MST
MAG OZONE UAM AIRSHED



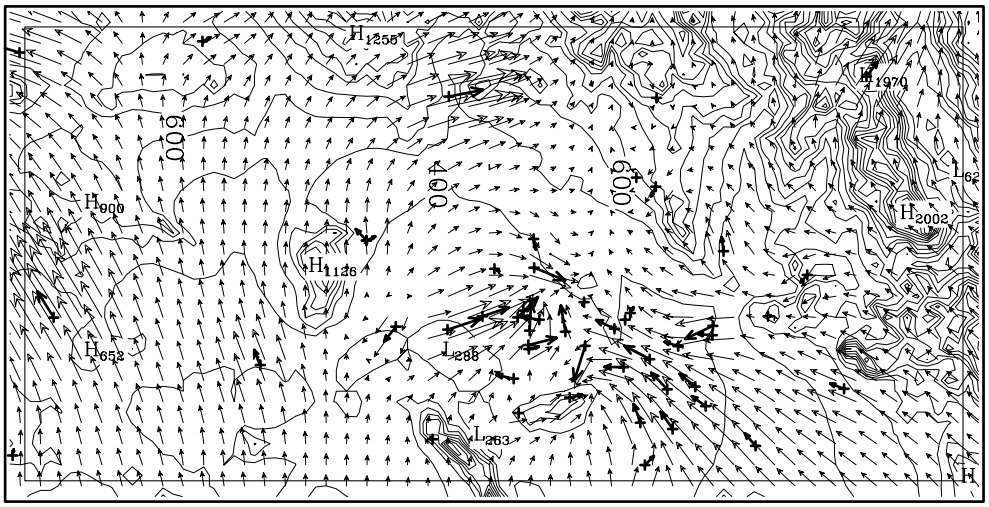

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 1 - 2 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



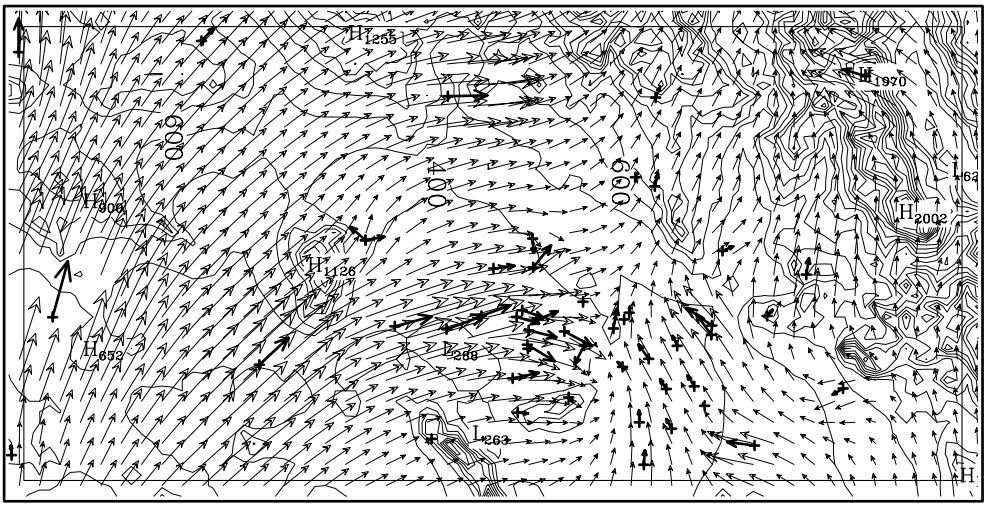

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 2 - 3 MST
MAG OZONE UAM AIRSHED



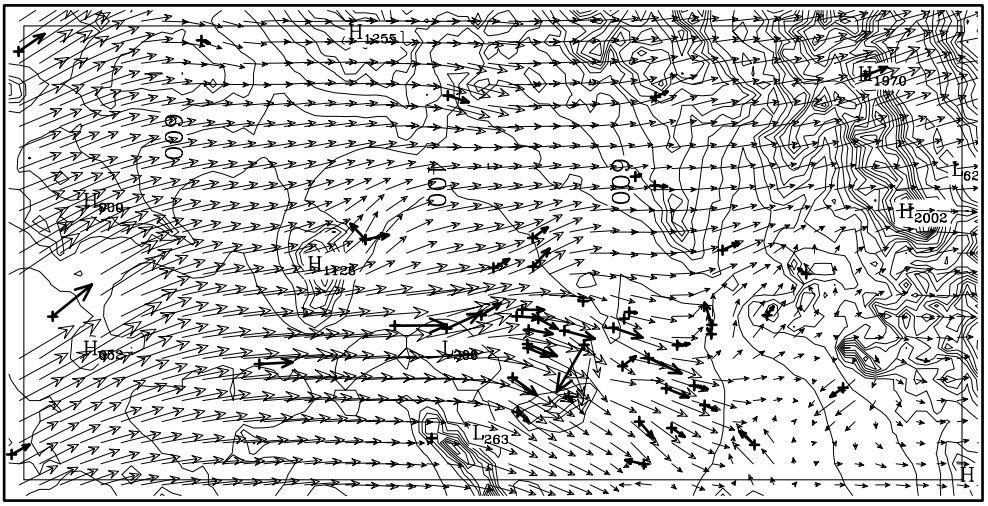

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 3 - 4 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



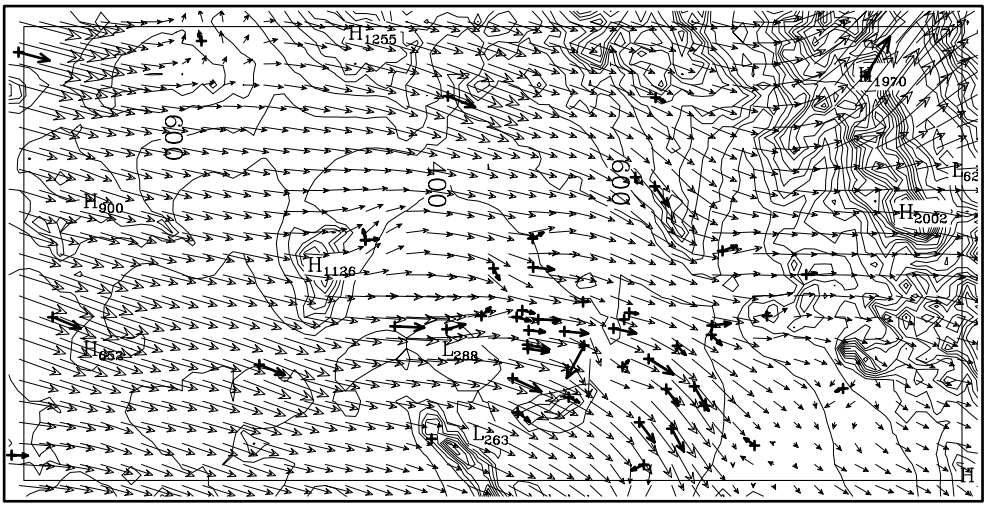

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 4 - 5 MST
MAG OZONE UAM AIRSHED



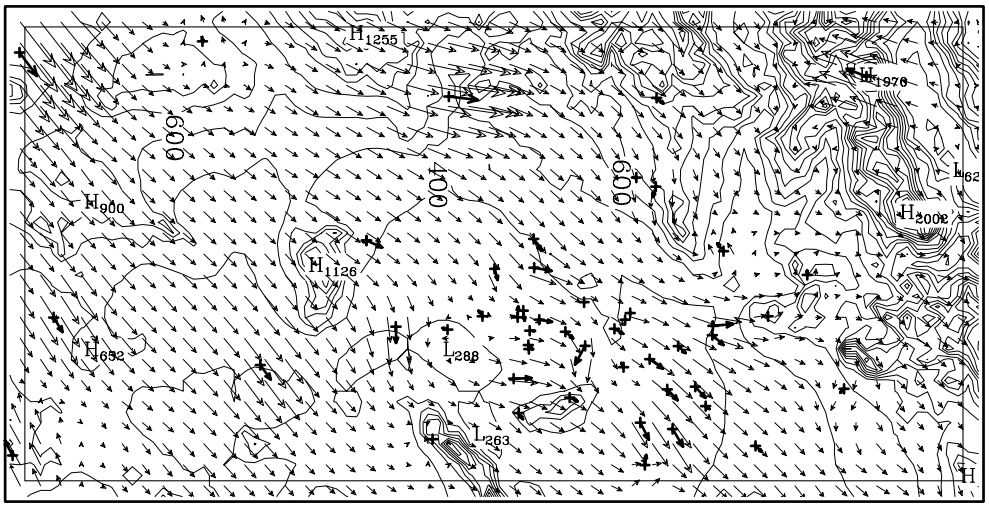

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 5 - 6 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



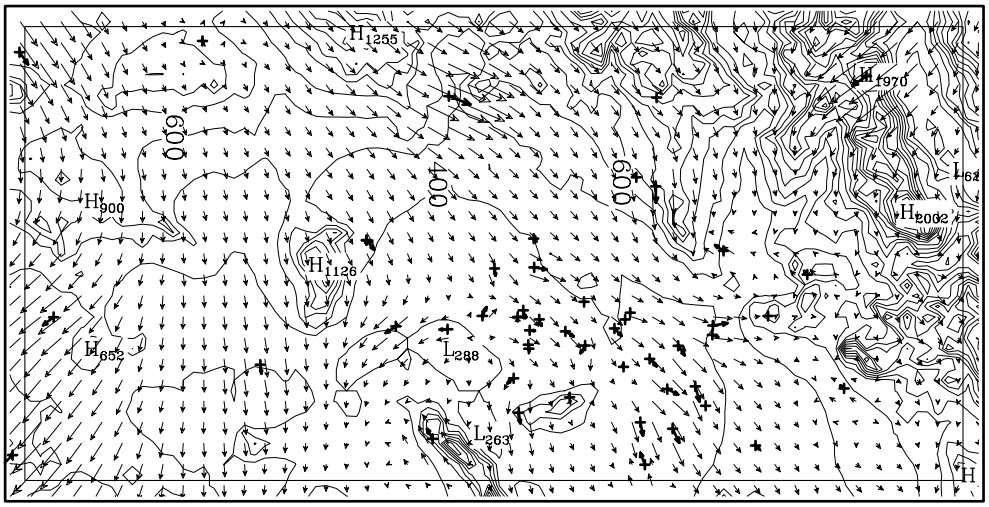

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 6 - 7 MST
MAG OZONE UAM AIRSHED



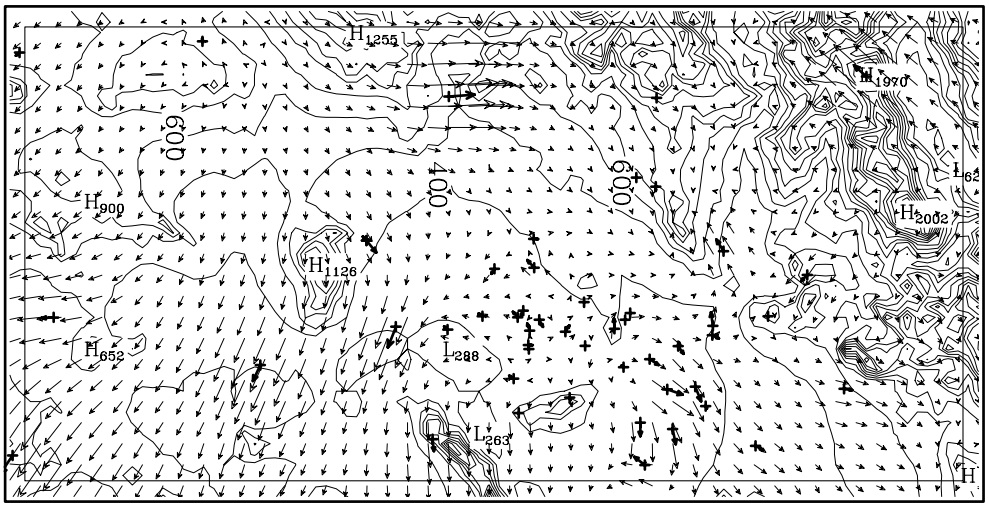

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 7 - 8 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



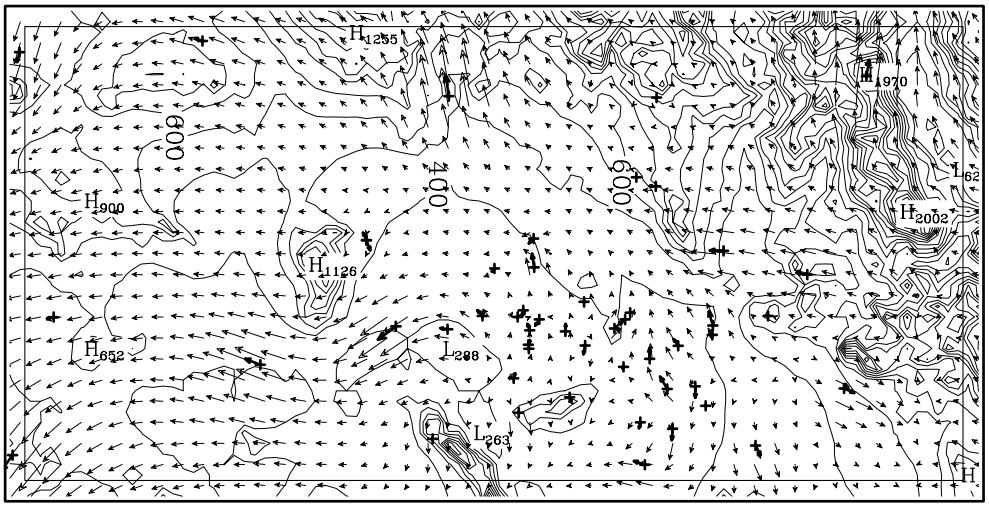

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 8 – 9 MST
MAG OZONE UAM AIRSHED



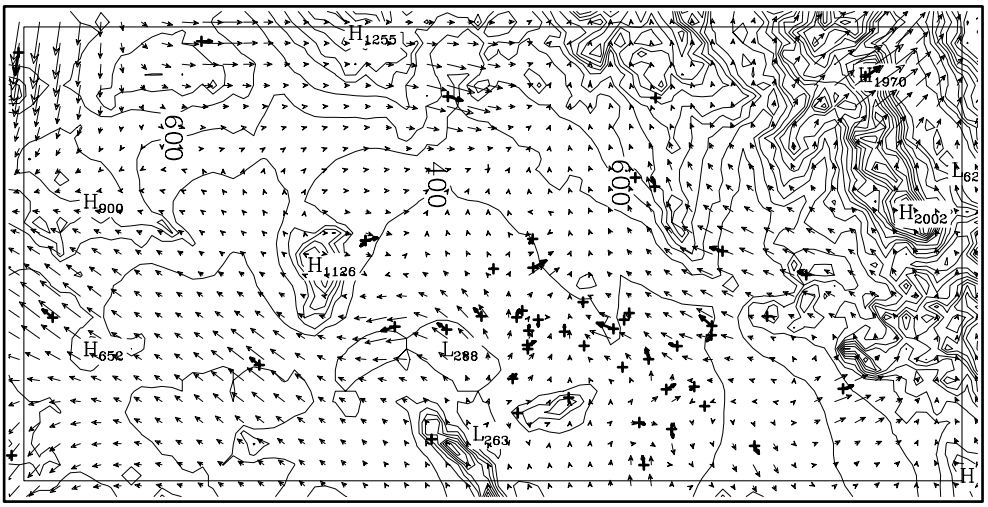

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 9 – 10 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



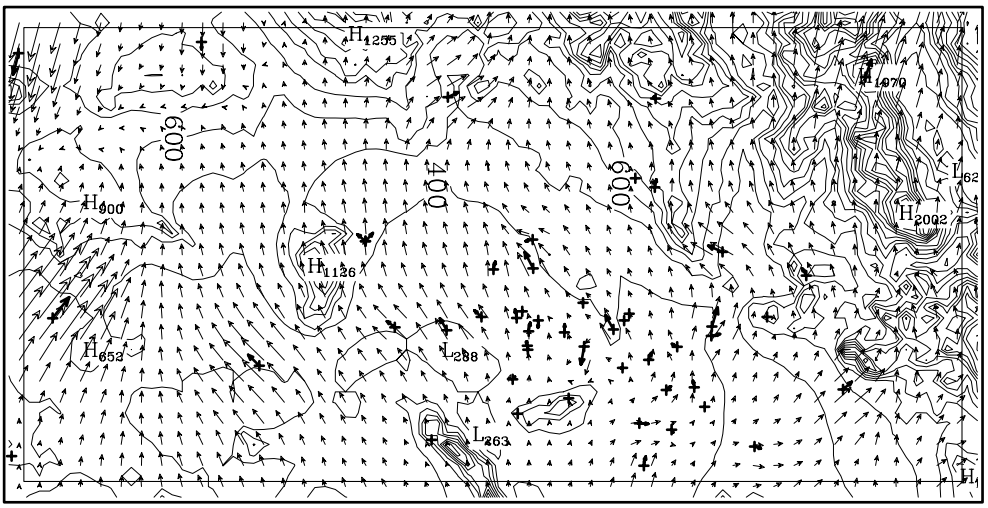

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 10 – 11 MST
MAG OZONE UAM AIRSHED



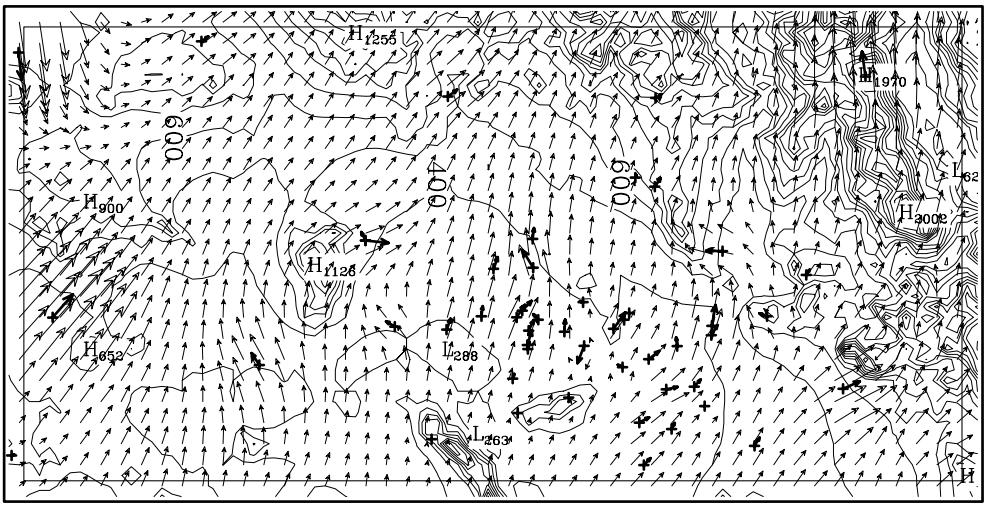

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 11 – 12 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



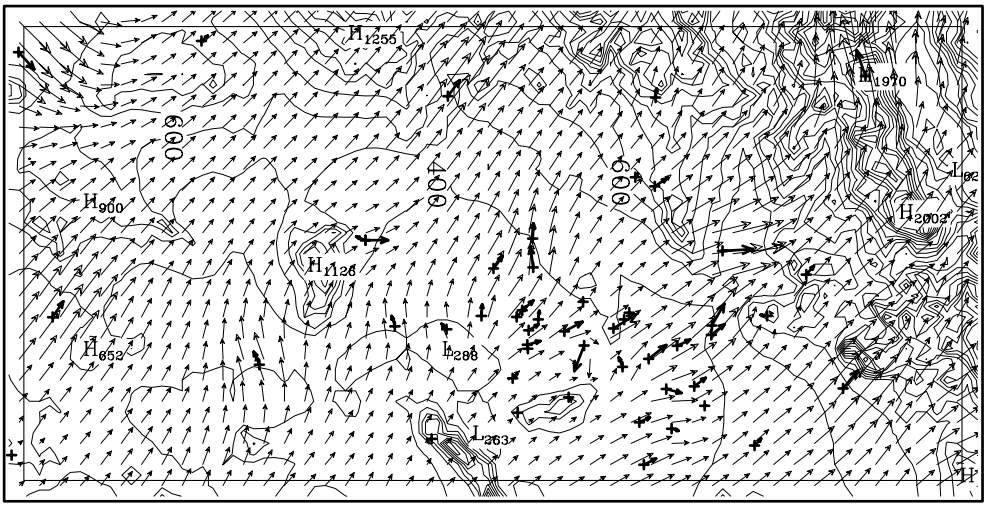

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 12 – 13 MST
MAG OZONE UAM AIRSHED



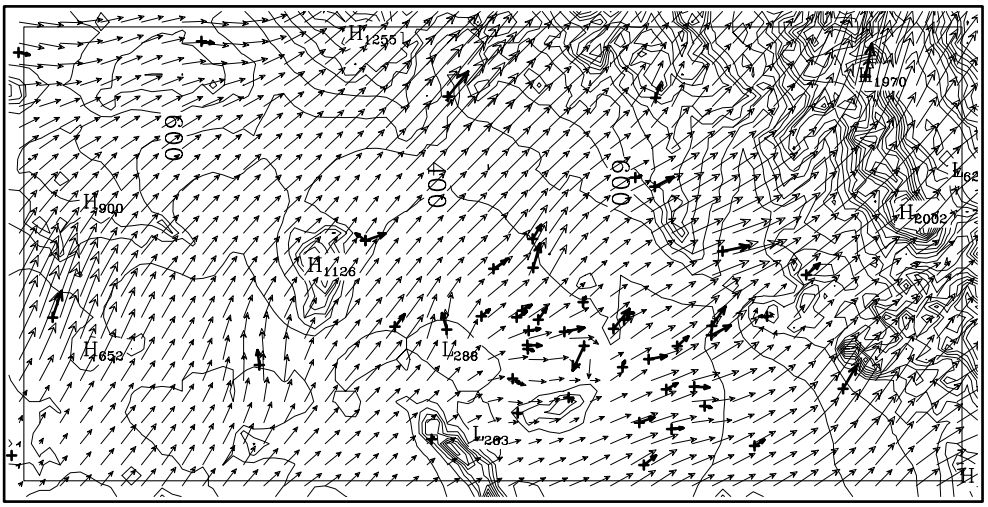

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 13 – 14 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



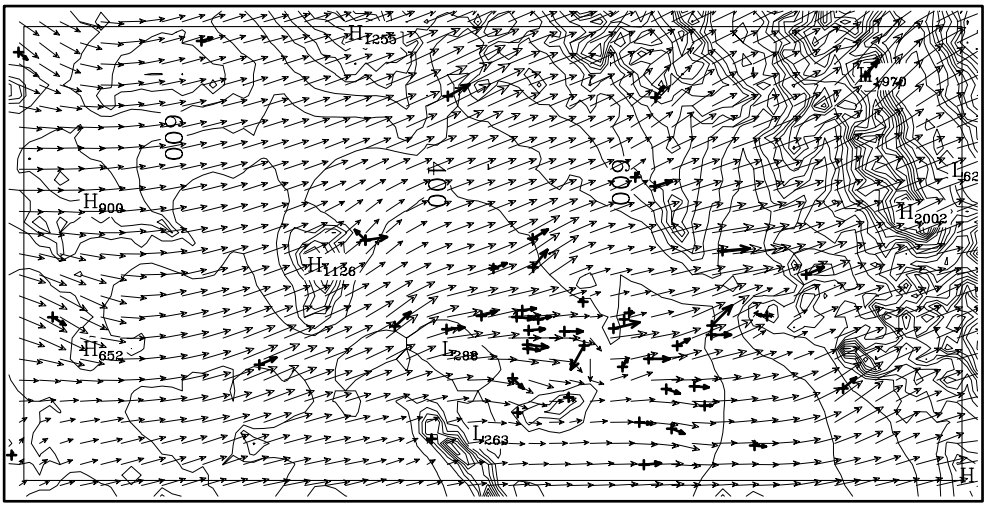

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 14 – 15 MST
MAG OZONE UAM AIRSHED



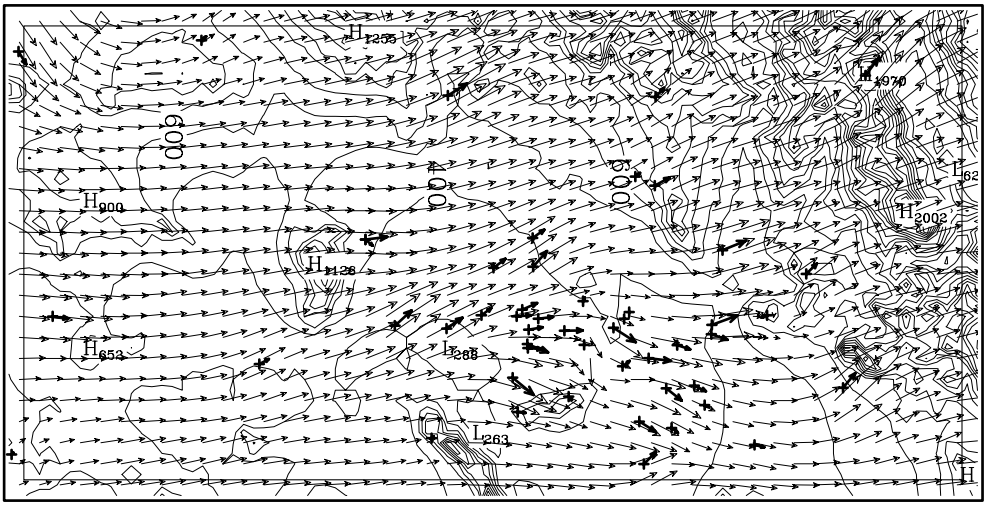

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 15 – 16 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



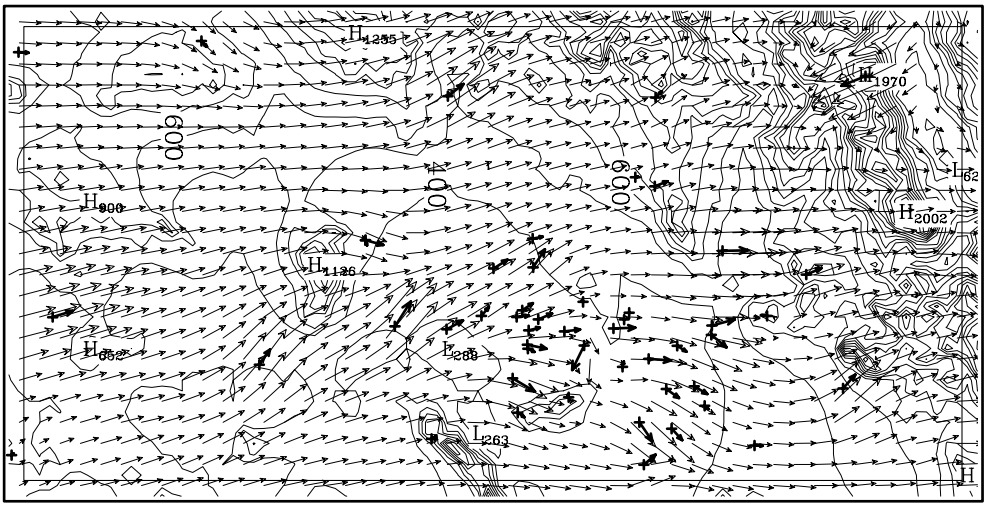

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 16 – 17 MST
MAG OZONE UAM AIRSHED



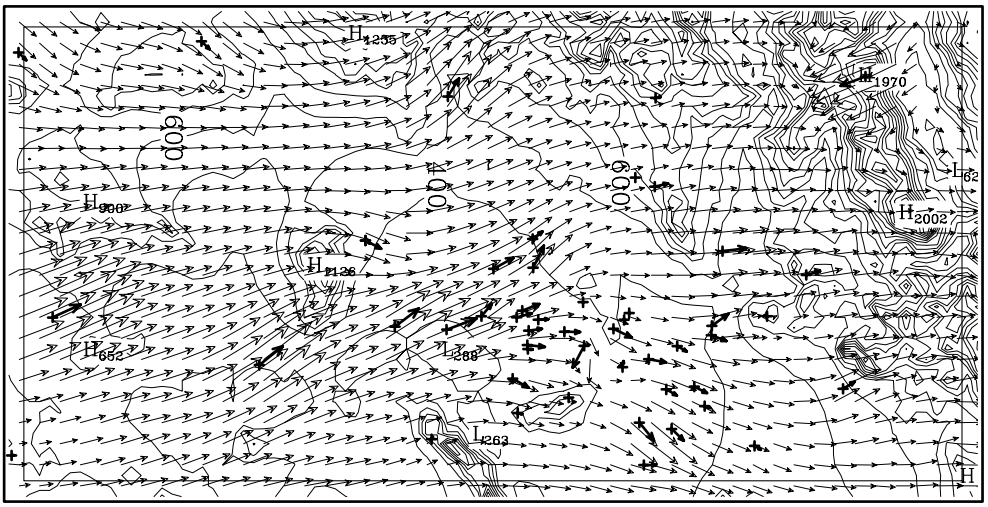

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 17 – 18 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



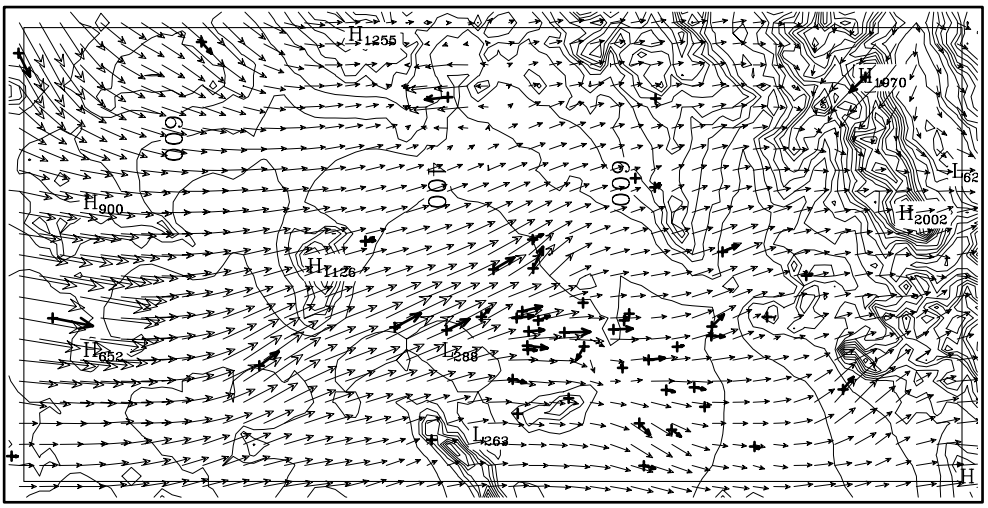

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 18 – 19 MST
MAG OZONE UAM AIRSHED



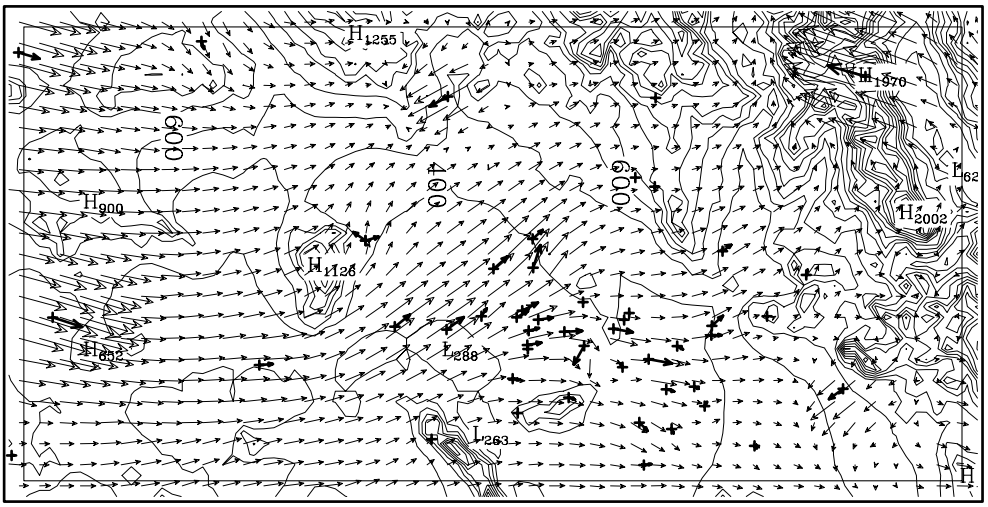

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 19 – 20 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



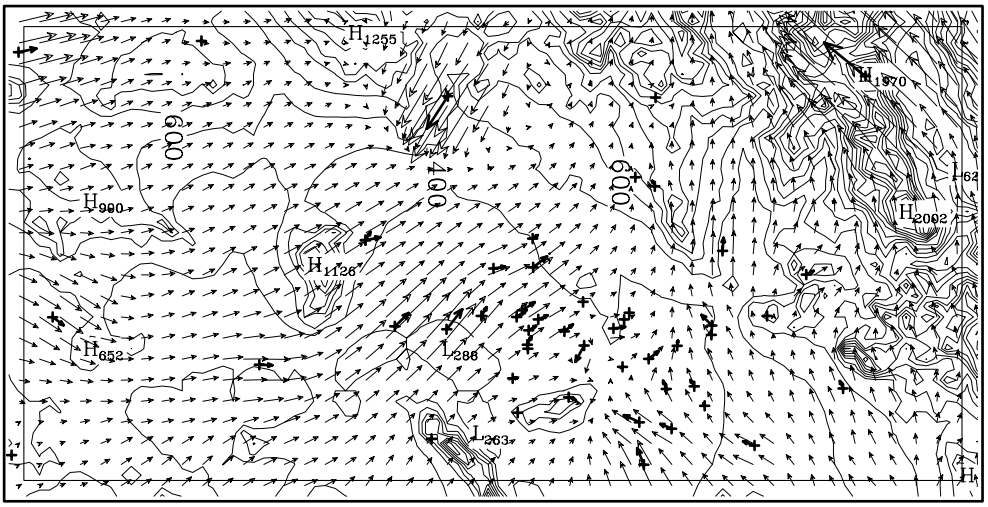

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 20 – 21 MST
MAG OZONE UAM AIRSHED



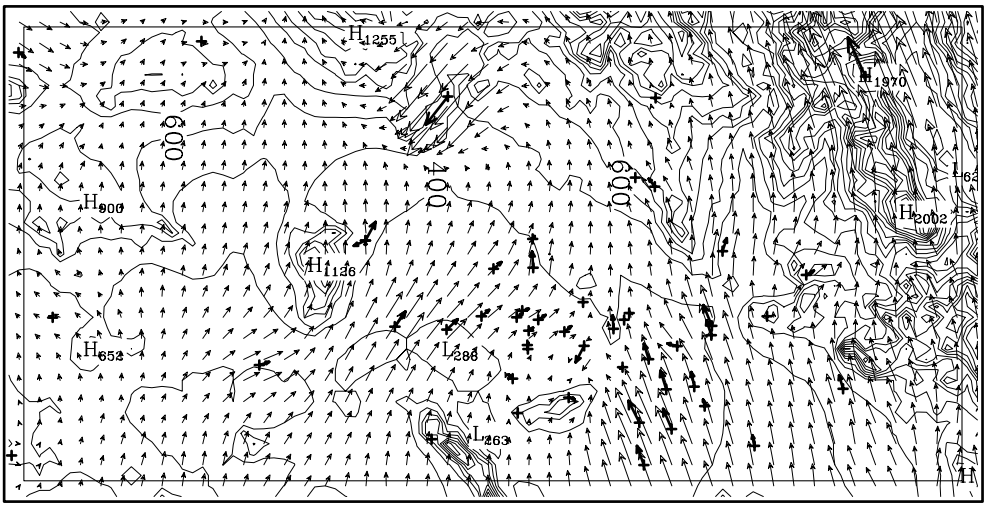

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 21 – 22 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



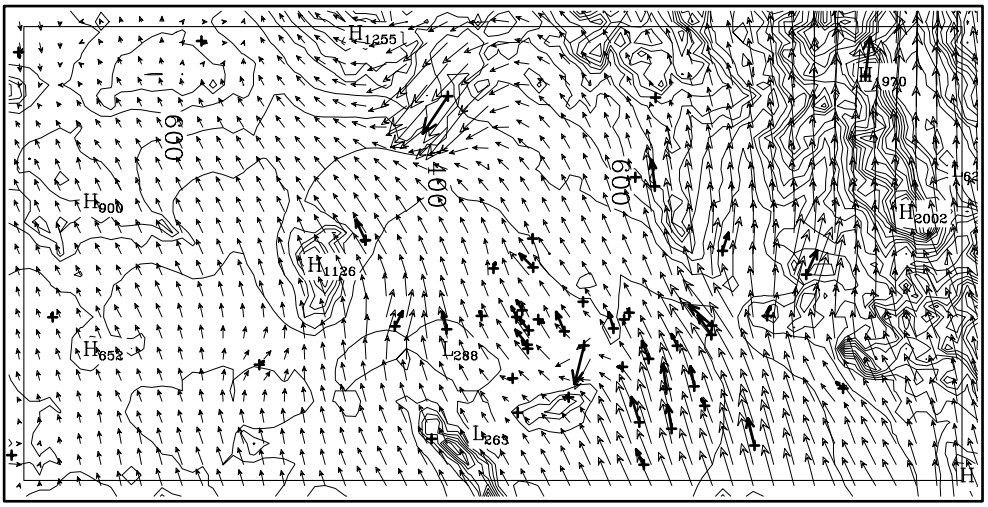

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 22 – 23 MST
MAG OZONE UAM AIRSHED



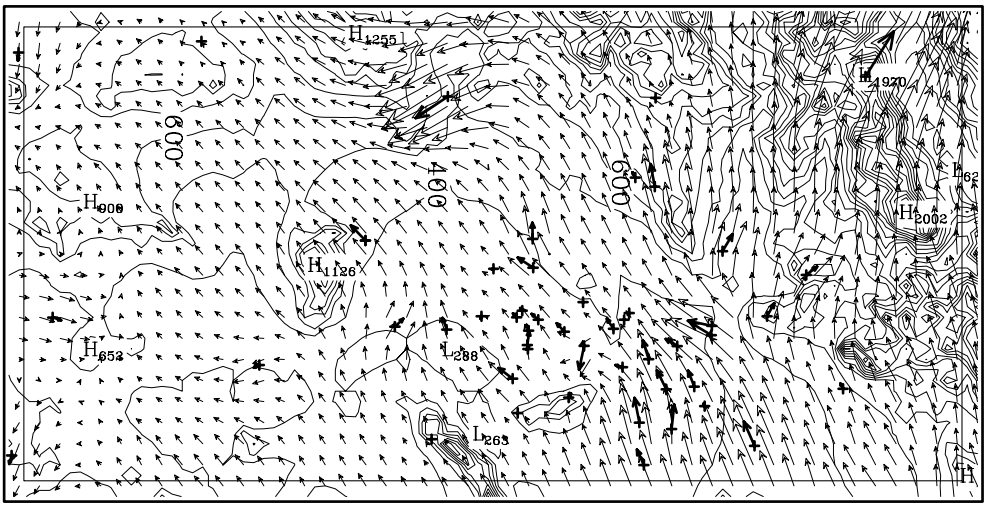

LAYER 1 DWM WIND FIELD (m/s) AUG 23, 1999 23 – 24 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



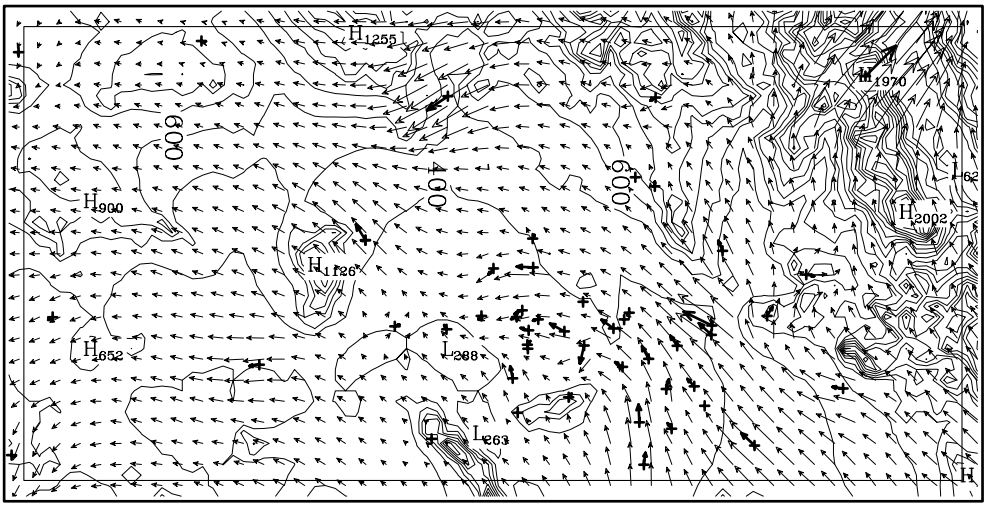

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 0 - 1 MST
MAG OZONE UAM AIRSHED



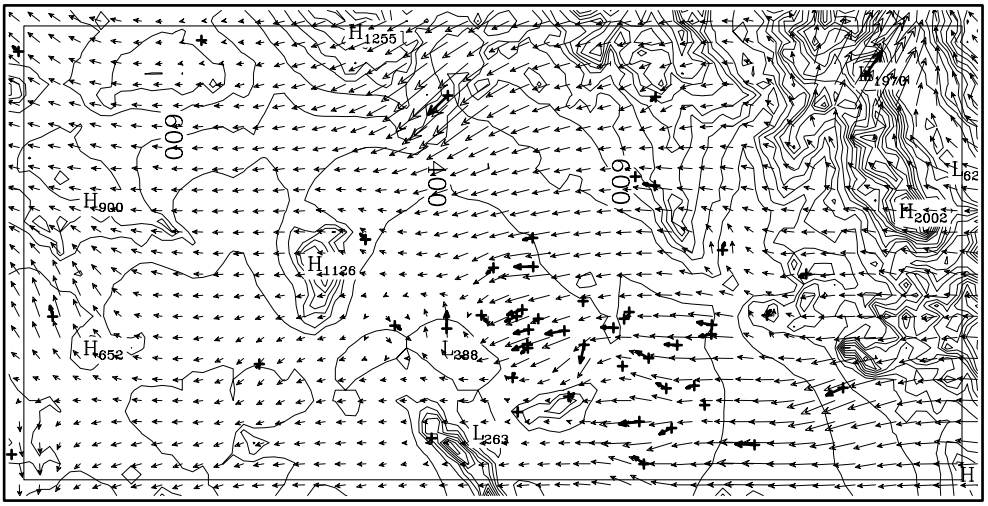

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 1 - 2 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



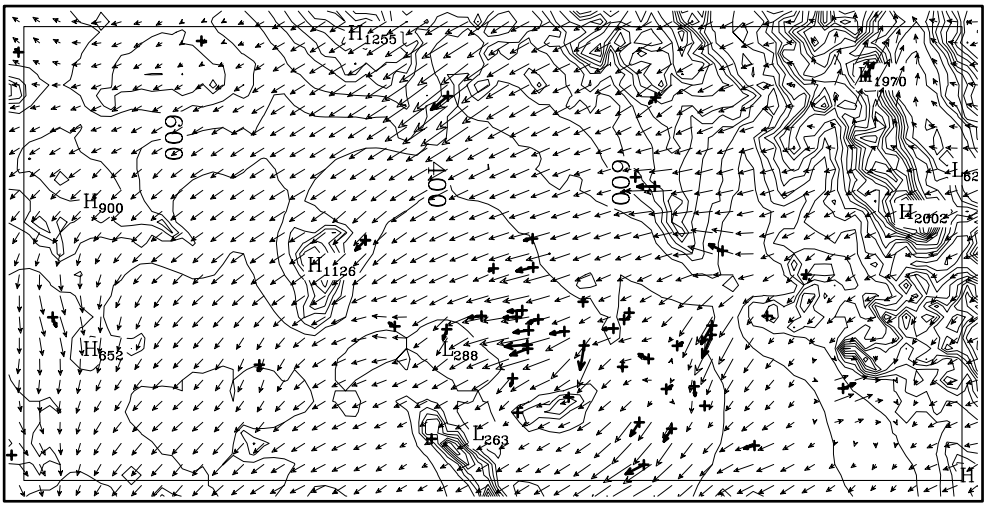

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 2 - 3 MST
MAG OZONE UAM AIRSHED



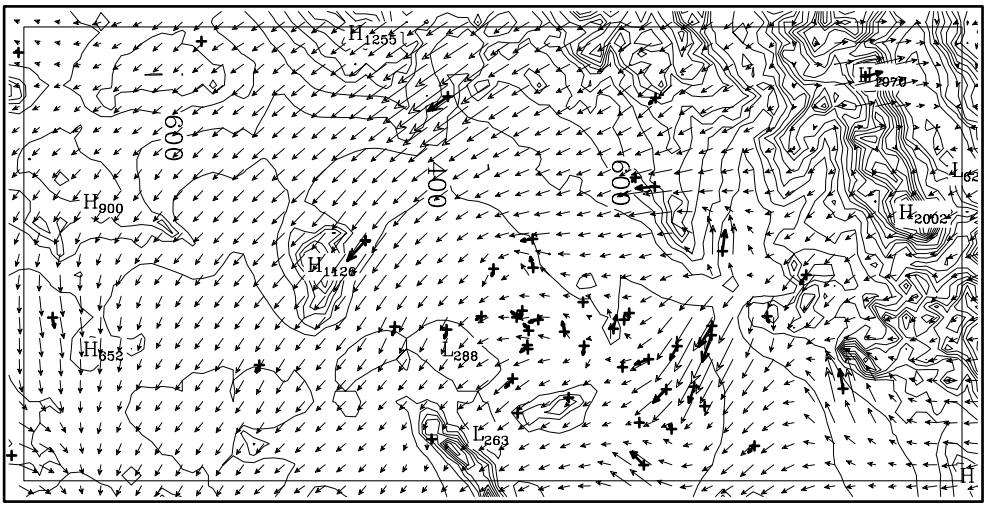

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 3 - 4 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



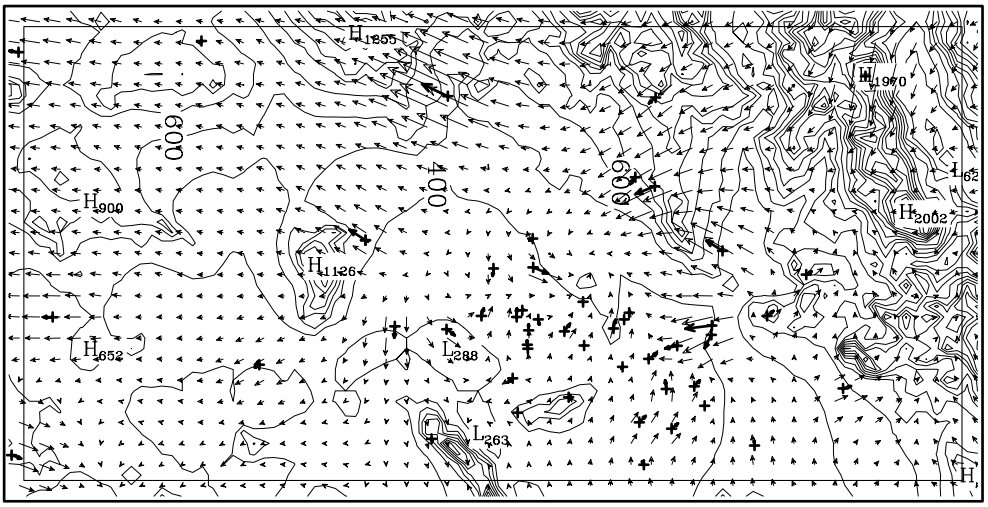

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 4 - 5 MST
MAG OZONE UAM AIRSHED



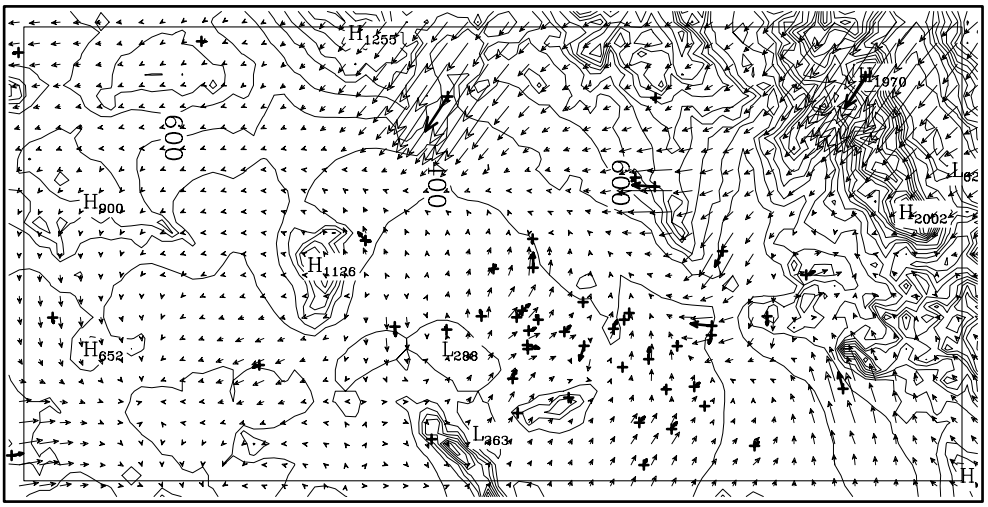

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 5 - 6 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



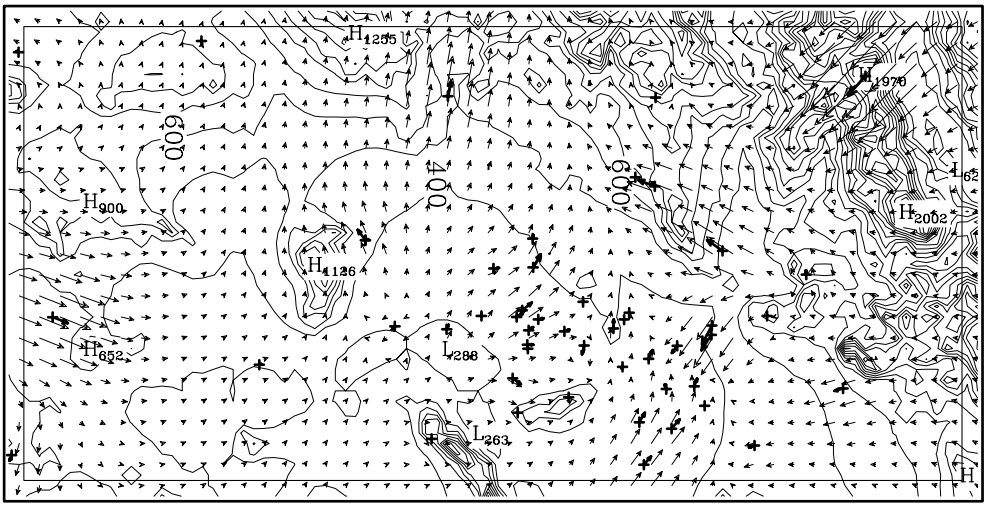

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 6 - 7 MST
MAG OZONE UAM AIRSHED



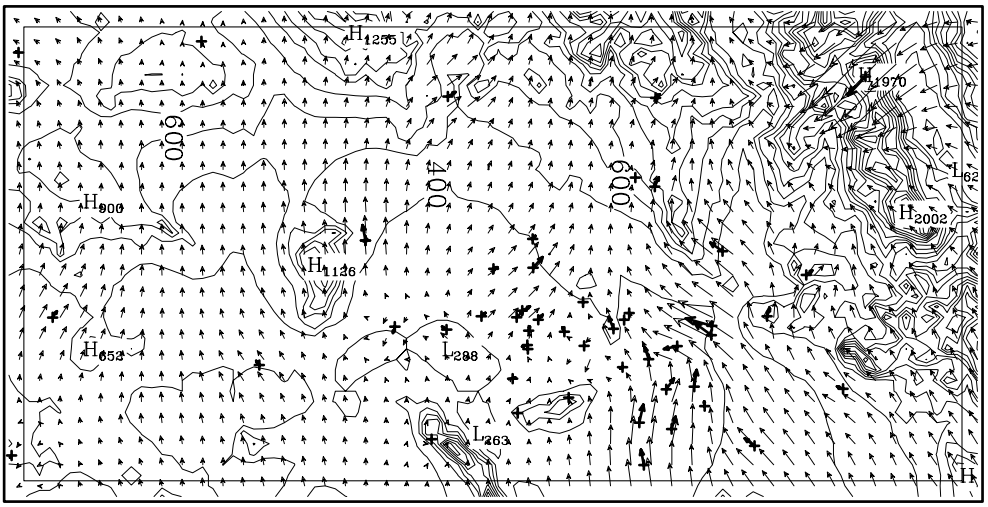

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 7 - 8 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



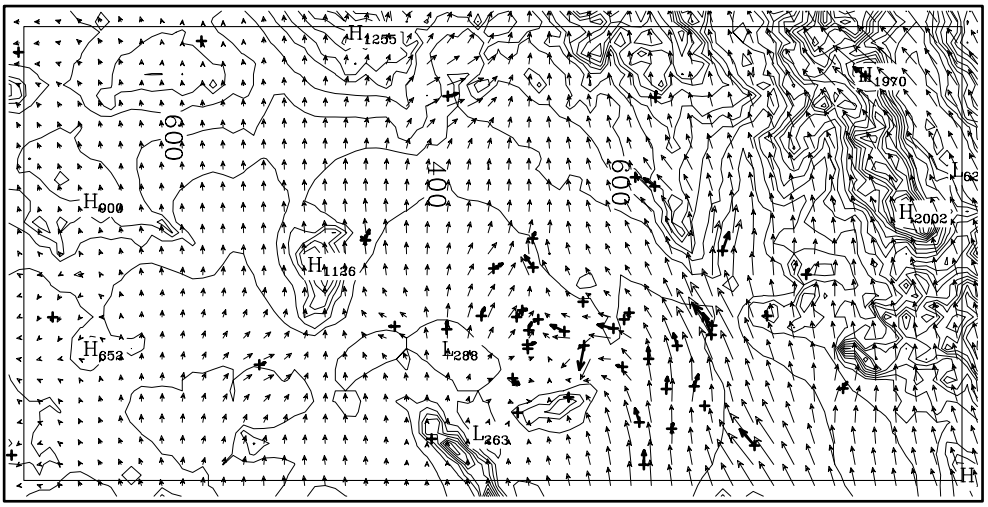

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 8 – 9 MST
MAG OZONE UAM AIRSHED



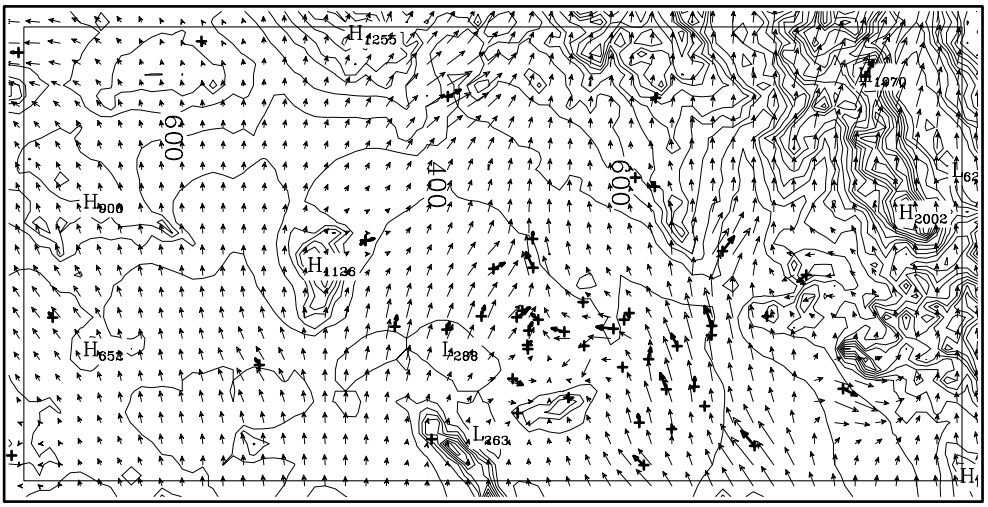

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 9 – 10 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



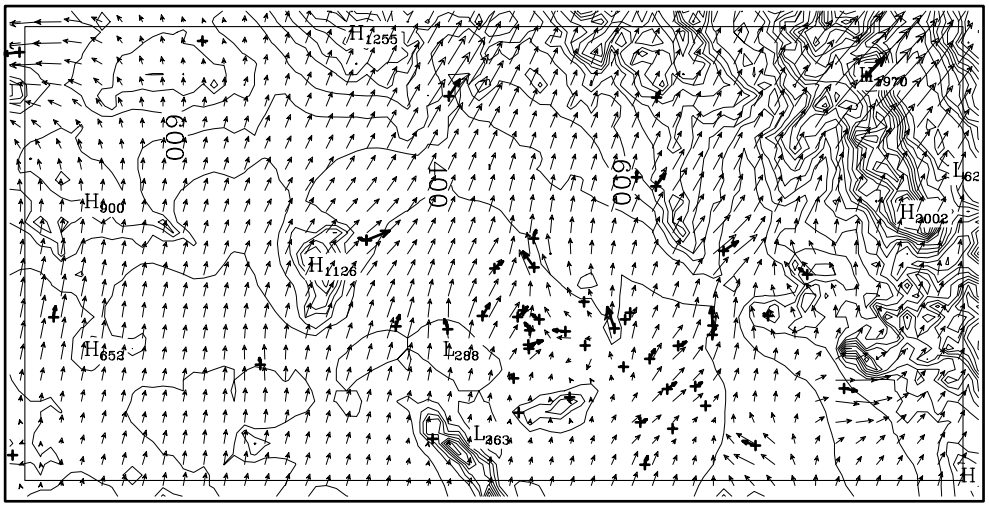

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 10 – 11 MST
MAG OZONE UAM AIRSHED



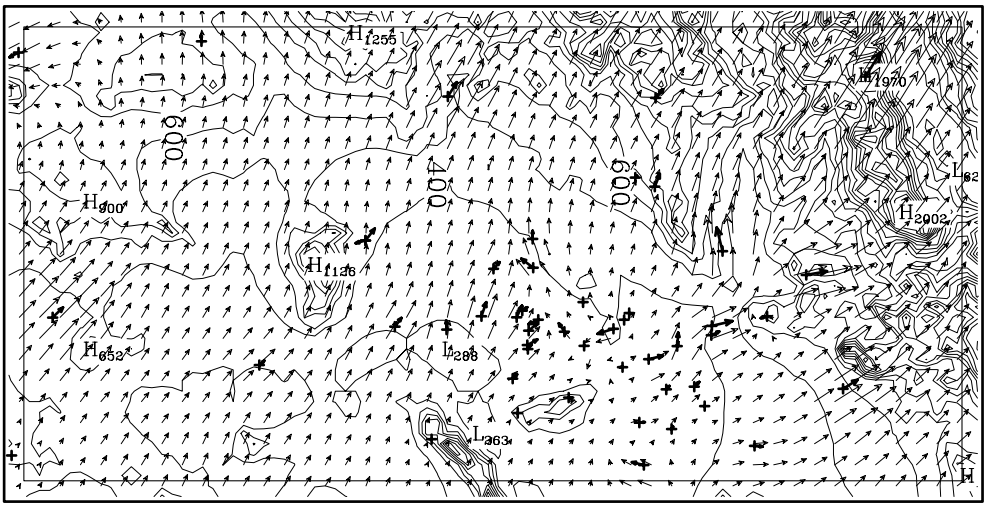

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 11 – 12 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



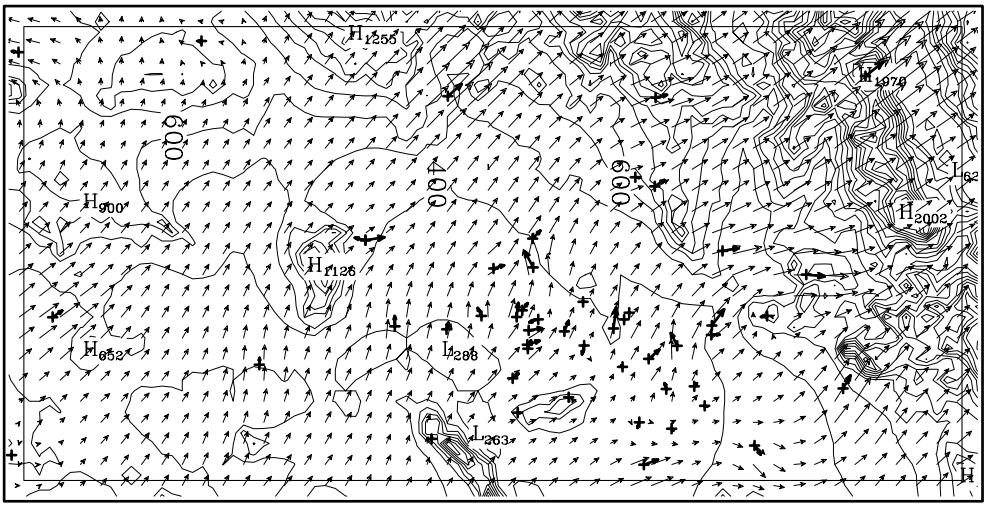

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 12 – 13 MST
MAG OZONE UAM AIRSHED



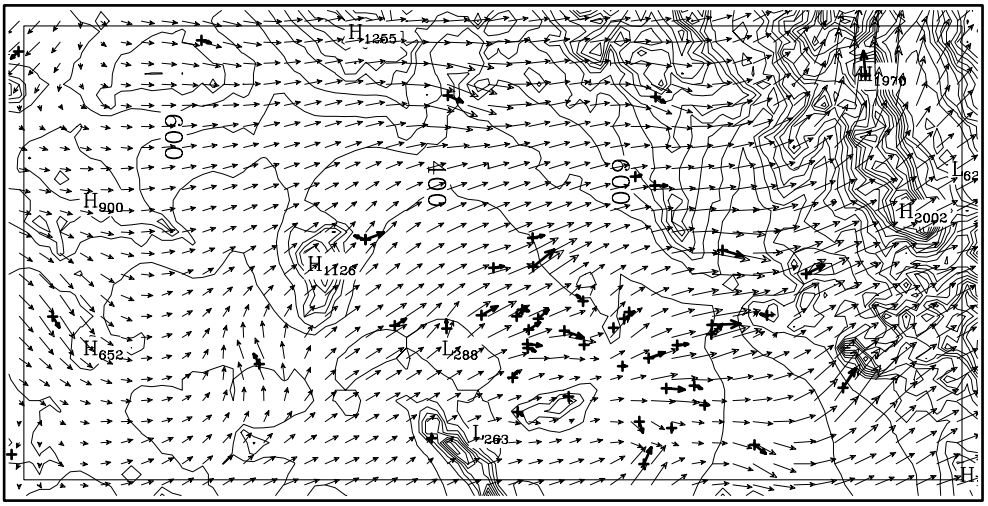

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 13 – 14 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



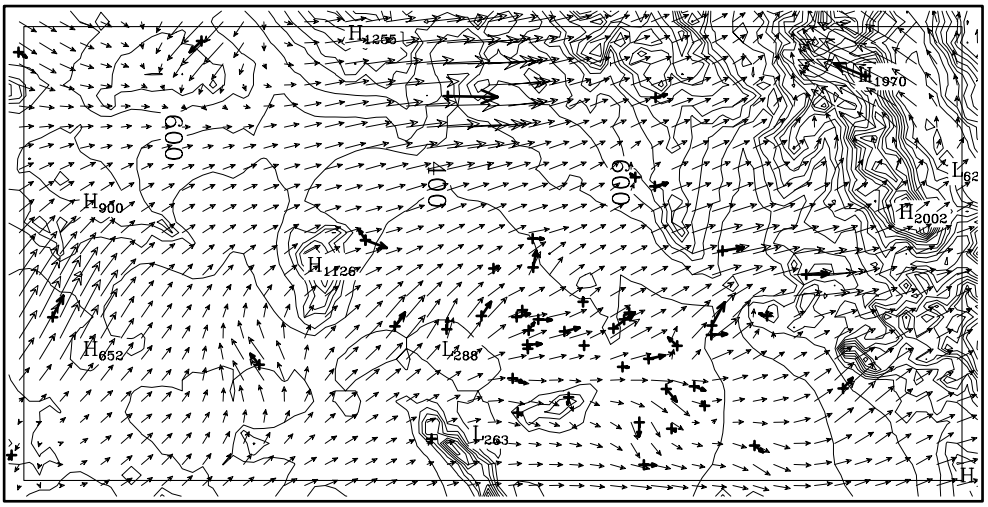

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 14 – 15 MST
MAG OZONE UAM AIRSHED



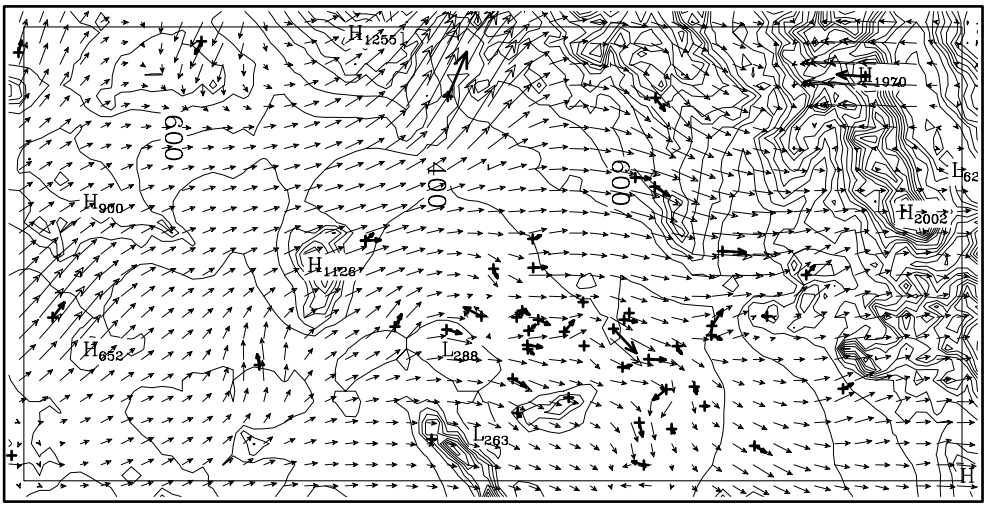

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 15 – 16 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



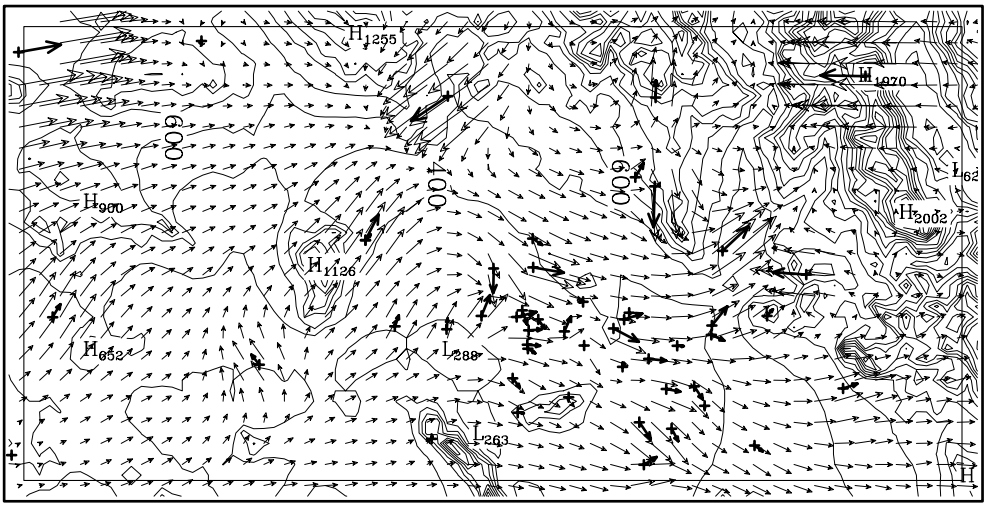

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 16 – 17 MST
MAG OZONE UAM AIRSHED



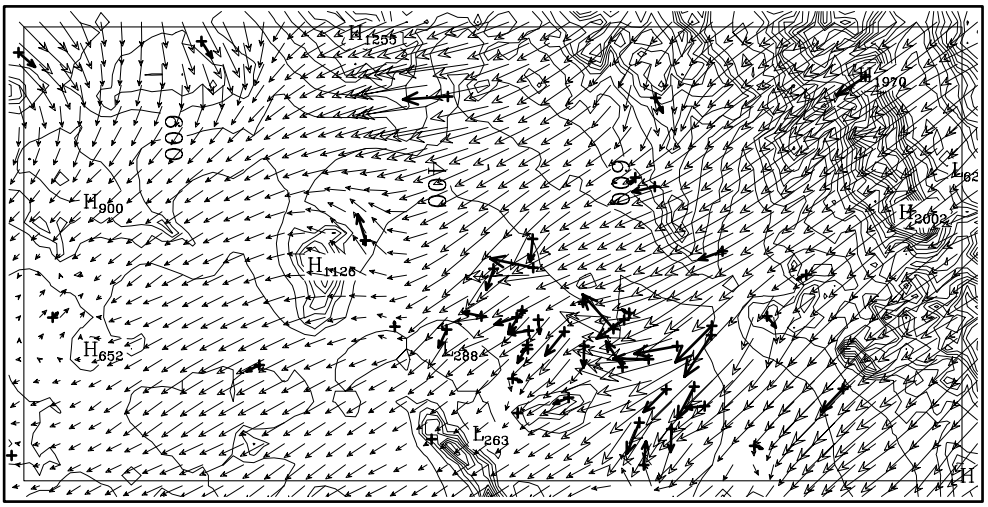

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 17 – 18 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



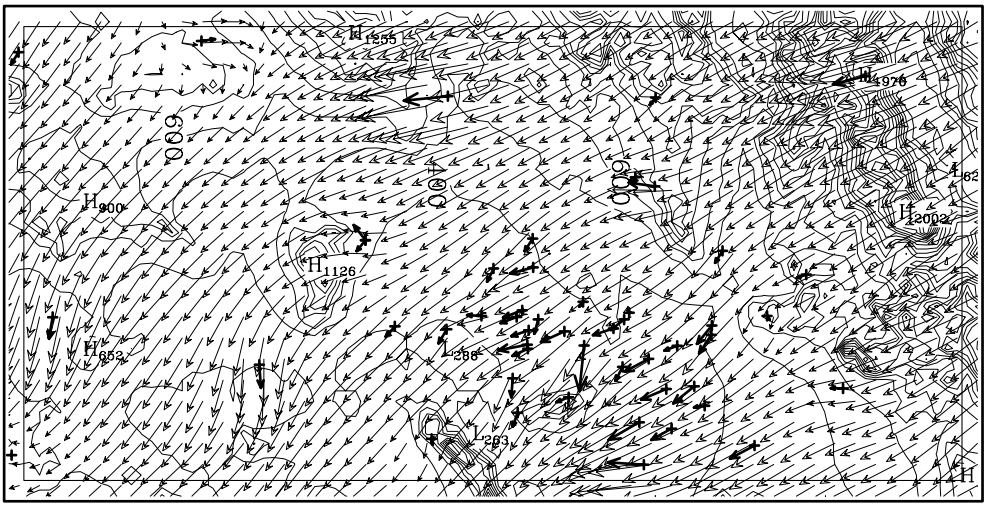

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 18 – 19 MST
MAG OZONE UAM AIRSHED



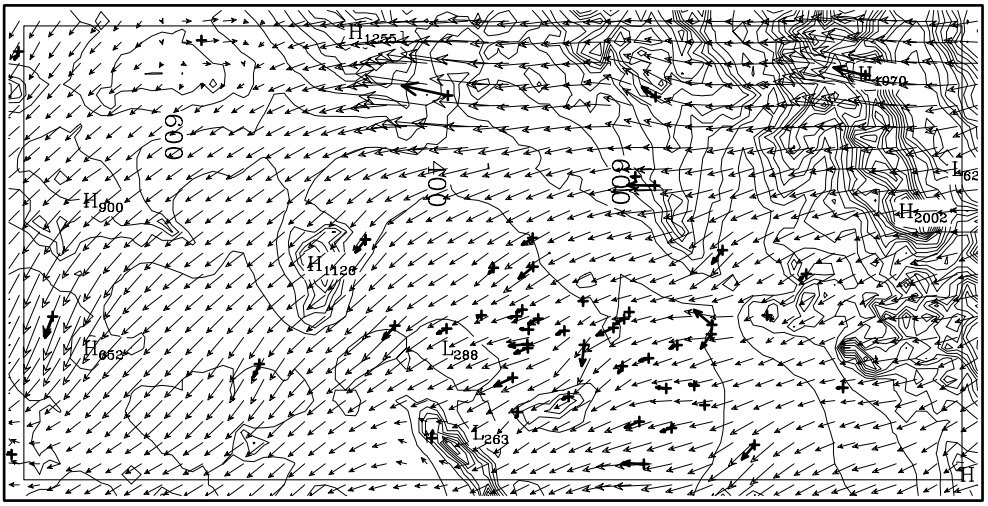

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 19 – 20 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



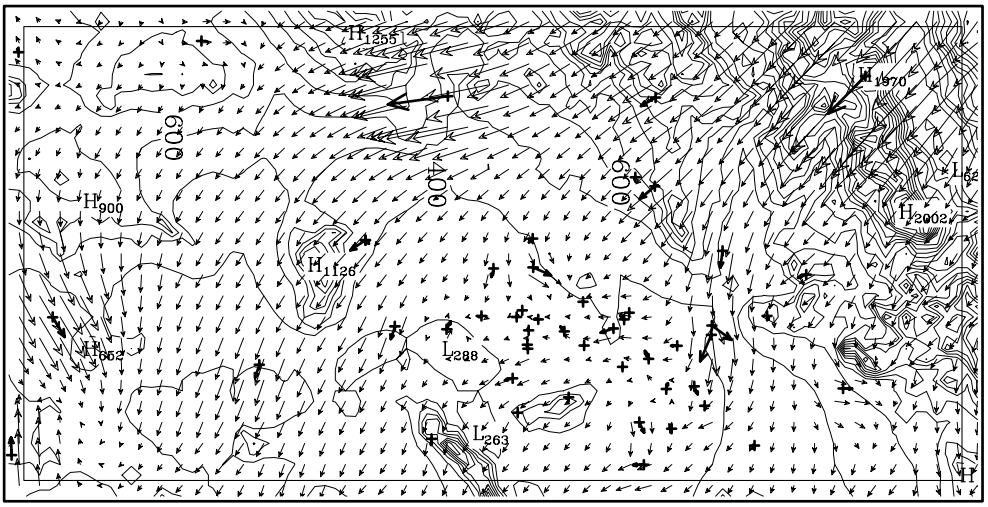

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 20 – 21 MST
MAG OZONE UAM AIRSHED



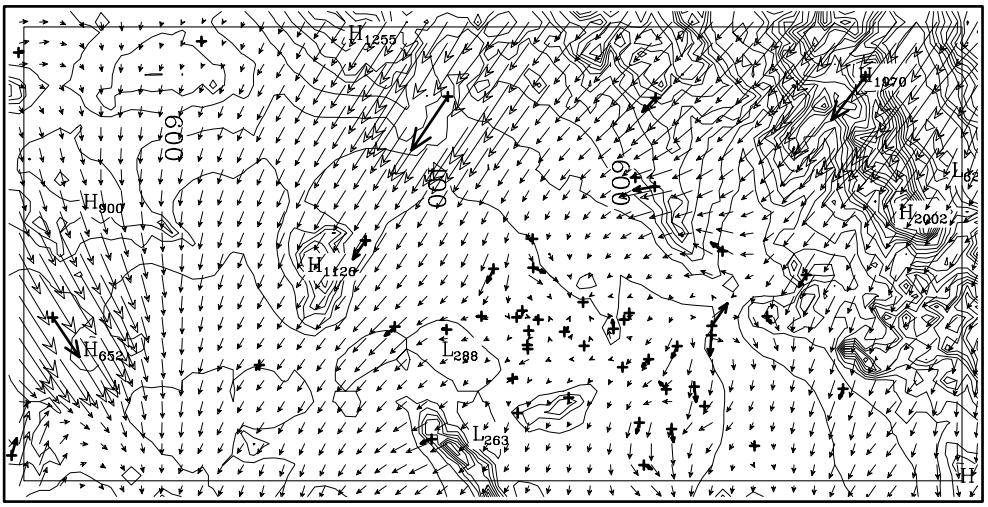

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 21 – 22 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR



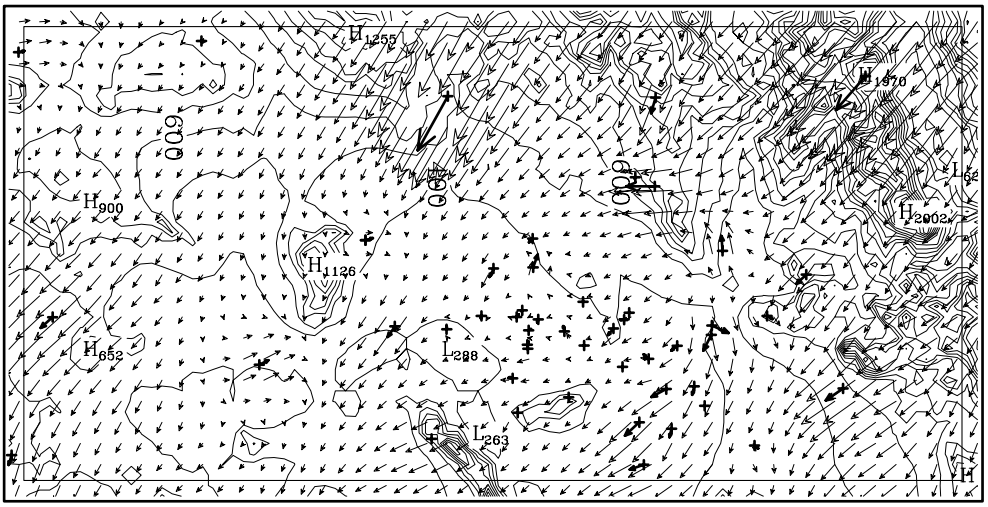

0.500E+01
MAXIMUM VECTOR

LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 22 – 23 MST
MAG OZONE UAM AIRSHED




LAYER 1 DWM WIND FIELD (m/s) AUG 24, 1999 23 – 24 MST
MAG OZONE UAM AIRSHED

0.500E+01
MAXIMUM VECTOR

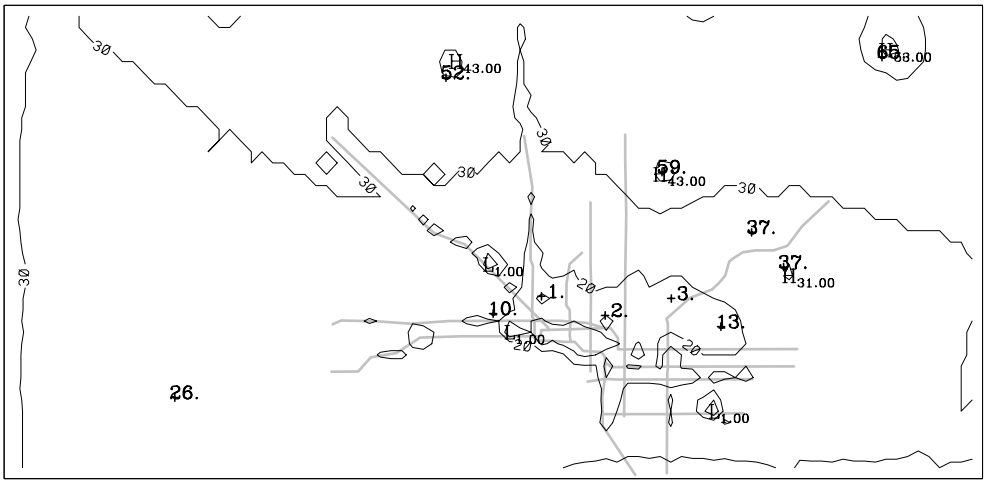



0.500E+01
MAXIMUM VECTOR

OZONE CONCENTRATION FIELDS FOR 1998 EPISODE

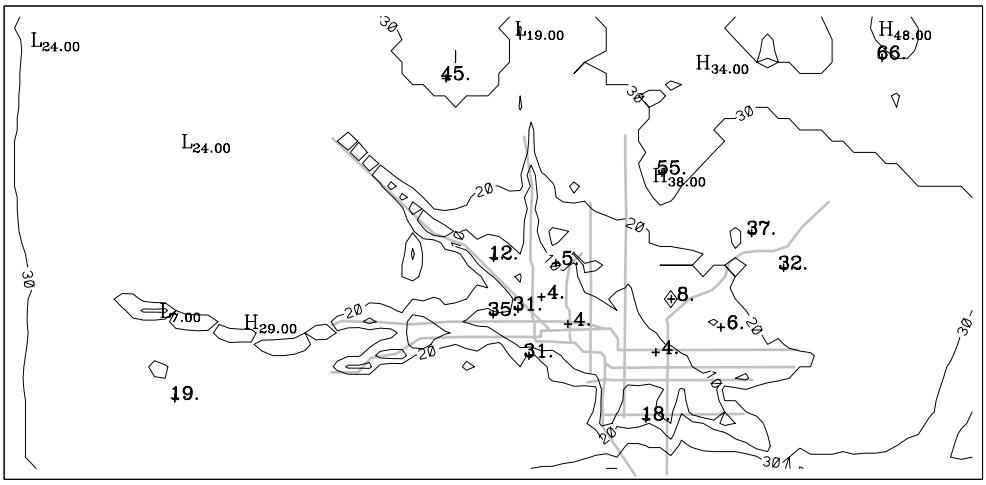
The plots shown here are the simulated and observed ozone concentrations. The plus signs indicate the locations of the monitoring sites. These hourly plots are from hour 0 on July 16, 1998 to hour 2400 on July 17, 1998.

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0000-0100 MST



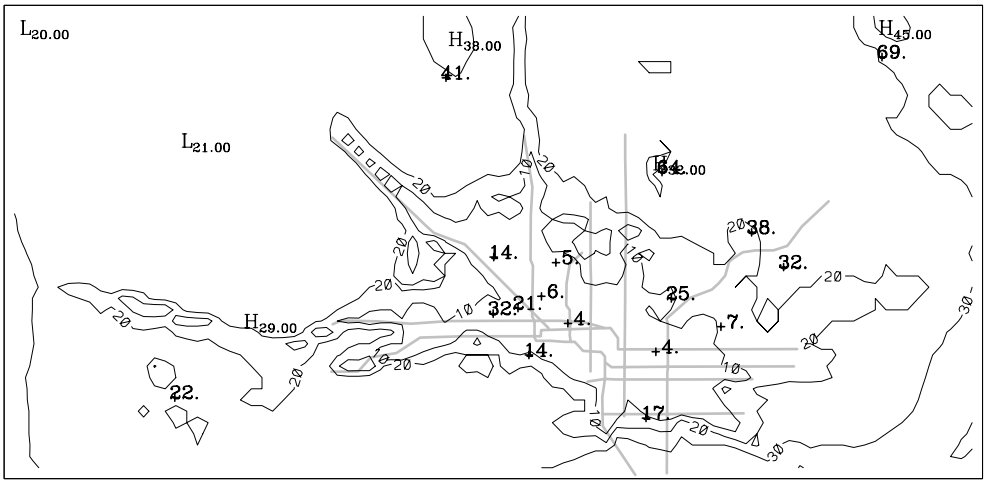

SIMULATED  MAX  53.0  MIN  1.0  AVG  28.5  MAX AT (83,39)
OBSERVED  MAX  65.0  MIN  1.0  AVG  27.7

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0100-0200 MST



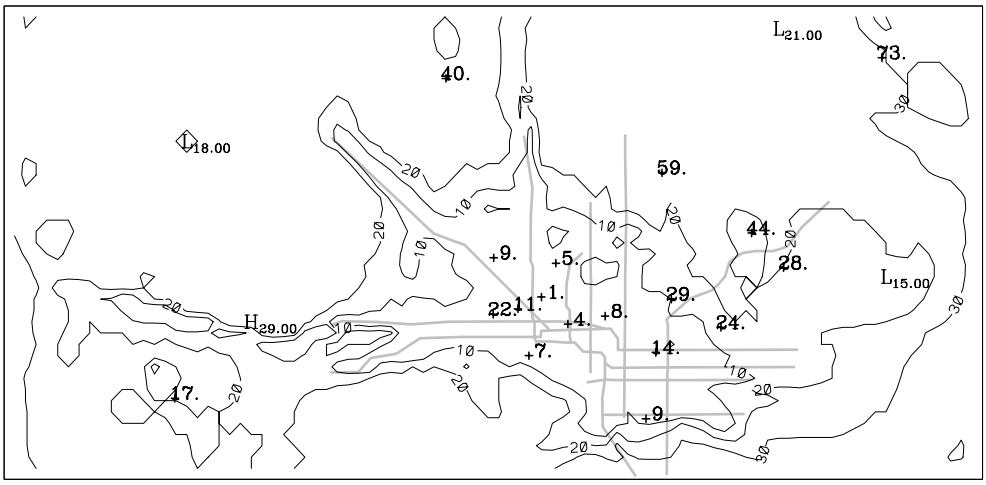

SIMULATED  MAX  48.0  MIN  0.0  AVG  24.8  MAX AT (83,41)
OBSERVED  MAX  66.0  MIN  2.0  AVG  23.0

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0200–0300 MST



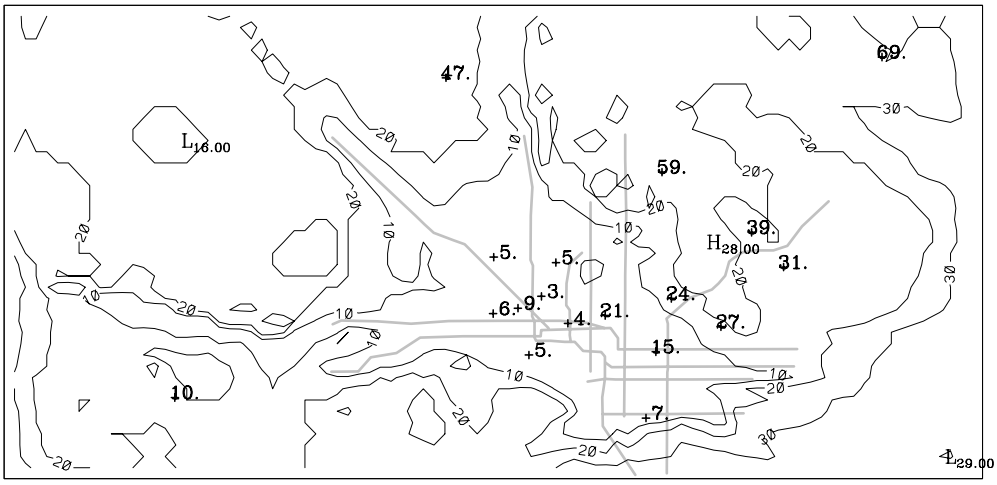

SIMULATED  MAX  45.0  MIN  0.0  AVG  22.3  MAX AT (83,41)
OBSERVED  MAX  69.0  MIN  2.0  AVG  23.2

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0300–0400 MST



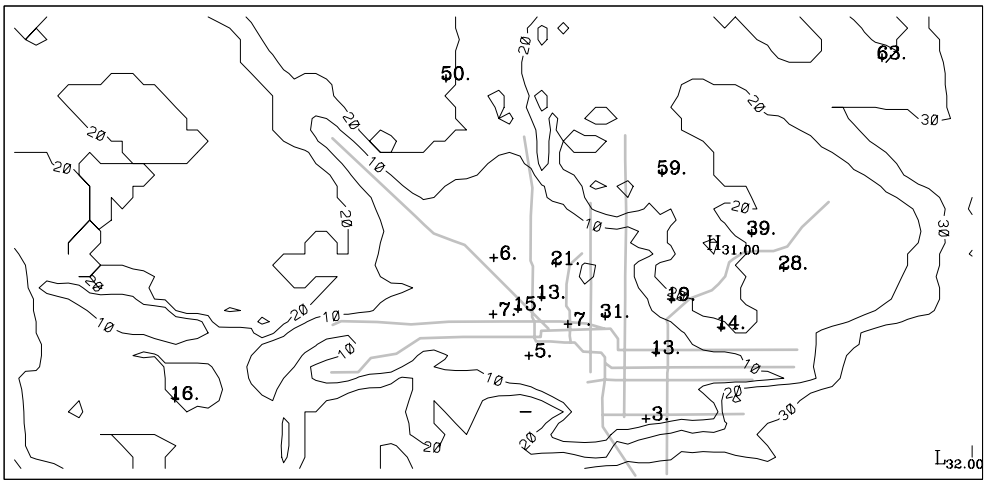

SIMULATED  MAX  41.0  MIN  0.0  AVG  20.4  MAX AT (82,42)
OBSERVED  MAX  73.0  MIN  1.0  AVG  22.4

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0400–0500 MST



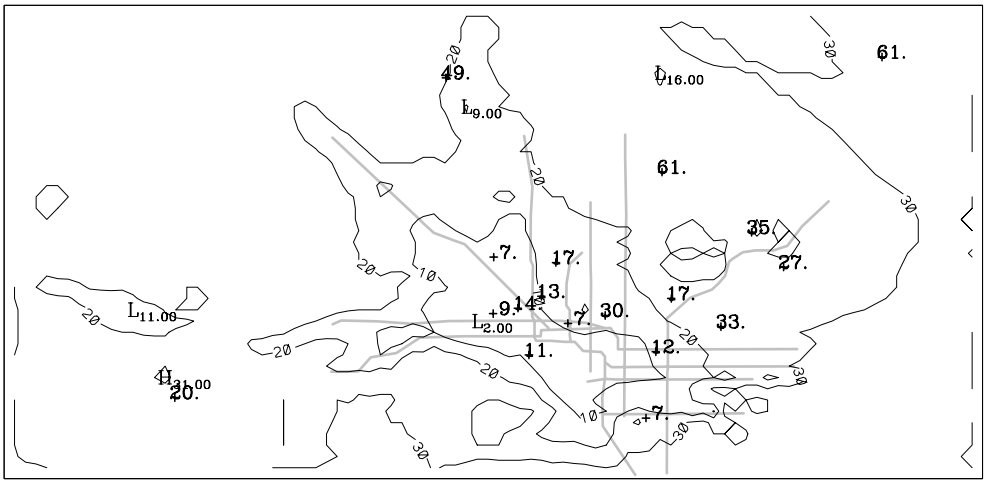

SIMULATED  MAX  40.0  MIN  0.0  AVG  18.8  MAX AT (91,02)
OBSERVED  MAX  69.0  MIN  3.0  AVG  21.4

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0500–0600 MST



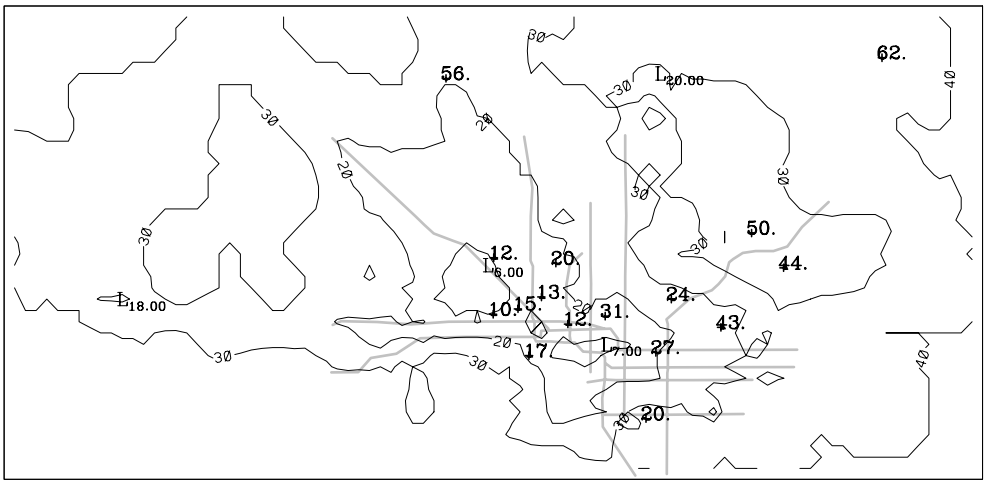

SIMULATED  MAX  41.0  MIN  0.0  AVG  18.8  MAX AT (91,25)
OBSERVED  MAX  63.0  MIN  3.0  AVG  22.7

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0600–0700 MST



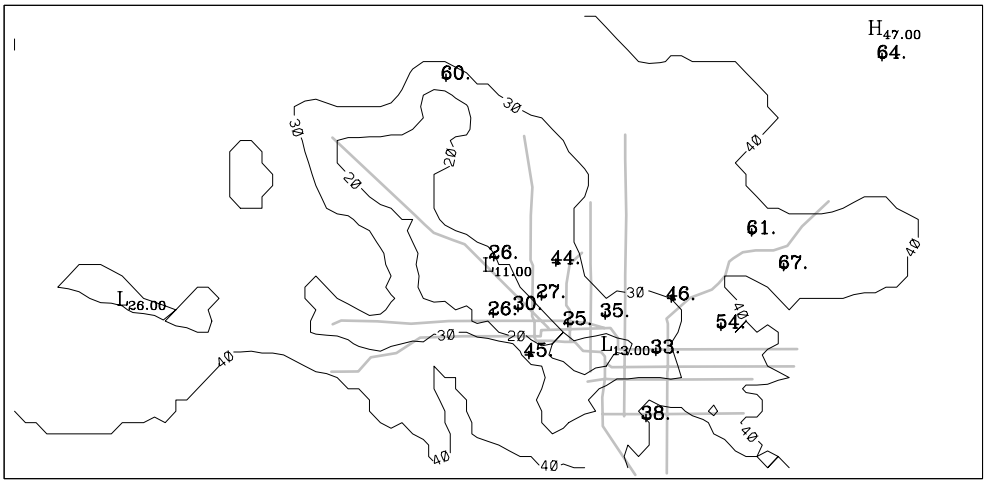

SIMULATED  MAX  41.0  MIN  2.0  AVG  24.8  MAX AT (91,21)
OBSERVED  MAX  61.0  MIN  7.0  AVG  23.9

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0700–0800 MST



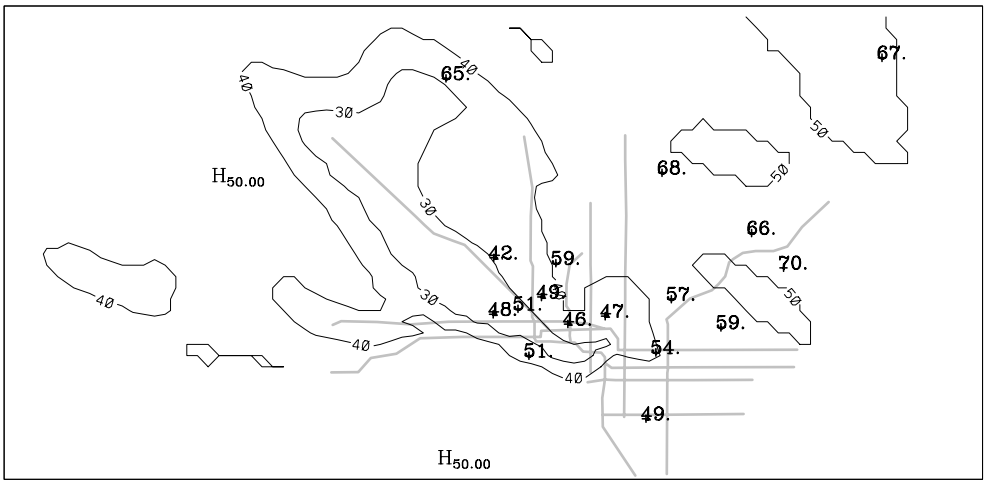

SIMULATED  MAX  41.0  MIN  6.0  AVG  29.4  MAX AT (90,35)
OBSERVED  MAX  62.0  MIN  10.0  AVG  29.8

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0800–0900 MST



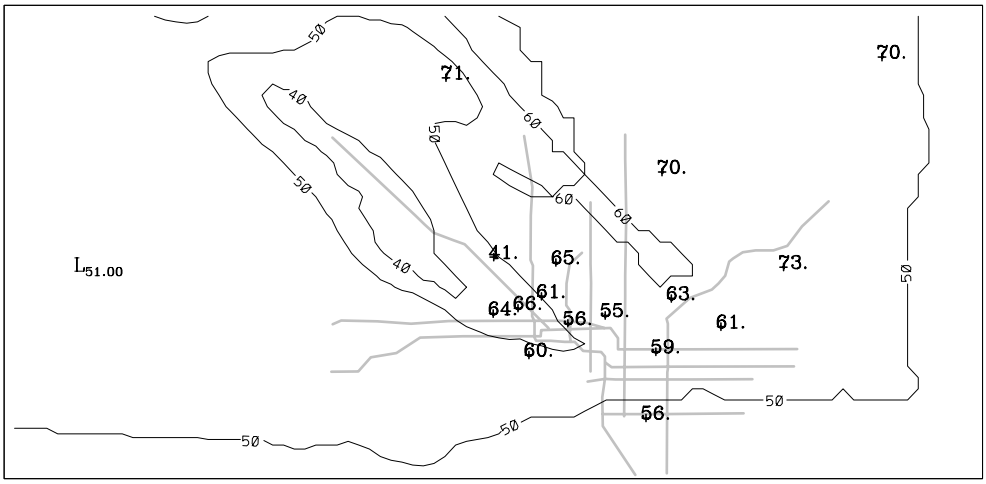

SIMULATED  MAX  47.0  MIN  11.0  AVG  35.8  MAX AT (82,41)
OBSERVED  MAX  67.0  MIN  20.0  AVG  42.3

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  0900–1000 MST



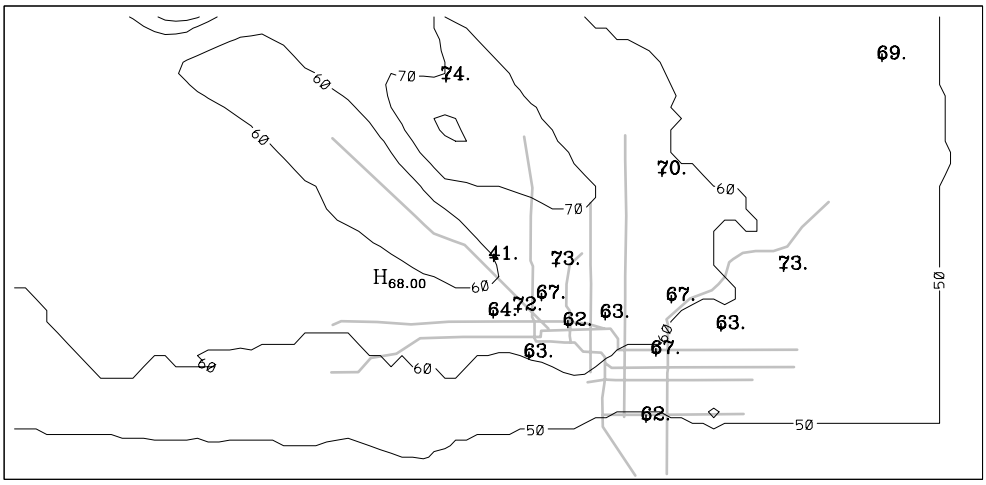

SIMULATED  MAX  52.0  MIN  23.0  AVG  43.9  MAX AT (74,42)
OBSERVED  MAX  70.0  MIN  20.0  AVG  53.8

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1000–1100 MST



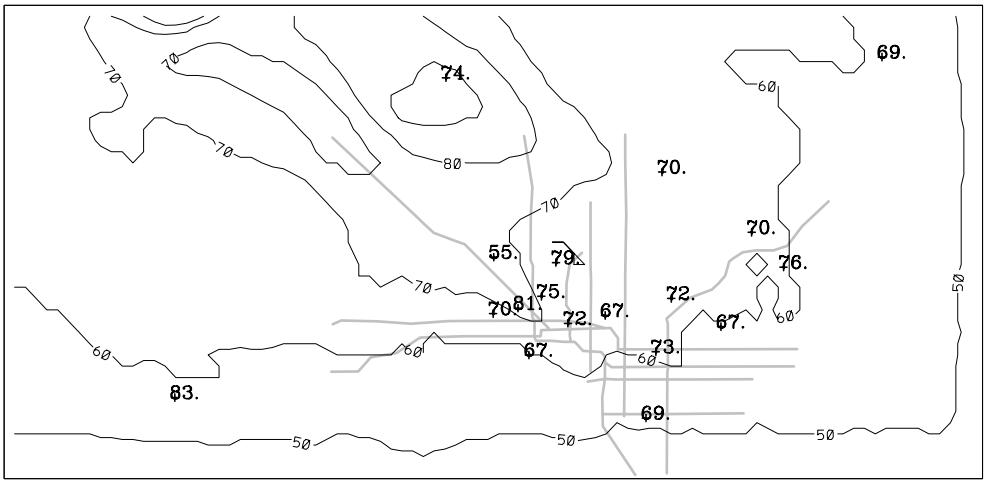

SIMULATED  MAX  62.0  MIN  36.0  AVG  52.3  MAX AT (46,41)
OBSERVED  MAX  73.0  MIN  20.0  AVG  59.8

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1100–1200 MST



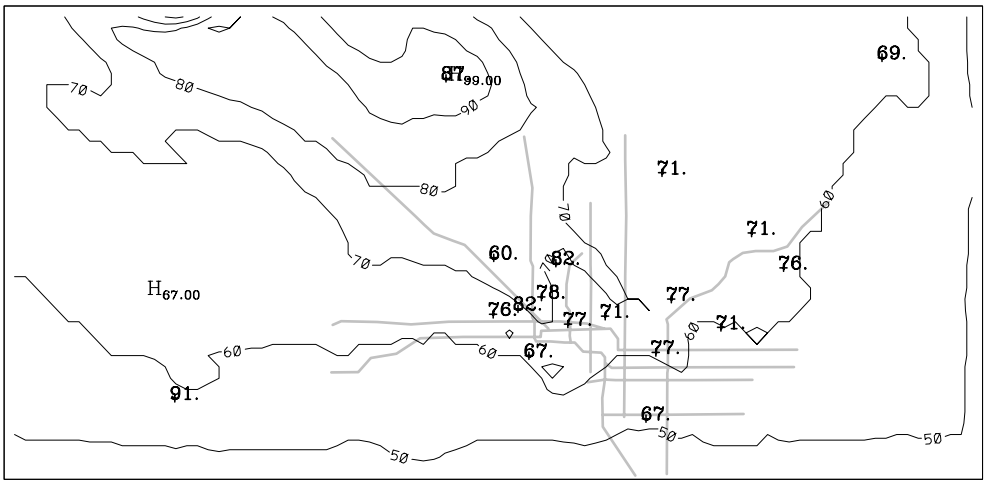

SIMULATED  MAX  81.0  MIN  41.0  AVG  58.5  MAX AT (42,33)
OBSERVED  MAX  74.0  MIN  20.0  AVG  63.1

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1200–1300 MST



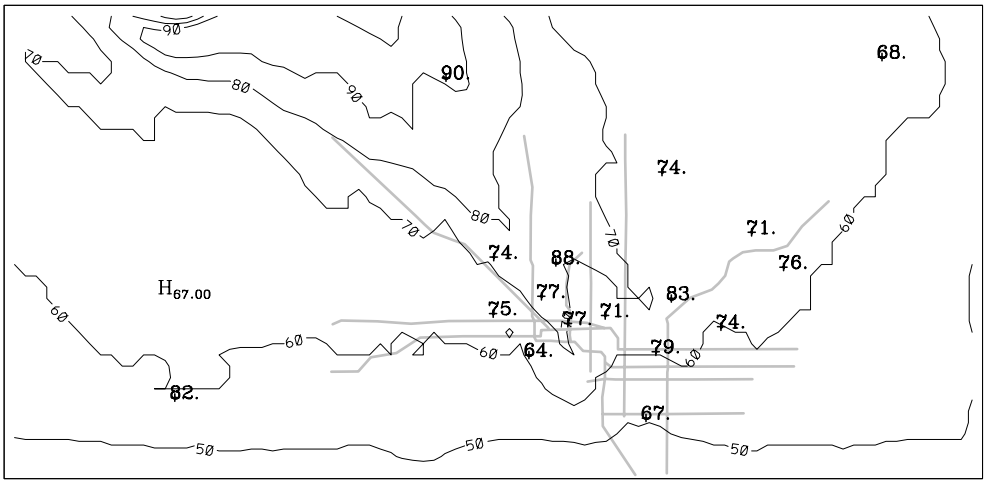

SIMULATED  MAX  95.0  MIN  42.0  AVG  62.1  MAX AT (41,35)
OBSERVED  MAX  83.0  MIN  55.0  AVG  71.6

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1300–1400 MST



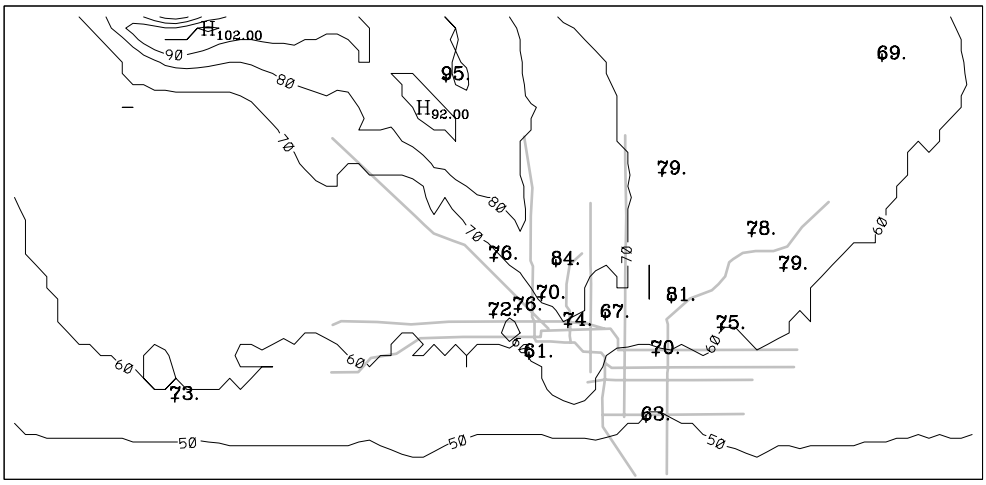

SIMULATED  MAX  99.0  MIN  42.0  AVG  63.8  MAX AT (43,37)
OBSERVED  MAX  91.0  MIN  60.0  AVG  75.0

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1400–1500 MST



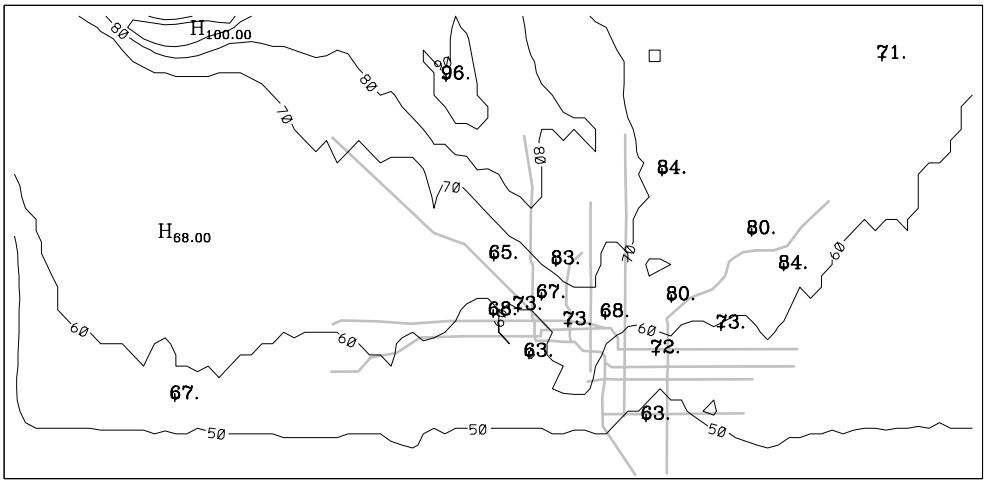

SIMULATED  MAX 100.0  MIN  42.0  AVG  64.1  MAX AT (20,41)
OBSERVED  MAX  90.0  MIN  64.0  AVG  76.2

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1500–1600 MST



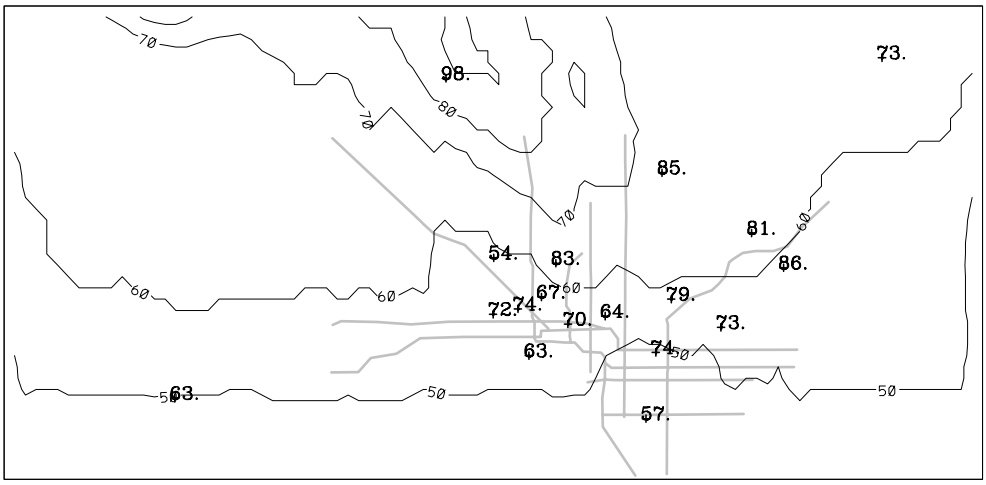

SIMULATED  MAX 102.0  MIN  42.0  AVG  63.7  MAX AT (20,41)
OBSERVED  MAX  95.0  MIN  61.0  AVG  74.6

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1600–1700 MST



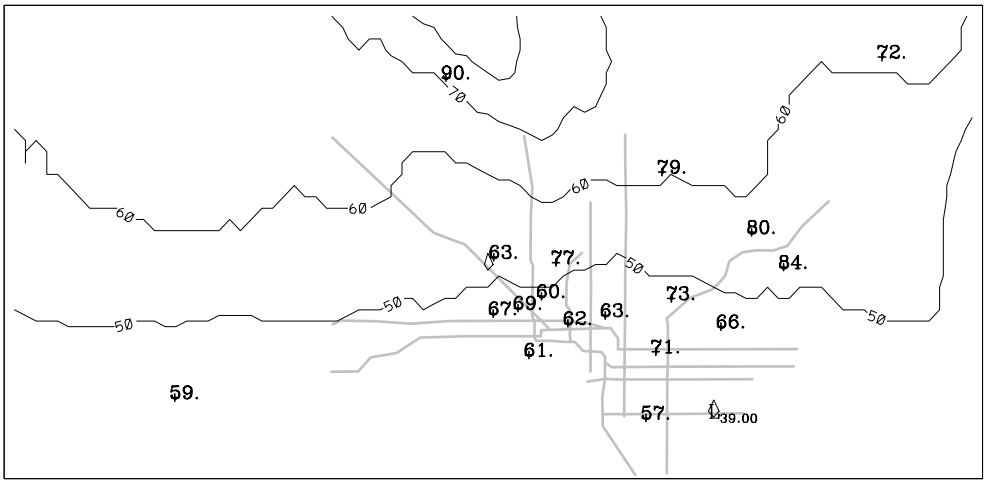

SIMULATED  MAX 100.0  MIN  41.0  AVG  62.9  MAX AT (19,41)
OBSERVED  MAX  96.0  MIN  63.0  AVG  73.9

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1700–1800 MST



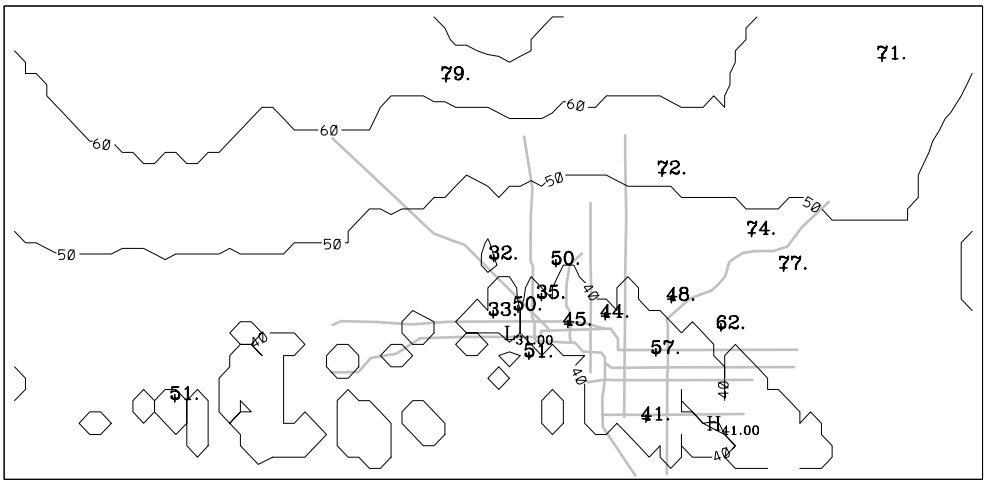

SIMULATED  MAX  92.0  MIN  40.0  AVG  59.4  MAX AT (43,41)
OBSERVED  MAX  98.0  MIN  54.0  AVG  73.1

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1800-1900 MST



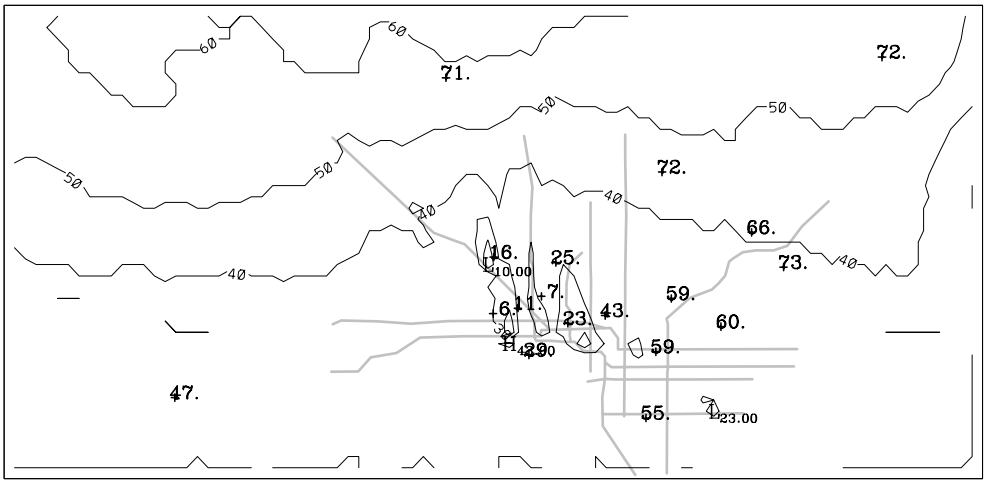

SIMULATED  MAX  88.0  MIN  39.0  AVG  54.2  MAX AT (46,42)
OBSERVED  MAX  90.0  MIN  57.0  AVG  69.6

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  1900-2000 MST



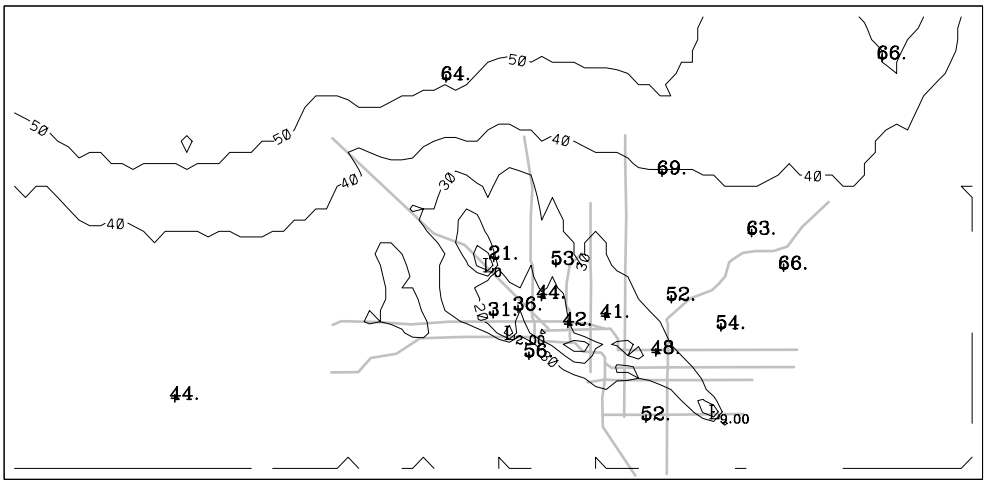

SIMULATED  MAX  78.0  MIN  31.0  AVG  48.9  MAX AT (46,42)
OBSERVED  MAX  79.0  MIN  32.0  AVG  54.0

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  2000–2100 MST



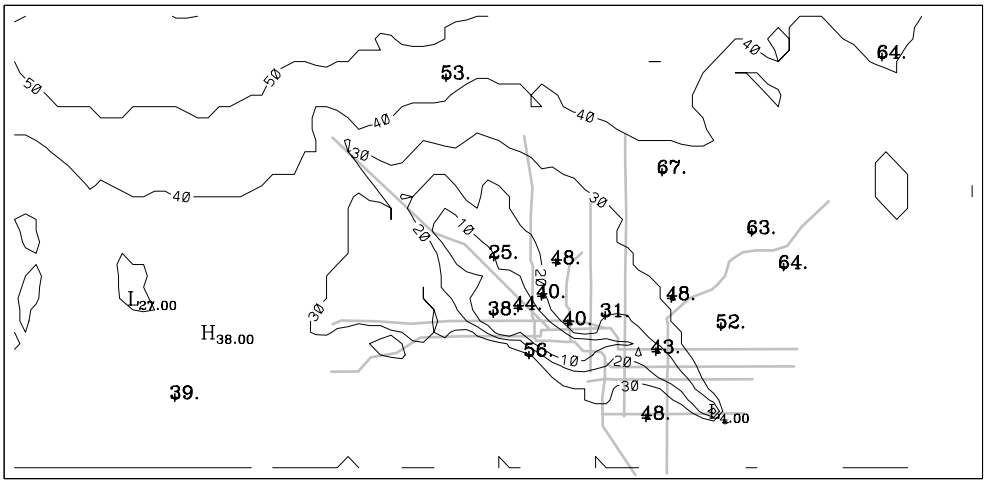

SIMULATED  MAX  68.0  MIN  10.0  AVG  44.1  MAX AT (46,42)
OBSERVED  MAX  73.0  MIN  6.0  AVG  44.1

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  2100–2200 MST



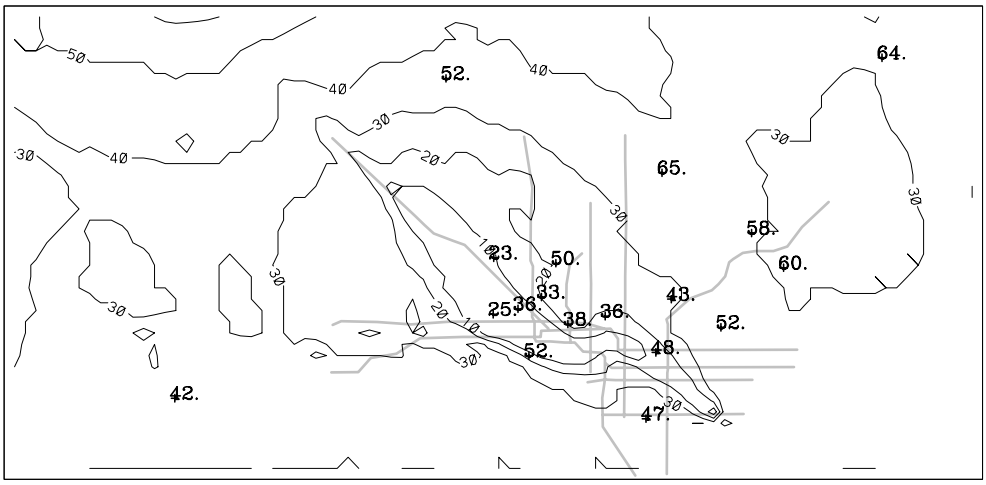

SIMULATED  MAX  60.0  MIN  0.0  AVG  39.8  MAX AT (08,42)
OBSERVED  MAX  69.0  MIN  21.0  AVG  50.1

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  2200–2300 MST



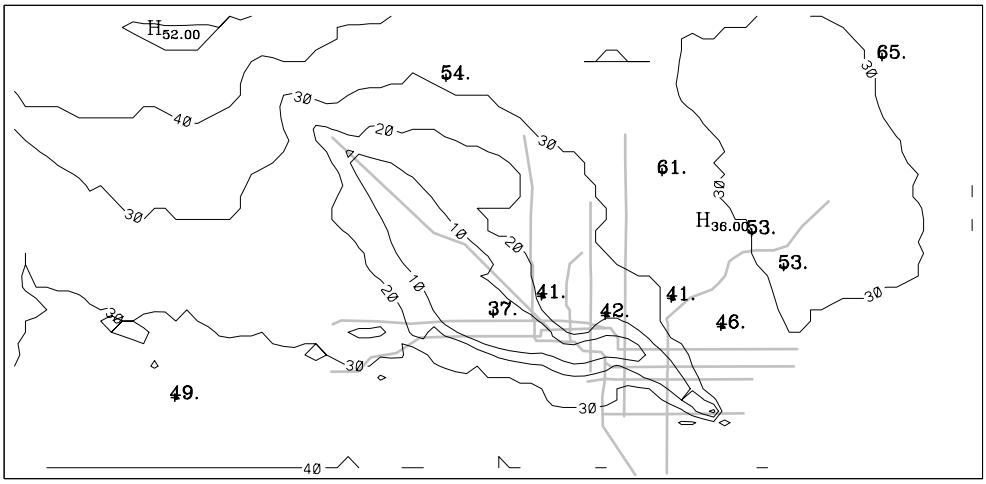

SIMULATED  MAX  57.0  MIN  0.0  AVG  35.9  MAX AT (08,42)
OBSERVED  MAX  67.0  MIN  25.0  AVG  47.9

LAYER 1 O3 CONCENTRATION (ppm)  7/16/1998  2300–2400 MST



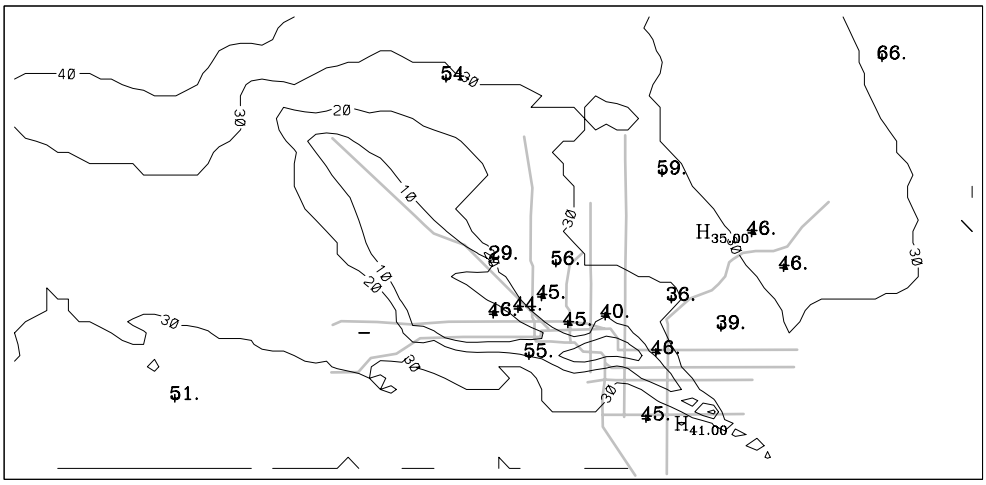

SIMULATED  MAX  55.0  MIN  0.0  AVG  32.8  MAX AT (23,42)
OBSERVED  MAX  65.0  MIN  23.0  AVG  45.8

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0000–0100 MST



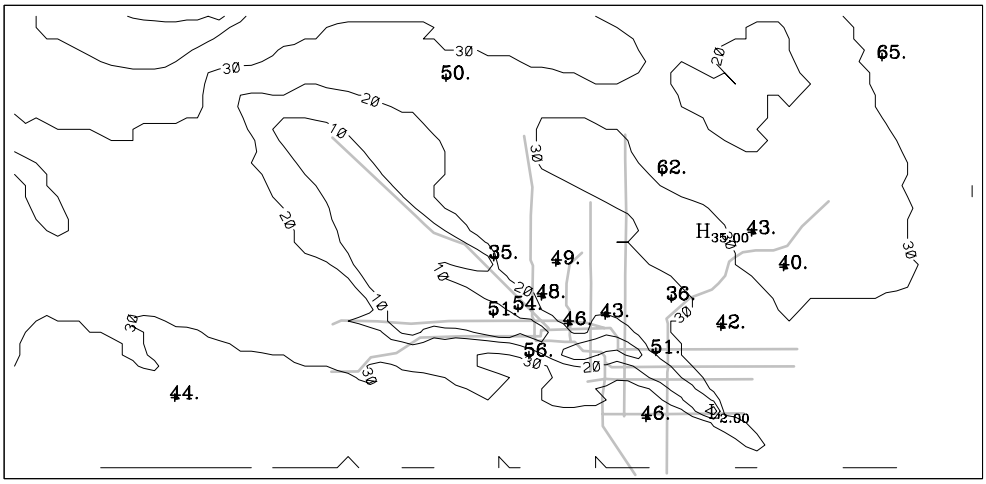

SIMULATED  MAX  52.0  MIN  0.0  AVG  30.7  MAX AT (15,41)
OBSERVED  MAX  65.0  MIN  23.0  AVG  46.4

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0100–0200 MST



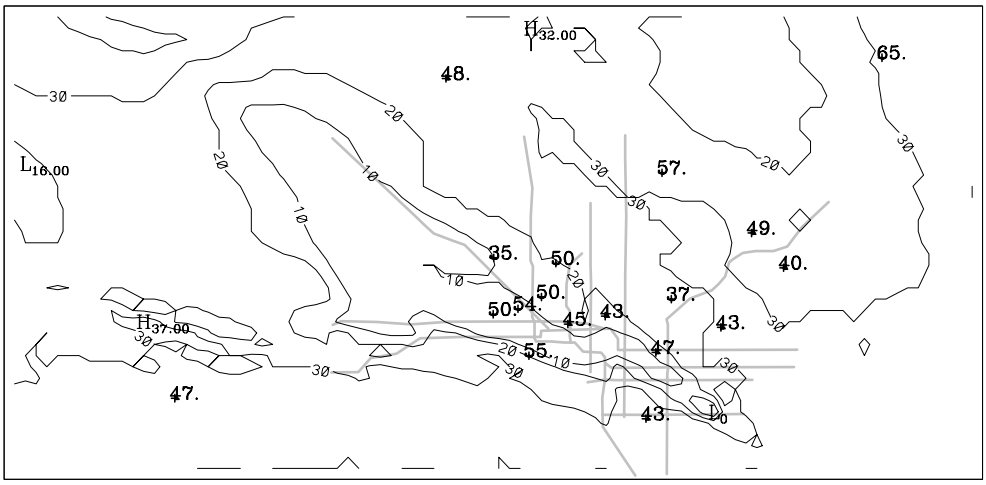

SIMULATED  MAX  49.0  MIN  0.0  AVG  29.4  MAX AT (12,41)
OBSERVED  MAX  66.0  MIN  29.0  AVG  47.1

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0200–0300 MST



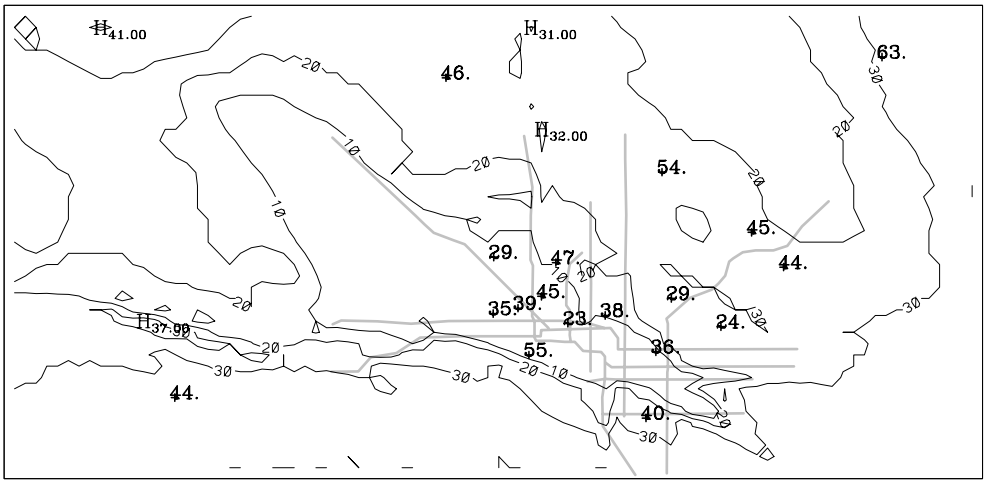

SIMULATED  MAX  47.0  MIN  0.0  AVG  27.9  MAX AT (10,41)
OBSERVED  MAX  65.0  MIN  35.0  AVG  47.8

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0300–0400 MST



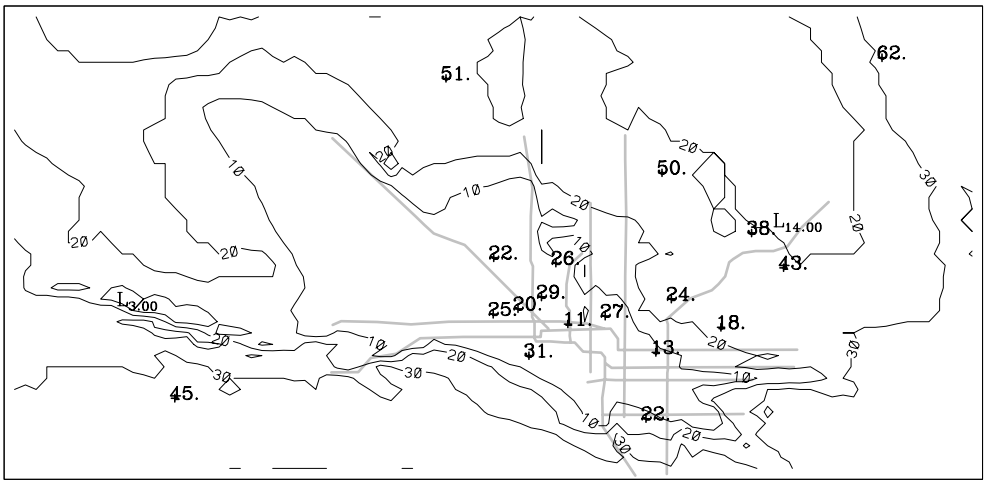

SIMULATED  MAX  44.0  MIN  0.0  AVG  25.8  MAX AT (10,41)
OBSERVED  MAX  65.0  MIN  35.0  AVG  47.7

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0400-0500 MST



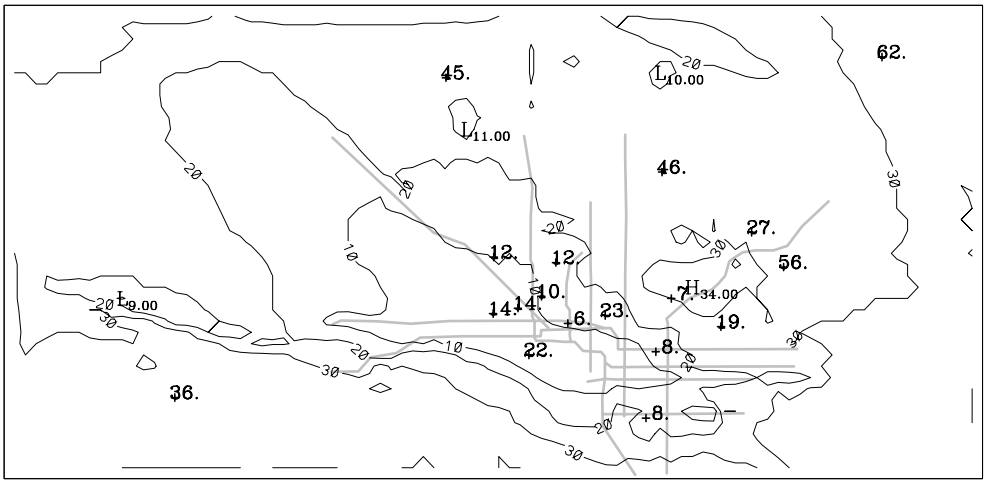

SIMULATED  MAX  41.0  MIN  0.0  AVG  23.3  MAX AT (10,41)
OBSERVED  MAX  63.0  MIN  23.0  AVG  40.9

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0500-0600 MST



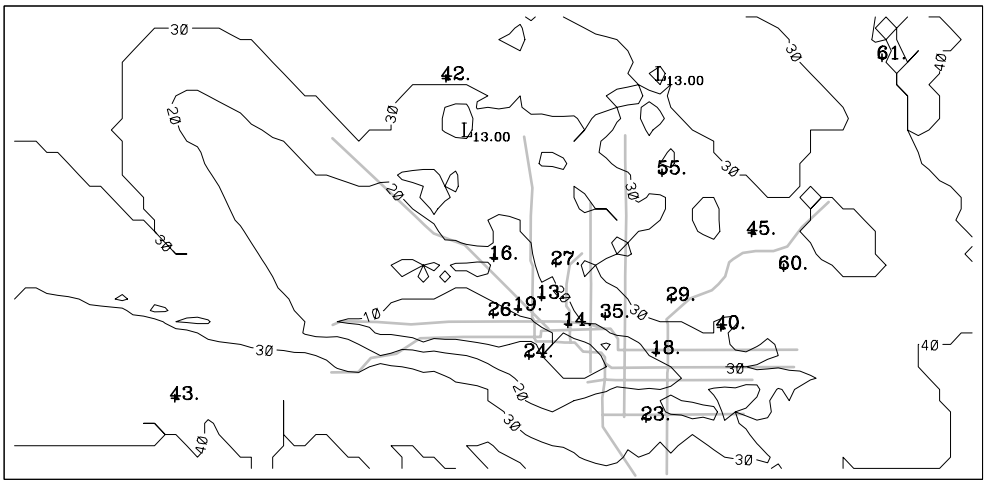

SIMULATED  MAX  41.0  MIN  0.0  AVG  21.5  MAX AT (91,26)
OBSERVED  MAX  62.0  MIN  11.0  AVG  30.9

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0600–0700 MST



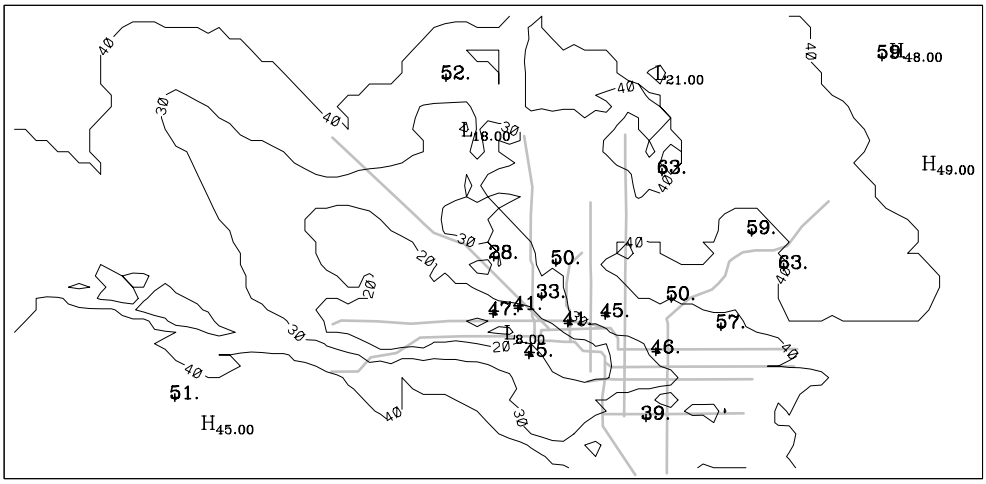

SIMULATED  MAX  41.0  MIN  1.0  AVG  25.3  MAX AT (91,26)
OBSERVED  MAX  62.0  MIN  6.0  AVG  23.7

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0700–0800 MST



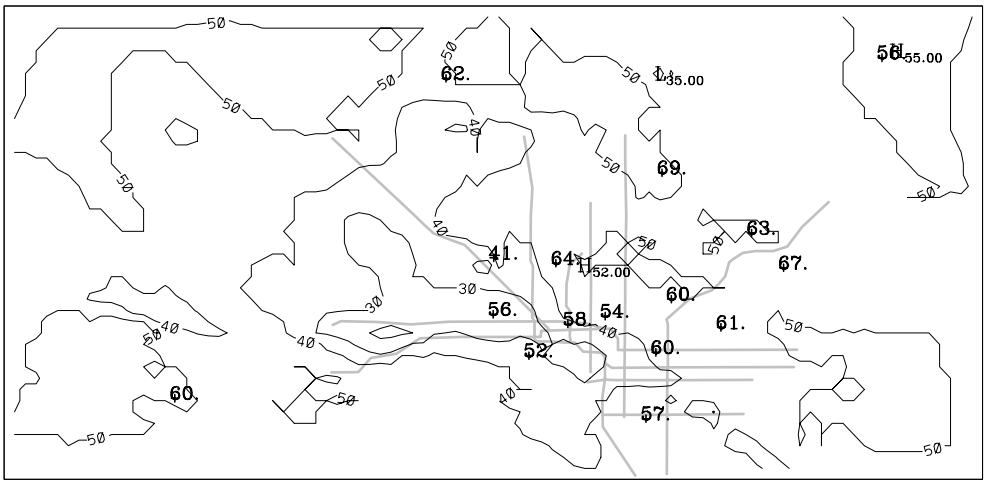

SIMULATED  MAX  42.0  MIN  4.0  AVG  29.3  MAX AT (87,30)
OBSERVED  MAX  61.0  MIN  13.0  AVG  32.8

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0800–0900 MST



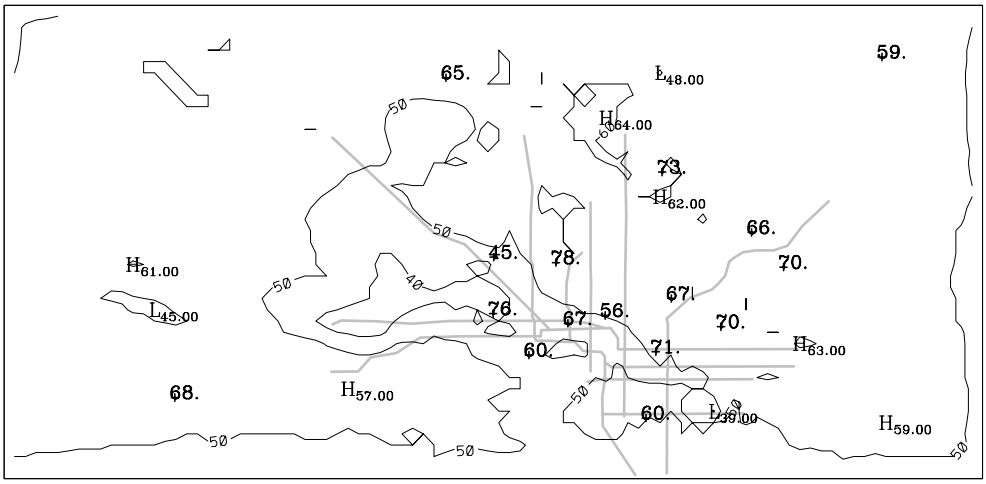

SIMULATED  MAX  49.0  MIN  8.0  AVG  36.2  MAX AT (87,29)
OBSERVED  MAX  63.0  MIN  28.0  AVG  48.3

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  0900–1000 MST



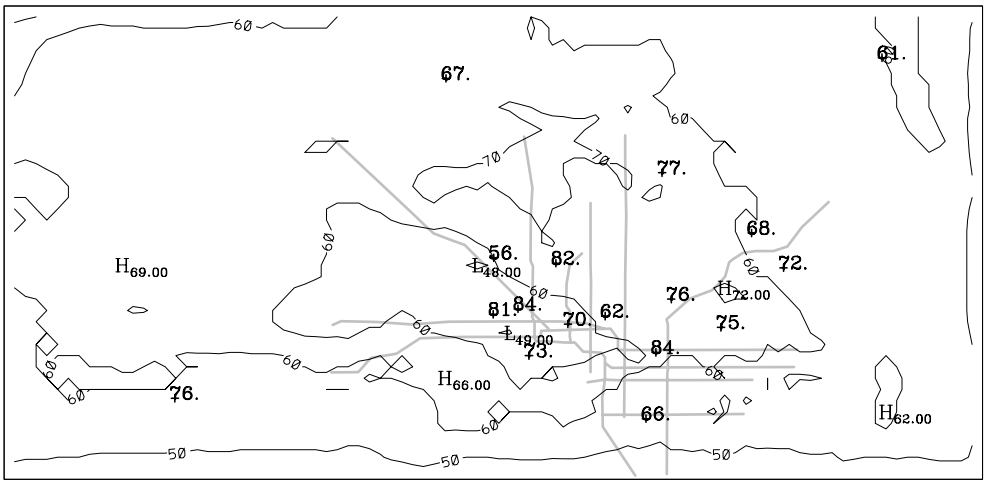

SIMULATED  MAX  55.0  MIN  18.0  AVG  45.4  MAX AT (84,39)
OBSERVED  MAX  69.0  MIN  33.0  AVG  56.3

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1000–1100 MST



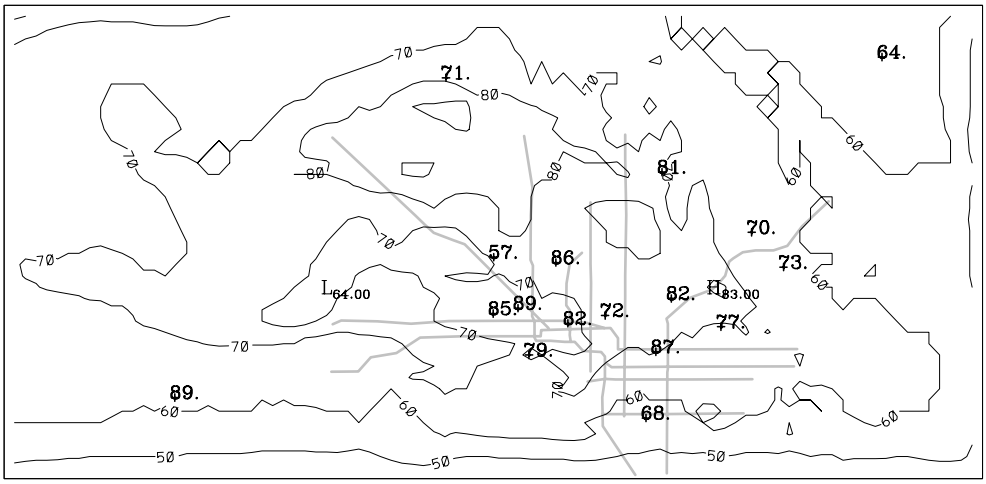

SIMULATED  MAX  64.0  MIN  35.0  AVG  53.3  MAX AT (57,33)
OBSERVED  MAX  78.0  MIN  33.0  AVG  62.5

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1100–1200 MST



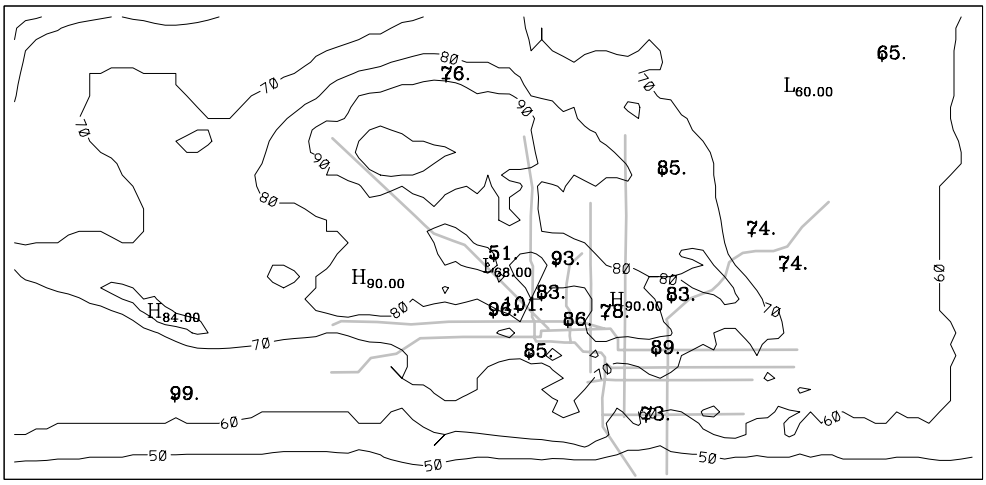

SIMULATED  MAX  75.0  MIN  42.0  AVG  59.8  MAX AT (49,27)
OBSERVED  MAX  84.0  MIN  33.0  AVG  70.2

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1200–1300 MST



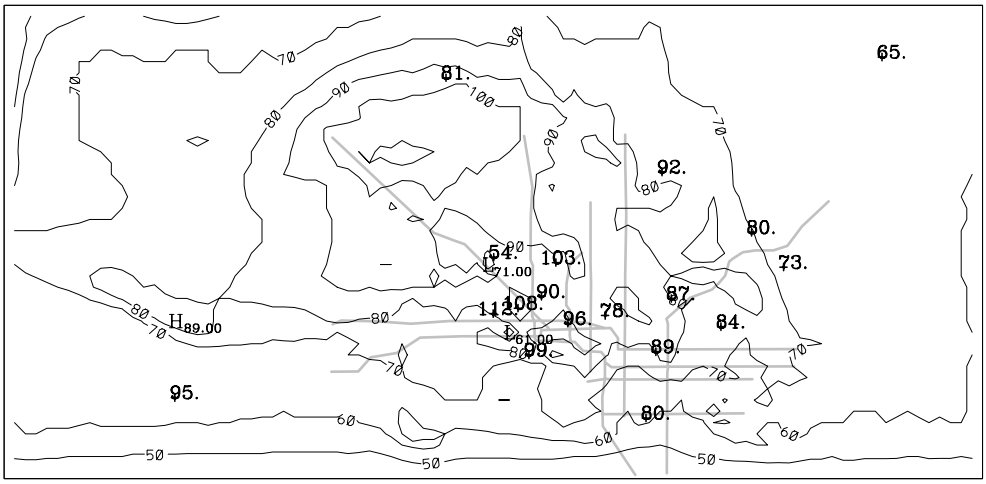

SIMULATED  MAX  91.0  MIN  43.0  AVG  65.4  MAX AT (39,28)
OBSERVED  MAX  89.0  MIN  33.0  AVG  74.7

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1300–1400 MST



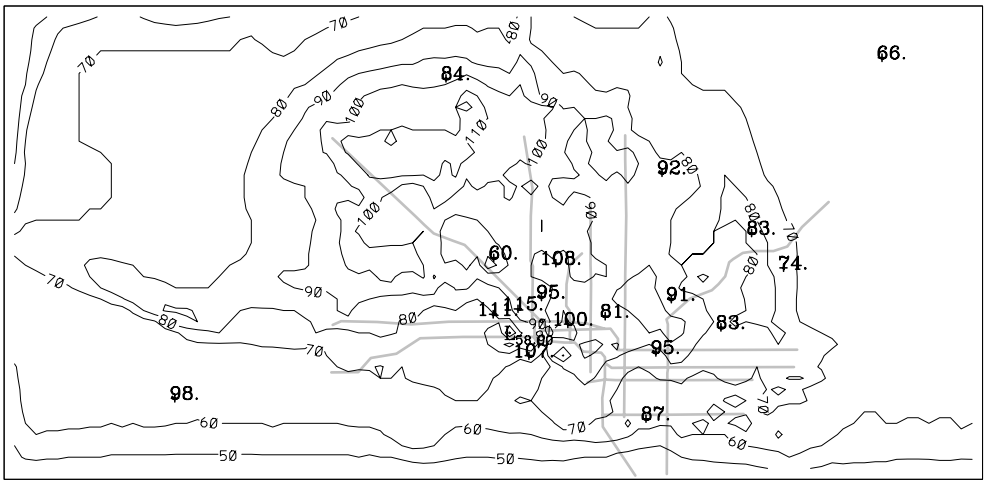

SIMULATED  MAX 104.0  MIN  42.0  AVG  69.0  MAX AT (36,30)
OBSERVED  MAX 101.0  MIN  51.0  AVG  81.6

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1400–1500 MST



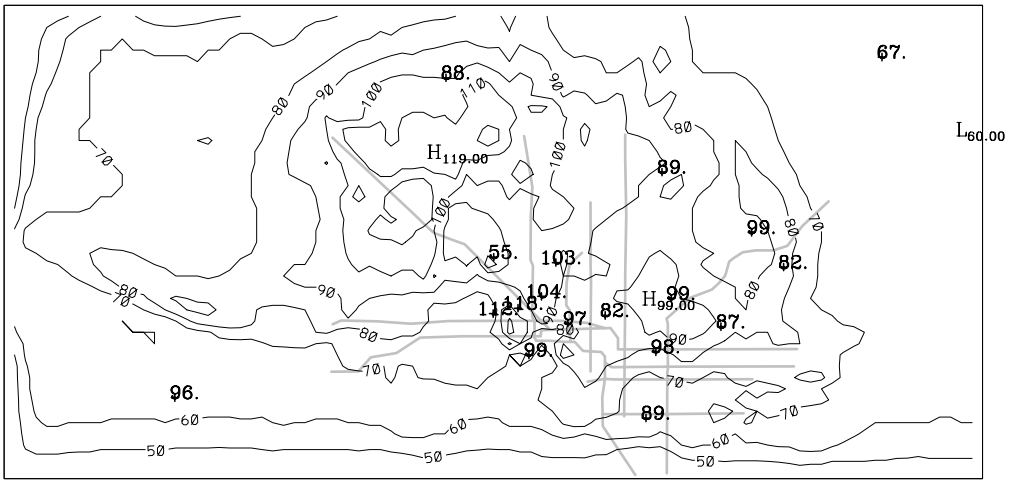

SIMULATED  MAX 112.0  MIN  42.0  AVG  71.5  MAX AT (37,30)
OBSERVED  MAX 112.0  MIN  54.0  AVG  87.0

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1500–1600 MST



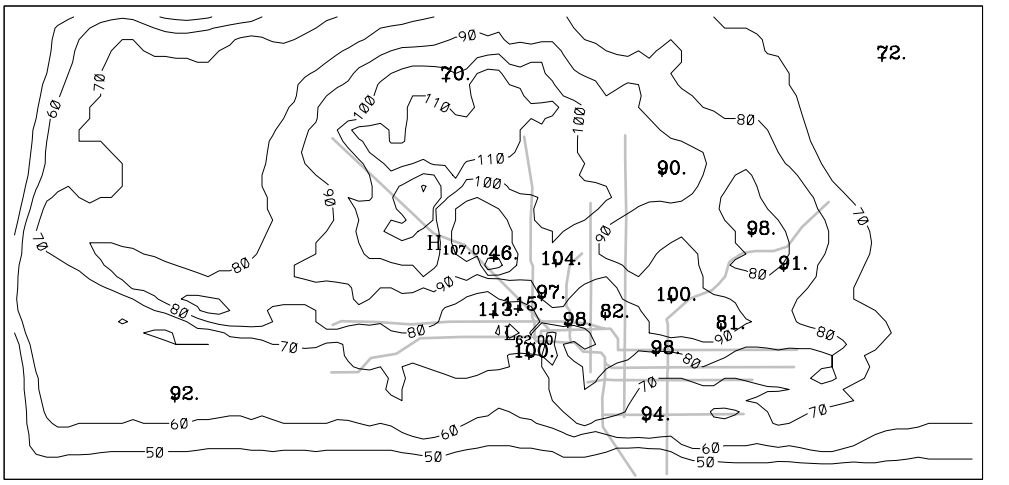

SIMULATED  MAX 116.0  MIN  42.0  AVG  73.3  MAX AT (40,30)
OBSERVED  MAX 115.0  MIN  60.0  AVG  90.6

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1600–1700 MST



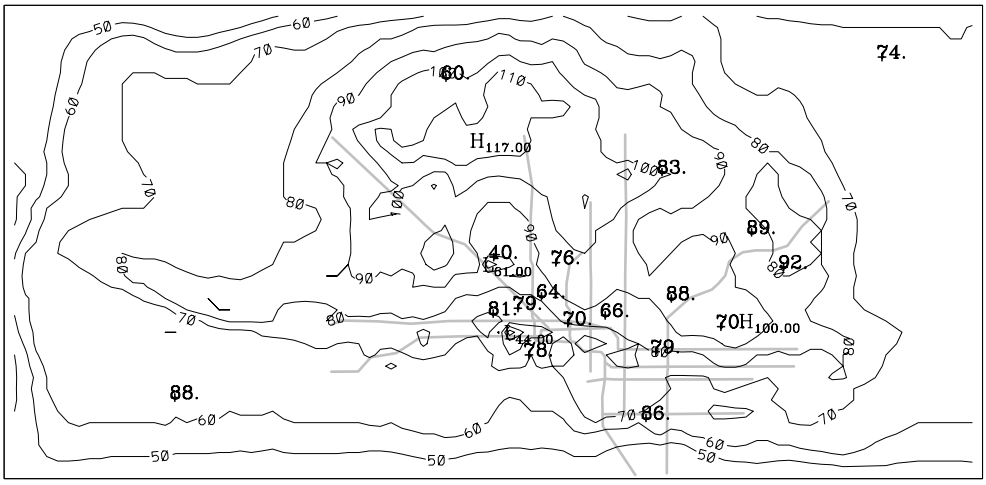

SIMULATED  MAX 119.0  MIN  41.0  AVG  73.9  MAX AT (41,30)
OBSERVED  MAX 118.0  MIN  55.0  AVG  92.4

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1700–1800 MST



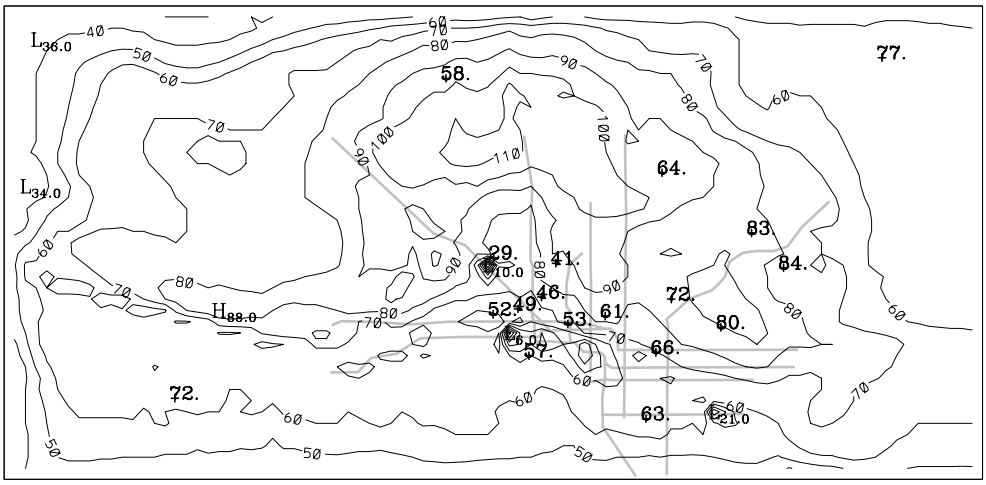

SIMULATED  MAX 118.0  MIN  41.0  AVG  74.8  MAX AT (46,36)
OBSERVED  MAX 115.0  MIN  46.0  AVG  91.2

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1800–1900 MST



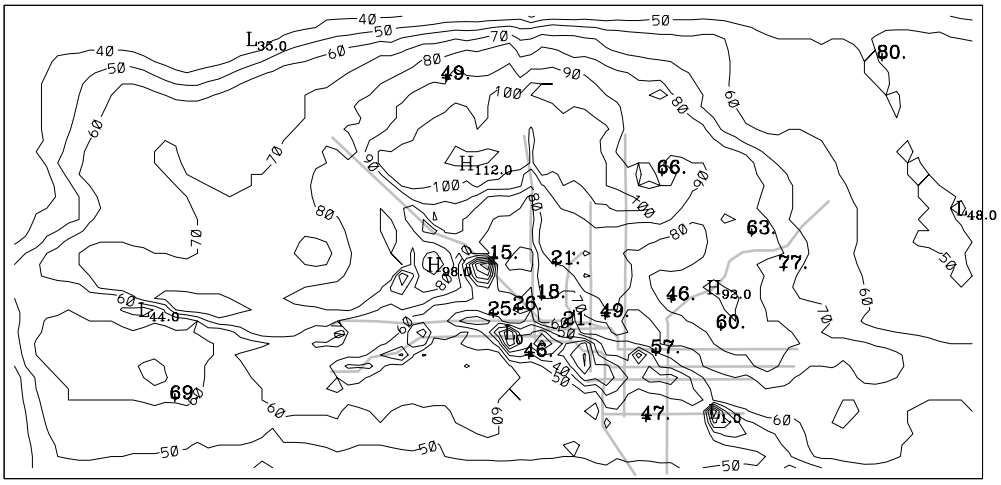

SIMULATED  MAX 117.0  MIN  39.0  AVG  73.3  MAX AT (45,31)
OBSERVED  MAX  92.0  MIN  40.0  AVG  75.7

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  1900–2000 MST




SIMULATED  MAX 113.0  MIN  6.0  AVG  68.7  MAX AT (46,31)
OBSERVED  MAX  84.0  MIN  29.0  AVG  61.5

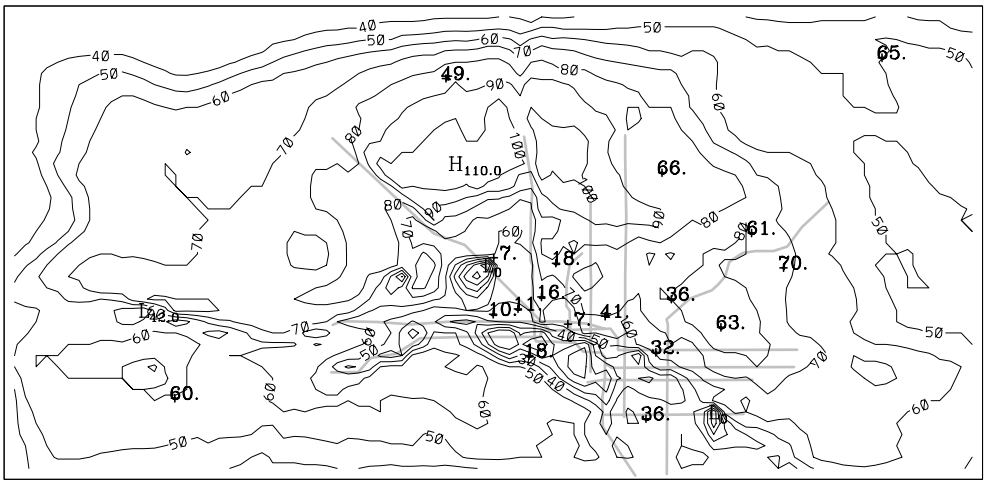
LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  2000–2100 MST




SIMULATED  MAX 112.0  MIN  0.0  AVG  64.4
OBSERVED  MAX  80.0  MIN  15.0  AVG  46.4

MAX AT (44,29)

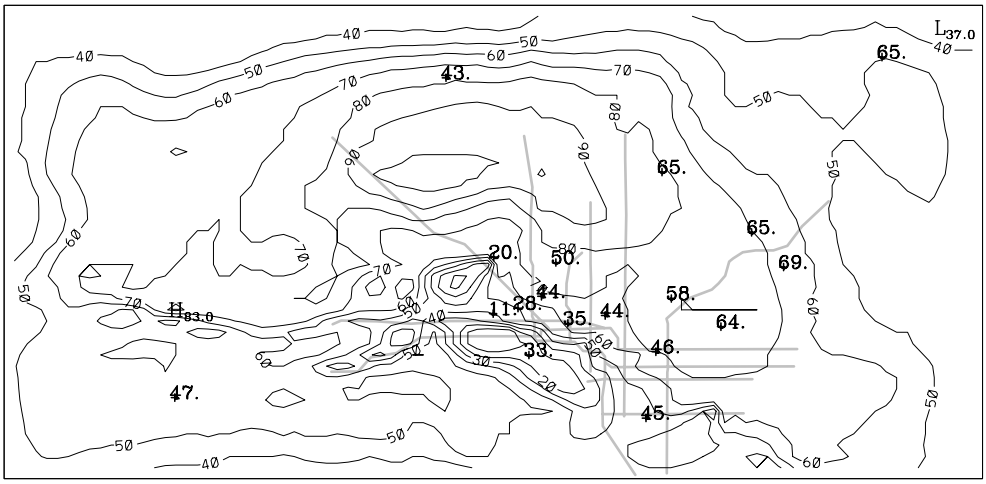
LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  2100–2200 MST




SIMULATED  MAX 110.0  MIN  0.0  AVG  61.3
OBSERVED  MAX  70.0  MIN  7.0  AVG  37.0

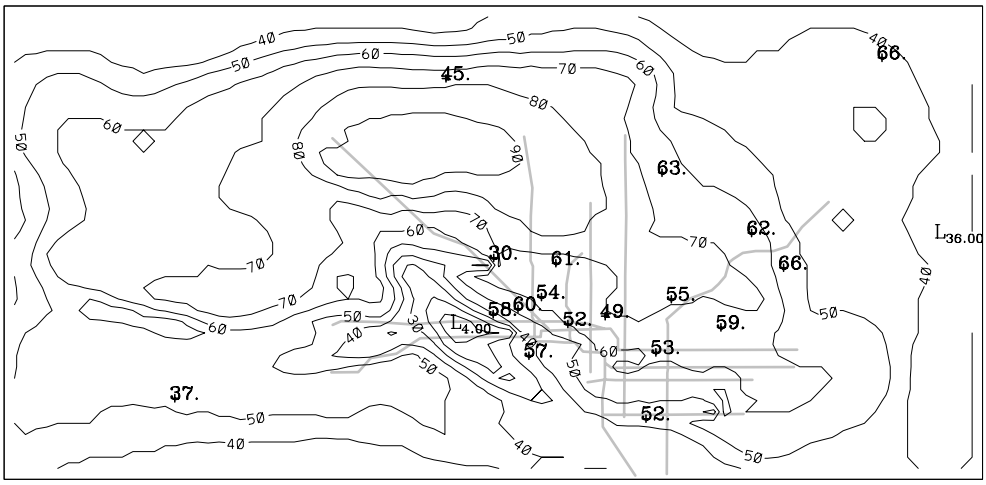
MAX AT (43,29)

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  2200–2300 MST




SIMULATED  MAX 104.0  MIN  0.0  AVG  58.6  MAX AT (39,28)
OBSERVED  MAX  69.0  MIN  11.0  AVG  46.2

LAYER 1 O3 CONCENTRATION (ppm)  7/17/1998  2300–2400 MST



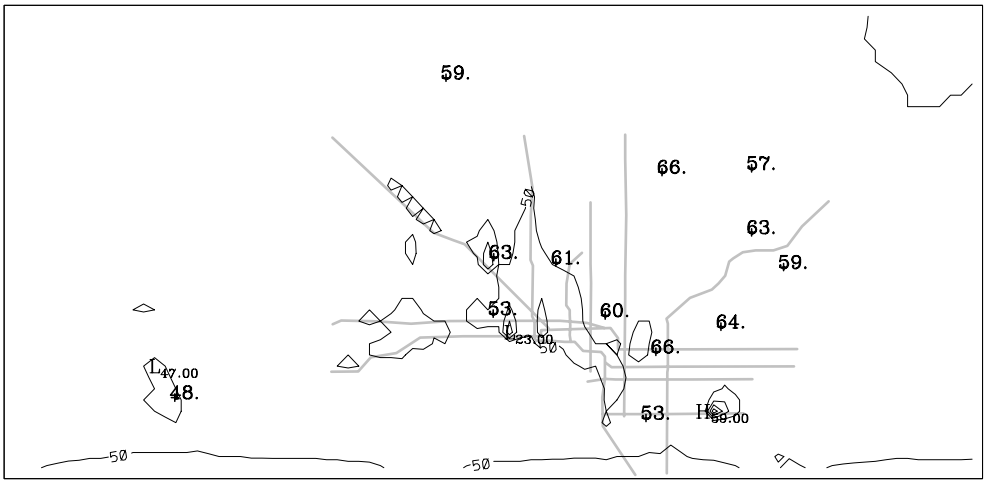

SIMULATED  MAX  98.0  MIN  4.0  AVG  54.8  MAX AT (36,30)
OBSERVED  MAX  66.0  MIN  30.0  AVG  54.4

Appendix IV-viii

# OZONE CONCENTRATION FIELDS FOR 1999 EPISODE

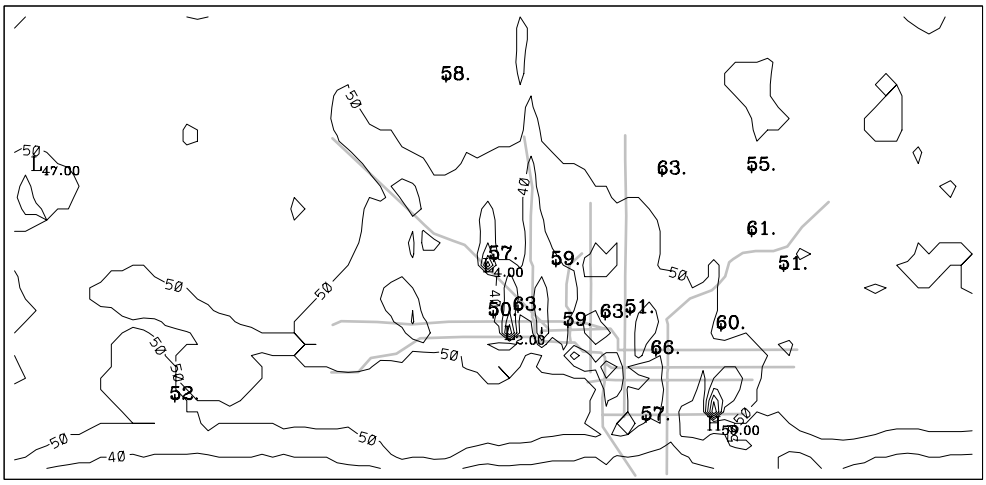
The plots shown here are the simulated and observed ozone concentrations. The plus signs indicate the locations of the monitoring sites. These hourly plots are from hour 0 on August 23, 1999 to hour 2400 on August 24, 1999.

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0000–0100 MST



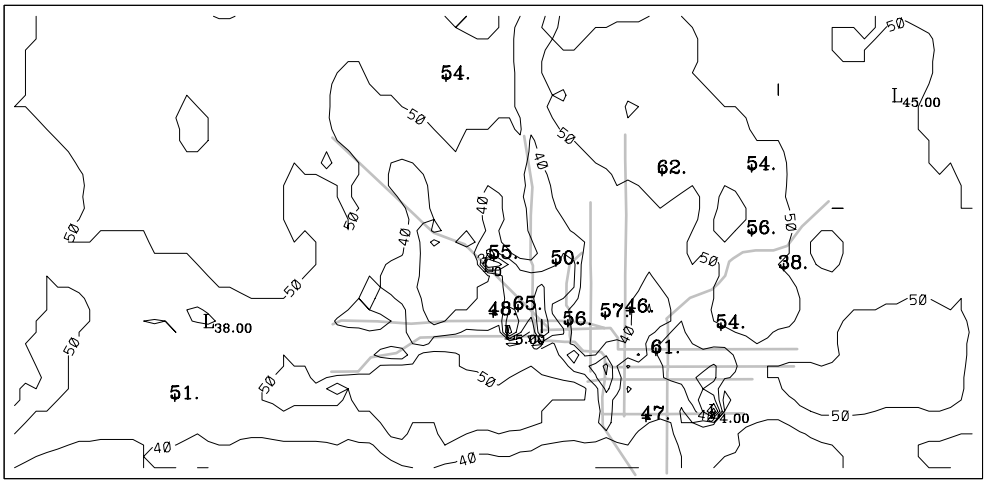

SIMULATED  MAX  66.0  MIN  13.0  AVG  54.5  MAX AT (84,41)
OBSERVED  MAX  66.0  MIN  48.0  AVG  59.4

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0100–0200 MST



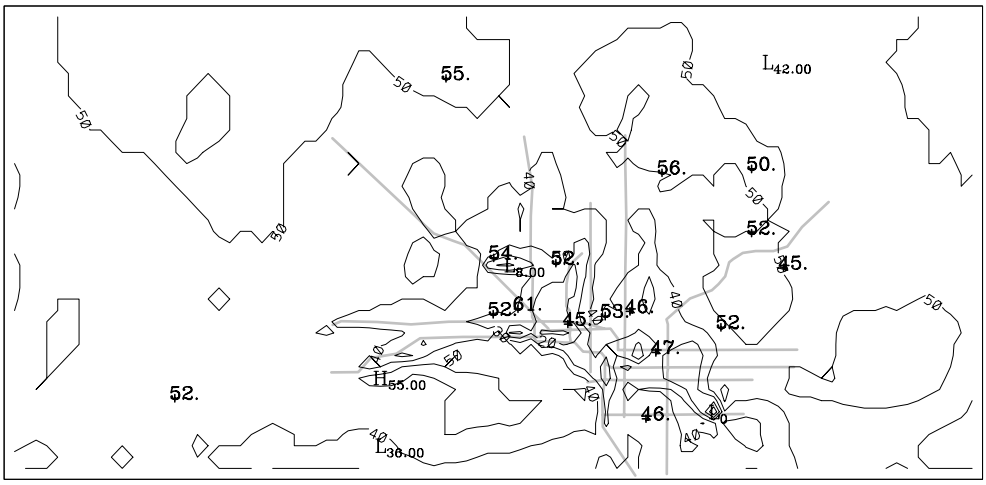

SIMULATED  MAX  62.0  MIN  0.0  AVG  49.9  MAX AT (86,42)
OBSERVED  MAX  66.0  MIN  50.0  AVG  57.8

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0200–0300 MST



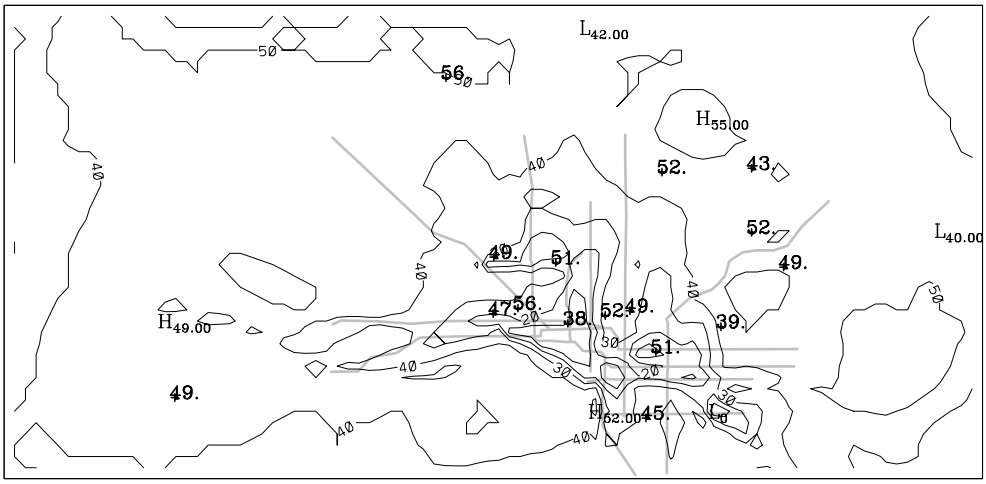

SIMULATED  MAX  58.0  MIN  0.0  AVG  47.2  MAX AT (89,42)
OBSERVED  MAX  65.0  MIN  38.0  AVG  53.4

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0300–0400 MST



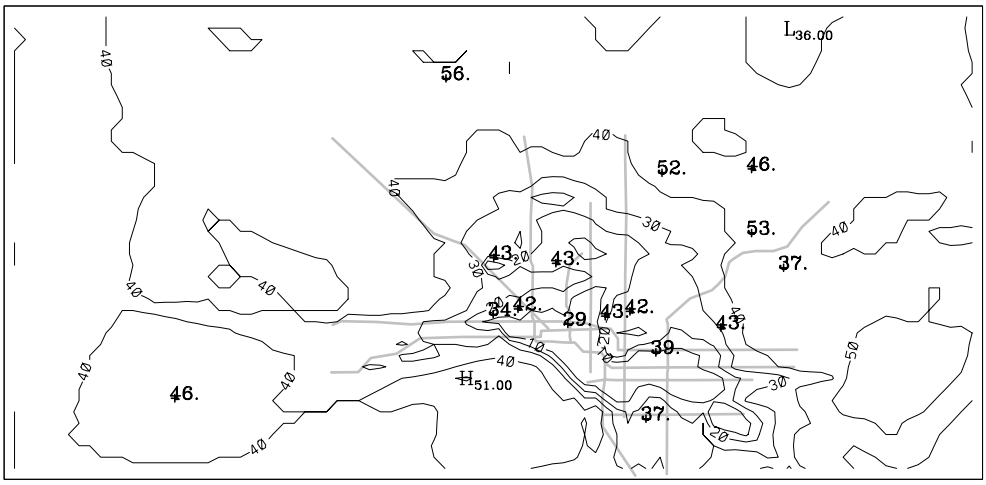

SIMULATED  MAX  56.0  MIN  0.0  AVG  45.2  MAX AT (90,41)
OBSERVED  MAX  61.0  MIN  45.0  AVG  51.1

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0400–0500 MST



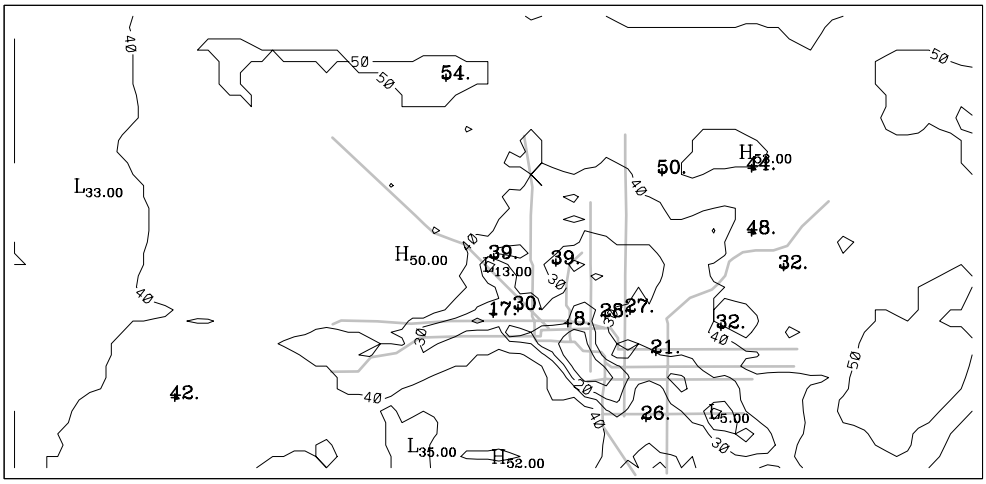

SIMULATED  MAX  56.0  MIN  0.0  AVG  42.3  MAX AT (90,40)
OBSERVED  MAX  56.0  MIN  38.0  AVG  48.6

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0500–0600 MST



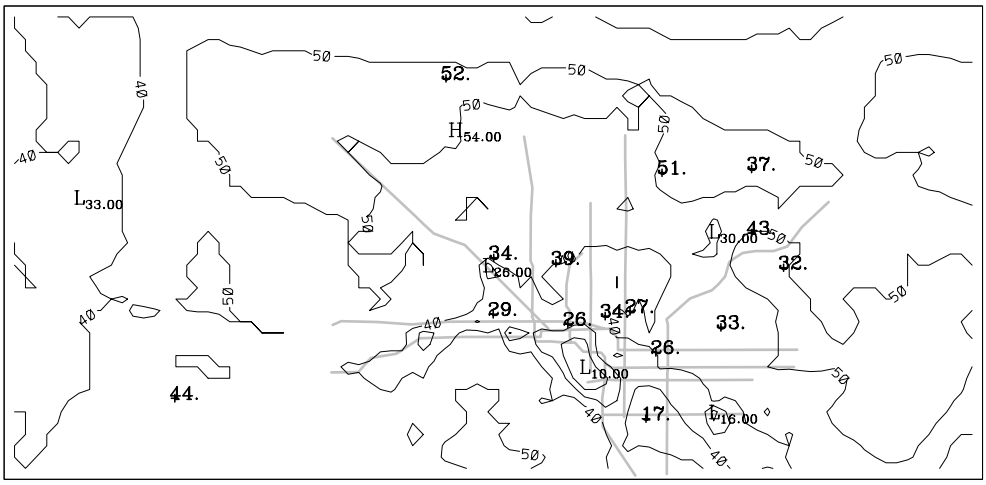

SIMULATED  MAX  55.0  MIN  0.0  AVG  39.5  MAX AT (84,12)
OBSERVED  MAX  56.0  MIN  29.0  AVG  42.8

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0600–0700 MST



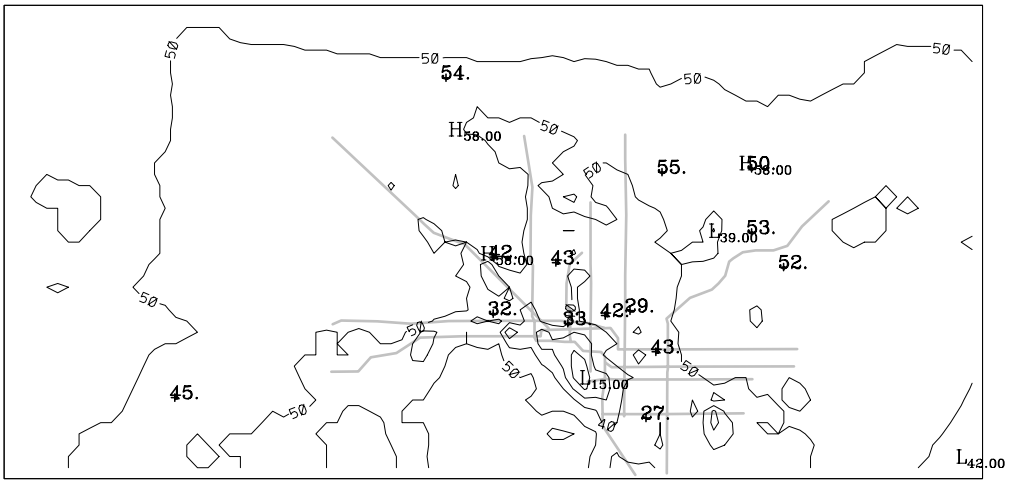

SIMULATED  MAX  55.0  MIN  4.0  AVG  42.3  MAX AT (83,11)
OBSERVED  MAX  54.0  MIN  8.0  AVG  33.6

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0700–0800 MST



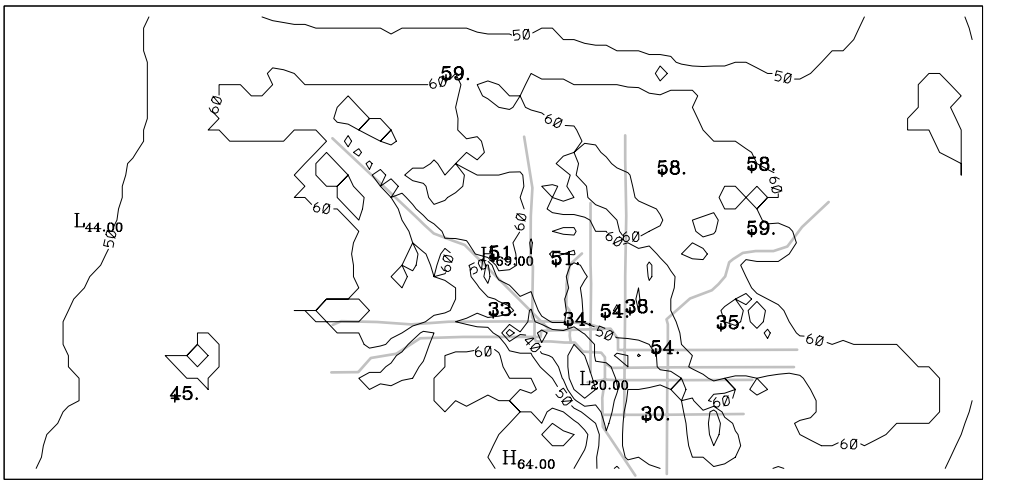

SIMULATED  MAX  57.0  MIN  10.0  AVG  45.5  MAX AT (91,34)
OBSERVED  MAX  52.0  MIN  17.0  AVG  34.6

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0800–0900 MST



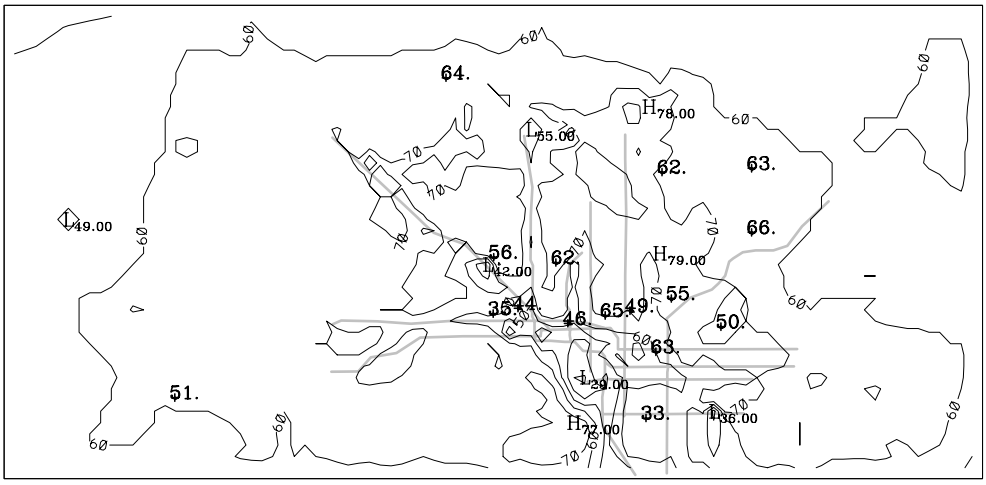

SIMULATED  MAX  58.0  MIN  15.0  AVG  49.6  MAX AT (90,35)
OBSERVED  MAX  55.0  MIN  27.0  AVG  41.4

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  0900–1000 MST



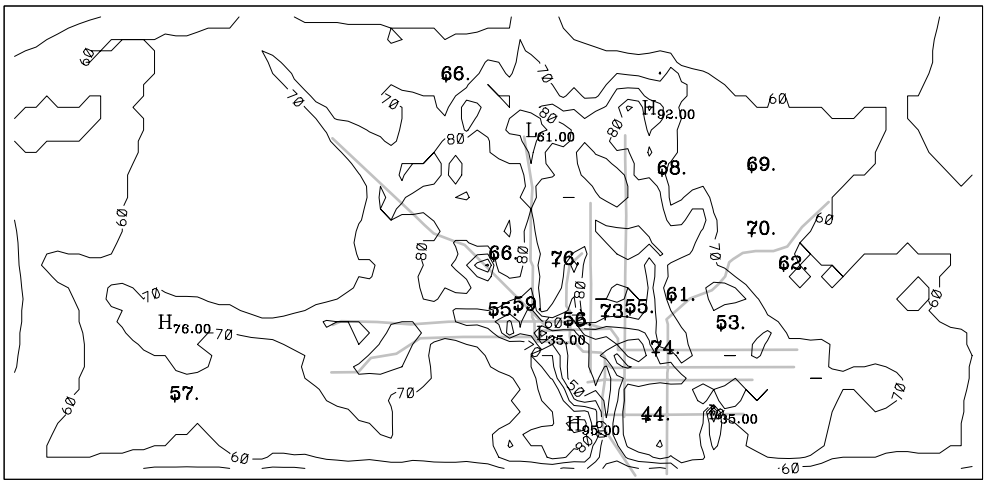

SIMULATED  MAX  69.0  MIN  20.0  AVG  55.6  MAX AT (46,21)
OBSERVED  MAX  59.0  MIN  30.0  AVG  46.3

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1000–1100 MST



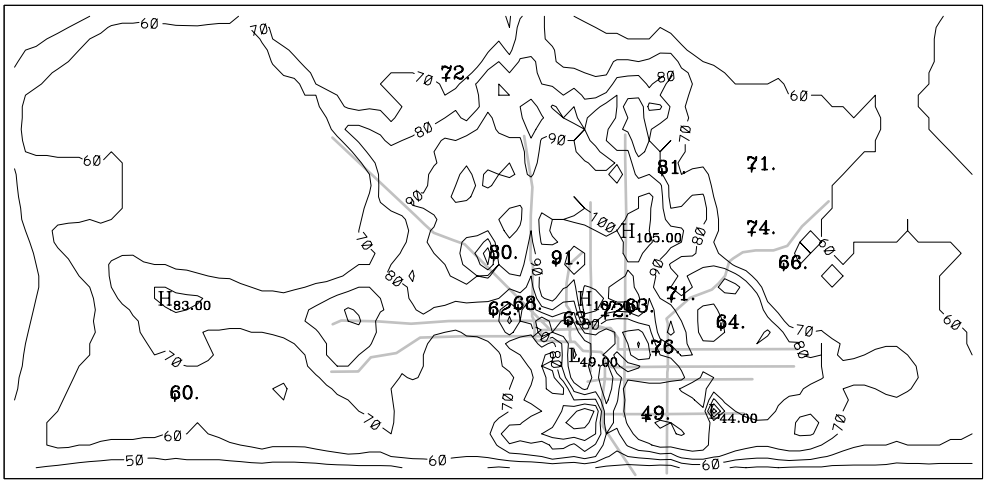

SIMULATED  MAX  81.0  MIN  29.0  AVG  61.7  MAX AT (47,20)
OBSERVED  MAX  66.0  MIN  33.0  AVG  53.9

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1100–1200 MST



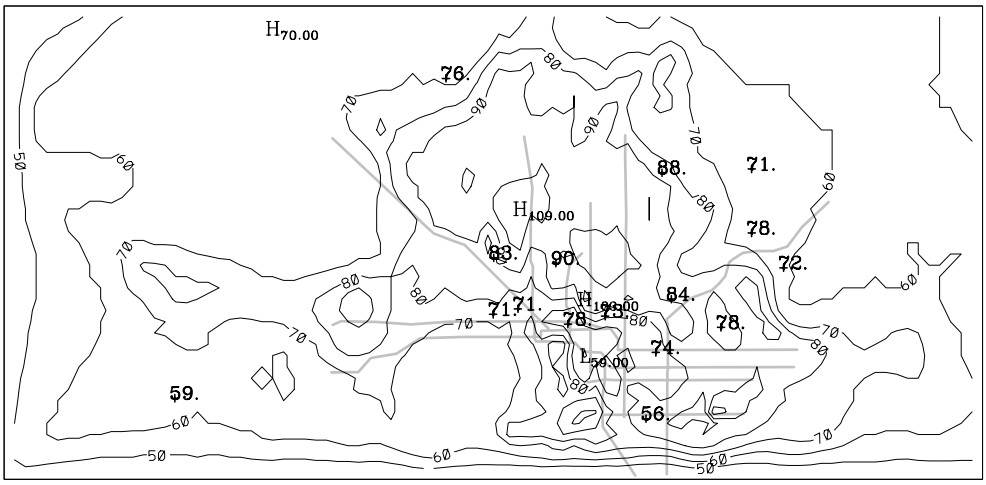

SIMULATED  MAX  95.0  MIN  35.0  AVG  66.2  MAX AT (54,06)
OBSERVED  MAX  76.0  MIN  44.0  AVG  62.6

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1200–1300 MST



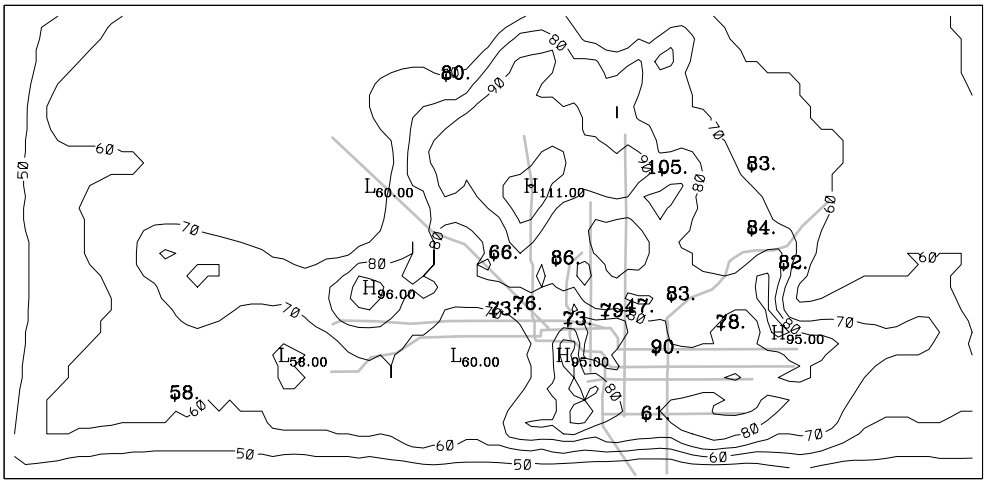

SIMULATED  MAX 107.0  MIN  42.0  AVG  68.9  MAX AT (55,17)
OBSERVED  MAX  91.0  MIN  49.0  AVG  69.6

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1300–1400 MST



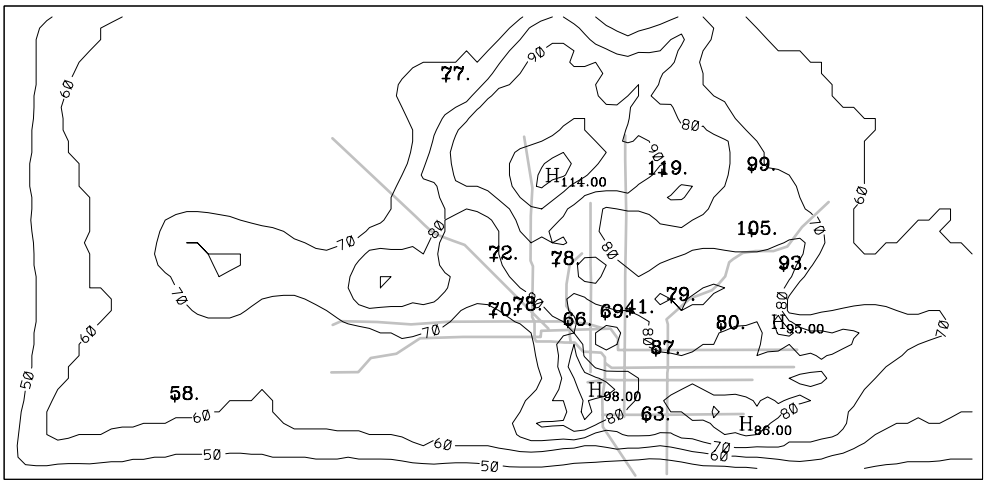

SIMULATED  MAX 109.0  MIN  42.0  AVG  68.6  MAX AT (49,25)
OBSERVED  MAX  90.0  MIN  56.0  AVG  74.4

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1400–1500 MST



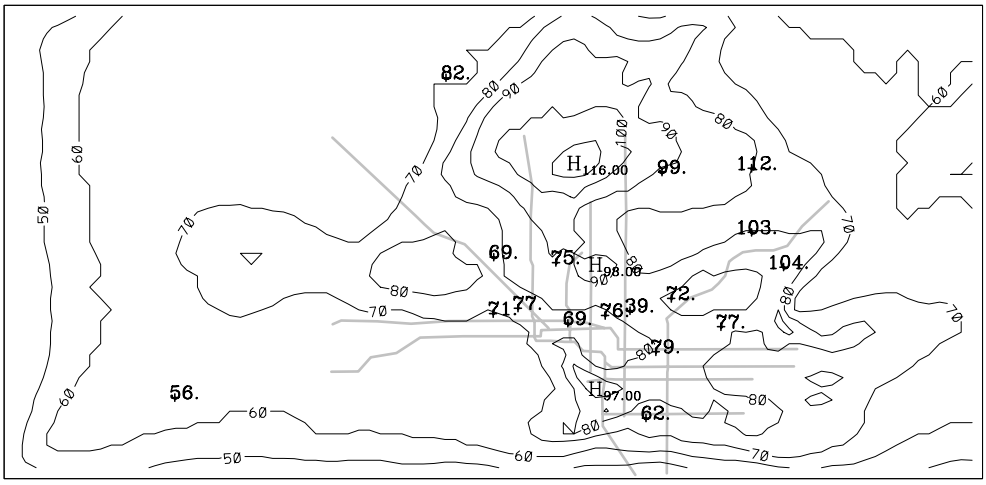

SIMULATED  MAX 111.0  MIN  43.0  AVG  67.8  MAX AT (50,27)
OBSERVED  MAX 105.0  MIN  47.0  AVG  76.7

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1500–1600 MST



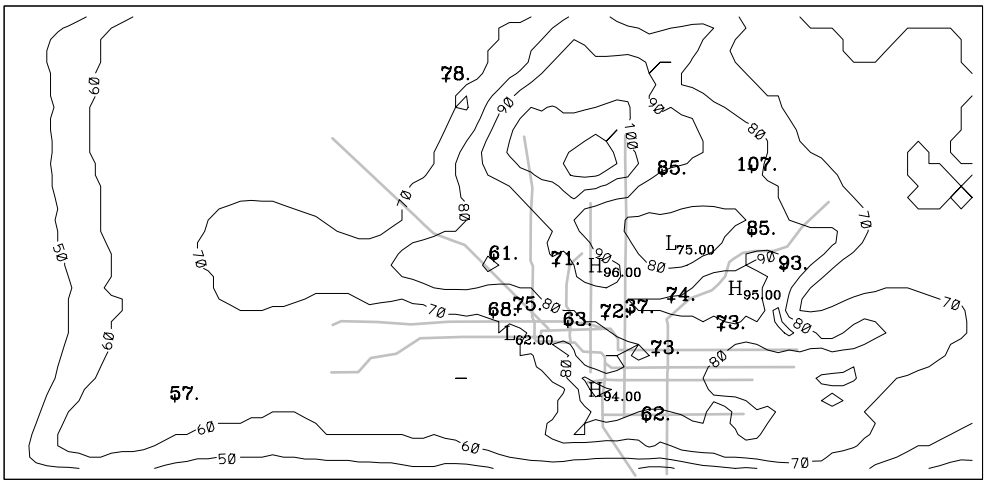

SIMULATED  MAX 114.0  MIN  42.0  AVG  68.6  MAX AT (52,28)
OBSERVED  MAX 119.0  MIN  41.0  AVG  78.5

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1600–1700 MST



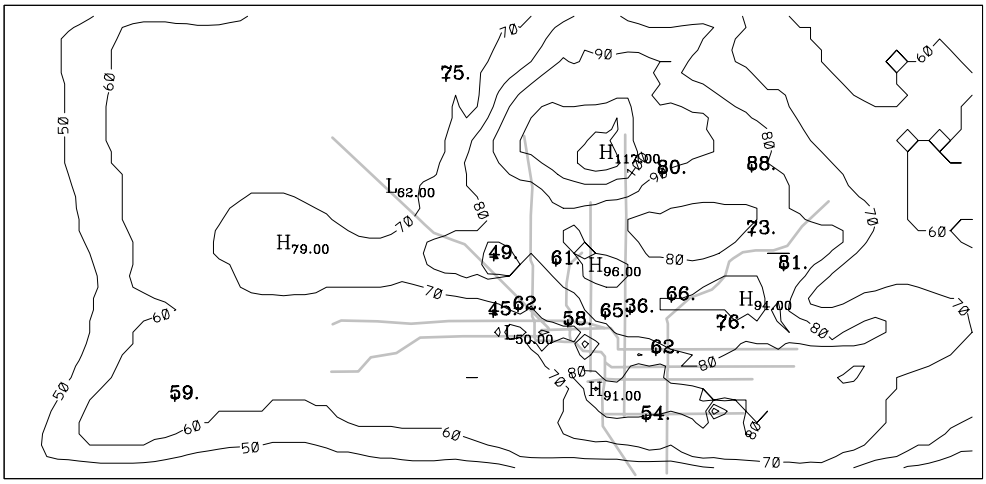

SIMULATED  MAX 116.0  MIN  41.0  AVG  69.2  MAX AT (54,29)
OBSERVED  MAX 112.0  MIN  39.0  AVG  77.8

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1700–1800 MST



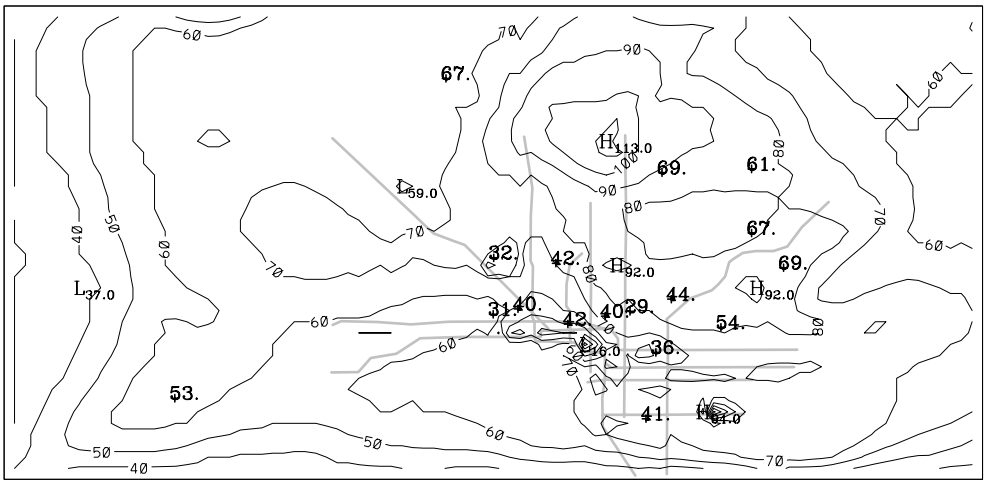

SIMULATED  MAX 116.0  MIN  40.0  AVG  69.4  MAX AT (57,30)
OBSERVED  MAX 107.0  MIN  37.0  AVG  72.6

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1800–1900 MST



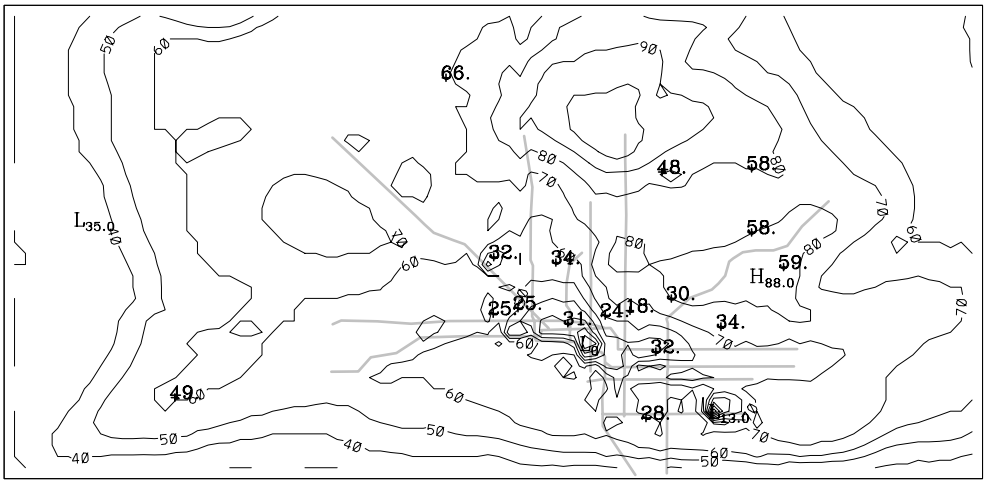

SIMULATED  MAX 117.0  MIN  40.0  AVG  68.3  MAX AT (57,30)
OBSERVED  MAX  88.0  MIN  36.0  AVG  64.1

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  1900–2000 MST



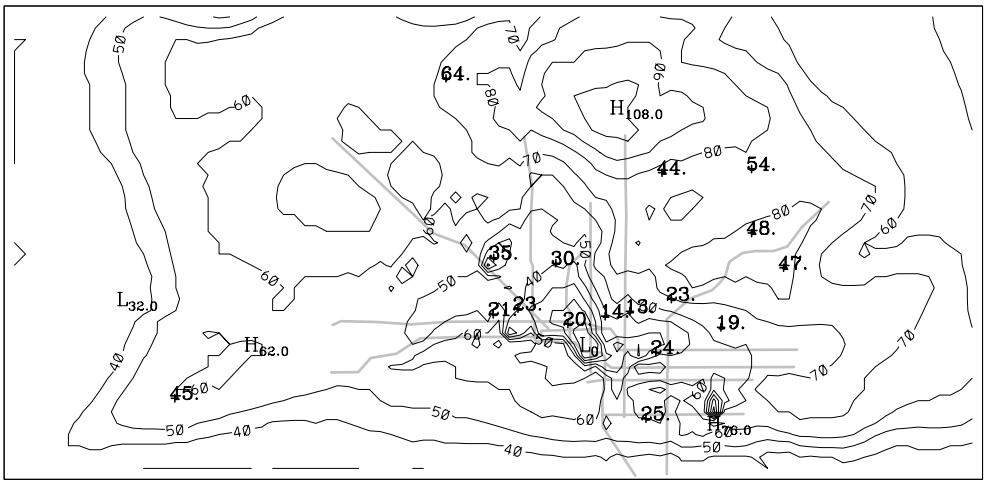

SIMULATED  MAX 113.0  MIN  16.0  AVG  65.3  MAX AT (57,31)
OBSERVED  MAX  69.0  MIN  29.0  AVG  48.1

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  2000–2100 MST



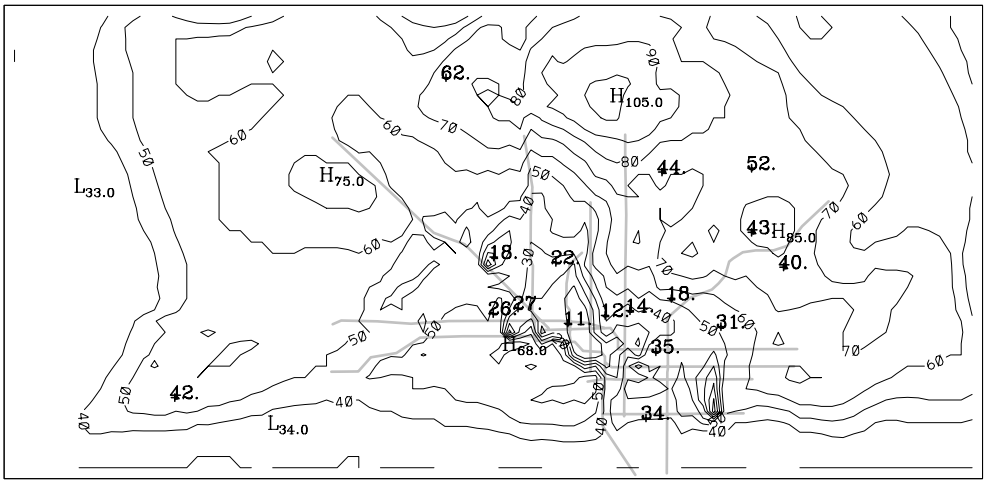

SIMULATED  MAX 109.0  MIN  0.0  AVG  61.8  MAX AT (58,33)
OBSERVED  MAX  66.0  MIN  18.0  AVG  38.3

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  2100–2200 MST



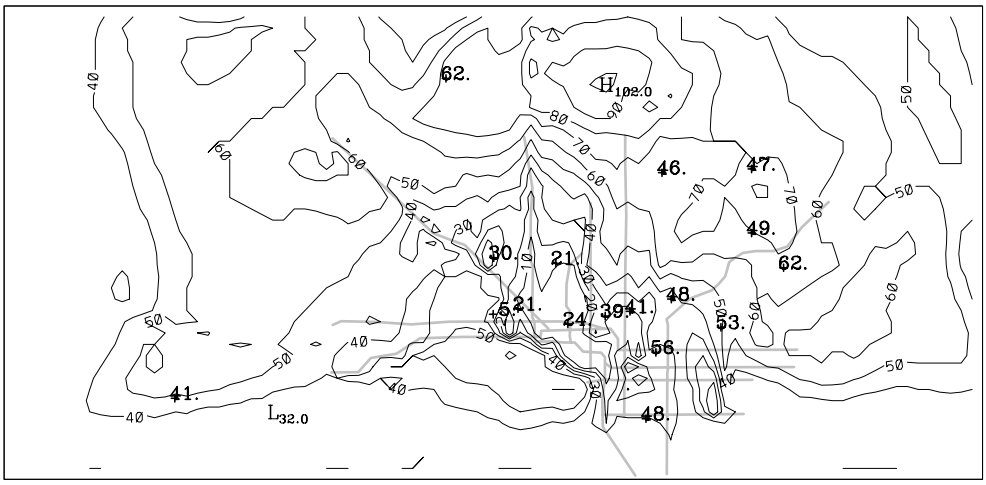

SIMULATED  MAX 108.0  MIN  0.0  AVG  58.4  MAX AT (58,34)
OBSERVED  MAX  64.0  MIN  13.0  AVG  32.3

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  2200–2300 MST



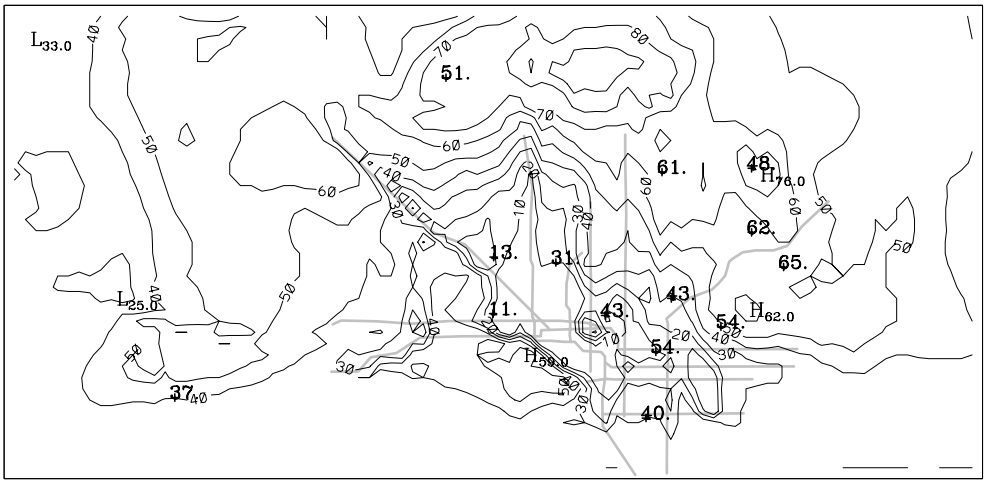

SIMULATED  MAX 105.0  MIN  0.0  AVG  54.7  MAX AT (58,35)
OBSERVED  MAX  62.0  MIN  11.0  AVG  31.2

LAYER 1 O3 CONCENTRATION (ppm)  8/23/1999  2300–2400 MST



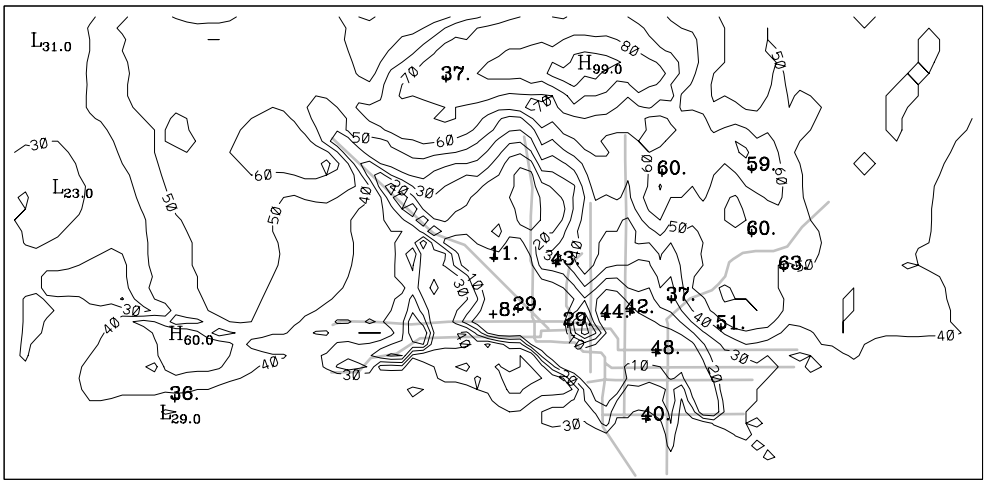

SIMULATED  MAX 102.0  MIN  0.0  AVG  49.3  MAX AT (57,36)
OBSERVED  MAX  62.0  MIN  5.0  AVG  40.8

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0000–0100 MST



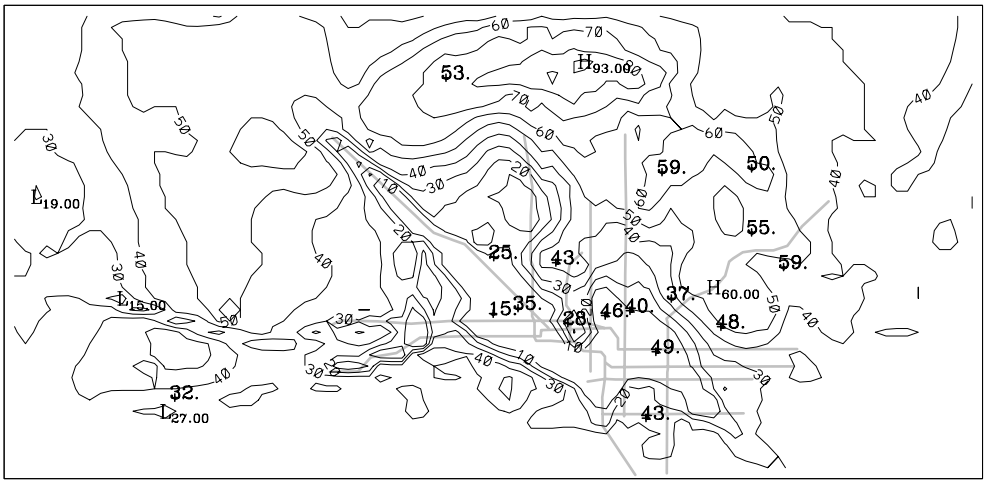

SIMULATED  MAX  99.0  MIN  0.0  AVG  44.7  MAX AT (55,38)
OBSERVED  MAX  65.0  MIN  11.0  AVG  41.1

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0100–0200 MST



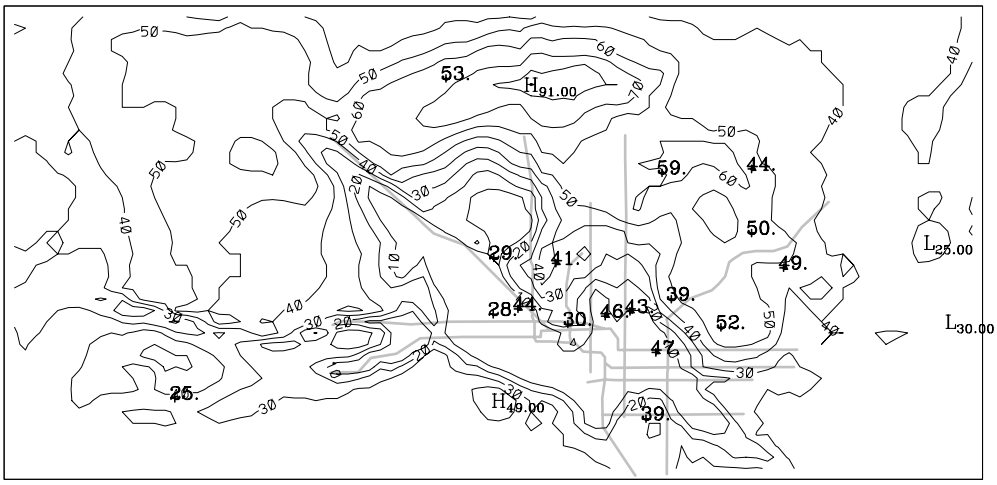

SIMULATED  MAX  99.0  MIN  0.0  AVG  41.9  MAX AT (55,38)
OBSERVED  MAX  63.0  MIN  8.0  AVG  41.0

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0200–0300 MST



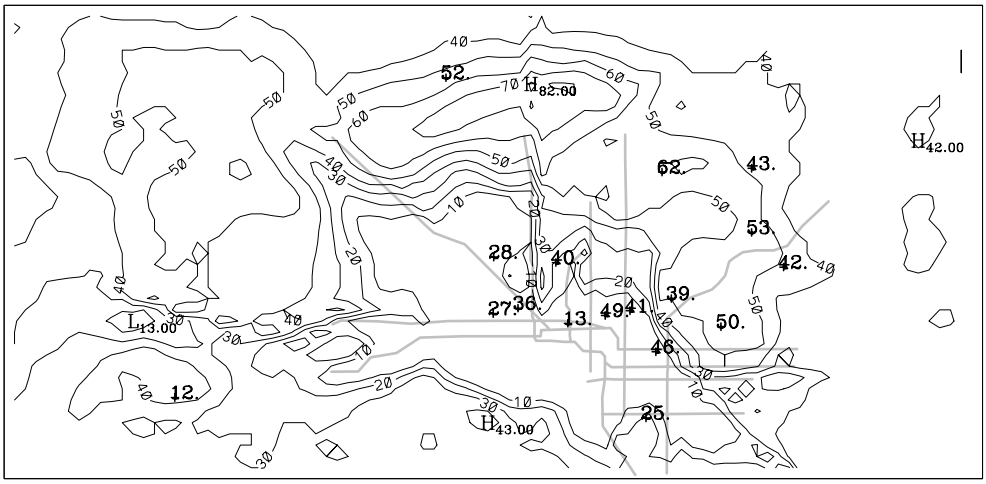

SIMULATED  MAX  93.0  MIN  0.0  AVG  39.8  MAX AT (55,38)
OBSERVED  MAX  59.0  MIN  15.0  AVG  42.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0300–0400 MST



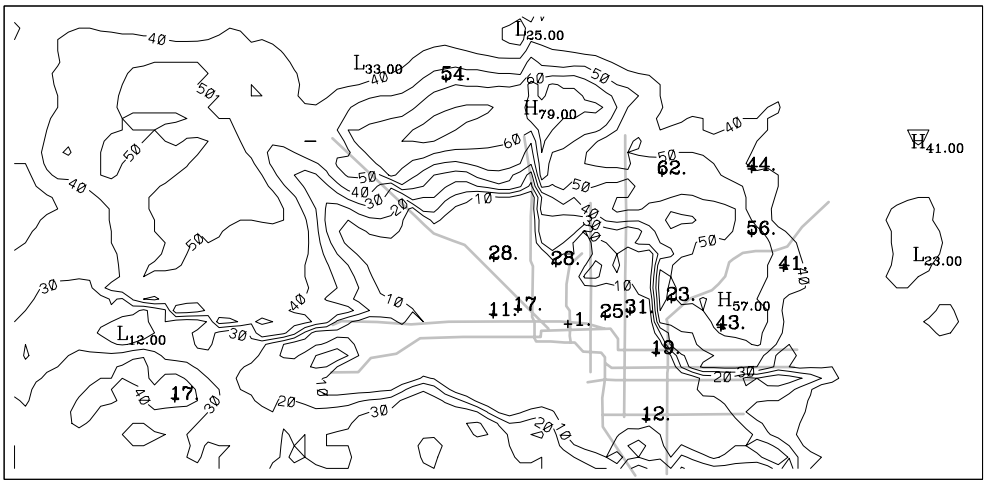

SIMULATED  MAX  91.0  MIN  0.0  AVG  38.0  MAX AT (50,36)
OBSERVED  MAX  59.0  MIN  25.0  AVG  42.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0400–0500 MST



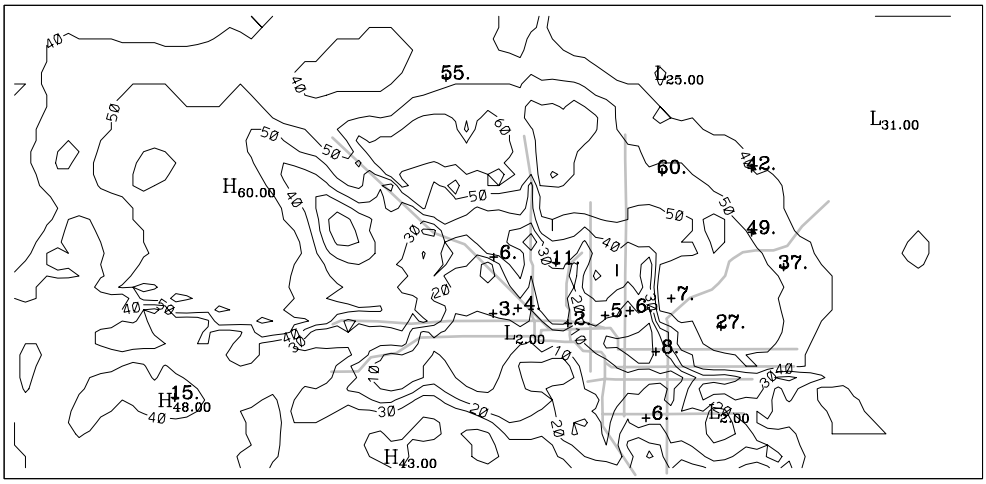

SIMULATED  MAX  82.0  MIN  0.0  AVG  35.5  MAX AT (50,36)
OBSERVED  MAX  62.0  MIN  12.0  AVG  38.7

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0500–0600 MST



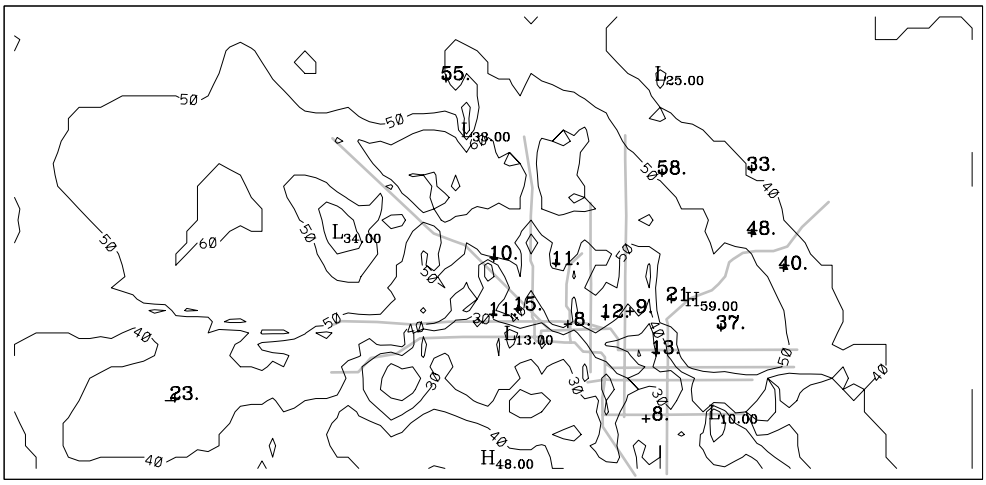

SIMULATED  MAX  79.0  MIN  0.0  AVG  33.2  MAX AT (50,34)
OBSERVED  MAX  62.0  MIN  1.0  AVG  30.1

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0600–0700 MST



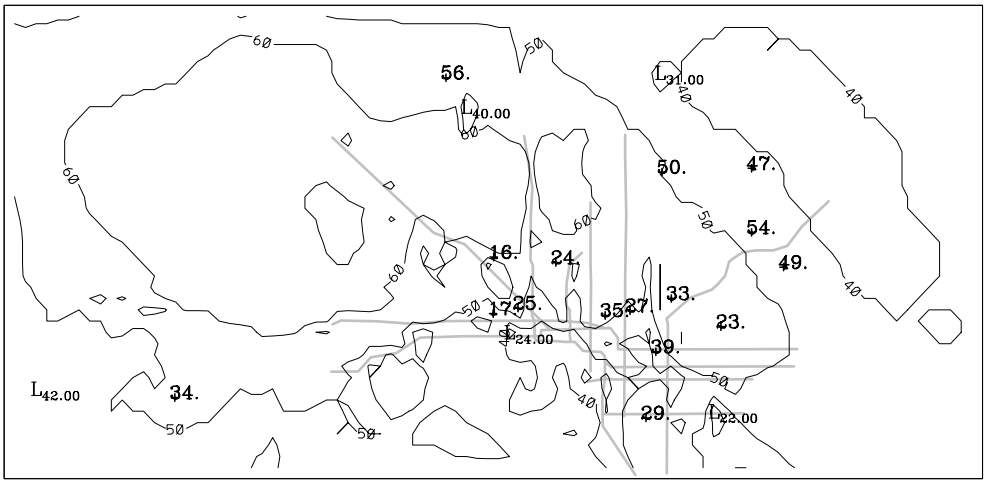

SIMULATED  MAX  68.0  MIN  2.0  AVG  38.2  MAX AT (40,31)
OBSERVED  MAX  60.0  MIN  2.0  AVG  20.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0700–0800 MST



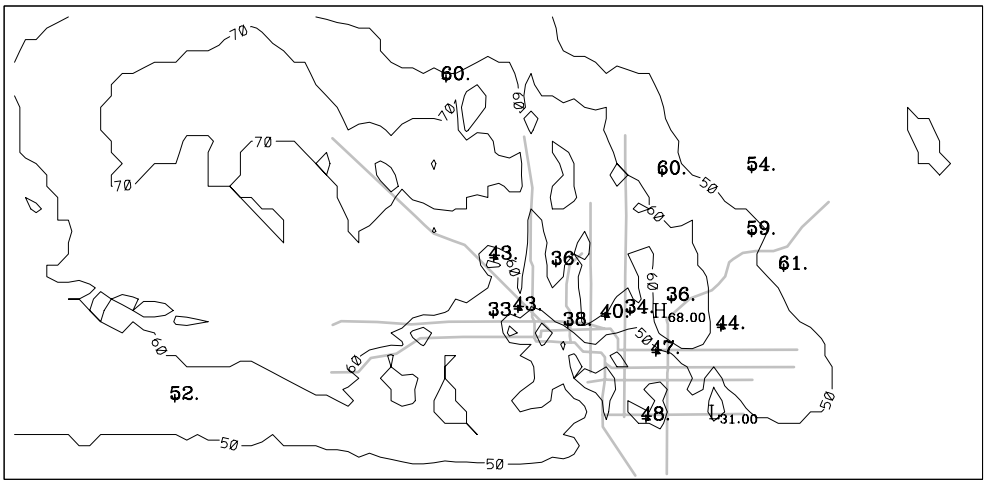

SIMULATED  MAX  69.0  MIN  10.0  AVG  43.9  MAX AT (41,30)
OBSERVED  MAX  58.0  MIN  8.0  AVG  24.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0800–0900 MST



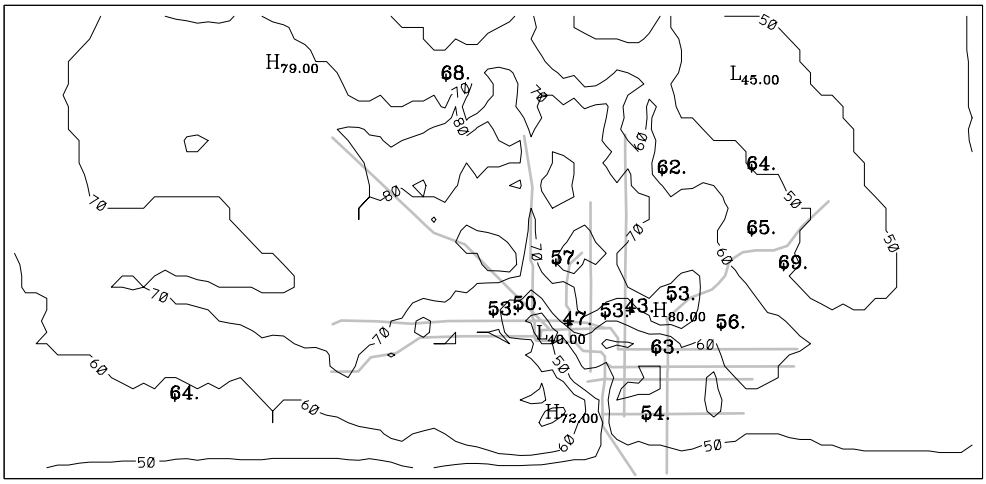

SIMULATED  MAX  70.0  MIN  22.0  AVG  50.2  MAX AT (38,30)
OBSERVED  MAX  56.0  MIN  8.0  AVG  33.3

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  0900–1000 MST



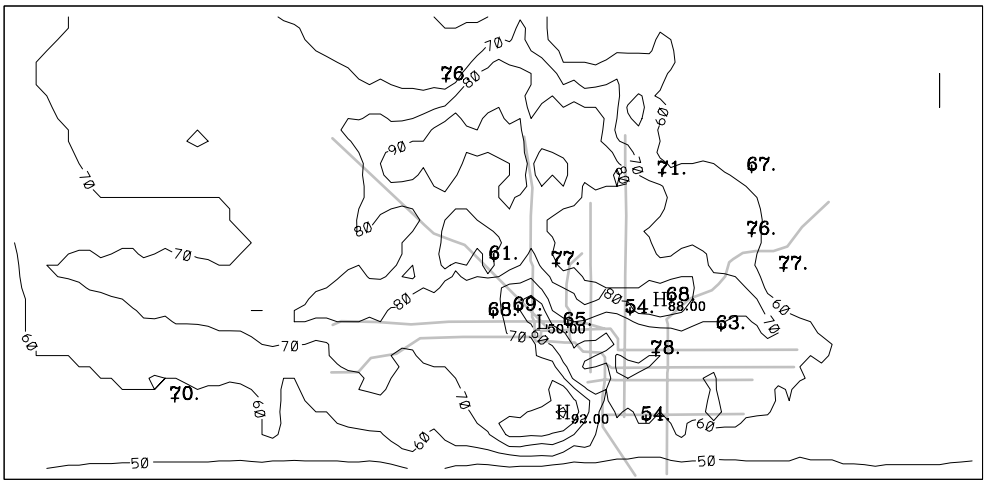

SIMULATED  MAX  75.0  MIN  31.0  AVG  56.4  MAX AT (23,38)
OBSERVED  MAX  61.0  MIN  33.0  AVG  46.4

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1000–1100 MST



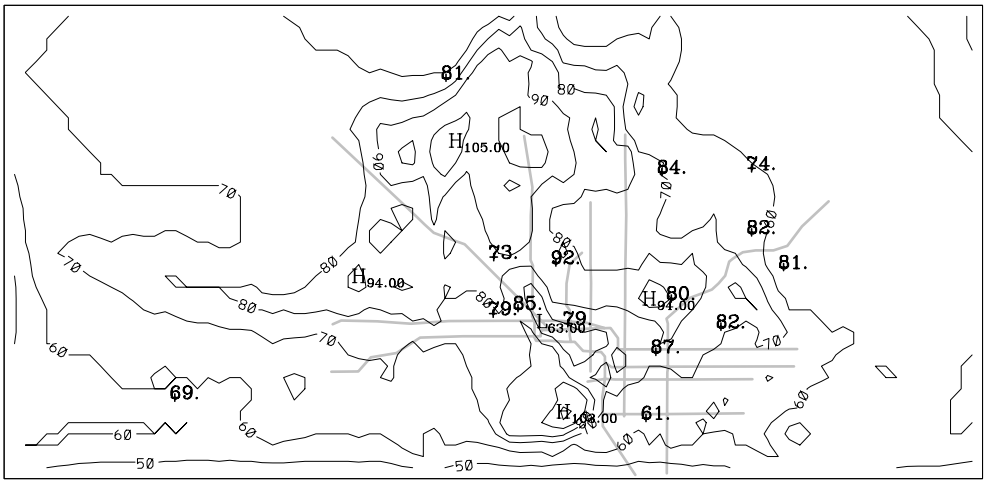

SIMULATED  MAX  86.0  MIN  40.0  AVG  61.8  MAX AT (42,28)
OBSERVED  MAX  69.0  MIN  43.0  AVG  56.7

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1100–1200 MST



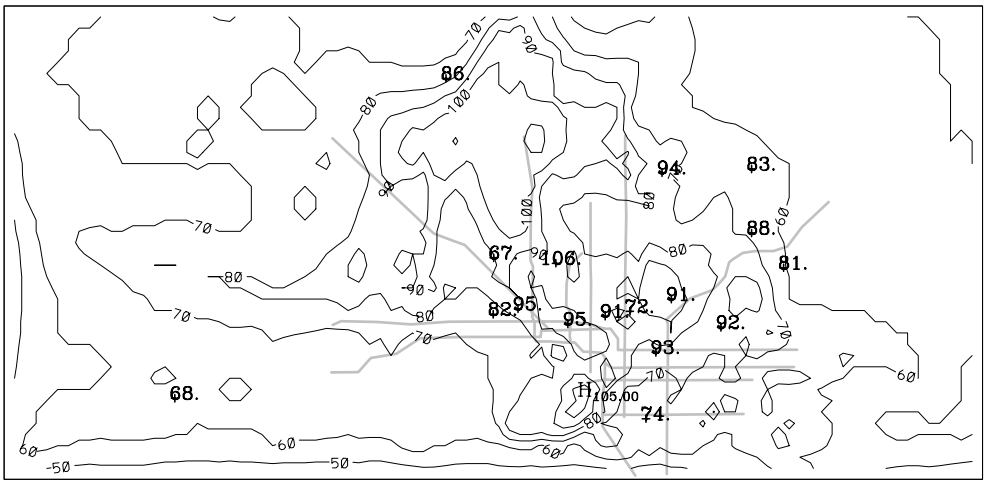

SIMULATED  MAX  96.0  MIN  44.0  AVG  65.9  MAX AT (43,30)
OBSERVED  MAX  78.0  MIN  53.0  AVG  67.5

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1200–1300 MST



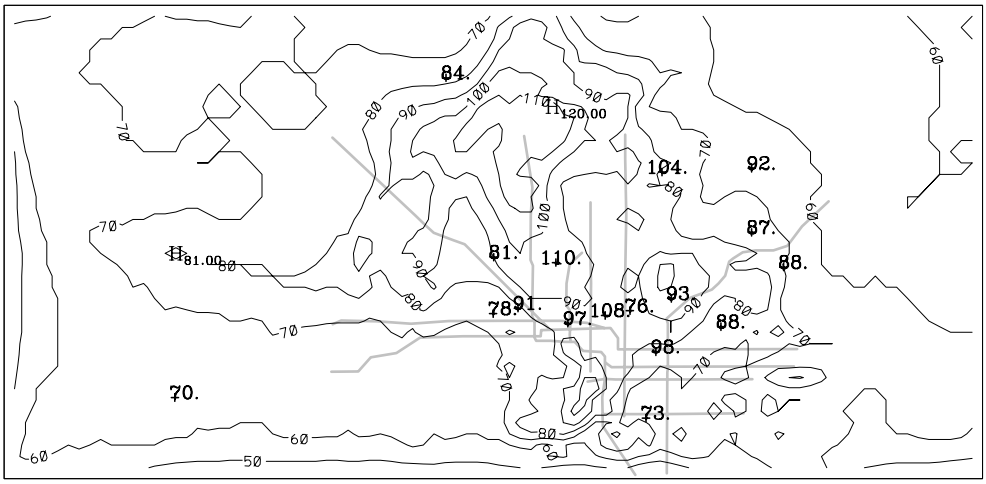

SIMULATED  MAX 105.0  MIN  46.0  AVG  68.1  MAX AT (43,31)
OBSERVED  MAX  92.0  MIN  53.0  AVG  76.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1300–1400 MST



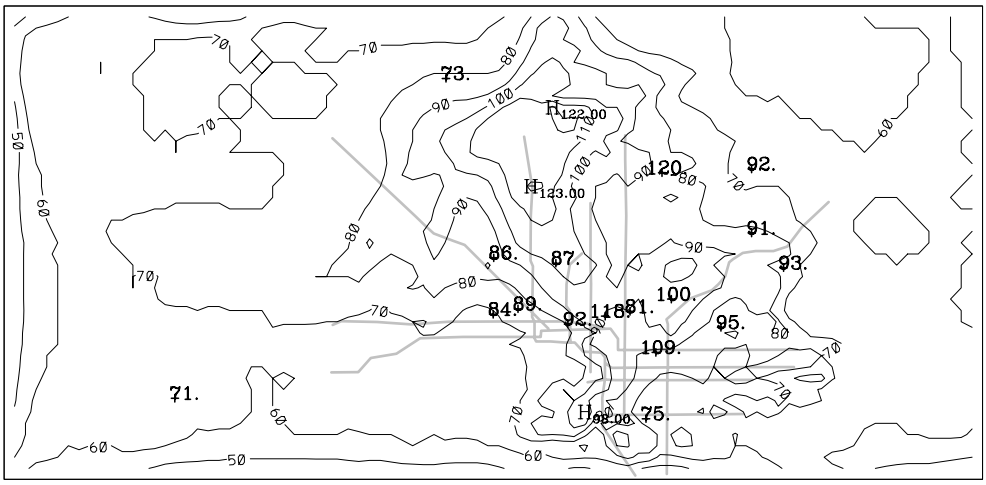

SIMULATED  MAX 112.0  MIN  45.0  AVG  69.3  MAX AT (50,31)
OBSERVED  MAX 106.0  MIN  67.0  AVG  85.8

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1400–1500 MST



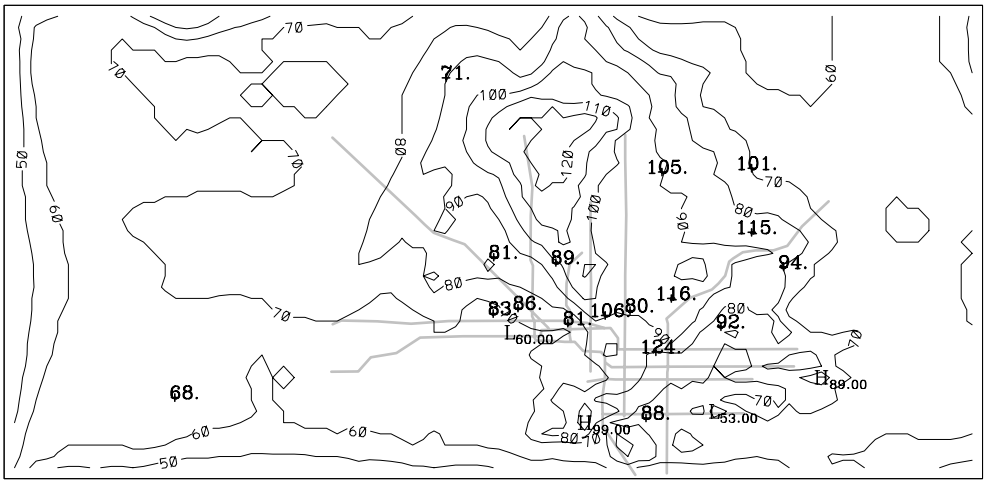

SIMULATED  MAX 120.0  MIN  43.0  AVG  70.2  MAX AT (52,34)
OBSERVED  MAX 110.0  MIN  70.0  AVG  89.3

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1500–1600 MST



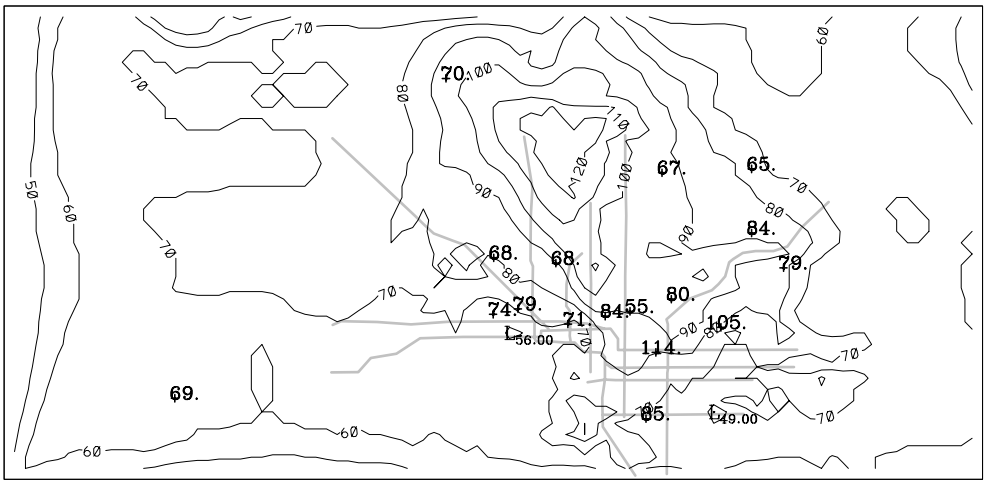

SIMULATED  MAX 123.0  MIN  44.0  AVG  70.7  MAX AT (50,27)
OBSERVED  MAX 120.0  MIN  71.0  AVG  91.5

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1600–1700 MST



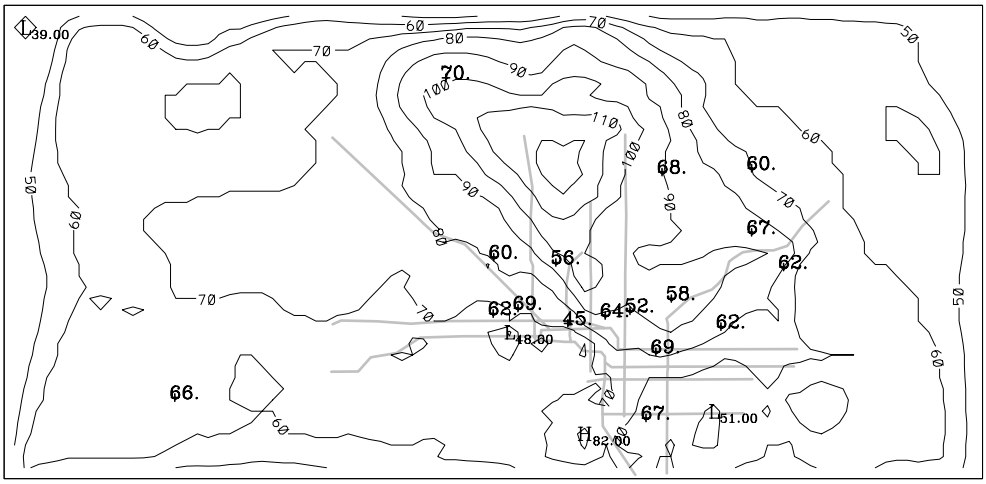

SIMULATED  MAX 123.0  MIN  42.0  AVG  71.1  MAX AT (55,33)
OBSERVED  MAX 124.0  MIN  68.0  AVG  92.9

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1700–1800 MST



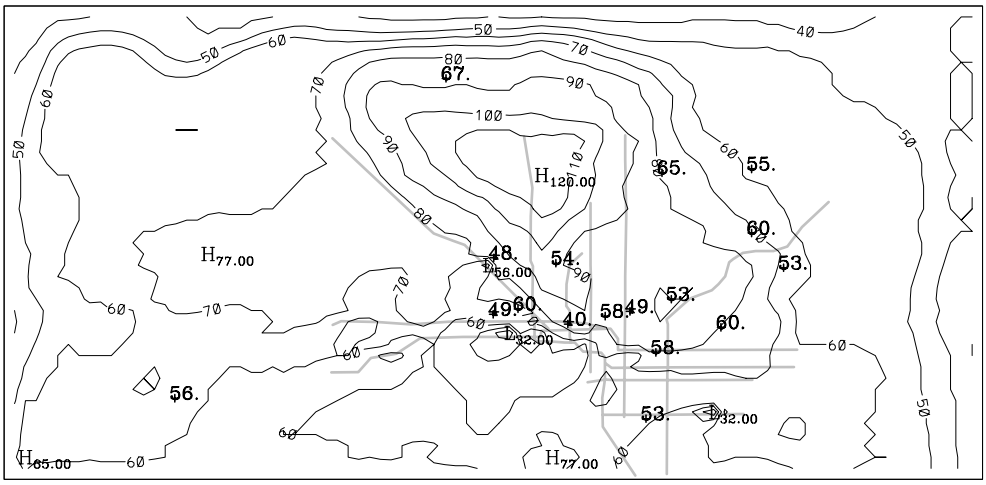

SIMULATED  MAX 125.0  MIN  41.0  AVG  70.8  MAX AT (53,29)
OBSERVED  MAX 114.0  MIN  55.0  AVG  77.5

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1800–1900 MST



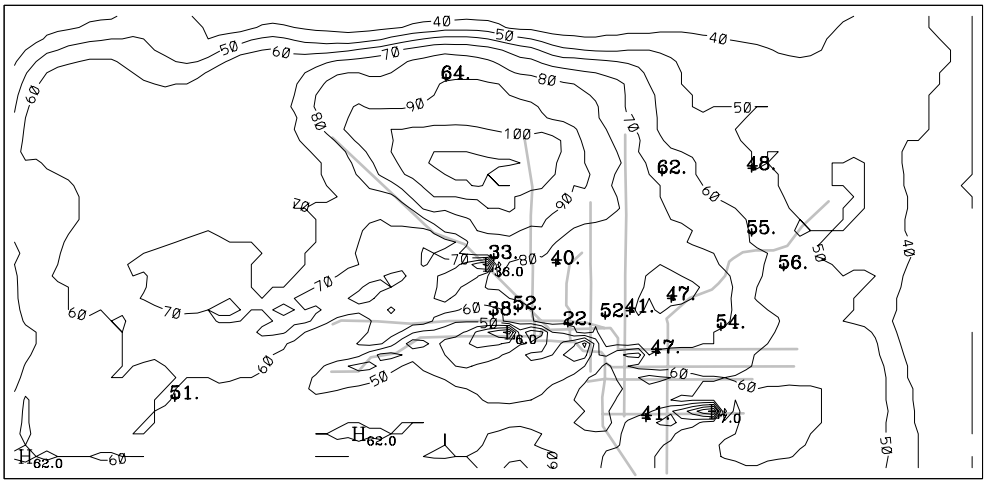

SIMULATED  MAX 124.0  MIN  39.0  AVG  69.2  MAX AT (53,28)
OBSERVED  MAX  70.0  MIN  45.0  AVG  62.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  1900–2000 MST



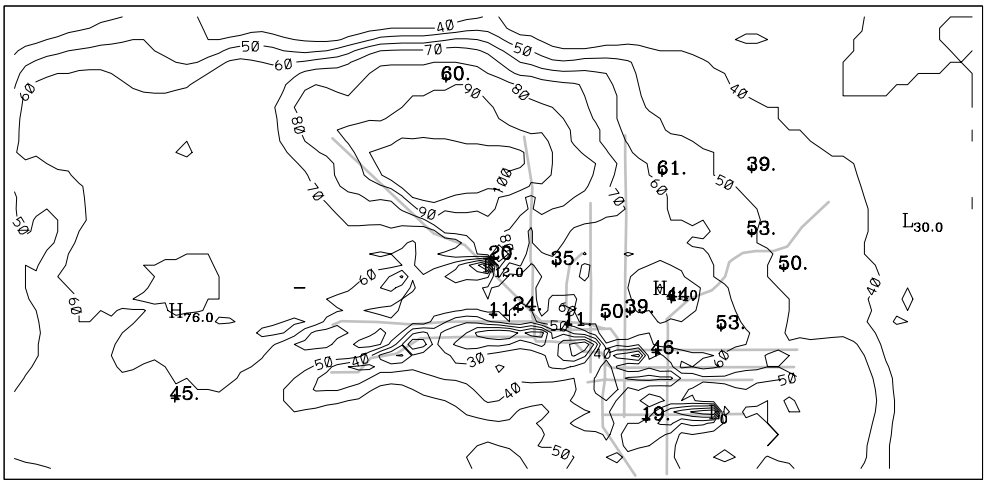

SIMULATED  MAX 120.0  MIN  32.0  AVG  64.9  MAX AT (51,28)
OBSERVED  MAX  67.0  MIN  40.0  AVG  55.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  2000–2100 MST



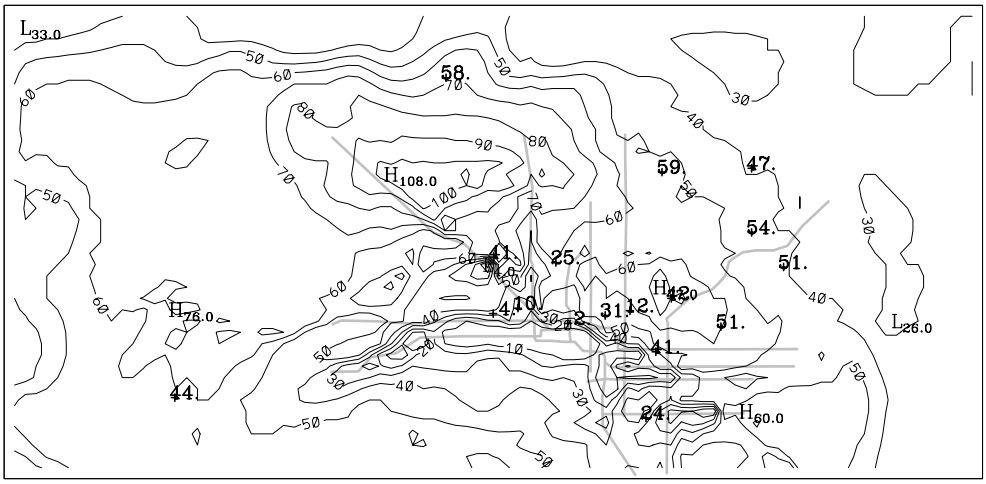

SIMULATED  MAX 113.0  MIN  6.0  AVG  59.9  MAX AT (43,29)
OBSERVED  MAX  64.0  MIN  22.0  AVG  47.2

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  2100–2200 MST



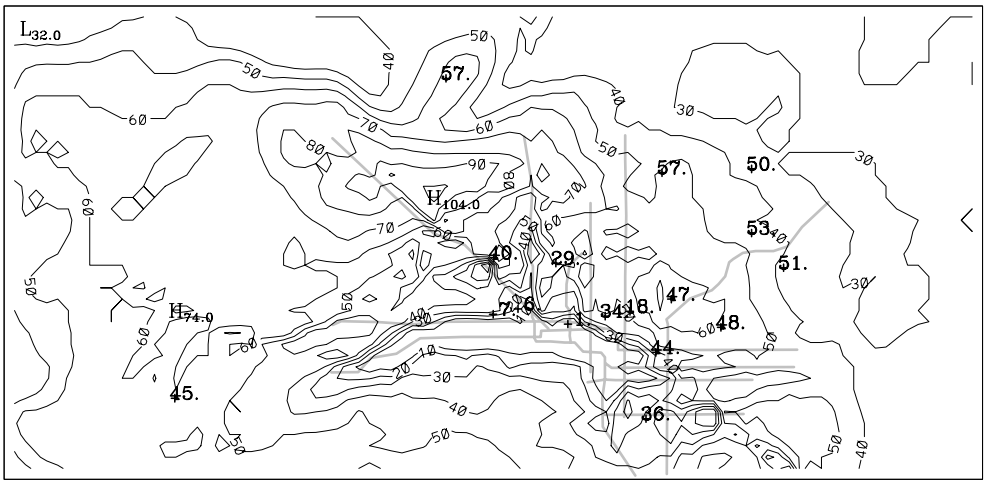

SIMULATED  MAX 110.0  MIN  0.0  AVG  55.3  MAX AT (41,27)
OBSERVED  MAX  61.0  MIN  11.0  AVG  38.8

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  2200–2300 MST




SIMULATED  MAX 108.0  MIN  0.0  AVG  50.2  MAX AT (37,28)
OBSERVED  MAX  59.0  MIN  2.0  AVG  35.1

LAYER 1 O3 CONCENTRATION (ppm)  8/24/1999  2300–2400 MST




SIMULATED  MAX 104.0  MIN  0.0  AVG  46.8  MAX AT (41,26)
OBSERVED  MAX  57.0  MIN  1.0  AVG  36.6

# APPENDIX VI

# 2006 and 2015 EMISSION INVENTORY DEVELOPMENT

App.VI-i

# Onroad Vehicle Emission Factor Estimation Procedure for 2006 and 2015

App.VI-i is followed by an attachment containing a sample of the MOBILE6 input files for 2015.

## ONROAD VEHICLE EMISSION FACTOR ESTIMATION PROCEDURE FOR 2006 and 2015

Emission Factor Model

Hydrocarbons in the form of total organic gases (TOGs), carbon monoxide (CO), and oxides of nitrogen (NOx) vehicle exhaust emission factors were calculated using MOBILE6, a model developed by the Environmental Protection Agency (EPA) for the purpose of estimating motor vehicle emission factors. The MOBILE6 runs were executed by the Maricopa Association of Governments (MAG). The contact person for the MOBILE6 emission estimates is Roger Roy (602-254-6300). More information about the MOBILE6 model may be found in the EPA User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, October 2002, EPA420-R-02-026, which may be found at the web site http://www.epa.gov/otaq/models.htm.

A series of MOBILE6 runs were performed to create a complete set of emission factors for input to the M6Link model.

Two Inspection/maintenance (I/M) scenarios were modeled:

1. With an I/M program in place.
2. No I/M program in place.

Five area types were modeled:

1. Central Business District
2. Urban Area
3. Urban Fringe
4. Suburban
5. Rural

Six days were modeled:

1. Sunday in August
2. Monday in August
3. Tuesday in August
4. Wednesday in July

5. Thursday in July

6. Friday in July

Three sets of control measures were applied to the MOBILE6 inputs, depending upon the location:

1. Attainment Area inside Area A

2. Attainment Area outside Area A

3. Nonattainment Area

Combinations of the above scenarios were processed through the MOBILE6 model for the creation of detailed MOBILE6 output files (2 I/M status conditions X 5 area types X 6 days X 3 control measure subareas).

The results of the I/M and non-I/M runs for each of the five area types were combined to reflect the proportions of I/M and non I/M vehicles by the M6Link program. The term I/M vehicles means vehicles which are required to undergo an emission test and inspection under the Arizona Vehicle Inspection/Maintenance Program. It is important to note that the I/M program is required for all vehicles of the appropriate age *registered* in the nonattainment area. However, it is assumed that 91.6 percent of the vehicles *operating* within the nonattainment area will participate in the I/M program, and that 8.4 percent will not participate in the program. These percentages reflect implementation of the committed control measure "Tougher Enforcement of Vehicle Registration and Emission Test Compliance". In the absence of any additional data, this percentage split is assumed to apply directly to VMT as well. Refer to ATTACHMENT ONE for the actual input files for 2015 run.

Development of Model Inputs

The inputs to MOBILE6 are grouped into three categories: Header inputs, Run inputs, and Scenario inputs. The input values used in the above described MOBILE6 runs are specified and explained below.

**Header Section**

1. **MOBILE6 INPUT FILE** identifies a MOBILE6 input file as a regular command input file rather than a batch file.

2. **DATABASE OUTPUT** instructs MOBILE6 to report output in database format.

3. **WITH FIELDNAMES** specifies that a header record of field names is to be generated for the database output file.

4. **DATABASE EMISSIONS : 2222 2222** indicates that all emissions types are reported in database output format if appropriate. The eight emission types are exhaust running emissions, exhaust start emissions, evaporative hot soak emissions, evaporative diurnal emissions, evaporative resting loss emissions, evaporative running loss emissions, evaporative crankcase emissions, and evaporative refueling emissions. For carbon monoxide and NOx, only exhaust running emissions and exhaust start emissions are relevant.

5. **DATABASE FACILITIES : Arterial Freeway Local Ramp None** instructs MOBILE6 to output emissions in the database output table specific to each of the four roadway types modeled by MOBILE6. Also, emissions that are independent of roadway type are output separately by MOBILE6.

6. **DATABASE VEHICLES : 22222 22222222 2 222 22222222 222** instructs MOBILE6 to output emission factors for all 28 vehicle classes considered by MOBILE6.

**Run Data Section**

The run data section includes information about the local inspection and maintenance programs, the anti-tampering program, and local vehicle registration data.

1. **I/M PROGRAM :1 1977 2050 1 T/O LOADED/IDLE** instructs MOBILE6 to model an I/M program with an I/M program start year of 1977 and 2050 end year. The program is an annual program "1". The program is a Test only rather than test and repair program "T/O". Finally, the program is a loaded/idle program. It is important to note that this command (and the majority of all commands dealing with I/M settings) appears five times in the MAG I/M run reflecting five components of the I/M program.

2. **I/M MODEL YEARS : 1 1967 2050** instructs MOBILE6 that the portion of the I/M program defined in the "I/M PROGRAM" line is applied to model year 1967 through 2050 model year vehicles.

3. **I/M VEHICLES : 1 11111 22222222 2** this instructs MOBILE6 which vehicle classes are subject to this component of the I/M program where the number two indicates that a particular vehicle class is subject to the program and the number one indicates that a particular vehicle class is not subject to the program.

4. **I/M STRINGENCY : 1 28.0** defines that the expected exhaust inspection failure rate for pre-1981 model year vehicles covered by the I/M program is 28.0 percent.

5. **I/M COMPLIANCE : 1 97.0** describes the expected compliance rate within this portion of the I/M program where the compliance rate is the percentage of vehicles in the fleet that complete the I/M program and receive either a certificate of compliance or a waiver.

6. **I/M WAIVER RATES: 1 1.3 1.0** specifies the percentage of vehicles that fail an

initial I/M test and do not pass a retest but receive a certificate of compliance. This input instructs MOBILE6 to set the waiver rate at 1.3 percent for pre-1981 model years and 1.0 percent for 1981 and later model years for this portion of the I/M program. These values reflect the implementation of the control measure "One-time Waiver from Vehicle Emissions Test".

7. **I/M GRACE PERIOD : 1 5** specifies that the vehicles first become subject to the local I/M program at five years of age.

8. **ANTI-TAMP PROG : 87 75 80 22222 22222222 2 11 097. 22111222** indicates information for the local anti-tampering program. Note that there may be more than one component of an anti-tampering program, requiring multiple inputs of this data.

   "**87**" indicates that the program began in 1987.
   "**75**" indicates that the earliest model year covered by the program is 1975.
   "**80**" indicates that the last model year covered by the program is 1980.
   "**22222**" indicates that the five light duty gasoline vehicle classes considered by MOBILE6 are all subject to this portion of the anti-tampering program.
   "**22222222**" indicates that the eight heavy duty gasoline vehicle classes considered by MOBILE6 are all subject to this portion of the anti-tampering program.
   "**2**" indicates that the gasoline powered buses are subject to this portion of the anti-tampering program.
   "**11**" indicates that credit is to be taken for the anti-tampering program and that the test is performed annually.
   **"097.**" indicates that the program compliance rate is 97 percent.
   "**22111222**" indicates that the ATP program consists of an air pump system disablement test, catalyst removal test, evaporative system disablement test, PCV system disablement test, and missing gas cap test. Omitted from the program are a fuel inlet restrictor disablement test, tailpipe lead deposit test, and EGR disablement test.

9. **REG DIST: 02reg15.d** indicates that local registration distribution data is provided for MOBILE6 use, rather than national default data, and that these data may be found in the external data file 02reg15.d. The data input to the runs performed for this analysis reflect ADOT registration data developed in 2002.

10. **DIESEL FRACTIONS :** indicates that the user is inputting data to reflect the fraction of vehicles by vehicle class that are diesel powered, where appropriate. In the case of MAG analysis, local data is used for the vehicle classes light duty gasoline vehicles, light duty trucks 1, and light duty trucks 2. For the remaining vehicle classes, MOBILE6 default data was input. Please note that the 42 lines of registration data following the DIESEL FRACTIONS: command have not been reproduced here, but may be seen in the sample MOBILE6 input file provided with this document.

**Scenario Data Section**

1. **SCENARIO RECORD : I/M Scenario** is a required field that provides a unique identifier to each scenario analyzed. The individual MOBILE6 runs performed by MAG for this analysis each have only one scenario.

2. **CALENDAR YEAR : 2006, 2015** indicates that the year analyzed is 2006 or 2015.

3. **EVALUATION MONTH : 7** indicates that the month analyzed was July (where January and July are the only months available for analysis by MOBILE6). Since the periods subject to analysis were July and August, the closest months available to model were July of 2006 and 2015.

4. **ALTITUDE : 1** indicates that the runs are being performed for a low-altitude region. The low altitude flag represents approximately 500 feet above sea level and the high altitude flag represents approximately 5,500 feet above sea level.

5. **HOURLY TEMPERATURES:** indicates the 24 hourly temperatures for the day being modeled, starting at 6 a.m. and ending at 5 a.m. the next morning in degrees Fahrenheit.

6. **RELATIVE HUMIDITY:** indicates the 24 hourly humidity values for the day being modeled, starting at 6 a.m. and ending at 5 a.m. the next morning in percent.

7. **BAROMETRIC PRESSURE: 28.63** indicates the average daily barometric pressure expressed in inches of mercury.

8. **SPEED VMT: s15na1mo.txt** indicates that the user has chosen to provide an external data file, s15na1mo.txt, that contains hourly speed distributions for both freeway and arterial roadway types. In this case, the file reflects area type 1, “a1" in the nonattainment area “n” for the Monday design day “mo” in 2015 “15".

9. **FUEL PROGRAM: 2 S** instructs MOBILE6 that the gasoline in use will be reformulated gasoline in use for the southern region.

10. **FUEL RVP : 7.0** indicates that the measure of fuel volatility Reid Vapor Pressure is expected to be 7.0 pounds per square inch during the period modeled.

Model Outputs

MOBILE6 was executed with the inputs described above to obtain a database of emission factors in grams per mile (g/mi) for CO, NOx, and the hydrocarbon (total organic gases) emissions. The database of emission factors represented emission factors split out by the vehicle classes, vehicle ages, hour of the day, roadway (facility) type on which the vehicle is driving. These outputs, in the units of grams per mile were input to the M6Link system for further processing.

## ATTACHMENT ONE

## MOBILE6 INPUT FILES

Attachment One contains a portion of the MOBILE6 input files for the I/M and no I/M runs for the modeling year 2015. The sample inputs reflects Area Type number 1 (central business district) and the Monday modeling day. The I/M input appears first followed by the no I/M input. The equivalent files for the modeling year 2006 would be identical to those shown below except have a modeling year of 2006 and contain different registration distribution and diesel fractions data.

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222


RUN DATA
EXPRESS HC AS TOG  :
I/M PROGRAM        : 1 1977 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 2050
I/M VEHICLES       : 1 11111 22222222 2
I/M STRINGENCY     : 1 28.0
I/M COMPLIANCE     : 1 97.0
I/M WAIVER RATES   : 1 1.3 1.0
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1977 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 28.0
I/M COMPLIANCE     : 2 97.0
I/M WAIVER RATES   : 2 1.3 1.0
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTCMP15.d
I/M PROGRAM        : 3 1977 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 3 1967 1980
I/M VEHICLES       : 3 22222 11111111 1
I/M STRINGENCY     : 3 28.0
I/M COMPLIANCE     : 3 97.0
I/M WAIVER RATES   : 3 1.3 1.0
I/M PROGRAM        : 4 2001 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 28.0
I/M COMPLIANCE     : 4 97.0
I/M WAIVER RATES   : 4 1.3 1.0
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2001 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M STRINGENCY     : 5 28.0
I/M COMPLIANCE     : 5 97.0
I/M WAIVER RATES   : 5 1.3 1.0
I/M GRACE PERIOD   : 5 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 097. 22111222
ANTI-TAMP PROG     :
87 81 95 11111 22222222 2 11 097. 22111222

*the tech12.d file must be located with Mobile6 execution file
*the user tech file tech12.1me should be renamed as tech12.d
*Two more I/M programs should not have overlapped motor vehicles.

REG DIST           : 02reg15.d
DIESEL FRACTIONS   :
0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050
0.0050 0.0050 0.0050 0.0050 0.0040 0.0060 0.0040 0.0040 0.0030 0.0030
0.0030 0.0030 0.0030 0.0040 0.0040
```

```
0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740
0.0740 0.0740 0.0740 0.0740 0.0660 0.0690 0.1030 0.0280 0.0600 0.0500
0.0390 0.0250 0.0400 0.0330 0.0280
0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740
0.0740 0.0740 0.0740 0.0740 0.0660 0.0690 0.1030 0.0280 0.0600 0.0500
0.0390 0.0250 0.0400 0.0330 0.0280
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0115 0.0111 0.0145 0.0115 0.0129
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0115 0.0111 0.0145 0.0115 0.0129
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2515 0.3263 0.2784 0.2963
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7715 0.7910 0.8105 0.8068 0.8280
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105

SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2015
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 82.9 86.1 89.6 92.8 95.3 97.4 99.3 100.8 102.8 104.1 104.3 103.3
                     101.1 97.6 94.9 93.0 91.1 90.0 89.2 87.9 87.2 86.6 86.3 85.8
RELATIVE HUMIDITY  : 48. 45. 37. 33. 29. 28. 27. 23. 20. 21. 21. 21.
                     21. 33. 33. 32. 34. 34. 36. 36. 37. 38. 38. 37.
BAROMETRIC PRES    : 28.63
SPEED VMT          : s15na1mo.txt
FUEL PROGRAM       : 2  S
FUEL RVP           : 7.0

END OF RUN
```

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222


RUN DATA
EXPRESS HC AS TOG  :

*the tech12.d file must be located with Mobile6 execution file
*the user tech file tech12.1me should be renamed as tech12.d
*Two more I/M programs should not have overlapped motor vehicles.

REG DIST           : 02reg15.d
DIESEL FRACTIONS   :
0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050
0.0050 0.0050 0.0050 0.0050 0.0040 0.0060 0.0040 0.0040 0.0030 0.0030
0.0030 0.0030 0.0030 0.0040 0.0040
0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740
0.0740 0.0740 0.0740 0.0740 0.0660 0.0690 0.1030 0.0280 0.0600 0.0500
0.0390 0.0250 0.0400 0.0330 0.0280
0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740 0.0740
0.0740 0.0740 0.0740 0.0740 0.0660 0.0690 0.1030 0.0280 0.0600 0.0500
0.0390 0.0250 0.0400 0.0330 0.0280
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0115 0.0111 0.0145 0.0115 0.0129
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0115 0.0111 0.0145 0.0115 0.0129
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2515 0.3263 0.2784 0.2963
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7715 0.7910 0.8105 0.8068 0.8280
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105
```

```
SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2015
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 82.9 86.1 89.6 92.8 95.3 97.4 99.3 100.8 102.8 104.1 104.3 103.3
                     101.1 97.6 94.9 93.0 91.1 90.0 89.2 87.9 87.2 86.6 86.3 85.8
RELATIVE HUMIDITY  : 48. 45. 37. 33. 29. 28. 27. 23. 20. 21. 21. 21.
                     21. 33. 33. 32. 34. 34. 36. 36. 37. 38. 38. 37.
BAROMETRIC PRES    : 28.63
SPEED VMT          : s15na1mo.txt
FUEL PROGRAM       : 2  S
FUEL RVP           : 7.0

END OF RUN
```

App.VI-ii

# Traffic Data

App.VI-ii contains a detailed description of the traffic data used to estimate onroad mobile source emissions.

**Socioeconomic Projections** The 1998, 1999, 2006, and 2015 population and employment for Maricopa County assumed in developing onroad mobile emissions for the CO maintenance plan are summarized in Table 1. The population and employment projections on which these estimates are based were officially approved by the Metropolitan Planning Organization (i.e., MAG). These projections are based on the Maricopa County population control totals developed by the Arizona Department of Economic Security (DES) in accordance with Executive Order 95-2. State agencies are required to use these forecasts for all planning purposes except where otherwise noted in the State Statutes. The Maricopa County totals were disaggregated to traffic analysis zones (TAZs) by MAG, using land use models and data from the 1995 Special Census and 1995 MAG Employment Survey.

In June 1997, the MAG Regional Council approved the TAZ estimates and projections of population and employment used in this analysis. These allocations take into account growth associated with programmed and planned transportation improvements. Population and employment, along with other socioeconomic characteristics, are input to the MAG travel demand models to produce travel and level of service estimates.

In June 2003 the MAG Regional Council "accepted" new TAZ projections based on the 2000 Census. These projections do not comply with executive order 95-2 because DES has not yet adopted official county control totals based on the 2000 census. These new MAG projections were not used in preparing the ozone maintenance plan because they were not available when the one-hour ozone modeling was performed. However, to account for increased growth in the new projections, emissions dependent upon population growth were increased by 8% in 2006 and 15% in 2025.

**Travel Demand Models** In 1994 MAG converted its transportation models from the mainframe-based Urban Transportation Planning System (UTPS) to a UNIX workstation version of EMME/2. Since that time, the MAG EMME/2 travel demand models, with a series of enhancements, have been validated against more than 4,000 1998 traffic counts. The enhanced EMME/2 models, now executing on microcomputers with an NT operating system, were used to develop the regional traffic forecasts for the CO maintenance plan.

The vehicle miles of travel (VMT) estimated by the MAG EMME/2 transportation models track closely with the Highway Performance Monitoring System (HPMS). HPMS is prepared each year by the Arizona Department of Transportation (ADOT) and submitted to the Federal Highway Administration. MAG submitted VMT tracking reports to EPA in 1999, 2000 and 2001 to fulfill a Serious Area CO Plan requirement. These reports showed that the VMT produced by the MAG transportation models is within three percent of actual HPMS VMT reported by ADOT. This confirms that the MAG travel demand model estimates are consistent with actual VMT reported by HPMS each year.

As part of enhancements to the EMME/2 models, the MAG trip distribution model was re-calibrated to operationalize a speed feedback loop. This feedback loop, which stabilizes in five iterations, simulates the impact which traffic congestion has on the length and destination of person trips. A composite impedance function (i.e., time and cost) is also used in the trip distribution and traffic assignment models. In addition, improved freeway

and arterial speeds, derived from the 1993 MAG Travel Speed and Delay Study, Maricopa Association of Governments, March 1995, are being used to ensure that the capacity-restrained speeds and delays in the model are consistent with empirical data.

**Traffic Assignments** One output of the MAG EMME/2 travel demand models is a traffic assignment. Traffic assignments are useful in preparing a spatially-accurate representation of VOC and NOx emissions from onroad mobile sources. To support the ozone maintenance plan, 1998, 1999, 2006, and 2015 traffic assignments were prepared using the latest socioeconomic projections available at the time, EMME/2 travel demand models, and highway and transit networks.

Table 1 summarizes traffic characteristics output by MAG traffic assignments for 1998, 1999, 2006, and 2015. The population and employment data shown in this table represent Maricopa County. All other data pertain to the transportation modeling area for the MAG 1541 traffic analysis zone system.

"Freeway Lane Miles" include metered and non-metered freeway ramps. "Percent PM Peak Freeway Lane Miles Congested" is the share of lane miles on freeways and ramps with a volume to practical capacity ratio above 0.90 during the PM peak hour. Table 2 summarizes VMT by facility type for the same years. The "Average Weekday VMT" in Tables 1 and 2 was derived from 24-hour traffic assignments for 1998, 1999, 2006, and 2015.

For the ozone maintenance plan, each traffic assignment was performed for four vehicle classes (light-duty commercial truck, medium-duty commercial truck, heavy-duty commercial truck, and all other vehicles) and four times of day (AM peak, midday, PM peak, and nighttime). Each of these sixteen assignments estimates the number of vehicles and capacity-restrained speeds on each highway link. There are more than 30,000 one-way links in a typical MAG highway network. The sixteen link files output by these assignments were input to the M6Link onroad mobile source emissions program described in Appendix III-i.

## TABLE 1

## TRAFFIC ASSIGNMENT CHARACTERISTICS

| Year | Resident Population[a] (1,000's) | Total Employment[a] (1,000's) | Average Weekday VMT (1,000's) | Freeway Lane Miles[b] | Percent PM Peak Freeway Lane Miles Congested[c] |
|---|---|---|---|---|---|
| 1998 | 2,784 | 1,396 | 68,147 | 1,344 | 20.6% |
| 1999 | 2,869 | 1,439 | 70,974 | 1,458 | 24.5% |
| 2006 | 3,406 | 1,718 | 90,017 | 1,979 | 25.6% |
| 2015 | 4,102 | 2,043 | 120,406 | 2,319 | 37.4% |

[a] Resident population and total employment projections for Maricopa County.
[b] Metered and non-metered ramps are included in the freeway lane miles.
[c] Percent of freeway (including ramps) lane miles on which the traffic volume exceeds 90 percent of lane capacity during the PM peak hour.

## TABLE 2

## VMT BY FACILITY TYPE

(in thousands of VMT per average weekday for the transportation modeling area)

| Year | Freeways[d] | Arterials | Collectors | Locals | Total |
|---|---|---|---|---|---|
| 1998 | 18,323 | 40,104 | 2,445 | 7,275 | 68,147 |
| 1999 | 20,744 | 40,321 | 2,404 | 7,505 | 70,974 |
| 2006 | 30,090 | 47,679 | 2,919 | 9,329 | 90,017 |
| 2015 | 39,843 | 64,639 | 3,854 | 12,070 | 120,406 |

[d] Includes VMT on metered and non-metered freeway ramps.

App.VI-iii

# Growth Factors

App.VI-iii contains growth factors based on the 2015 population projections approved by the MAG Regional Council in June 1997 and developed from the 1995 Special Census. The 2015 employment factors by SIC were based on from projections prepared by the Arizona Department of Economic Security.

For evaluating maintenance of ozone (O3) National Ambient Air Quality Standards (NAAQS), an estimate of emissions in 2006 and the 2015 maintenance years is necessary. MAG has created the growth factors to project emissions from the 1998 and 1999 Periodic Carbon Monoxide Emissions Inventory, MCESD, November 2001 to the ozone modeling years 2006 and 2015. These factors are based on population forecasts approved by the MAG Regional Council in June 1997 and developed from the 1995 Special Census and employment forecasts by Standard Industrial Classification (SIC) provided by the Arizona Department of Economic Security. The growth factors were developed to estimate future emissions based on changes in population, employment, land use, agriculture, and aviation.

BACKGROUND

State and local air pollution control agencies responsible for ozone nonattainment areas are required to prepare base year and future year (including maintenance year) inventories. These inventories are a critical component of State Implementation Plans (SIPs) and are required as a result of the U.S. Environmental Protection Agency's (EPA) programs for the control of ground level ozone. The development of the growth factors used to project the 1998 and 1999 annual NOx and VOC emissions to 2006 and 2015 are described below. A Notable exception are power plants, where maximum permit data is used for 2006 and 2015 emissions. For power plants operated by APS, emissions levels for 2006 and 2015 were obtained directly from APS, as shown in ATTACHMENT ONE.

The 1998 and 1999 Periodic Ozone Emissions Inventory, MCESD, August 2002, and the EPA guidance document Procedures For Preparing Emissions Projections, EPA450/4-91-019, May, 1991 were used to develop growth factors. The following equation, obtained from the Procedures document, illustrates the calculation of growth factors:

$$\textit{Projected Year Growth Factor} = \frac{\textit{Value of Growth Indicator in Projection Year}}{\textit{Value of Growth Indicator in Periodic Year}}$$

Growth factors were applied to the 1998 and 1999 annual NOX and VOC emissions for point (except power plant emissions), area and nonroad mobile sources to determine annual projected emissions. As indicated above, 2006 and 2015 power plant emissions were considered to be at the maximum level defined in the permits.

Growth Factors

Details on how the growth factors were estimated are discussed on the following pages. The categories for these growth factors include: Socioeconomic, Land Use, Agricultural, Aviation, and Little Use. For each category, growth factors are based on one or more growth indicators. Although several growth factors were obtained from annual projections (i.e. employment Standard Industrial Classifications (SICs)), other growth projections were extrapolated from data not available on an annual basis. For example, population estimates were only available in five-year increments.

## Socioeconomic Growth Factors

In June 1997, MAG approved population forecasts based on the 1995 Special Census. Estimated employment in Maricopa County by SIC is available from AzDES for the years 1973 through 2010. These data were extrapolated to 2015 by MAG as described in ATTACHMENT TWO. ATTACHMENT THREE provides an explanation of the SIC codes. The population projections for Maricopa County were also developed by AzDES for the years 2000 through 2020, by five year increments. The population projections used to develop the 2006 and 2015 growth factors are summarized in Table 1. The general methodology for creating a growth factor consisted of dividing the value of the growth indicator in the projection year by the value of the growth indicator in the base year. For example, the growth factor from 1999 to 2015 for a category based on population is 4,677,500 divided by 2,913,475 or 1.61.

### TABLE 1. MARICOPA COUNTY RESIDENT POPULATION

| YEAR | POPULATION |
|---|---|
| 1999 | 2,913,475 |
| 2006 | 3,725,645 |
| 2015 | 4,677,500 |

Table 2 displays the growth factors for point sources other than peaking power plants. It is important to note that emissions from the existing peaking power plants and the new base load units for 2006 and 2015 were estimated by MCESD based on the maximum operation levels defined in the permits or applications. The data listed in the "Reference" column in Table 2 identify the growth indicator used to create the growth factor for each point source.

### TABLE 2. 2006 and 2015 POINT SOURCE GROWTH FACTORS

| Point Source | SIC | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| 91st AVE. WASTEWATER TREATMENT PLANT | 4952 | 1.28 | 1.61 | POP |
| A F LORTS COMPANY INC. | 2599 | 1.16 | 1.37 | 38 |
| A FORZANO AND SON INC. | 2511 | 1.09 | 1.24 | 3334 |
| AG PRODUCTS/AMERICAN GOOSENECK INC. | 3412 | 1.09 | 1.24 | 3334 |
| ALLIED TUBE & PIPE CONDUIT CO. | 3317 | 1.09 | 1.24 | 3334 |
| AMERON PIPE | 3272 | 0.92 | 0.95 | 32 |
| ARCO PRODUCTS CO. | 5171 | 1.28 | 1.61 | POP |
| ARIZONA PACIFIC SPAS | 3088 | 1.12 | 1.28 | MADUR |
| ASPEN FURNITURE LLC | 2511 | 1.16 | 1.37 | 38 |
| ASPEN II | 2517 | 1.16 | 1.37 | 38 |
| B & D LITHO INC. | 2752 | 1.15 | 1.33 | 27 |
| BF GOODRICH AIRCRAFT EVACUATION SYSTEMS | 3357 | 0.99 | 0.93 | 19 |
| BELDEN COMMUNICATIONS DIV. | 3069 | 1.16 | 1.37 | 38 |

| Point Source | SIC | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| BIG SURF | 7996 | 1.35 | 1.86 | SERV78 |
| BILLBOARD POSTER CO. INC. | 7312 | 1.15 | 1.33 | 27 |
| BROWN-EVANS DISTRIBUTING BP#1 | 5171 | 1.28 | 1.61 | POP |
| BRYANT INDUSTRIES INC. | 2431 | 1.12 | 1.28 | MADUR |
| BUSE PRINTING & ADVERTISING | 2752 | 1.15 | 1.33 | 27 |
| CALJET/WILLIAMS | 5171 | 1.28 | 1.61 | POP |
| CALVERT OIL CO. | 5171 | 1.28 | 1.61 | POP |
| CASE PRODUCTS | 2521 | 1.16 | 1.37 | 38 |
| CAVCO INDUSTRIES INC. | 2451 | 1.12 | 1.28 | MADUR |
| CEM-TEC CORPORATION | 3441 | 1.09 | 1.24 | 3334 |
| CENTURY GRAPHICS INC. | 2752 | 1.15 | 1.33 | 27 |
| CESAR COLOR INC. | 2759 | 1.15 | 1.33 | 27 |
| CHAMBERS BELT CO. INC. | 3111 | 1.09 | 1.24 | 3334 |
| CHAPMAN CHEVROLET-ISUZU INC. | 5511 | 1.22 | 1.51 | TRD55 |
| CHEVRON USA INC. | 5171 | 1.28 | 1.61 | POP |
| CHOLLA CUSTOM CABINETS INC. | 2434 | 1.12 | 1.28 | MADUR |
| CHRIS FISCHER PRODUCTIONS INC. | 2431 | 1.12 | 1.28 | MADUR |
| CITY OF PHOENIX 23RD AVE WASTEWATER TREATMENT PLANT | 4952 | 1.28 | 1.61 | POP |
| CITY OF SCOTTSDALE WATER SERVICES DIVISION | 9511 | 1.28 | 1.61 | POP |
| CLAYTON HOMES - EL MIRAGE | 2451 | 1.12 | 1.28 | MADUR |
| CMC WIRELESS COMPONENT | 8711 | 1.12 | 1.28 | MADUR |
| COPPERSTATE CABINET CO. INC. | 2434 | 1.12 | 1.28 | MADUR |
| COPPERSTATE RUBBER OF ARIOZONA | 3052 | 1.04 | 1.08 | 26 |
| COURIER GRAPHICS CORP. | 2752 | 1.15 | 1.33 | 27 |
| CREATIVE SHUTTERS INC. | 2431 | 1.12 | 1.28 | MADUR |
| DESERT SUN FIBERGLASS SYSTEMS | 3089 | 1.16 | 1.37 | 38 |
| DOLPHIN INC. | 3324 | 1.16 | 1.37 | 38 |
| EARNHARDT DODGE AUTO BODY | 7532 | 1.22 | 1.51 | TRD55 |
| EMPIRE MACHINERY CO. | 5082 | 1.16 | 1.37 | 38 |
| FLEETWOOD HOMES OF ARIZONA INC. | 2451 | 1.12 | 1.28 | MADUR |
| FLIPCHIP TECHNOLOGIES | 3674 | 1.19 | 1.40 | 36 |
| FOREST DESIGNS | 2511 | 1.16 | 1.37 | 38 |
| G & G PRINTERS INC. | 2752 | 1.15 | 1.33 | 27 |
| GAYLORD CONTAINER CORP. | 2653 | 1.04 | 1.08 | 26 |
| GCR TRUCK TIRE CENTER | 7534 | 1.35 | 1.84 | SERV75 |
| HADCO PHOENIX INC. | 3672 | 1.19 | 1.40 | 36 |
| HEALTH FACTORS INTERNATIONAL INC. | 2834 | 1.09 | 1.19 | MANDUR |
| HENRY PRODUCTS INC. | 3086 | 1.04 | 1.08 | 26 |
| HERITAGE GRAPHICS INC. | 2752 | 1.15 | 1.33 | 27 |
| HERITAGE SHUTTERS INC. | 2431 | 1.12 | 1.28 | MADUR |
| HEXCEL SATELLITE PRODUCTS | 3663 | 1.19 | 1.40 | 36 |
| HIGHLAND PRODUCTS INC. | 3086 | 1.04 | 1.08 | 26 |
| HOLSUM BAKERY INC. | 2051 | 1.09 | 1.17 | 20 |
| HONEYWELL AEROSPACE SERVICES | 3724 | 0.99 | 0.93 | 19 |
| HONEYWELL AIR TRANSPORT SYSTEMS | 3812 | 0.99 | 0.93 | 19 |
| HONEYWELL ENGINES & SYSTEMS | 3728 | 0.99 | 0.93 | 19 |
| HONEYWELL INTERNATIONAL INC. | 3724 | 0.99 | 0.93 | 19 |
| HONEYWELL SATELLITE SYSTEMS OPERATIONS | 3769 | 1.12 | 1.28 | MADUR |
| IMSAMET OF ARIZONA | 3341 | 1.16 | 1.37 | 38 |
| INNOVEX SOUTHWEST INC. | 3679 | 1.19 | 1.40 | 36 |

| Point Source | SIC | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| INSULFOAM | 3086 | 1.04 | 1.08 | 26 |
| INTEL CORP. CHANDLER CAMPUS | 3674 | 1.19 | 1.40 | 36 |
| INTEL CORP. OCOTILLO CAMPUS | 3674 | 1.19 | 1.40 | 36 |
| INTERPIPE EQUIPMENT INC. | 3479 | 1.09 | 1.24 | 3334 |
| INTESYS TECHNOLOGIES INC. | 3479 | 1.09 | 1.24 | 3334 |
| IRONWOOD LITHOGRAPHERS INC. | 2752 | 1.15 | 1.33 | 27 |
| ISOLA LAMINATE SYSTEMS CORP. | 3679 | 1.19 | 1.40 | 36 |
| KELLEY MOORE PAINT CO. INC. | 2851 | 1.09 | 1.24 | 3334 |
| KIRKWOOD SHUTTERS LTD | 2431 | 1.16 | 1.37 | 38 |
| L & M LAMINATES AND MARBLE | 3088 | 1.12 | 1.28 | MADUR |
| LEGENDS FURNITURE INC. | 2511 | 1.16 | 1.37 | 38 |
| LITHO TECH INC. | 2752 | 1.15 | 1.33 | 27 |
| LOU GRUBB CHEVROLET | 7538 | 1.22 | 1.51 | TRD55 |
| LUKE AFB | 9711 | 1.00 | 1.00 | NO GROWTH |
| ME WEST / CAPITOL CASTINGS INC | 3325 | 1.09 | 1.24 | 3334 |
| MAAX SPAS | 3088 | 1.16 | 1.37 | 38 |
| MAGIC WOODS INC. | 2512 | 1.12 | 1.28 | MADUR |
| MAIL-WELL ENVELOPE | 2677 | 1.15 | 1.33 | 27 |
| MARLAM INDUSTRIES INC. | 3089 | 1.04 | 1.08 | 26 |
| MASTERCRAFT CABINETS INC. | 2434 | 1.12 | 1.28 | MADUR |
| MCCARTHY CABINET CO. | 2434 | 1.12 | 1.28 | MADUR |
| MECHTRONICS OF ARIZONA CORP. | 3499 | 1.16 | 1.37 | 38 |
| MEDTRONIC MICROELECTRONICS CENTER | 3674 | 1.19 | 1.40 | 36 |
| MESA FULLY FORMED INC. | 3281 | 1.09 | 1.24 | 3334 |
| MESA MATERIALS INC. | 1442 | 1.22 | 1.50 | MAMIN |
| METAL-WELD SPECIALTIES INC. | 3446 | 1.09 | 1.24 | 3334 |
| MEYER & LUNDAHL MANUFACTURING CO. | 2521 | 1.16 | 1.37 | 38 |
| MICROCHIP TECHNOLOGY INC. | 3674 | 1.19 | 1.40 | 36 |
| MICROSEMI CORP. | 3674 | 1.19 | 1.40 | 36 |
| MONIER INC. | 3272 | 0.92 | 0.95 | 32 |
| MOSIAC PRINTED CIRCUITS INC. | 3672 | 1.19 | 1.40 | 36 |
| MOTOROLA INC. | 3674 | 1.19 | 1.40 | 36 |
| MTD SOUTHWEST INC. | 3524 | 1.12 | 1.28 | MADUR |
| MUNTERS CORP. | 3585 | 1.16 | 1.37 | 38 |
| NATIONAL COUNTERTOPS & CABINET | 2434 | 1.12 | 1.28 | MADUR |
| NATURALLY VITAMIN | 2834 | 1.09 | 1.19 | MANDUR |
| NELCO TECHNOLOGY INC. | 3672 | 1.19 | 1.40 | 36 |
| NESCO MANUFACTURING INC. | 3086 | 1.04 | 1.08 | 26 |
| NEW DIRECTIONS INC. | 2511 | 1.16 | 1.37 | 38 |
| NORTH PHOENIX BAPTIST CHURCH | 8661 | 1.34 | 1.83 | 84 |
| OAKCRAFT INC. | 2434 | 1.16 | 1.37 | 38 |
| OASIS BEDROOM CO. | 2511 | 1.16 | 1.37 | 38 |
| ON SEMICONDUCTOR | 3674 | 1.19 | 1.40 | 36 |
| O'NEIL PRINTING INC. | 2752 | 1.15 | 1.33 | 27 |
| PALM HARBOR HOMES INC. | 2451 | 1.16 | 1.37 | 38 |
| PAN-GLO WEST | 7699 | 1.38 | 1.91 | SERV |
| PARKER HANNIFIN CORP. | 3724 | 0.99 | 0.93 | 19 |
| PATRICIAN MARBLE CO. LLP | 3089 | 1.04 | 1.08 | 26 |
| PATRICK DOOR INC. | 2431 | 1.16 | 1.37 | 38 |
| PENN RACQUET SPORTS | 3949 | 1.35 | 1.86 | 78 |
| PHOENIX BRICK YARD | 3251 | 1.16 | 1.37 | 38 |

| Point Source | SIC | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| PHOENIX HEAT TREATING INC. | 3398 | 1.09 | 1.24 | 3334 |
| PHOENIX NEWSPAPERS INC. | 2711 | 1.15 | 1.33 | 27 |
| PHOENIX TRANSIT SYSTEM | 4111 | 1.16 | 1.37 | 38 |
| PILLSBURY BAKERIES & FOOD SERVICE | 2051 | 1.09 | 1.17 | 20 |
| PING INC. | 3449 | 1.35 | 1.86 | 78 |
| PRECISION TRUCK PAINTING & REPAIR | 3479 | 1.09 | 1.24 | 3334 |
| PRESTO CASTING CO. | 3369 | 1.09 | 1.24 | 3334 |
| QUEBECOR WORLD - PHOENIX DIV. | 2752 | 1.15 | 1.33 | 27 |
| RANDALLS VIP TRAILERS INC. | 3479 | 1.09 | 1.24 | 3334 |
| REDMAN HOMES INC. | 2451 | 1.16 | 1.37 | 38 |
| REDSTONE INDUSTRIES INC. | 3089 | 1.04 | 1.08 | 26 |
| REXAM BEVERAGE CAN COMPANY | 3411 | 1.09 | 1.24 | 3334 |
| ROCKFORD CORPORATION | 3672 | 1.19 | 1.40 | 36 |
| SAMUEL LAWRENCE FURNITURE CO. | 2511 | 1.16 | 1.37 | 38 |
| SCHUFF STEEL CO. | 3441 | 1.09 | 1.24 | 3334 |
| SCHULT HOMES | 2451 | 1.16 | 1.37 | 38 |
| SCOTTSDALE SHUTTERS INC. | 2431 | 1.16 | 1.37 | 38 |
| SFPP LP | 4226 | 1.35 | 1.84 | 75 |
| SKUNK CREEK LANDFILL | 4953 | 1.25 | 1.59 | 48 |
| ST MICROELECTRONICS | 3674 | 1.19 | 1.40 | 36 |
| STONE CREEK INC. | 2511 | 1.16 | 1.37 | 38 |
| STOROPACK INC. | 3086 | 1.04 | 1.08 | 26 |
| SUB ZERO FREEZER CO. INC. | 3632 | 1.19 | 1.40 | 36 |
| SUNBURST SHUTTERS INC. | 2431 | 1.16 | 1.37 | 38 |
| SUNLAND BEEF CO. | 2011 | 1.09 | 1.17 | 20 |
| SUPREME OIL CO. | 5171 | 1.04 | 1.08 | 26 |
| TEAM FORMS | 2752 | 1.15 | 1.33 | 27 |
| TEAM TWO DESIGN ASSOC INC. | 2511 | 1.16 | 1.37 | 38 |
| TED LEVINE DRUM CO. | 7997 | 1.09 | 1.24 | 3334 |
| TEXACO PHOENIX SALES TERMINAL | 5171 | 1.04 | 1.08 | 26 |
| THE BOEING COMPANY | 3721 | 0.99 | 0.93 | 19 |
| THE HEIL CO. | 3799 | 1.16 | 1.37 | 38 |
| THE PHOENICIAN | 7011 | 1.09 | 1.12 | 70 |
| THORNWOOD FURNITURE MFG. | 2511 | 1.16 | 1.37 | 38 |
| THUNDERBIRD FURNITURE | 2511 | 1.16 | 1.37 | 38 |
| TOSCO PHOENIX TERMINAL | 5171 | 1.04 | 1.08 | 26 |
| TRADE PRINTERS INC. | 2761 | 1.15 | 1.33 | 27 |
| TREFFERS PRECISION INC. | 3471 | 1.09 | 1.24 | 3334 |
| TRENDWOOD INC. | 2511 | 1.16 | 1.37 | 38 |
| U-HAUL INTL. TECHNICAL CENTER | 7538 | 1.22 | 1.51 | TRD55 |
| ULTRA INSTALLATIONS INC. | 3087 | 1.04 | 1.08 | 26 |
| UNITED DAIRYMEN OF ARIZONA | 2023 | 1.09 | 1.17 | 20 |
| UNITED METRO MATERIALS INC. | 1442 | 1.22 | 1.50 | MIN+MAN+TRD |
| UNITED MODULAR | 2452 | 1.16 | 1.37 | 38 |
| VALLEY INDUSTRIAL PAINTING | 3479 | 1.09 | 1.24 | 3334 |
| VAW OF AMERICA INC. | 3354 | 1.09 | 1.24 | 3334 |
| VULCAN MATERIALS CO. | 2951 | 0.92 | 0.95 | 32 |
| W R MEADOWS OF AZ | 2899 | 1.09 | 1.24 | 3334 |
| WEAVER QUALITY SHUTTERS INC. | 2431 | 1.16 | 1.37 | 38 |
| WESTERN PACKAGING | 2671 | 1.04 | 1.08 | 26 |
| WESTERN SHUTTER LLC. | 2431 | 1.16 | 1.37 | 38 |

| Point Source | SIC | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| WESTERN STATES PETROLEUM #107 | 5171 | 1.04 | 1.08 | 26 |
| WINCUP HOLDINGS INC. | 3086 | 1.16 | 1.37 | 38 |
| WOODS LITHOGRAPHICS INC. | 2752 | 1.15 | 1.33 | 27 |
| WOODSTUFF MANUFACTURING INC. | 2511 | 1.16 | 1.37 | 38 |
| WYNN'S PRECISION INC. | 3069 | 1.16 | 1.37 | 38 |

Table 3 displays the growth factors for area sources, aircraft, and locomotives. The data listed in the "Reference" column identify the growth indicator used to create the growth factor for each source.

## TABLE 3. 2006 and 2015 AREA SOURCE, AIRCRAFT, AND LOCOMOTIVE OZONE GROWTH FACTORS

| Area Source Category | SCC Code | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| Industrial Fuel External Combustion - Distillate Oil | 2102004000 | 1.22 | 1.50 | MIN+MAN+TRD |
| Industrial Fuel External Combustion - Natural Gas | 2102006001 | 1.22 | 1.50 | MIN+MAN+TRD |
| Industrial Fuel External Combustion - Natural Gas | 2102006002 | 1.22 | 1.50 | MIN+MAN+TRD |
| Commercial/Institutional Fuel External Combustion | 2103006001 | 1.22 | 1.50 | MIN+MAN+TRD |
| Commercial/Institutional Fuel Internal Combustion, Recip & Turbine Engines | 2103006002 | 1.22 | 1.50 | MIN+MAN+TRD |
| Residential Fuel External Combustion | 2104006000 | 1.28 | 1.61 | POP |
| Woodstoves and Fireplaces | 2104008000 | 1.28 | 1.61 | POP |
| Industrial Pharmaceutical Manufacturing | 2301030000 | 1.09 | 1.19 | MANDUR |
| Industrial - Food and Kindred Products | 2302000000 | 1.09 | 1.17 | MAN20 |
| Industrial - Food and Kindred Bakery Products | 2302050000 | 1.09 | 1.17 | MAN20 |
| Industrial - Mineral Processes | 2305000000 | 0.89 | 0.93 | MIN |
| Industrial - Rubber/Plastics | 2308000000 | 1.12 | 1.25 | MAN |
| Industrial - Machinery | 2312000000 | 1.12 | 1.28 | MADUR |
| Industrial - NEC | 2399000000 | 1.12 | 1.25 | MAN |
| Surface Coating - Architectural Coatings | 2401001000 | 1.28 | 1.61 | POP |
| Surface Coating - Auto Refinishing | 2401005000 | 1.35 | 1.84 | SERV75 |
| Surface Coating - Traffic Markings | 2401008000 | 1.34 | 1.81 | TC4041 |
| Surface Coating - Factory Finished Wood | 2401015000 | 1.16 | 1.37 | MAN38 |
| Surface Coating - Wood Furniture | 2401020000 | 1.16 | 1.37 | MAN38 |
| Surface Coating - Metal Furniture | 2401025000 | 1.16 | 1.37 | MAN38 |
| Surface Coating - Paper | 2401030000 | 1.04 | 1.08 | MAN26 |
| Surface Coating - Plastic Products | 2401035000 | 1.04 | 1.08 | MAN26 |
| Surface Coating - Metal Coils | 2401045000 | 1.12 | 1.28 | MADUR |
| Surface Coating - Misc. Finished Metals | 2401050000 | 1.12 | 1.28 | MADUR |
| Surface Coating - Machinery | 2401055000 | 1.12 | 1.28 | MADUR |
| Surface Coating - Large Appliances | 2401060000 | 1.12 | 1.28 | MADUR |
| Surface Coating - Marine | 2401080000 | 1.12 | 1.28 | MADUR |
| Surface Coating - Railroad | 2401085000 | 1.12 | 1.28 | MADUR |
| Surface Coating - Misc. Manufacturing | 2401090000 | 1.12 | 1.25 | MAN |
| Surface Coating - Industrial Mainten | 2401100000 | 1.12 | 1.25 | MAN |
| Surface Coating - Other Special Purpose | 2401200000 | 1.12 | 1.25 | MAN |
| Area Source Category | SCC Code | 2006 GF | 2015 GF | Growth Reference |
| Degreasing - Misc. Manufacturing | 2415045000 | 1.12 | 1.25 | MAN |
| Degreasing - Auto Repair Services | 2415065000 | 1.35 | 1.84 | SERV75 |
| Degreasing - Open Top | 2415100000 | 1.12 | 1.25 | MAN |
| Degreasing - Conveyerized Degreasing | 2415200000 | 1.12 | 1.25 | MAN |

| Area Source Category | SCC Code | 2006 GF | 2015 GF | Growth Reference |
|---|---|---|---|---|
| Degreasing - Cold Cleaning | 2415300000 | 1.12 | 1.25 | MAN |
| Dry Cleaning | 2420000000 | 1.28 | 1.61 | POP |
| Graphic Arts | 2425000000 | 1.15 | 1.33 | MAN27 |
| Cutback Asphalt | 2461021000 | 1.28 | 1.61 | POP |
| Emulsified Asphalt | 2461022000 | 1.28 | 1.61 | POP |
| Asphalt Roofing | 2461023000 | 1.28 | 1.61 | POP |
| Pesticide Application | 2461800000 | 1.28 | 1.61 | POP |
| Solvent - NEC | 2461900000 | 1.12 | 1.25 | MAN |
| Solvent - Misc. | 2465000000 | 1.12 | 1.25 | MAN |
| Solvent - Personal Care Products | 2465100000 | 1.12 | 1.25 | MAN |
| Solvent - Household Products | 2465200000 | 1.12 | 1.25 | MAN |
| Solvent - Automotive Aftermarket Products | 2465400000 | 1.12 | 1.25 | MAN |
| Solvent - Adhesives and Sealants | 2465600000 | 1.12 | 1.25 | MAN |
| Solvent - Misc. Consumer | 2465900000 | 1.12 | 1.25 | MAN |
| Bulk Stations/Terminals | 2501050120 | 1.28 | 1.61 | POP |
| Gasoline Service Stations - Stage 1: Submerged Filling | 2501060051 | 1.28 | 1.61 | POP |
| Gasoline Service Stations - Stage 1: Balanced Submerged Filling | 2501060053 | 1.28 | 1.61 | POP |
| Gasoline Service Stations - Stage 2 | 2501060100 | 1.28 | 1.61 | POP |
| Gasoline Service Stations - Underground Tank | 2501060200 | 1.28 | 1.61 | POP |
| Petroleum Product Storage - Working Loss | 2501995180 | 1.28 | 1.61 | POP |
| Petroleum Product Transport - Tank Cleaning | 2505000900 | 1.28 | 1.61 | POP |
| Petroleum Product Transport | 2505030120 | 1.28 | 1.61 | POP |
| Organic Chemical Storage - Breathing Loss | 2510000000 | 1.28 | 1.61 | POP |
| On-site Incineration | 2601000000 | 1.28 | 1.61 | POP |
| Open Burning | 2610000000 | 1.00 | 1.00 | no grow |
| Landfills | 2620030000 | 1.28 | 1.61 | POP |
| Public Waste Treatment Works | 2630020000 | 1.28 | 1.61 | POP |
| Waste Disposal, Treatment, and Recovery - Treatment, Storage and Disposal Facilities | 2640020000 | 1.28 | 1.61 | POP |
| Waste Disposal, Treatment, and Recovery - Leaking Underground Storage Tanks | 2660000000 | 1.28 | 1.61 | POP |
| Other Combustion | 2810001000 | 1.28 | 1.61 | POP |
| Structure Fires | 2810030000 | 1.28 | 1.61 | POP |
| Motor Vehicle Fires | 2810050000 | 1.28 | 1.61 | POP |
| Hospitals | 2850000000 | 1.28 | 1.61 | POP |
| Railroad Equipment | 2285000000 | 1.28 | 1.61 | POP |
| Aircraft - Air Carrier | 2275020000 | 1.24 | 1.46 | carrier ops |
| Aircraft - General | 2275050000 | 1.00 | 0.81 | gen & taxi ops |
| Aircraft - Air Taxi | 2275060000 | 1.00 | 0.81 | gen & taxi ops |
| Aircraft - Military | 2275010000 | 1.00 | 1.00 | military ops |

**Aviation Growth Factors -**

Air Carrier operations are available as actual 1999 and 2015 forecasted operations in the Draft Regional Aviation System Plan (RASP) Update: Working Paper No. 2, Maricopa Association of Governments, September 2001. As with the other growth factors, the 2015/1999 growth factor was developed by dividing the 2015 operations by the 1999 operations. The 2015/1999 air carrier operations growth factor was used to project air carrier based aviation and nonroad mobile source emissions from 1999 to 2015 and the same was done for general aviation operations. General/taxi operations are available as

actual 1999 and 2015 forecasted operations in the Draft Regional Aviation System Plan (RASP) Update: Working Paper No. 2, Maricopa Association of Governments, September 2001. As with the other growth factors, the 2015 growth factor was developed by dividing the 2015 operations by the 1999 operations. The 2015 general/taxi operations growth factors are used to project general/taxi operations based aviation source emissions from 1999 to 2015. Military operations data availability was limited. The 2006 aviation forecasted operations were derived by a trend analysis from the RASP Working Paper #2, 2005 and 2015 forecasted operations. A conservative estimate, which considers recent military cutbacks, of no growth is assumed. Table 5 provides the information used to develop the 2015 growth factors, including the 1999 operations, 2015 forecasted operations, and 2015 growth factors.

Table 5. Maricopa County Aviation Statistics/Growth Factors

| Growth Factor Type | Actual 1999 Operations | Interpolated 2006 Operations | Forecasted 2015 Operations | 2006 Growth Factor | 2015 Growth Factor |
|---|---|---|---|---|---|
| Air Carrier | 476,327 | 592,671 | 695,800 | 1.24 | 1.46 |
| General Aviation | 69,027 | 68,785 | 55,720 | 1.00 | 0.81 |
| Military | N/A | N/A | N/A | N/A | 1.00 |

The growth factors for nonroad equipment are contained in ATTACHMENT FOUR. The data listed in the "Reference" column identify the growth indicator used to create the growth factor for each nonroad equipment type. The nonroad equipment types are split into three subcategories: two-stroke gasoline engines, four-stroke gasoline engines, and diesel engines. It is important to note that the growth factors listed in this memo do not reflect the effect of implementation of the Federal Phase 2 nonroad engine standards.

**Agricultural Growth Factors**

Nonroad mobile equipment related to agricultural activities was projected using the change in total harvested acreage as a growth indicator. The 1999, 2006 and 2015 acreage totals for Maricopa County are listed in Table 5. The 2006 and 2015 total acreage were estimated by assuming the historical average annual change in acreage (from 1979 to 1999) was equal to the annual change from 1999 to 2015, a change of 8,615 acres per year. The 1995 Farm Bill discontinued the incentive for the agricultural set aside program. Under this program, farmers were paid to set aside a portion of their land and not farm on the set aside land. Emissions from agricultural land and activities for the 2006 and 2015 inventories were adjusted to reflect the impact of the discontinuation of the set aside program. The acreage harvested for 1999 was obtained from 1999 Arizona Agricultural Statistics, Arizona Agricultural Statistics Service, July 2000 and the historical annual change in acreage was obtained from Agricultural Statistics: Historical Summary of County Data 1978 to 1989, Arizona Agricultural Statistics Service, 1990, and the annual Arizona Agricultural Statistics for 1990 through 1999, Arizona Agricultural Statistics Service.

Growth factors were derived by dividing the 2006 and 2015 total harvested acreage by the 1999 harvested acreage.

**TABLE 5. CALCULATION OF ANNUAL GROWTH FOR FARM EQUIPMENT**

| Year | Acreage Harvested | Growth Factor |
|---|---|---|
| 1999 | 236,000 | N/A |
| 2006 | 175,695 | 0.74 |
| 2015 | 98,160 | 0.42 |

### Little Use Growth Factors

Consistent with the assumptions MCESD incorporated into the 1999 Periodic Ozone Emissions Inventory for Maricopa County, Arizona Nonattainment Area (MCESD, 2002), emissions for several nonroad equipment types were expected to change little over time due to the existing pattern of usage for these equipment categories. These sources included shredders <5HP, tillers <5HP, wood splitters, and chippers/stump grinders. Shredders and tillers are typically used at ranch-style residences on large lots with overgrown trees. Since ranch-style residences are rarely being built, the use of shredders and tillers was not expected to increase. Chippers/stump grinders are typically used to clear land for development. Due to the desert nature of the nonattainment area, these tools are rarely used for land clearing. As a result, a growth factor of 1.00 was applied to the aforementioned equipment categories.

# ATTACHMENT ONE

# APS FUTURE YEAR POWER PLANT EMISSIONS

## 2006 Projected NOx Emissions in lbs/hr

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 16-Jul | 0 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 1 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 2 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 3 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 4 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 5 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 6 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 7 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 8 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 12.1 | 12.1 |
| | 9 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 12.1 | 12.1 |
| | 10 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 11 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 12 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 169 | 169 |
| | 13 | 95.92 | 95.92 | 14.1 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 169 | 169 |
| | 14 | 95.92 | 95.92 | 14.1 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 15 | 95.92 | 95.92 | 273.7 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 16 | 95.92 | 95.92 | 273.7 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 17 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 18 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 19 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 20 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 21 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 22 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 23 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| Daily | English | 1.151 | 1.151 | 0.429 | 0.000 | 0.000 | 0.245 | 0.581 | 0.581 | 0.545 | 0.545 | 0.000 | 0.000 | 0.510 | 0.510 | 0.459 | 0.459 |
| 17-Jul | 0 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 1 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 2 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 3 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 4 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 17-Jul | 5 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 6 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 7 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 8 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 9 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 10 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 11 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 12 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 13 | 95.92 | 95.92 | 273.7 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 14 | 95.92 | 95.92 | 273.7 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 15 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 16 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 17 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 18 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 19 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 20 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 21 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 22 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| | 23 | 95.92 | 95.92 | 14.1 | 0 | 0 | 14.25 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 17.2 | 17.2 | 12.1 | 12.1 |
| 23-Aug | 0 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 1 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 2 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 3 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 4 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 5 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 6 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 7 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 169 | 169 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 8 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 169 | 169 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 9 | 149.2 | 149.2 | 273.7 | 0 | 0 | 21.4 | 169 | 169 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 10 | 149.2 | 149.2 | 273.7 | 0 | 0 | 21.4 | 169 | 169 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 11 | 149.2 | 149.2 | 25.8 | 0 | 0 | 87.8 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 23-Aug | 12 | 149.2 | 149.2 | 25.8 | 0 | 0 | 87.8 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 13 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 14 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 15 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 16 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 17 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 18 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 19 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 20 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 21 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 22 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 23 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| Daily | English | 1.790 | 1.790 | 0.558 | 0.000 | 0.000 | 0.323 | 0.581 | 0.581 | 0.613 | 0.545 | 0.000 | 0.000 | 0.292 | 0.292 | 0.292 | 0.292 |
| 24-Aug | 0 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 1 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 2 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 3 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 4 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 5 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 6 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 7 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 8 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 9 | 149.2 | 149.2 | 273.7 | 0 | 0 | 87.8 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 10 | 149.2 | 149.2 | 273.7 | 0 | 0 | 87.8 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 11 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 12 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 13 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 14 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 15 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 16 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 17 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 24-Aug | 18 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 19 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 20 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 21 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 22 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| | 23 | 149.2 | 149.2 | 25.8 | 0 | 0 | 21.4 | 24.3 | 24.3 | 51.1 | 45.4 | 0 | 0 | 24.3 | 24.3 | 24.3 | 24.3 |
| Daily | English | 1.790 | 1.790 | 0.558 | 0.000 | 0.000 | 0.323 | 0.292 | 0.292 | 0.613 | 0.545 | 0.000 | 0.000 | 0.581 | 0.581 | 0.581 | 0.581 |

* Redhawk is also known as Pinnacle West.

## 2006 Projected VOC Emissions in lbs/hr

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 16-Jul | 0 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 1 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 2 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 3 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 4 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 5 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 6 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 7 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 8 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 3.85 | 3.85 |
| | 9 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 3.85 | 3.85 |
| | 10 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 11 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 12 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 29 | 29 |
| | 13 | 0.7 | 0.7 | 1.7 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 29 | 29 |
| | 14 | 0.7 | 0.7 | 1.7 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 15 | 0.7 | 0.7 | 12.4 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 16 | 0.7 | 0.7 | 12.4 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 17 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 18 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 19 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 20 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 21 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 22 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 23 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| Daily | English | 0.0084 | 0.0084 | 0.0311 | 0 | 0 | 0.0196 | 0.1118 | 0.1118 | 0.0036 | 0.0036 | 0 | 0 | 0.1125 | 0.1125 | 0.0965 | 0.0965 |
| 17-Ju | 0 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 1 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 2 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 3 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 17-Jul | 4 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 5 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 6 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 7 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 8 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 9 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 10 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 11 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 12 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 13 | 0.7 | 0.7 | 12.4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 14 | 0.7 | 0.7 | 12.4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 15 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 16 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 17 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 18 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 19 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 20 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 21 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 22 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| | 23 | 0.7 | 0.7 | 1.7 | 0 | 0 | 0.6 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.45 | 5.45 | 3.85 | 3.85 |
| Daily | English | 0.0084 | 0.0084 | 0.0311 | 0 | 0 | 0.0196 | 0.0646 | 0.0646 | 0.0036 | 0.0036 | 0 | 0 | 0.0654 | 0.0654 | 0.0462 | 0.0462 |
| 23-Aug | 0 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 1 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 2 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 3 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 4 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 5 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 6 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 7 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 29 | 29 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 8 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 29 | 29 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 9 | 1.05 | 1.05 | 3.1 | 0 | 0 | 13 | 29 | 29 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 23-Aug | 10 | 1.05 | 1.05 | 3.1 | 0 | 0 | 13 | 29 | 29 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 11 | 1.05 | 1.05 | 12.4 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 12 | 1.05 | 1.05 | 12.4 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 13 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 14 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 15 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 16 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 17 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 18 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 19 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 20 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 21 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 22 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 23 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| Daily | English | 0.0126 | 0.0126 | 0.0465 | 0 | 0 | 0.0236 | 0.104 | 0.104 | 0.00408 | 0.0036 | 0 | 0 | 0.135 | 0.135 | 0.135 | 0.135 |
| 24-Aug | 0 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 7.7 | 7.7 |
| | 1 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 7.7 | 7.7 |
| | 2 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 7.7 | 7.7 |
| | 3 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 29 | 29 | 7.7 | 7.7 |
| | 4 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 5 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 6 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 7 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 8 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 9 | 1.05 | 1.05 | 3.1 | 0 | 0 | 13 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 10 | 1.05 | 1.05 | 3.1 | 0 | 0 | 13 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 11 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 12 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 13 | 1.05 | 1.05 | 12.4 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 14 | 1.05 | 1.05 | 12.4 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 15 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 24-Aug | 16 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 17 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 18 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 19 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 20 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 21 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 22 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| | 23 | 1.05 | 1.05 | 3.1 | 0 | 0 | 0.96 | 4.6 | 4.6 | 0.34 | 0.3 | 0 | 0 | 7.7 | 7.7 | 7.7 | 7.7 |
| Daily | English | 0.0126 | 0.0126 | 0.0465 | 0 | 0 | 0.0236 | 0.0552 | 0.0552 | 0.00408 | 0.0036 | 0 | 0 | 0.135 | 0.135 | 0.0924 | 0.0924 |

* Redhawk is also known as Pinnacle West.

## 2015 Projected NOx Emissions in lbs/hr

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 16-Jul | 0 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 1 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 2 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 3 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 169 | 169 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 4 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 5 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 6 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 7 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 8 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 9 | 42.6 | 170.5 | 32.8 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 10 | 42.6 | 170.5 | 32.8 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 11 | 42.6 | 170.5 | 273.7 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 169 | 169 | 169 | 169 |
| | 12 | 42.6 | 170.5 | 273.7 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 13 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 14 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 15 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 16 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 17 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 18 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 19 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 20 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 21 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 22 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 23 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| Daily | English | 0.511 | 2.046 | 0.635 | 0.000 | 0.000 | 0.339 | 0.581 | 0.581 | 0.545 | 0.545 | 0.000 | 0.000 | 0.500 | 0.500 | 0.500 | 0.500 |
| 17-Jul | 0 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 1 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 2 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 3 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 17-Jul | 4 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 5 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 6 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 7 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 8 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 9 | 42.6 | 170.5 | 32.8 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 10 | 42.6 | 170.5 | 32.8 | 0 | 0 | 87.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 11 | 42.6 | 170.5 | 273.7 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 12 | 42.6 | 170.5 | 273.7 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 13 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 14 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 15 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 16 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 17 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 18 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 19 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 20 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 21 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 22 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| | 23 | 42.6 | 170.5 | 32.8 | 0 | 0 | 22.8 | 24.3 | 24.3 | 45.4 | 45.4 | 0 | 0 | 16.2 | 16.2 | 16.2 | 16.2 |
| Daily | English | 0.511 | 2.046 | 0.635 | 0.000 | 0.000 | 0.339 | 0.292 | 0.292 | 0.545 | 0.545 | 0.000 | 0.000 | 0.194 | 0.194 | 0.194 | 0.194 |
| 23-Aug | 0 | 255.8 | 138.5 | 28.1 | 0 | 0 | 87.8 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 1 | 255.8 | 138.5 | 28.1 | 0 | 0 | 87.8 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 2 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 3 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 4 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 5 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 6 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 169 | 169 |
| | 7 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 169 | 169 |
| | 8 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 169 | 169 |
| | 9 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 169 | 169 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 23-Aug | 10 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 11 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 12 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 13 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 14 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 15 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 16 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 17 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 18 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 19 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 20 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 21 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 22 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 23 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| Daily | English | 3.070 | 1.662 | 0.337 | 0.000 | 0.000 | 0.401 | 0.292 | 0.292 | 0.817 | 0.749 | 0.000 | 0.000 | 0.292 | 0.292 | 0.540 | 0.540 |
| 24-Aug | 0 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 1 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 2 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 3 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 4 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 5 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 6 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 7 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 8 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 9 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 10 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 11 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 12 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 13 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 14 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 15 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 24-Aug | 16 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 17 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 18 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 19 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 20 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 21 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 22 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| | 23 | 255.8 | 138.5 | 28.1 | 0 | 0 | 28.5 | 24.3 | 24.3 | 68.1 | 62.4 | 0 | 0 | 24.3 | 24.3 | 20.2 | 20.2 |
| Daily | English | 3.070 | 1.662 | 0.337 | 0.000 | 0.000 | 0.342 | 0.292 | 0.292 | 0.817 | 0.749 | 0.000 | 0.000 | 0.292 | 0.292 | 0.242 | 0.242 |

* Redhawk is also known as Pinnacle West.

## 2015 Projected VOC Emissions in lbs/hr

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 16-Jul | 0 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 1 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 2 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 3 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 29 | 29 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 4 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 5 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 6 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 7 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 8 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 9 | 0.3 | 1.2 | 4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 10 | 0.3 | 1.2 | 4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 11 | 0.3 | 1.2 | 6.85 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 12 | 0.3 | 1.2 | 6.85 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 29 | 29 | 29 | 29 |
| | 13 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 14 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 15 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 16 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 17 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 18 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 19 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 20 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 21 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 22 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 23 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| Daily | English | 0.004 | 0.014 | 0.051 | 0.000 | 0.000 | 0.024 | 0.112 | 0.112 | 0.004 | 0.004 | 0.000 | 0.000 | 0.109 | 0.109 | 0.109 | 0.109 |
| 17-Jul | 0 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 1 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 2 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 3 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 4 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 17-Jul | 5 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 6 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 7 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 8 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 9 | 0.3 | 1.2 | 4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 10 | 0.3 | 1.2 | 4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 11 | 0.3 | 1.2 | 6.85 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 12 | 0.3 | 1.2 | 6.85 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 13 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 14 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 15 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 16 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 17 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 18 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 19 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 20 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 21 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 22 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| | 23 | 0.3 | 1.2 | 4 | 0 | 0 | 1.02 | 5.38 | 5.38 | 0.3 | 0.3 | 0 | 0 | 5.13 | 5.13 | 5.13 | 5.13 |
| Daily | English | 0.004 | 0.014 | 0.051 | 0.000 | 0.000 | 0.024 | 0.065 | 0.065 | 0.004 | 0.004 | 0.000 | 0.000 | 0.062 | 0.062 | 0.062 | 0.062 |
| 23-Aug | 0 | 1.8 | 0.98 | 3.4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 1 | 1.8 | 0.98 | 3.4 | 0 | 0 | 13 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 2 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 3 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 4 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 5 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 6 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 29 | 29 |
| | 7 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 29 | 29 |
| | 8 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 29 | 29 |
| | 9 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 29 | 29 |
| | 10 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 23-Aug | 11 | 1.8 | 0.98 | 6.85 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 12 | 1.8 | 0.98 | 6.85 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 13 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 14 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 15 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 16 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 17 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 18 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 19 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 20 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 21 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 22 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 23 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| Daily | English | 0.022 | 0.012 | 0.044 | 0.000 | 0.000 | 0.027 | 0.065 | 0.065 | 0.005 | 0.005 | 0.000 | 0.000 | 0.092 | 0.092 | 0.122 | 0.122 |
| 24-Aug | 0 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 1 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 2 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 3 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 4 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 5 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 6 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 7 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 8 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 9 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 10 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 11 | 1.8 | 0.98 | 6.85 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 12 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 13 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 14 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 15 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 16 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |

| | | West Phoenix | | | | | | | | Ocotillo | | | | Redhawk* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | CC1 | CC2 | CC3 | CT1 | CT2 | CC4 | CC5A | CC5B | SB1 | SB2 | CT1 | CT2 | CC1A | CC1B | CC2A | CC2B |
| 24-Aug | 17 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 18 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 19 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 20 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 21 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 22 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| | 23 | 1.8 | 0.98 | 3.4 | 0 | 0 | 1.28 | 5.38 | 5.38 | 0.45 | 0.41 | 0 | 0 | 7.7 | 7.7 | 6.4 | 6.4 |
| Daily | English | 0.022 | 0.012 | 0.043 | 0.000 | 0.000 | 0.015 | 0.065 | 0.065 | 0.005 | 0.005 | 0.000 | 0.000 | 0.092 | 0.092 | 0.077 | 0.077 |

* Redhawk is also known as Pinnacle West.

## ATTACHMENT TWO

## 2006 & 2015 Growth Factor Projections

| Year | W&S | MIN | CON | CON15 | CON16 | CON17 | MAMAN | MADUR | MAN19 | MAN32 | MA3334 | MAN35 | MAN36 | MAN38 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 1434111 | 6504 | 50442 | 14012 | 8553 | 69001 | 161695 | 122868 | 17506 | 4902 | 14337 | 9795 | 47258 | 29070 |
| 1999 | 1489455 | 6370 | 50963 | 12881 | 7923 | 71032 | 165612 | 126109 | 17678 | 4784 | 14466 | 9981 | 49432 | 29768 |
| 2000 | 1544526 | 6240 | 51594 | 11864 | 7671 | 73305 | 169078 | 128943 | 17817 | 4717 | 14625 | 10151 | 51162 | 30471 |
| 2001 | 1599444 | 6119 | 52226 | 10993 | 7588 | 75724 | 172261 | 131537 | 17888 | 4642 | 14815 | 10303 | 52748 | 31141 |
| 2002 | 1654993 | 6019 | 52857 | 10266 | 7584 | 78450 | 175154 | 133897 | 17808 | 4577 | 14993 | 10437 | 54225 | 31857 |
| 2003 | 1710670 | 5927 | 53488 | 9659 | 7612 | 81117 | 177872 | 136074 | 17721 | 4522 | 15188 | 10562 | 55526 | 32555 |
| 2004 | 1766441 | 5846 | 54120 | 9211 | 7648 | 83794 | 180343 | 138061 | 17613 | 4467 | 15401 | 10668 | 56692 | 33219 |
| 2005 | 1822811 | 5754 | 54751 | 8909 | 7676 | 86643 | 182636 | 139916 | 17514 | 4418 | 15601 | 10796 | 57712 | 33875 |
| 2006 | 1880399 | 5669 | 55382 | 8732 | 7718 | 89416 | 184906 | 141839 | 17422 | 4383 | 15804 | 10893 | 58852 | 34485 |
| 2007 | 1938068 | 5644 | 56014 | 8638 | 7772 | 92545 | 186612 | 143256 | 17318 | 4357 | 15994 | 10958 | 59558 | 35071 |
| 2008 | 1996570 | 5633 | 56645 | 8602 | 7849 | 95599 | 188269 | 144631 | 17214 | 4335 | 16186 | 10991 | 60273 | 35632 |
| 2009 | 2056061 | 5630 | 57276 | 8627 | 7946 | 98659 | 189804 | 145901 | 17128 | 4326 | 16396 | 10980 | 60876 | 36195 |
| 2010 | 2117176 | 5624 | 57907 | 8694 | 8063 | 101717 | 191219 | 147058 | 17025 | 4330 | 16593 | 10947 | 61424 | 36738 |
| 2011 | 2178728 | 5690 | 58539 | 8659 | 8108 | 105371 | 194538 | 149838 | 16922 | 4373 | 16857 | 10990 | 63002 | 37519 |
| 2012 | 2240279 | 5756 | 59170 | 8623 | 8152 | 109025 | 197857 | 152618 | 16818 | 4416 | 17122 | 11033 | 64581 | 38300 |
| 2013 | 2301831 | 5822 | 59801 | 8588 | 8197 | 112679 | 201175 | 155398 | 16715 | 4459 | 17386 | 11076 | 66159 | 39081 |
| 2014 | 2363382 | 5888 | 60433 | 8552 | 8242 | 116333 | 204494 | 158178 | 16612 | 4502 | 17650 | 11119 | 67737 | 39862 |
| 2015 | 2424934 | 5955 | 61064 | 8517 | 8286 | 119987 | 207813 | 160957 | 16508 | 4545 | 17914 | 11163 | 69315 | 40643 |

| Year | MANDUR | MAN20 | MAN26 | MAN27 | TCPU | TC4041 | TC48 | TRD | WTRD | RTRD | TRD53 | TRD54 | TRD55 | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 38827 | 9644 | 15942 | 13241 | 75789 | 47424 | 28365 | 357322 | 91418 | 265904 | 38688 | 37988 | 32211 | 1998 |
| 1999 | 39503 | 9827 | 16117 | 13559 | 79039 | 49653 | 29386 | 372992 | 96994 | 275998 | 40506 | 39014 | 33403 | 1999 |
| 2000 | 40135 | 10004 | 16262 | 13869 | 82311 | 51838 | 30473 | 388059 | 102717 | 285342 | 42131 | 39911 | 34505 | 2000 |
| 2001 | 40724 | 10174 | 16376 | 14174 | 85710 | 54170 | 31540 | 402856 | 108469 | 294387 | 43563 | 40789 | 35609 | 2001 |
| 2002 | 41257 | 10327 | 16458 | 14472 | 89112 | 56500 | 32612 | 417578 | 114435 | 303143 | 44883 | 41605 | 36713 | 2002 |
| 2003 | 41798 | 10451 | 16557 | 14790 | 92585 | 58929 | 33656 | 431818 | 120500 | 311318 | 46050 | 42395 | 37778 | 2003 |
| 2004 | 42282 | 10556 | 16640 | 15086 | 96103 | 61404 | 34699 | 445783 | 126646 | 319138 | 47109 | 43158 | 38798 | 2004 |
| 2005 | 42720 | 10640 | 16707 | 15373 | 99758 | 63983 | 35775 | 459726 | 132851 | 326875 | 48146 | 43849 | 39768 | 2005 |
| 2006 | 43067 | 10693 | 16740 | 15634 | 103419 | 66606 | 36812 | 473812 | 139228 | 334583 | 49060 | 44507 | 40682 | 2006 |
| 2007 | 43356 | 10714 | 16773 | 15869 | 107040 | 69271 | 37770 | 487444 | 145633 | 341811 | 49894 | 45085 | 41537 | 2007 |
| 2008 | 43638 | 10725 | 16790 | 16123 | 110718 | 72042 | 38676 | 500987 | 152041 | 348946 | 50693 | 45581 | 42451 | 2008 |
| 2009 | 43903 | 10714 | 16824 | 16365 | 114417 | 74851 | 39566 | 514388 | 158578 | 355809 | 51504 | 46037 | 43342 | 2009 |
| 2010 | 44161 | 10693 | 16858 | 16610 | 118286 | 77770 | 40515 | 527817 | 165397 | 362420 | 52276 | 46451 | 44252 | 2010 |
| 2011 | 44706 | 10851 | 16964 | 16881 | 121979 | 80239 | 41739 | 543465 | 171597 | 371868 | 53486 | 47319 | 45479 | 2011 |
| 2012 | 45251 | 11010 | 17071 | 17152 | 125673 | 82708 | 42964 | 559113 | 177797 | 381316 | 54697 | 48186 | 46705 | 2012 |
| 2013 | 45795 | 11168 | 17177 | 17424 | 129366 | 85176 | 44188 | 574761 | 183996 | 390765 | 55907 | 49054 | 47932 | 2013 |
| 2014 | 46340 | 11327 | 17284 | 17695 | 133059 | 87645 | 45413 | 590409 | 190196 | 400213 | 57117 | 49922 | 49158 | 2014 |
| 2015 | 46885 | 11485 | 17390 | 17966 | 136752 | 90114 | 46637 | 606057 | 196396 | 409661 | 58328 | 50790 | 50385 | 2015 |

| TRD58 | TRD52 | FIRE | FIRE60 | FIRE64 | SERV | SERV70 | SERV73 | SERV80 | SERVOS | SERV71 | SERV72 | SERV75 | SERV78 | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99083 | 57934 | 102663 | 54698 | 47965 | 462960 | 25724 | 150151 | 96038 | 191047 | 12810 | 15364 | 23987 | 26434 | 1998 |
| 102650 | 60425 | 105749 | 56777 | 48972 | 486456 | 26238 | 160511 | 99976 | 199730 | 13502 | 15994 | 25162 | 27650 | 1999 |
| 105832 | 62963 | 108659 | 58707 | 49952 | 510582 | 26711 | 171105 | 104175 | 208592 | 14217 | 16618 | 26320 | 28922 | 2000 |
| 109007 | 65419 | 111193 | 60292 | 50901 | 535369 | 27138 | 182056 | 108550 | 217625 | 14942 | 17183 | 27478 | 30223 | 2001 |
| 112168 | 67774 | 113718 | 61799 | 51919 | 560875 | 27545 | 193525 | 113000 | 226804 | 15675 | 17733 | 28659 | 31553 | 2002 |
| 115085 | 70010 | 116126 | 63221 | 52905 | 587004 | 27903 | 205330 | 117633 | 236136 | 16411 | 18247 | 29892 | 32942 | 2003 |
| 117962 | 72110 | 118406 | 64548 | 53858 | 613640 | 28182 | 217445 | 122339 | 245674 | 17183 | 18721 | 31177 | 34358 | 2004 |
| 120911 | 74202 | 120612 | 65839 | 54773 | 640814 | 28408 | 229839 | 127232 | 255335 | 17956 | 19171 | 32487 | 35801 | 2005 |
| 124055 | 76279 | 122795 | 67090 | 55704 | 669038 | 28550 | 242710 | 132449 | 265329 | 18764 | 19650 | 33851 | 37233 | 2006 |
| 127032 | 78263 | 125005 | 68298 | 56707 | 697854 | 28607 | 255817 | 137879 | 275551 | 19608 | 20102 | 35239 | 38722 | 2007 |
| 130081 | 80141 | 127130 | 69459 | 57671 | 727460 | 28607 | 269375 | 143532 | 285946 | 20471 | 20564 | 36684 | 40194 | 2008 |
| 132942 | 81984 | 129233 | 70640 | 58594 | 758099 | 28578 | 283652 | 149274 | 296595 | 21372 | 21037 | 38151 | 41721 | 2009 |
| 135734 | 83706 | 131372 | 71841 | 59531 | 790083 | 28550 | 298685 | 155245 | 307604 | 22291 | 21521 | 39677 | 43265 | 2010 |
| 139289 | 86288 | 134317 | 73890 | 60509 | 818188 | 28735 | 311737 | 159801 | 318076 | 23175 | 22015 | 41008 | 44899 | 2011 |
| 142844 | 88870 | 137263 | 75938 | 61486 | 846293 | 28921 | 324789 | 164356 | 328548 | 24059 | 22509 | 42338 | 46532 | 2012 |
| 146399 | 91451 | 140208 | 77987 | 62464 | 874398 | 29106 | 337841 | 168912 | 339021 | 24943 | 23002 | 43669 | 48166 | 2013 |
| 149954 | 94033 | 143154 | 80035 | 63441 | 902503 | 29291 | 350893 | 173467 | 349493 | 25827 | 23496 | 45000 | 49800 | 2014 |
| 153509 | 96615 | 146099 | 82084 | 64419 | 930607 | 29476 | 363945 | 178023 | 359965 | 26712 | 23990 | 46331 | 51433 | 2015 |

| SERV81 | SERV82 | SERV83 | SERV84 | GOV | GOVSL | GOVSCH | GOVFED | MAN+MIN+TRD | MAN+CON | #3334+#35+#36+#38 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9527 | 11295 | 44654 | 46976 | 175612 | 69443 | 86948 | 19221 | 525521 | 212137 | 100460 |
| 9537 | 11634 | 47110 | 49142 | 181401 | 71040 | 90948 | 19413 | 544974 | 216575 | 103647 |
| 9537 | 11971 | 49654 | 51353 | 186757 | 72674 | 94495 | 19588 | 563377 | 220672 | 106409 |
| 9537 | 12294 | 52286 | 53682 | 191630 | 74273 | 97613 | 19745 | 581236 | 224487 | 109007 |
| 9527 | 12602 | 55004 | 56051 | 196237 | 75833 | 100541 | 19863 | 598751 | 228011 | 111512 |
| 9527 | 12904 | 57755 | 58459 | 200950 | 77349 | 103658 | 19943 | 615617 | 231360 | 113831 |
| 9517 | 13201 | 60642 | 60874 | 205666 | 78896 | 106768 | 20002 | 631972 | 234463 | 115980 |
| 9508 | 13491 | 63614 | 63308 | 210282 | 80395 | 109864 | 20022 | 648116 | 237387 | 117984 |
| 9498 | 13788 | 66667 | 65877 | 214895 | 81842 | 113050 | 20002 | 664387 | 240288 | 120034 |
| 9489 | 14078 | 69801 | 68512 | 219514 | 83316 | 116216 | 19982 | 679700 | 242626 | 121581 |
| 9479 | 14359 | 72942 | 71253 | 224323 | 84815 | 119586 | 19922 | 694889 | 244914 | 123082 |
| 9470 | 14661 | 76151 | 74032 | 229258 | 86342 | 123054 | 19863 | 709822 | 247080 | 124447 |
| 9461 | 14969 | 79502 | 76919 | 234302 | 87896 | 126622 | 19783 | 724660 | 249126 | 125702 |
| 9439 | 15309 | 82693 | 79534 | 238684 | 89389 | 130119 | 19825 | 743693 | 253077 | 128369 |
| 9417 | 15648 | 85884 | 82149 | 243067 | 90881 | 133616 | 19866 | 762726 | 257027 | 131035 |
| 9395 | 15988 | 89076 | 84765 | 247449 | 92374 | 137112 | 19908 | 781759 | 260977 | 133702 |
| 9373 | 16328 | 92267 | 87380 | 251832 | 93867 | 140609 | 19950 | 800792 | 264927 | 136369 |
| 9351 | 16667 | 95458 | 89995 | 256214 | 95360 | 144106 | 19991 | 819825 | 268877 | 139035 |

# ATTACHMENT THREE

## Growth Factor Projection Column Heading Definitions

| COLUMN HEADING DEFINITIONS | |
|---|---|
| **Column Heading** | **Corresponding Employment Category** |
| MAMIN or MIN | Total Mining Employment |
| MACON or CON | Total Construction Employment |
| CON15 or 15 | General Building Construction Employment |
| CON16 or 16 | Heavy (Street, Highway) Construction Employment |
| CON17 or 17 | Special Trades Construction Employment |
| MAMAN or MAN | Total Manufacturing Employment |
| MADUR or DUR | Total Durable Goods Manufacturing Employment |
| MAN19 or 19 | Aircraft Manufacturing Employment |
| MAN32 or 32 | Aggregates Manufacturing Employment |
| MA3334 or 3334 | Primary and Fabricated Materials Manufacturing Employment |
| MAN35 or 35 | Nonelectric Machinery Manufacturing Employment |
| MAN36 or 36 | Electric Equipment Manufacturing Employment |
| MAN38 or 38 | Other Durables Manufacturing Employment |
| Employment Reference | Employment Category |
| MANDUR or NDUR | Total Nondurable Goods Manufacturing Employment |
| MAN20 or 20 | Food and Kindred Manufacturing Employment |
| MAN26 or 26 | Other Nondurable Goods Manufacturing Employment |
| MAN27 or 27 | Printing Manufacturing Employment |
| TCPU | Transportation, Communications, and Public Utilities Employment |
| TC4041 or 4041 | Transportation Employment |
| TC48 or 48 | Communications and Public Utilities Employment |
| MATRD or TRD | Total Trade Employment |
| MAWTRD or WTRD | Total Wholesale Trade Employment |
| MARTRD or RTRD | Total Retail Trade Employment |
| TRD53 or 53 | General Merchandise and Apparel Trade Employment |
| TRD54 or 54 | Food Stores Trade Employment |
| TRD55 or 55 | Auto Dealers and Services Trade Employment |
| TRD58 or 58 | Eating and Drinking Services Trade Employment |
| TRD52 or 52 | Other Trade Employment |
| FIRE | Total Finance, Insurance, and Real Estate Employment |
| FIRE60 or 60 | Finance Employment |
| FIRE64 or 64 | Insurance Employment |

| COLUMN HEADING DEFINITIONS | |
|---|---|
| **Column Heading** | **Corresponding Employment Category** |
| MASER or SERV | Total Services Employment |
| SERV70 or 70 | Lodging Services Employment |
| SERV73 or 73 | Business Services Employment |
| SERV80 or 80 | Health Services Employment |
| SERVOS | Membership Organizations Services Employment |
| SERV71 or 71 | Agricultural Services Employment |
| SERV72 or 72 | Personal Services Employment |
| SERV75 or 75 | Auto and Misc. Services Employment |
| Employment Reference | Employment Category |
| SERV78 or 78 | Recreation and Amusement Services Employment |
| SERV81 or 81 | Legal Services Employment |
| SERV82 or 82 | Educational Services Employment |
| SERV83 or 83 | Professional Services Employment |
| SERV84 or 84 | Other Services Employment |
| GOV | Total Government Employment |
| GOVSL | State and Local Government Employment |
| GOVSCH | Public School Employment |
| GOVFED | Federal Government Employment |
| MAMAN+MACON | Total Manufacturing and Construction Employment |
| MAMAN+MAMIN+MATRD | Total Manufacturing, Mining, and Trade Employment |

# ATTACHMENT FOUR

## Growth Factors for Nonroad Equipment

| 2015 NONROAD EQUIPMENT OZONE GROWTH FACTORS | | | | |
|---|---|---|---|---|
| Nonroad Equipment Type | ASC Code | 2006 GF | 2015 GF | Growth Reference |
| 2-Stroke Gasoline | | | | |
| Off-Road Motorcycles | 2260001010 | 1.28 | 1.61 | Population |
| All Terrain Vehicles (ATVs) | 2260001030 | 1.28 | 1.61 | Population |
| Golf Carts | 2260001050 | 1.38 | 1.91 | Employment - MASER |
| Specialty Vehicles Carts | 2260001060 | 1.38 | 1.91 | Employment - MASER |
| Asphalt Pavers | 2260002003 | 1.09 | 1.47* | Employment - CON |
| Tampers/Rammers | 2260002006 | 1.09 | 1.47* | Employment - CON |
| Plate Compactors | 2260002009 | 1.09 | 1.47* | Employment - CON |
| Paving Equipment | 2260002021 | 1.09 | 1.47* | Employment - CON |
| Bore/Drill Rigs | 2260002033 | 1.09 | 1.47* | Employment - CON |
| Aerial Lifts | 2260003010 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Forklifts | 2260003020 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Sweepers/Scrubbers | 2260003030 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Other General Industrial Equipment | 2260003040 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Lawn Mowers | 2260004010 | 1.28 | 1.61 | Population |
| Tillers <5 HP | 2260004015 | 1.00 | 1.00 | LITTLE USE |
| Chainsaws <4 HP | 2260004020 | 1.00 | 1.00 | LITTLE USE |
| Trimmers/Edgers/Brush Cutters | 2260004025 | 1.39 | 1.98 | Employment - 71 |
| Leaf Blowers/Vacuums | 2260004030 | 1.39 | 1.98 | Employment - 71 |
| Shredders <5 HP | 2260004050 | 1.00 | 1.00 | LITTLE USE |
| Other Lawn & Garden Equipment | 2260004075 | 1.28 | 1.61 | Population |
| Generator Sets <50 HP | 2260006005 | 1.11 | 1.33* | Employment - MAN+CON |
| Pumps <50 HP | 2260006010 | 1.11 | 1.33* | Employment - MAN+CON |
| Gas Compressors <50 HP | 2260006020 | 1.11 | 1.33* | Employment - MAN+CON |
| Chainsaws >4 HP | 2260007005 | 1.38 | 1.91 | Employment - MASER |
| Aircraft Support Equipment | 2260008005 | 1.24 | 1.46 | carrier ops |
| Terminal Tractors | 2260008010 | 1.24 | 1.46 | carrier ops |
| 4-Stroke Gasoline | | | | |
| Off-Road Motorcycles | 2265001010 | 1.28 | 1.61 | Population |
| All Terrain Vehicles (ATVs) | 2265001030 | 1.28 | 1.61 | Population |
| Minibikes | 2265001040 | 1.28 | 1.61 | Population |
| Golf Carts | 2265001050 | 1.38 | 1.91 | Employment - MASER |
| Specialty Vehicles Carts | 2265001060 | 1.38 | 1.91 | Employment - MASER |
| Asphalt Pavers | 2265002003 | 1.09 | 1.47* | Employment - CON |
| Tampers/Rammers | 2265002006 | 1.09 | 1.47* | Employment - CON |
| Plate Compactors | 2265002009 | 1.09 | 1.47* | Employment - CON |
| Rollers | 2265002015 | 1.09 | 1.47* | Employment - CON |
| Paving Equipment | 2265002021 | 1.09 | 1.47* | Employment - CON |
| Surfacing Equipment | 2265002024 | 1.09 | 1.47* | Employment - CON |
| Signal Boards | 2265002027 | 1.09 | 1.47* | Employment - CON |
| Trenchers | 2265002030 | 1.09 | 1.47* | Employment - CON |
| Bore/Drill Rigs | 2265002033 | 1.09 | 1.47* | Employment - CON |
| Concrete/Industrial Saws | 2265002039 | 1.09 | 1.47* | Employment - CON |
| Cement and Mortar Mixers | 2265002042 | 1.09 | 1.47* | Employment - CON |
| Cranes | 2265002045 | 1.09 | 1.47* | Employment - CON |
| Crushing/Proc. Equipment | 2265002054 | 1.09 | 1.47* | Employment - CON |
| Rough Terrain Forklifts | 2265002057 | 1.09 | 1.47* | Employment - CON |
| Rubber Tired Loaders | 2265002060 | 1.09 | 1.47* | Employment - CON |
| Tractors/Loaders/Backhoes | 2265002066 | 1.09 | 1.47* | Employment - CON |
| Skid Steer Loaders | 2265002072 | 1.09 | 1.47* | Employment - CON |

| 2015 NONROAD EQUIPMENT OZONE GROWTH FACTORS | | | | |
|---|---|---|---|---|
| Nonroad Equipment Type | ASC Code | | 2015 GF | Growth Reference |
| Dumpers/Tenders | 2265002078 | 1.09 | 1.47* | Employment - CON |
| Other Construction Equipment | 2265002081 | 1.09 | 1.47* | Employment - CON |
| Aerial Lifts | 2265003010 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Forklifts | 2265003020 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Sweepers/Scrubbers | 2265003030 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Other General Industrial Equipment | 2265003040 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Other Material Handling Equipment | 2265003050 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Lawn Mowers | 2265004010 | 1.28 | 1.61 | Population |
| Tillers <5 HP | 2265004015 | 1.00 | 1.00 | LITTLE USE |
| Trimmers/Edgers/Brush Cutters | 2265004025 | 1.39 | 1.98 | Employment - 71 |
| Leaf Blowers/Vacuums | 2265004030 | 1.39 | 1.98 | Employment - 71 |
| Rear Engine Riding Mowers | 2265004040 | 1.28 | 1.61 | Population |
| Front Mowers | 2265004045 | 1.28 | 1.61 | Population |
| Shredders <5 HP | 2265004050 | 1.00 | 1.00 | LITTLE USE |
| Lawn & Garden Tractors | 2265004055 | 1.28 | 1.61 | Population |
| Wood Splitters | 2265004060 | 1.00 | 1.00 | LITTLE USE |
| Chippers/Stump Grinders | 2265004065 | 1.00 | 1.00 | LITTLE USE |
| Commercial Turf Equipment | 2265004070 | 1.39 | 1.98 | Employment - 71 |
| Other Lawn & Garden Equipment | 2265004075 | 1.28 | 1.61 | Population |
| 2-Wheel Tractors | 2265005010 | 0.74 | 0.42 | ag stats |
| Agricultural Tractors | 2265005015 | 0.74 | 0.42 | ag stats |
| Combines | 2265005020 | 0.74 | 0.42 | ag stats |
| Agricultural Mowers | 2265005030 | 0.74 | 0.42 | ag stats |
| Sprayers | 2265005035 | 0.74 | 0.42 | ag stats |
| Tillers >5 HP | 2265005040 | 0.74 | 0.42 | ag stats |
| Swathers | 2265005045 | 0.74 | 0.42 | ag stats |
| Hydro Power Units | 2265005050 | 0.74 | 0.42 | ag stats |
| Other Agricultural Equipment | 2265005055 | 0.74 | 0.42 | ag stats |
| Generator Sets <50 HP | 2265006005 | 1.11 | 1.33* | Employment - MAN+CON |
| Pumps <50 HP | 2265006010 | 1.11 | 1.33* | Employment - MAN+CON |
| Air Compressors <50 HP | 2265006015 | 1.11 | 1.33* | Employment - MAN+CON |
| Welders <50 HP | 2265006025 | 1.11 | 1.33* | Employment - MAN+CON |
| Pressure Washers <50 HP | 2265006030 | 1.11 | 1.33* | Employment - MAN+CON |
| Aircraft Support Equipment | 2265008005 | 1.24 | 1.46 | carrier ops |
| Terminal Tractors | 2265008010 | 1.24 | 1.46 | carrier ops |
| Diesel | | | | |
| Specialty Vehicles Carts | 2270001060 | 1.38 | 1.91 | Employment - MASER |
| Asphalt Pavers | 2270002003 | 1.09 | 1.47* | Employment - CON |
| Plate Compactors | 2270002009 | 1.09 | 1.47* | Employment - CON |
| Concrete Pavers | 2270002012 | 1.09 | 1.47* | Employment - CON |
| Rollers | 2270002015 | 1.09 | 1.47* | Employment - CON |
| Scrapers | 2270002018 | 1.09 | 1.47* | Employment - CON |
| Paving Equipment | 2270002021 | 1.09 | 1.47* | Employment - CON |
| Signal Boards | 2270002027 | 1.09 | 1.47* | Employment - CON |
| Trenchers | 2270002030 | 1.09 | 1.47* | Employment - CON |
| Bore/Drill Rigs | 2270002033 | 1.09 | 1.47* | Employment - CON |
| Excavators | 2270002036 | 1.09 | 1.47* | Employment - CON |
| Concrete/Industrial Saws | 2270002039 | 1.09 | 1.47* | Employment - CON |
| Cement and Mortar Mixers | 2270002042 | 1.09 | 1.47* | Employment - CON |

| 2015 NONROAD EQUIPMENT OZONE GROWTH FACTORS | | | | |
|---|---|---|---|---|
| Nonroad Equipment Type | ASC Code | | 2015 GF | Growth Reference |
| Cranes | 2270002045 | 1.09 | 1.47* | Employment - CON |
| Graders | 2270002048 | 1.09 | 1.47* | Employment - CON |
| Off-Highway Trucks | 2270002051 | 1.09 | 1.47* | Employment - CON |
| Crushing/Proc. Equipment | 2270002054 | 1.09 | 1.47* | Employment - CON |
| Rough Terrain Forklifts | 2270002057 | 1.09 | 1.47* | Employment - CON |
| Rubber Tired Loaders | 2270002060 | 1.09 | 1.47* | Employment - CON |
| Rubber Tired Dozers | 2270002063 | 1.09 | 1.47* | Employment - CON |
| Tractors/Loaders/Backhoes | 2270002066 | 1.09 | 1.47* | Employment - CON |
| Crawler Tractors | 2270002069 | 1.09 | 1.47* | Employment - CON |
| Skid Steer Loaders | 2270002072 | 1.09 | 1.47* | Employment - CON |
| Off-Highway Tractors | 2270002075 | 1.09 | 1.47* | Employment - CON |
| Dumpers/Tenders | 2270002078 | 1.09 | 1.47* | Employment - CON |
| Other Construction Equipment | 2270002081 | 1.09 | 1.47* | Employment - CON |
| Aerial Lifts | 2270003010 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Forklifts | 2270003020 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Sweepers/Scrubbers | 2270003030 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Other General Industrial Equipment | 2270003040 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Other Material Handling Equipment | 2270003050 | 1.22 | 1.50 | Employment - MAN+MIN+TRD |
| Rear Engine Riding Mowers | 2270004040 | 1.28 | 1.61 | Population |
| Lawn & Garden Tractors | 2270004055 | 1.28 | 1.61 | Population |
| Wood Splitters | 2270004060 | 1.00 | 1.00 | LITTLE USE |
| Chippers/Stump Grinders | 2270004065 | 1.00 | 1.00 | LITTLE USE |
| Commercial Turf Equipment | 2270004070 | 1.39 | 1.98 | Employment - 71 |
| Other Lawn & Garden Equipment | 2270004075 | 1.28 | 1.61 | Population |
| Agricultural Tractors | 2270005015 | 0.74 | 0.42 | ag stats |
| Combines | 2270005020 | 0.74 | 0.42 | ag stats |
| Balers | 2270005025 | 0.74 | 0.42 | ag stats |
| Sprayers | 2270005035 | 0.74 | 0.42 | ag stats |
| Swathers | 2270005045 | 0.74 | 0.42 | ag stats |
| Hydro Power Units | 2270005050 | 0.74 | 0.42 | ag stats |
| Other Agricultural Equipment | 2270005055 | 0.74 | 0.42 | ag stats |
| Generator Sets <50 HP | 2270006005 | 1.11 | 1.33* | Employment - MAN+CON |
| Pumps <50 HP | 2270006010 | 1.11 | 1.33* | Employment - MAN+CON |
| Air Compressors <50 HP | 2270006015 | 1.11 | 1.33* | Employment - MAN+CON |
| Welders <50 HP | 2270006025 | 1.11 | 1.33* | Employment - MAN+CON |
| Pressure Washers <50 HP | 2270006030 | 1.11 | 1.33* | Employment - MAN+CON |
| Aircraft Support Equipment | 2270008005 | 1.24 | 1.46 | carrier ops |
| Terminal Tractors | 2270008010 | 1.24 | 1.46 | carrier ops |

***NOTE: The Construction related growth reference growth factors were reduced an additional 18 percent due to lower MAG construction interim employment estimates. The Net reduction for MAN + CON growth reference growth factors were an additional 7 percent.**

App.VI-iv

Committed Maintenance Measures

COMMITTED MAINTENANCE MEASURE #1

Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30

September 10, 2003

The “Summer Fuel Reformulation: California Phase 2 and Federal Phase II Reformulated Gasoline with 7 psi from May 1 through September 30" measure affects emissions from onroad vehicle gasoline-powered engines. With the implementation of this measure, a cleaner burning formulation of gasoline than would otherwise be used will be sold in the modeling area during the ozone season. The methodology used to estimate the benefit is described below. In this analysis, all onroad credit for committed measure package gasoline is applied using the MOBILE6 model.

To estimate the effect of the expected gasoline formulation on onroad emissions, the MOBILE6 model was used. MOBILE6 accepts as input data for the gasoline vapor pressure (RVP), oxygenate content, and sulfur content. The MOBILE6 model runs performed for this analysis in 2006 and 2015 incorporate the committed maintenance measure package RVP value (7.0 psi). Additionally, in MOBILE6, a flag is available to indicate that reformulated gasoline is to be assumed in the analysis.

To estimate the effect of the cleaner burning gasoline, MOBILE6 was performed using both the committed measure package and the base case (1999 conditions) formulations. The emissions estimated by the two runs were processed through the M6Link program independently and the difference in final emissions estimates was calculated. The reformulated gasoline was set to reflect the southern location of Arizona using the "S" option. The credit for this measure is applied to the entire modeling domain as it is assumed that the gasoline quality is consistent across the modeling domain due to the structure of the Arizona gasoline distribution system. Additional information about the options available to the user of MOBILE6 for the modeling of gasoline quality may be found on pages 148 through 167 of the User’s Guide to MOBILE6.1 and MOBILE6.2 Mobile Source Emission Factor Model, October 2002.

No specific credit was taken for reformulated gasoline on nonroad emissions as it is assumed that the very stringent nonroad engine standards include that the engines will use cleaner burning reformulated gasoline.

The base year inventory for 1999 reflected actual monitored gasoline formulation qualities from that season. It is important to note that reformulated gasoline was implemented by 1999.

The emission reduction credit attributable to this maintenance measure in 2015 is 1.8% and 0.6% for NOx and VOC respectively.

# COMMITTED MAINTENANCE MEASURE #2

## Phased-In Emission Test Cutpoints

September 10, 2003

The "Phased-In Emission Test Cutpoints" measure affects onroad emissions. With the implementation of this measure, vehicles which are subject to the enhanced I/M program are held to a stricter set of cutpoints than would otherwise be the case. The stricter cutpoints were implemented in January 2000. If a vehicle exceeds the emission levels set by the cutpoint for carbon monoxide, hydrocarbons, or NOx, the vehicle fails the test.

The Arizona Department of Environmental Quality (ADEQ) provided a table of emission testing cutpoints for each model year vehicle subject to the enhanced I/M program in the May 28, 2001 ADEQ memo Cutpoints for IM147 for MOBILE6. These cutpoints are entered into a data file in a format appropriate for input to the MOBILE6 model. The format for the table appropriate for input to MOBILE6 may be found in section 2.8.9.4.g of the User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, EPA420-R-02-028, October 2002.

The phase 2 test cutpoints (I/M147 program) that reflect the enhanced program are indicated in the following table. The LDGV cutpoints were used in the MOBILE6 Block 1 cutpoint values. The LDGT1 cutpoints were used in Block 2. The LDGT2 cutpoints were used in Blocks 3 and 4.

| Model Year | Vehicle Class | Hydrocarbons | CO | NOx |
|---|---|---|---|---|
| 1981-1982 | LDGV | 2.50 | 21.80 | 3.40 |
| 1983-1985 | LDGV | 2.00 | 17.30 | 3.40 |
| 1986-1989 | LDGV | 1.40 | 12.80 | 2.40 |
| 1990-1993 | LDGV | 0.80 | 10.10 | 2.40 |
| 1994+ | LDGV | 0.70 | 10.10 | 1.90 |
| 1981-1985 | LDGT1 | 3.40 | 35.30 | 5.40 |
| 1986-1989 | LDGT1 | 2.50 | 21.80 | 4.40 |
| 1990-1993 | LDGT1 | 1.70 | 17.30 | 3.90 |
| 1994+ | LDGT1 | 1.40 | 17.30 | 2.90 |
| 1981-1985 | LDGT2 | 3.70 | 42.50 | 6.90 |
| 1986-1987 | LDGT2 | 3.40 | 35.30 | 5.40 |
| 1988-1989 | LDGT2 | 2.50 | 21.80 | 5.40 |
| 1990-1993 | LDGT2 | 2.50 | 21.80 | 4.90 |
| 1994+ | LDGT2 | 2.00 | 21.80 | 3.90 |

While the previous table lists the cutpoints used for model years back to 1981, due to the structure of MOBILE6, only the cutpoints back to the model year 1991 are considered when performing a July 2015 run. Similarly, only the cutpoints back to the model year 1982 are considered when performing a July (for August) 2006 run. This is because the MOBILE6 model only considers the most recent 25 model years in any particular run. In July 2015, the 25$^{th}$ model year included in the modeling is a 1991 vehicle.

The following table indicates the base case cutpoints as used in the I/M240 program, based upon Appendix A Failure Rate Analysis and Development of Fast-Pass, Retest, and CPP Algorithms for IM147 Max CO Cutpoints, Sierra Research, December 14, 1999.

| Model Year | Vehicle Class | Hydrocarbons | CO | NOx |
|---|---|---|---|---|
| 1981-1982 | LDGV | 2.00 | 60.0 | 3.0 |
| 1983-1985 | LDGV | 2.00 | 30.0 | 3.0 |
| 1986-1990 | LDGV | 2.00 | 30.0 | 3.0 |
| 1991-1993 | LDGV | 1.20 | 20.0 | 2.5 |
| 1994-1995 | LDGV | 1.20 | 20.0 | 2.5 |
| 1996+ | LDGV | 0.80 | 15.0 | 2.0 |
| 1981-1983 | LDGT1 | 7.50 | 100.0 | 7.0 |
| 1984-1985 | LDGT1 | 3.20 | 80.0 | 7.0 |
| 1986-1987 | LDGT1 | 3.20 | 80.0 | 7.0 |
| 1988-1990 | LDGT1 | 3.20 | 80.0 | 3.5 |
| 1991-1993 | LDGT1 | 2.40 | 60.0 | 3.0 |
| 1994-1995 | LDGT1 | 2.40 | 60.0 | 3.0 |
| 1996+ | LDGT1 | 1.00 | 20.0 | 2.5 |
| 1981-1983 | LDGT2 | 7.50 | 100.0 | 7.0 |
| 1984-1986 | LDGT2 | 3.20 | 80.0 | 7.0 |
| 1987 | LDGT2 | 3.20 | 80.0 | 7.0 |
| 1988-1990 | LDGT2 | 3.20 | 80.0 | 5.0 |
| 1991-1993 | LDGT2 | 2.40 | 60.0 | 4.5 |
| 1994-1995 | LDGT2 | 2.40 | 60.0 | 4.5 |
| 1996+ | LDGT2 | 2.40 | 60.0 | 4.0 |

The benefit from the stricter cutpoints was estimated by running the M6Link model with the MOBILE6 outputs developed using the base case cutpoints and then rerunning M6Link with the MOBILE6 outputs developed using the stricter cutpoints. In both cases, MOBILE6 was run with a five year grace period from the I/M program for the newest model year vehicles.

The emission reduction credit attributable to this maintenance measure in 2015 is less than -0.1% (increase) and 0.1% for NOx and VOC respectively.

COMMITTED MAINTENANCE MEASURE #3

One Time Waiver from Vehicle Emissions Test

September 10, 2003

The “One Time Waiver from Vehicle Emissions Test” measure affects onroad emissions. With the implementation of this measure, vehicles are allowed no more than a single I/M waiver after January 1, 1997. The methodology used to estimate the emissions reduction is described below.

MOBILE6 uses as input the waiver rates for two age groups of vehicles. The first age group is vehicles of model years before 1981. The second age group is vehicles of model years 1981 and newer. It is assumed that absent this control measure, the waiver rate for pre-1981 model year vehicles would be four percent and the waiver rate for model year vehicles 1981 and newer would be three percent. The base case waiver rates incorporate no set limit on the number of waivers which a given vehicle may receive. This measure sets a limit of one on the number of waivers which any vehicle may receive.

It has been estimated that the average remaining life span of a vehicle which has received a waiver is three years (page E-5 of Feasibility and Cost-Effective Study of New Air Pollution Control Measures Pertaining to Mobile Sources, Sierra Research, Inc., June 1993). It was assumed that the 1994 base case run includes the three-year life after waiver implicitly through the MOBILE6 waiver rates of 4 percent and 3 percent. This measure effectively reduces that three-year life to one year, and result in approximately two thirds of the reductions of a change to zero waivers. With the implementation of this control measure, the waiver rate for pre-1981 model year vehicles would be one and one third percent and the waiver rate for model year vehicles 1981 and newer would be one percent.

The base case input to MOBILE6 of four percent waivers for pre-1981 model year vehicles was changed to one 1.3 percent to reflect this measure. The base case input to MOBILE6 of three percent waivers for 1981 and newer model year vehicles was changed to one percent to reflect this measure.

The emission reduction credit attributable to this maintenance measure in 2015 is less than 0.1% and less than 0.1% for NOx and VOC respectively.

COMMITTED MAINTENANCE MEASURE #4

Coordinate Traffic Signal Systems

September 10, 2003

The "Coordinate Traffic Signal Systems" measure affects onroad emissions. With the implementation of this measure, vehicles in the modeling area spend less time idling at traffic lights than is assumed in the base case. The methodology used to estimate the emissions reduction is described below.

This measure affects onroad emissions through a reduction in idling time at traffic signals. The estimation of the benefit from the measure involves the estimation of three factors, which were multiplied together to estimate a total emission reduction.

The three factors involved in the calculation of the benefit from this measure are as follows:

- The idling emission rate per hour from an average onroad vehicle,
- The reduction in idle time per intersection, and
- The total number of intersections which will be affected by this measure.

*Estimate of the idling emission rate per hour from an average onroad vehicle*

The average idling rate was estimated using MOBILE6. Two MOBILE6 runs were performed, reflecting I/M and non-I/M. One vehicle speed, 2.5 miles per hour was used. Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation, EPA, January 2002 recommends running the mobile model at a speed of 2.5 miles per hour since the mobile model does not calculate idle emissions directly. The output from MOBILE6, in units of grams per mile, was converted to the desired units of grams per hour by multiplication of 2.5 miles per hour.

Hourly temperatures were input, from which MOBILE6 calculated the ambient daily temperature internally. The I/M and non-I/M results were weighted (0.916 for I/M and 0.084 non-I/M) to determine the net emission rate. The MOBILE6 calculated emission rates are shown in the following table.

| | I/M | non-IM | Net |
|---|---|---|---|
| VOC Emission rate (grams per mile) 2015 | 2.928 | 3.363 | 2.96 |
| CO Emission rate (grams per mile) 2015 | 15.912 | 20.831 | 16.33 |
| NOx Emission rate (grams per mile) 2015 | 1.057 | 1.235 | 1.07 |
| Weighting Fraction | 0.916 | 0.084 | 1.000 |

The net VOC emission rate of 2.96 grams per mile, or 7.41 grams per hour were obtained from the weighting of the emission rates. The net CO emission rate is 16.33 grams per mile, or 40.81 grams per hour. The net NOx emission rate is 1.07 grams per mile, or 2.68 grams per hour.

*Estimate of reduction in idle time per intersection*

The amount of vehicle idling time per intersection saved with implementation of the measure was estimated using data from the Final Report of the Governor's Alternative Transportation System Task Force, November 1996. That report referenced a study which estimated that, on average, 16,366 hours of delay per intersection would be saved through enhanced traffic signal coordination. This annual benefit was calculated with the assumption that retiming primarily affects weekday time periods other than late at night. With approximately 260 weekdays per year, 16,366 hours of delay per year equates to approximately 62.9 hours of delay per weekday.

*Estimate of the total number of intersections which will be affected by this measure*

Consistent with the serious area carbon monoxide attainment demonstration, it is estimated that 661 signals in the modeling area will be upgraded as a result of this measure. This is likely a conservative estimate since the ozone modeling domain is larger than the CO modeling domain.

*Estimate of the Total Emission Reduction*

Combining the estimated reduction in idling due to the synchronization of the traffic signals, the reduction in VOC emissions is 0.31 metric tons per day,

$$661 \text{ intersections} \times \frac{62.9 \text{ hours}}{\text{intersection}} \times \frac{7.41 \text{ grams}}{\text{hour}} \times \frac{1 \text{ metric ton}}{1 \times 10^6 \text{ grams}} = \frac{0.31 \text{ metric tons}}{\text{day}}$$

the reduction in CO emissions is 1.70 metric tons per day,

$$661 \text{ intersections} \times \frac{62.9 \text{ hours}}{\text{intersection}} \times \frac{40.8 \text{ grams}}{\text{hour}} \times \frac{1 \text{ metric ton}}{1 \times 10^6 \text{ grams}} = \frac{1.70 \text{ metric tons}}{\text{day}}$$

and the reduction in NOx emissions is 0.11 metric tons per day,

$$661 \text{ intersections} \times \frac{62.9 \text{ hours}}{\text{intersection}} \times \frac{2.68 \text{ grams}}{\text{hour}} \times \frac{1 \text{ metric ton}}{1 \times 10^6 \text{ grams}} = \frac{0.11 \text{ metric tons}}{\text{day}}$$

This measure was not modeled through the M6Link program, but as a post-processing measure to M6Link. The net emissions reduction in metric tons resulting from this control measure was estimated using the method described above. The net reduction was compared to the total onroad emissions, estimated before post-processing, output by the M6Link model. The fractional reduction in the total emissions from M6Link resulting from this control measure was applied to the M6Link output using the M6Link utility program. A similar methodology was used for the 2006 analysis.

The emission reduction credit attributable to this maintenance measure in 2015 is less than 0.1% and 0.1% for NOx and VOC respectively.

COMMITTED MAINTENANCE MEASURE #5

Develop Intelligent Transportation Systems

September 10, 2003

The “Develop Intelligent Transportation Systems” measure affects onroad emissions. With the implementation of this measure, vehicles in the modeling area will spend less time idling at traffic lights and will be better able to avoid traffic congestion than is assumed in the base case. The methodology used to estimate the emissions reduction is described below.

This measure affects net onroad emissions through three improvements to the transportation system. These three changes are an improvement of traffic signal coordination, the installation of ITS instrumentation along eight arterial corridors, and the addition of 33 centerline miles of freeway into the freeway management system (FMS).

The average onroad emission rates were estimated using the EPA MOBILE6 model (MOBILE6). Two MOBILE6 runs were performed, reflecting I/M and non-I/M. Both runs were consistent with the base MOBILE6 runs input to M6Link, except for vehicle speed and roadway types were set to be appropriate for this ITS analysis. The output format was changed from database format to a text format because an overall fleetwide emission factor was needed rather than a detailed breakdown of emission rates by vehicle age and type. Several vehicle speeds were processed, including a speed used to calculate the idle emission rate. Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation, EPA, January 2002 recommends running the mobile model at a speed of 2.5 miles per hour since the mobile model does not calculate idle emissions directly. The output from MOBILE6, in units of grams per mile, was converted to the desired units of grams per hour by multiplication of 2.5 miles per hour.

Hourly temperatures were input, from which MOBILE6 calculated the ambient daily temperature internally. The I/M and non-I/M results were weighted (0.916 for I/M and 0.084 non-I/M) to determine the net emission rate. The MOBILE6 calculated emission rates are shown in the following table. All units are in grams per mile except for the Total Idle emission rate which is in grams per hour.

| **VOC Emissions (all units in grams per mile unless otherwise noted)** | | | |
|---|---|---|---|
| Speed (miles per hour) | IM | non-IM | Total |
| Idle (2.5) | 2.928 | 3.363 | 7.41 g/hour |
| 20.0 | 0.549 | 0.641 | 0.56 |
| 23.9 | 0.514 | 0.598 | 0.52 |
| 30.3 | 0.475 | 0.552 | 0.48 |
| 33.3 | 0.462 | 0.535 | 0.47 |
| Weightings--> | 0.916 | 0.084 | 1.000 |

| CO Emissions (all units in grams per mile unless otherwise noted) | | | |
|---|---|---|---|
| Speed (miles per hour) | IM | non-IM | Total |
| Idle (2.5) | 15.912 | 20.831 | 40.81 g/hour |
| 20.0 | 5.444 | 6.674 | 5.55 |
| 23.9 | 5.196 | 6.353 | 5.29 |
| 30.3 | 5.010 | 6.095 | 5.10 |
| 33.3 | 5.019 | 6.095 | 5.11 |
| Weightings--> | 0.916 | 0.084 | 1.000 |

| NOx Emissions (all units in grams per mile unless otherwise noted) | | | |
|---|---|---|---|
| Speed (miles per hour) | IM | non-IM | Total |
| Idle (2.5) | 1.057 | 1.235 | 2.68 g/hour |
| 20.0 | 0.596 | 0.695 | 0.60 |
| 23.9 | 0.566 | 0.661 | 0.57 |
| 30.3 | 0.537 | 0.627 | 0.54 |
| 33.3 | 0.532 | 0.621 | 0.54 |
| Weightings--> | 0.916 | 0.084 | 1.000 |

### *Traffic Signal Coordination*

It is assumed that 95 traffic signals, in addition to the 661 traffic signals modeled for the Coordinate Traffic Signal Systems measure, will be enhanced as a result of this measure. The methodology developed for the Coordinate Traffic Signal Systems measure was followed in the modeling of this measure, resulting in an emissions reduction of 0.04 metric tons of VOCs,

$$95 \text{ intersections} \times \frac{62.9 \text{ hours}}{\text{Intersection}} \times \frac{7.41 \text{ grams}}{\text{hour}} \times \frac{1 \text{ metric ton}}{1 \times 10^6 \text{ grams}} = \frac{0.04 \text{ metric tons}}{\text{day}}$$

0.24 metric tons of CO,

$$95 \text{ intersections} \times \frac{62.9 \text{ hours}}{\text{Intersection}} \times \frac{40.81 \text{ grams}}{\text{hour}} \times \frac{1 \text{ metric ton}}{1 \times 10^6 \text{ grams}} = \frac{0.24 \text{ metric tons}}{\text{day}}$$

and 0.02 metric tons of NOx.

$$95 \text{ intersections} \times \frac{62.9 \text{ hours}}{\text{Intersection}} \times \frac{2.68 \text{ grams}}{\text{hour}} \times \frac{1 \text{ metric ton}}{1 \times 10^6 \text{ grams}} = \frac{0.02 \text{ metric tons}}{\text{day}}$$

***Installation of ITS through the AzTECH program***

This portion of the ITS measure affects net CO emissions through an increase in average vehicle speeds. The installation of ITS alerts drivers of congestion incidents, permitting efficient rerouting of traffic and increasing vehicle speeds. The average, per vehicle-mile, change in emission rates from the speed increase was estimated using MOBILE6. The change in per vehicle-mile emissions was multiplied by the vehicle miles traveled on each affected facility type to estimate the net change in emissions.

Four vehicle speeds were processed, reflecting data in the Final Report of the Governor's Alternative Transportation System Task Force. These speeds are 30.3 and 20 miles per hour, reflecting arterial speeds with and without implementation of the measure and 33.3 and 23.9 miles per hour, reflecting freeway speeds with and without the measure.

The Governor's Alternative Transportation System Task Force estimates that two congested miles per vehicle on arterials and two congested miles per vehicle on freeways could be avoided per congestion incident with the system. Combining the emission rate savings estimated with MOBILE6 with congested mileage savings estimated by the Task Force, the following pollution change was estimated per vehicle:

$$\frac{2 \text{ art. Miles}}{\text{Vehicle}} \times \frac{(0.56 - 0.48) \text{ grams}}{\text{Mile}} + \frac{2 \text{ fwy. Miles}}{\text{Vehicle}} \times \frac{(0.52 - 0.47) \text{ grams}}{\text{Mile}} = 0.26 \text{ gm/veh. VOC}$$

$$\frac{2 \text{ art. Miles}}{\text{Vehicle}} \times \frac{(5.6 - 5.1) \text{ grams}}{\text{Mile}} + \frac{2 \text{ fwy. Miles}}{\text{Vehicle}} \times \frac{(5.3 - 5.1) \text{ grams}}{\text{Mile}} = 1.4 \text{ gm/veh. CO}$$

$$\frac{2 \text{ art. Miles}}{\text{Vehicle}} \times \frac{(0.60 - 0.54) \text{ grams}}{\text{Mile}} + \frac{2 \text{ fwy. Miles}}{\text{Vehicle}} \times \frac{(0.57 - 0.54) \text{ grams}}{\text{Mile}} = 0.18 \text{ gm/veh. NOx}$$

Rerouting of vehicles was estimated to increase average vehicle trip length by 0.6 miles on non-congested arterials. This increase in trip length would offset the previously calculated emission changes by:

$$\frac{0.6 \text{ arterial miles}}{\text{Vehicle}} \times \frac{0.48 \text{ grams}}{\text{Mile}} = 0.29 \text{ grams/vehicle VOC}$$

$$\frac{0.6 \text{ arterial miles}}{\text{Vehicle}} \times \frac{5.10 \text{ grams}}{\text{Mile}} = 3.06 \text{ grams/vehicle CO}$$

$$\frac{0.6 \text{ arterial miles}}{\text{Vehicle}} \times \frac{0.54 \text{ grams}}{\text{Mile}} = 0.32 \text{ grams/vehicle NOx}$$

The result is a net emission increase of 0.03 grams of VOC, 1.66 grams of CO, and 0.14 grams of NOx per vehicle. The Governor's Alternative Transportation System Task Force estimates that the average congestion incident affects 9960 vehicles and that the 100 affected arterials (150 additional freeway miles with one arterial every 1.5 miles) each have an average of 1.5 incidents per 5 weekdays. The estimate of 150 additional freeway miles of instrumentation (equivalent to 100 arterials) is a conservative one because nearly 150 miles of arterial streets in eight "smart" corridors were complete by 1999. The estimate of

0.075 incidents per mile-day is based upon estimates in the Governor's Alternative Transportation System Task Force report which indicates that of 133 instrumented arterials, there are 0.3 incidents per day, covering 532 center lane miles, and therefore...

$$\frac{133 \text{ arterials}}{} \times \frac{0.3 \text{ incidents}}{\text{Day}} \times \frac{1}{532 \text{ CL miles}} = \frac{0.075 \text{ incidents}}{\text{Mile-day}}$$

The estimated pollution reduction per incident is:

$$\frac{9960 \text{ vehicles}}{\text{incident}} \times \frac{0.03 \text{ grams VOC increase}}{\text{Vehicle}} \times \frac{1 \text{ kg}}{1000 \text{ grams}} = \frac{0.3 \text{ kg VOC increase}}{\text{Incident}}$$

$$\frac{9960 \text{ vehicles}}{\text{incident}} \times \frac{1.66 \text{ grams CO increase}}{\text{Vehicle}} \times \frac{1 \text{ kg}}{1000 \text{ grams}} = \frac{16.5 \text{ kg CO increase}}{\text{Incident}}$$

$$\frac{9960 \text{ vehicles}}{\text{incident}} \times \frac{0.14 \text{ grams NOx increase}}{\text{Vehicle}} \times \frac{1 \text{ kg}}{1000 \text{ grams}} = \frac{1.4 \text{ kg NOx increase}}{\text{Incident}}$$

The final estimated increase from this portion of the measure is 0.005 metric tons of VOC, 0.19 metric tons of CO, and 0.02 metric tons of NOx per day.

$$\frac{150 \text{ miles}}{} \times \frac{.075 \text{ incidents}}{\text{Mile - day}} \times \frac{0.3 \text{ kg VOC}}{\text{Incident}} \times \frac{1 \text{ metric ton}}{1000 \text{ kg}} = \frac{0.004 \text{ metric tons VOC}}{\text{Day}}$$

$$\frac{150 \text{ miles}}{} \times \frac{.075 \text{ incidents}}{\text{Mile - day}} \times \frac{16.5 \text{ kg CO}}{\text{Incident}} \times \frac{1 \text{ metric ton}}{1000 \text{ kg}} = \frac{0.19 \text{ metric tons CO}}{\text{Day}}$$

$$\frac{150 \text{ miles}}{} \times \frac{.075 \text{ incidents}}{\text{Mile - day}} \times \frac{1.4 \text{ kg NOx}}{\text{Incident}} \times \frac{1 \text{ metric ton}}{1000 \text{ kg}} = \frac{0.02 \text{ metric tons NOx}}{\text{Day}}$$

***Freeway Management System Expansion***

The methodology developed by Sierra Research in the document Feasibility and Cost Effectiveness of New Air Pollution Control Measures Pertaining to Mobile Sources will be followed in the modeling of this measure. Sierra estimated that the FMS expansion would result in a change in freeway vehicle speeds for the years 1995 and 2005. For 1995, the freeway speeds were assumed to increase by 0.33 percent and for 2005 the speeds were assumed to increase 1.17 percent.

For the purposes of this analysis, theMOBILE6.2 model was run to estimate the change in emissions from an increase in freeway vehicle speeds of 1.17 percent. The resulting effect was an increase of CO freeway emissions by 0.38 percent, NOx emissions by 0.18 percent, and a decrease in VOC emissions by 0.22 percent. These effects were incorporated into the onroad modeling chain by reprogramming the M6Link model to apply these emission factor adjustments to freeway link emissions.

***Summary***

These post-processed changes to the emissions for each of the three pollutants are indicated in the following table. This emission changes are applied across the board. It is important to note that the change in emissions assumed for each component of the control measure are summed together since the benefit is generally applied to different roadways. The units in the table below are metric tons (mt) unless otherwise noted. A minus sign

indicates an emissions increase. The results are reported to the nearest 10 kg (equivalent to 0.01 metric tons) unless the effects are expected to be less than 0.01 metric tons.

The changes to the onroad emissions are applied to the onroad UAM-ready emissions using the EMSCOR utility, except for the FMS effects, which are applied using M6Link.

| Part of Measure | VOC | CO | NOx |
|---|---|---|---|
| Traffic Signal | 0.04 mt | 0.24 mt | 0.02 mt |
| AzTECH Program | -0.004 mt | -0.19 mt | -0.02 mt |
| FMS | 0.02 mt | -0.83 mt | -0.04 mt |
| Total | 0.06 mt | 0.78 mt (inc) | 0.04 mt (inc) |

The emission reduction credit attributable to this maintenance measure in 2015 is less than -0.1% (increase) and 0.1% for NOx and VOC respectively.

COMMITTED MAINTENANCE MEASURE #6

Tougher Enforcement of Vehicle Registration and Emission Test Compliance

September 11, 2003

The “Tougher Enforcement of Vehicle Registration and Emission Test Compliance” measure affects onroad emissions. With the implementation of this measure, the number of vehicles which are expected to be registered in the nonattainment area and tested in the I/M program is increased, resulting in a cleaner onroad vehicle fleet. The methodology used to estimate the emissions reduction is described below.

Without this control measure, the weighting of I/M versus non-I/M emission factors from the EPA MOBILE6 model (MOBILE6) was assumed to be 89.6 percent I/M and 10.4 percent non-I/M. The weighting factors are an input to the M6Link control file. This measure was modeled by adjusting the weighting between I/M and non-I/M emission factors from MOBILE6.

The Report of the Governor’s Air Quality Strategies Task Force, December 2, 1996 estimated that an additional 41,000 vehicles would be emission tested as a result of this measure. This estimate was confirmed with the Arizona Department of Environmental Quality and the Arizona Department of Transportation as being a reasonable, and perhaps conservative, estimate of the number of vehicles registered as a result of this measure.

This measure was modeled by an adjustment of the weighting between I/M and non-I/M emission factors from MOBILE6. The number of vehicles registered in Maricopa County is during the time of the Task Force estimate was approximately 1.83 million. The inspection of an additional 41,000 vehicles would be an additional 2.0 percent of the vehicles being emissions tested. It is assumed that the increase in the vehicles being emission tested, taken as a fraction, would remain constant or increase over time. The number of vehicles which participate in the I/M program was increased by 2.0 percent for the 2015 analysis, changing the weighting from 89.6/10.4 to 91.6/8.4.

The emission reduction credit attributable to this maintenance measure in 2015 is 0.1% and 0.1% for NOx and VOC respectively.

COMMITTED MAINTENANCE MEASURE #7

Maricopa County Rule 348: Aerospace Manufacturing and Rework Operations

September 9, 2003

Maricopa County adopted Rule 348 on April 4, 1999 to implement reasonably available control technology (RACT) for aerospace manufacturing and rework operations. The rule was approved into the SIP effective November 19, 1999 (64 FR 50759). The purpose of the rule is to limit the emissions of volatile organic compounds from the manufacture and rework of aerospace vehicles and their components. Some of the vehicles included in Rule 348 are airplanes, helicopters, missiles, rockets and space vehicles.

This SIP approved measure is a RACT measure in the Serious Area Ozone Plan and a RACT and committed measure in the Maintenance Plan. Additional information on this measure can be found in the Serious Area Ozone Plan on page 2-4. Rule 348 has a control efficiency of 3% and rule effectiveness of 80% for SCC codes 31399999, 39999999, 40200701, 40100901, 40203001, 40299999, 40400213, and 40799999.

Since CNTLEM can not be run on point sources in EPS2.0, this measure was applied to the appropriate point sources/SCC codes in a spreadsheet and then entered into the 2015 ozone point source emission inventory files (in EPS2.0 AFS format) and run through the EPS2.0 modeling chain.

The emission reduction credit attributable to this maintenance measure in 2015 is less than 0.1% for VOC. There is no effect on NOx.

# APPENDIX B

# APPENDIX B

# EXHIBIT 1:

# RESOLUTION TO IMPLEMENT RACT FOR THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA. MARICOPA COUNTY BOARD OF SUPERVISORS. DECEMBER 17, 2003.

Maricopa Association of Governments
Received
JAN 10 2004

**RESOLUTION TO IMPLEMENT RACT FOR THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

**WHEREAS,** as the Maricopa Association of Governments (MAG) has been designated by the Governor of Arizona as the regional air quality planning agency in Maricopa County; and

**WHEREAS,** the Maricopa County nonattainment area has been reclassified as a Serious Area for ozone according to the Clean Air Act; and

**WHEREAS,** the One-hour Ozone Redesignation Request and Maintenance Plan is required to include Reasonably Available Control Technology (RACT); and

**WHEREAS,** MAG's goal is to request redesignation to attainment for the one-hour ozone standard; and

**WHEREAS,** an enforceable commitment to complete implementation of RACT in three source categories; and

**WHEREAS,** Arizona Revised Statutes 49-406 G. requires that each agency that commits to implement a control measure describe that commitment in a resolution adopted by the governing body which specifies its authority for implementing the measures as provided in statute, ordinance, or rule; a program for enforcement of the measures; and the level of personnel and funding allocated to the implementation of the measure.

**NOW, THEREFORE BE IT RESOLVED BY THE BOARD OF SUPERVISORS, MARICOPA COUNTY (BOARD)** as follows:

**SECTION 1.** That the BOARD agrees to proceed with a good faith effort to implement the measures identified in Exhibit A, which is part of this resolution.

**SECTION 2.** That the BOARD commits to implement the measures as scheduled and with the funding sources identified. Recognizing, however, that the availability of necessary funding may depend on the funding programs or processes of various state and federal agencies, Maricopa County reserves the right to reevaluate and, if necessary, modify the funding or schedules for implementation actions.

**PASSED AND ADOPTED** by the Board of Supervisors of Maricopa County, Arizona, this 17th day of December, 2003

Fulton Brock, Chairman

ATTEST:

Clerk of the Board

# EXHIBIT A

# ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN

## ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN

**Measure Title:** RACT for Major Sources and Sources Subject to CTGs. This revised commitment supercedes all previous commitments identified as the Serious Area One-hour Ozone Plan.

**Measure Description:** Complete implementation of RACT for three remaining source categories by revising Rule 331 Solvent Cleaning to correct deficiencies identified by EPA, adopting new proposed Rule 358 Polystyrene Foam Operations, and issuing the Title V permit for a fiberboard saturator and submitting the RACT provisions as a SIP revision.

**Responsible Agency and Authority for Implementation:** The Maricopa County Board of Supervisors is authorized by A.R.S. §49-479 to adopt rules for air pollution control and by A.R.S. §49-480 to establish, administer and enforce a program for air quality permits. The Board adopted rules establishing an air quality permit program and pursuant to A.R.S. §49-473, designated the Environmental Services Department to issue permits and administer and enforce the permit program. By operation of A.R.S. §49-471, the executive head of the department designated under A.R.S. §49-473 serves as the Air Pollution Control Officer. The Air Pollution Control Officer is specifically authorized to take the enforcement actions set forth in A.R.S.§§49-502, 49-511, 49-512 and 49-513.

**Implementation Schedule:** Specific commitments are described below:

Revise Rule 331 Solvent Cleaning:

| | |
|---|---|
| November—December 2003 | Conduct workshops and stakeholder meetings. |
| February—March 2004 | Publish Notice of Proposed Rulemaking and conduct Oral Proceeding. |
| April—May 2004 | Board consideration and action on Draft Notice of Final Rulemaking. |
| May—June 2004 | Rule becomes effective 30 days after Board action as the revisions are administrative. |
| July 2004 | Submit rule to EPA. |

New Rule 358 Polystyrene Foam Operations

| | |
|---|---|
| November—December 2003 | Publish Notice of Proposed Rulemaking and conduct Oral Proceeding. |
| February—March 2004* | Board consideration and action on Draft Notice of Final Rulemaking. |
| March—April 2004 | Rule becomes effective 30 days after Board action as the revisions are administrative. Proposed implementation schedule requires installation of controls within 18 months of rule adoption. |

| | |
|---|---|
| April—June 2004 | Submit rule to EPA. |

*Add two—three additional months if public comments require a substantive revision to the proposed rule

Source Specific RACT by Permit

| | |
|---|---|
| October—December 2003 | Notification of availability of draft Title V permit published. Comment period closes December 5, 2003. |

1. No public comment or extension request:

| | |
|---|---|
| December 2003 | Submit to EPA for 45-day review and comment. |
| February 2003 | Address comments and finalize permit. |
| February—March 2004 | Publish notice of SIP revision and hold public hearing. |
| April 2004 | Submit source-specific RACT provisions from permit to EPA. |
| February—May 2004 | Complete design and award contracts for emission control system (ECS) |
| January 2005 | Complete installation of ECS |
| March 2005 | Complete performance testing on new ECS |

2. Extension request without public comment adds 30 days to schedule in 1.

3. Public comment without a request for public hearing adds 15 additional days to 1 and 2.

4. Public Hearing request will add 90 additional days to schedule for 1 and 2. EPA may also find it necessary to request an extension of their comment period.

5. EPA objections will add another 90 days for Department response plus another 45 day EPA review period to schedule in 1.

**Level of Personnel and Funding:**

Manpower: The Department has 19 inspectors, aides, engineers, and supervisors who are available to monitor compliance at previously permitted facilities, perform field observations and respond to complaints as needed.

Funding: Maricopa County Environmental Service Department's annual revenue for the air quality program is anticipated to be approximately $6 million.

**Enforcement Program:** These requirements are administered through a permit program which includes review of permit, inspection of facilities, performance of compliance test methods and

review of records and activities. The Department's enforcement options include orders of abatement, civil actions for injunctive relief or civil penalties, and filing a class 1 misdemeanor citation. The actual process is further described in the Department's Air Enforcement Policy. The enforcement policy includes:

- guidelines for initiating various enforcement actions
- guidelines for reinspection
- defines the timely and appropriate action by laying out guidelines for which type of violation is appropriate for specific enforcement actions and for the timeframes for escalating enforcement actions when appropriate
- identify high priority violations
- guidelines for when to seek penalties reflecting the economic benefit of non-compliance, if feasible
- guidelines for seeking and determining higher penalties, when appropriate, for repeat violations of the same nature

**Monitoring Program:** The Department will track the milestones in each facility's compliance schedule contained in Rule 358 and the Title V permit for the fiberboard saturator to verify that RACT has been implemented.

The Department is not anticipating any additional emission reductions from the revision necessary to correct the deficiencies identified by EPA for Rule 331. The revisions are primarily administrative in nature. The department estimates that approximately 100—150 TPY have been or will be reduced by sources complying with new Rule 358 Polystyrene Foam Operations. Another 24 TPY is estimated to be reduced when the fiberboard saturator implements the new controls in 2005 (56.3 TPY X 0.85 = 24.1 TPY).

# APPENDIX B

# EXHIBIT 2:

# NEGATIVE DECLARATION FOR FIBERGLASS BOAT MANUFACTURING. LETTER FROM MARICOPA COUNTY TO ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY. NOVEMBER 25, 2003.

# Maricopa County
Environmental Services Department

Albert F. Brown, Director
.001 North Central, Ste 595
Phoenix, Arizona 85004-1950
Phone: (602) 506-6623
Fax: (602) 506-5141
TDD: (602) 506-6704

November 25, 2003

Mr. Stephen A. Owens, Director
Arizona Department of Environmental Quality
1110 W. Washington St.
Phoenix, Arizona 85007

Dear Mr. Owens:

Under CAA sections 182(a)(2)(A) and (b)(2) a State Implementation Plan (SIP) for moderate and above ozone nonattainment areas must include reasonably available control technology (RACT) for source categories covered by control technique guidelines (CTGs) and all other major sources. To fulfill the CAA section § 182 (b)(2)(C), Maricopa County agreed to impose source-specific RACT standards in Title V permits for four major sources in three source categories listed in Chapter 2 of the Final Serious Area Ozone State Implementation Plan for Maricopa County. Fiberglass Boat Manufacturing is on that list.

With this letter I am providing notice that Sea Ray Boats, Inc. located at 4140 East Raymond Street, Phoenix, AZ 85040, closed their manufacturing facility on December 31, 2001 prior to issuance of their Title V permit. A copy of the closure request letter is attached.

In order to ensure our compliance with the referenced SIP commitments, the Environmental Services Department (MCESD) reviewed Department permit files, the 2002 Arizona Industrial Directory and the Toxic Release Inventory System to determine if any other major sources of fiberglass boat manufacturing exist in Maricopa County. Based on this review, MCESD declares that there are no other major sources of fiberglass boat manufacturing present in Maricopa County.

Thank you for your cooperation and consideration. If you have any questions, please contact Jo Crumbaker of my staff at (602) 506-6705.

Sincerely,

Albert F. Brown, R.S., M.P.A.
Director

Enclosure

Cc: Julie Rose, EPA
Wienke Tax, EPA
Nancy Wrona, ADEQ
Lindy Bauer, MAG

December 3, 2001

Mr. Dale Lieb
Manager, Title V Permits Section
Maricopa County Environmental Services Department
Air Pollution Control Division
First Floor
1001 North Central Avenue, Suite 100
Phoenix, Arizona 85004

**Subject: Notification of Intent to Cancel Existing Unitary Operating Permits and Related Minor Modifications to Existing Maricopa County Air Quality Permits for Sea Ray Boats, Inc. Facility Located at 4140 E. Raymond St., Phoenix, Arizona 85040**

Dear Mr. Lieb:

Sea Ray Boats, Inc. (Sea Ray) is submitting this letter to notify Maricopa County Environmental Services Department (MCESD), Air Pollution Control Division (APCD), of Sea Ray's intent to close the Phoenix, facility and cease operations at the facility located at 4140 East Raymond Street, Phoenix, Arizona, no later than December 31, 2001. Sea Ray will be relocating existing equipment, materials/chemicals and finished products from Phoenix to an existing facility in Knoxville, Tennessee.

Existing process and support equipment covered under previously submitted air quality permits and related minor modifications will be maintained in storage, or utilized in the manufacturing process(es) at the Tennessee facility; or otherwise disposed of. Therefore, Sea Ray requests to cancel existing MCESD unitary operating air quality permits including permit numbers 8603022, 9300166 and V95012 on December 31, 2001; Sea Ray also requests to cancel all related minor modifications to those existing Maricopa County air quality permits.

Sea Ray would also like to withdraw the Title V Air Quality permit application previously submitted to MCESD on September 18, 1995.

In addition to canceling the air quality permits and related minor modifications, Sea Ray requests to cancel related operation and maintenance (O&M) plans for air pollution control equipment identified in the air quality permit numbers 8603022, 9300166 and V95012, and related minor modifications.

RECEIVED

DEC 12 2001

MCESD
AIR QUALITY DIVISION
ADMINISTRATION

i:\swg\project\searay\airpermitcancel.ltr\12/06/2001slb

Should you have any questions regarding this letter or require additional information, please do not hesitate to contact Mr. Nate Carr (Sea Ray) (602) 437-1120; or Mr. Pete Cantelou (Cantelou, Powell, Inc.) at (321) 259-1525. Upon final closure of the Phoenix facility, Mr. Cantelou will remain as Sea Ray's contact for environmental issues.

Sincerely,

**SEA RAY BOATS, INC.**

Ken Oglesby
General Manager

cc: Mr. Nate Carr, Environmental, Health & Safety Manager, Sea Ray Boats, Inc., Phoenix, Arizona
Mr. Steve Bowles, The Southwestern Group, L.L.C., Tempe, Arizona
Mr. Carroll Dekle, Maricopa County Environmental Services Department, Phoenix, Arizona
Mr. Pete Cantelou, Cantelou, Powell, Inc., Melbourne, Florida

SLB:slb

# APPENDIX C

# APPENDIX C

# EXHIBIT 1:

# PUBLIC HEARING PROCESS DOCUMENTATION

**CERTIFICATION OF HOLDING OF PUBLIC HEARING ON THE MAG ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

I affirm that a public hearing was held jointly by the Arizona Department of Environmental Quality and the Maricopa Association of Governments (MAG) starting at 5:30 p.m. Monday, March 1, 2004 at the MAG Offices, Saguaro Room, 302 North 1st Avenue, Phoenix, Arizona and that the hearing was held in accordance with the Arizona open meeting laws and 40 CFR 51.102 (d) to receive public comment on the MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area.

March 1, 2004
Date

Gaye Knight
Gaye Knight, City of Phoenix
Member of the MAG Air Quality Technical
Advisory Committee/Hearing Officer

STATE OF ARIZONA )
) ss.
COUNTY OF MARICOPA )

Personally appeared before me the above-named Gaye Knight known to me to be the same person who executed the foregoing instrument and to be the City of Phoenix representative on the Maricopa Association of Governments Air Quality Technical Advisory Committee and acknowledged to me that she executed the same as her free act.

SUBSCRIBED AND SWORN TO before me on this 2nd day of March 2004.

OFFICIAL SEAL
VALERIE DAY
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires Aug. 16, 2004

Valerie Day
Notary Public

My Commission Expires:
August 16, 2004

**AFFIDAVIT OF PUBLICATION**

# THE ARIZONA REPUBLIC

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Gloria Saldivar, being first duly sworn, upon oath deposes and says: That she is a legal advertising representative of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

**The Arizona Republic**

**January 30, 2004**

Gloria Saldivar

Sworn to before me this
3RD day of
February A.D. 2004

OFFICIAL SEAL
MARILYN GREENWOOD
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires May 23, 2007

Marilyn Greenwood
Notary Public

**PUBLIC HEARING ON THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

March 1, 2004-5:30 p.m.
MAG Offices, Saguaro Room
302 N. 1st Avenue, Second Floor Phoenix, Arizona 85003

The Arizona Department of Environmental Quality (ADEQ) and Maricopa Association of Governments (MAG) will jointly conduct a public hearing on the Draft One-Hour Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. The purpose of the hearing is to receive public comments.

ADEQ and MAG are requesting that the U.S. Environmental Protection Agency redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred since 1996. The modeling analysis in the ozone maintenance plan demonstrates that the standard will continue to be met through 2015. With the submittal of this request and plan, the Maricopa County nonattainment area has satisfied all of the requirements to be redesignated to attainment for the one-hour ozone standard.

The maintenance plan includes some measures which apply to Area A as defined by the Arizona Legislature in 2001. Area A is larger than the one-hour ozone nonattainment area and includes portions of Maricopa, Pinal, and Yavapai counties. Also, the plan contains a negative declaration from the Maricopa County Environmental Services Department that there are no longer major sources of fiberglass boat manufacturing present in the Maricopa County area.

The draft document is available for review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Public comments are welcome at the hearing, or may be submitted in writing by 5:30p.m. on March 1, 2004 to Lindy Bauer at the address below. After considering the public comments, the MAG Regional Council may take action on the redesignation request and maintenance plan on March 24, 2004. The ADEQ may then adopt the plan for submittal to the EPA.

Contact Person: Lindy Bauer, MAG (602) 254-6300 302 N. 1st Avenue, Suite 300 Phoenix, AZ 85003 Fax: (602) 254-6490

**04038** January 30, 2004

MARICOPA ASSOCIATION of GOVERNMENTS

302 North 1st Avenue, Suite 300 ▲ Phoenix, Arizona 85003
Phone (602) 254-6300 ▲ FAX (602) 254-6490
E-mail: mag@mag.maricopa.gov ▲ Web site: www.mag.maricopa.gov

January 30, 2004

TO: Interested Parties for Air Quality

FROM: Lindy Bauer, Environmental Director

SUBJECT: PUBLIC HEARING ON THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

Public Hearing
March 1, 2004 at 5:30 p.m.
MAG Office, Saguaro Room
302 N. 1st Avenue, Second Floor
Phoenix, Arizona 85003

The Maricopa Association of Governments (MAG) and the Arizona Department of Environmental Quality will jointly conduct a public hearing on the Draft One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. The purpose of the hearing is to receive public comments on the redesignation request and maintenance plan which demonstrates that the one-hour ozone standard will continue to be met through 2015.

The maintenance plan includes some measures which apply to Area A as defined by the Arizona Legislature in 2001. Area A is larger than the one-hour ozone nonattainment area and includes portions of Maricopa, Pinal, and Yavapai counties. Also, the plan contains a negative declaration from the Maricopa County Environmental Services Department that there are no longer major sources of fiberglass boat manufacturing present in the Maricopa County area.

The U.S. Environmental Protection Agency is also being requested to redesignate the nonattainment area to attainment for one-hour ozone standard. There have been no violations of the federal one-hour ozone standard in the area since 1996. For your information and convenience, a copy of the public hearing notice is enclosed. The documents are available for public review at the MAG Office, third floor, from 8:00 a.m. to 5:00 p.m. Monday through Friday.

Please publish the following announcement as a legal advertisement in the Arizona Republic on Friday, January 30, 2004.

**PUBLIC HEARING ON THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

March 1, 2004 - 5:30 p.m.
MAG Offices, Saguaro Room
302 N. 1st Avenue, Second Floor
Phoenix, Arizona 85003

The Arizona Department of Environmental Quality (ADEQ) and Maricopa Association of Governments (MAG) will jointly conduct a public hearing on the Draft One-Hour Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. The purpose of the hearing is to receive public comments.

ADEQ and MAG are requesting that the U.S. Environmental Protection Agency redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred since 1996. The modeling analysis in the ozone maintenance plan demonstrates that the standard will continue to be met through 2015. With the submittal of this request and plan, the Maricopa County nonattainment area has satisfied all of the requirements to be redesignated to attainment for the one-hour ozone standard.

The maintenance plan includes some measures which apply to Area A as defined by the Arizona Legislature in 2001. Area A is larger than the one-hour ozone nonattainment area and includes portions of Maricopa, Pinal, and Yavapai counties. Also, the plan contains a negative declaration from the Maricopa County Environmental Services Department that there are no longer major sources of fiberglass boat manufacturing present in the Maricopa County area.

The draft document is available for review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on March 1, 2004 to Lindy Bauer at the address below. After considering the public comments, the MAG Regional Council may take action on the redesignation request and maintenance plan on March 24, 2004. The ADEQ may then adopt the plan for submittal to the EPA.

Contact Person: Lindy Bauer, MAG (602) 254-6300
302 N. 1st Avenue, Suite 300
Phoenix, AZ 85003
Fax: (602) 254-6490

TITLE VI
LETTER EXAMPLE

MARICOPA ASSOCIATION of GOVERNMENTS

302 North 1st Avenue, Suite 300 ▲ Phoenix, Arizona 85003
Phone (602) 254-6300 ▲ FAX (602) 254-6490
Email: mag@mag.maricopa.gov ▲ Website: www.mag.maricopa.gov

January 30, 2004

Mr. Jeff Battle
President & CEO
Scottsdale Foundation for the Handicapped
7507 E. Osborn Road
Scottsdale, Arizona 85251

Dear Mr. Battle:

You are cordially invited to the public hearing on the Draft One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. The hearing will be held jointly by the Arizona Department of Environmental Quality and Maricopa Association of Governments on Monday, March 1, 2004 at 5:30 p.m. in the Saguaro Room at the MAG Office, 302 N. 1st Avenue, Second Floor, Phoenix, Arizona, 85003. The purpose of the hearing is to discuss the draft document and receive comments. Written and verbal comments are welcomed at the public hearing. After considering the public comments, the MAG Regional Council may take action on the redesignation request and maintenance plan on March 24, 2004.

The U.S. Environmental Protection Agency is being requested to redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred in the area since 1996. The air quality modeling analysis in the maintenance plan demonstrates that the standard will continue to be met through 2015. With the submittal of this request and plan, the Maricopa County nonattainment area has satisfied all of the requirements to be redesignated to attainment for the one-hour ozone standard.

The draft documents are available for review at the MAG Office, third floor, from 8:00 a.m. to 5:00 p.m., Monday through Friday. We hope to see you or your representative at the hearing and to include your input in future planning efforts. For your convenience, a copy of the public hearing notice is attached. If you have any questions or would like to set up a time for us to meet with your organization, please call me at (602) 254-6300.

Sincerely,

Lindy Bauer

Lindy Bauer
Environmental Director

Please publish the following announcement as a legal advertisement in the Arizona Republic on Friday, January 30, 2004.

**PUBLIC HEARING ON THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

March 1, 2004 - 5:30 p.m.
MAG Offices, Saguaro Room
302 N. 1st Avenue, Second Floor
Phoenix, Arizona 85003

The Arizona Department of Environmental Quality (ADEQ) and Maricopa Association of Governments (MAG) will jointly conduct a public hearing on the Draft One-Hour Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. The purpose of the hearing is to receive public comments.

ADEQ and MAG are requesting that the U.S. Environmental Protection Agency redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred since 1996. The modeling analysis in the ozone maintenance plan demonstrates that the standard will continue to be met through 2015. With the submittal of this request and plan, the Maricopa County nonattainment area has satisfied all of the requirements to be redesignated to attainment for the one-hour ozone standard.

The maintenance plan includes some measures which apply to Area A as defined by the Arizona Legislature in 2001. Area A is larger than the one-hour ozone nonattainment area and includes portions of Maricopa, Pinal, and Yavapai counties. Also, the plan contains a negative declaration from the Maricopa County Environmental Services Department that there are no longer major sources of fiberglass boat manufacturing present in the Maricopa County area.

The draft document is available for review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on March 1, 2004 to Lindy Bauer at the address below. After considering the public comments, the MAG Regional Council may take action on the redesignation request and maintenance plan on March 24, 2004. The ADEQ may then adopt the plan for submittal to the EPA.

Contact Person: Lindy Bauer, MAG (602) 254-6300
302 N. 1st Avenue, Suite 300
Phoenix, AZ 85003
Fax: (602) 254-6490

MARICOPA ASSOCIATION of GOVERNMENTS

302 North 1st Avenue, Suite 300 ▲ Phoenix, Arizona 85003
Phone (602) 254-6300 ▲ FAX (602) 254-6490
E-mail: mag@mag.maricopa.gov ▲ Web site: www.mag.maricopa.gov

February 2, 2004

TO: Leslie Rogers, Federal Transit Administration
Robert Hollis, Federal Highway Administration
Stephen Owens, Arizona Department of Environmental Quality
Victor Mendez, Arizona Department of Transportation
Ken Driggs, Regional Public Transportation Authority
Al Brown, Maricopa County Environmental Services Department
Wienke Tax, U. S. Environmental Protection Agency, Region IX

FROM: Lindy Bauer, Environmental Director

SUBJECT: TRANSMITTAL OF THE DRAFT ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

The Maricopa Association of Governments has prepared a Draft One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area (see attached plan and appendices). The U.S. Environmental Protection Agency is being requested to redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred in the area since 1996.

The air quality modeling analysis in the maintenance plan demonstrates that the standard will continue to be met through 2015. With the submittal of this request and plan, the Maricopa County nonattainment area has satisfied all of the requirements to be redesignated to attainment for the one-hour ozone standard.

On March 1, 2004, a public hearing will be conducted jointly by the Arizona Department of Environmental Quality and MAG at the MAG Offices, Saguaro Room, Second Floor, Phoenix, Arizona at 5:30 p.m. After considering public comments, the MAG Regional Council may take action on the redesignation request and maintenance plan on March 24, 2004. If you have any questions, please do not hesitate to contact me at (602) 254-6300.

Please publish the following announcement as a legal advertisement in the Arizona Republic on Friday, January 30, 2004.

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The maintenance plan includes some measures which apply to Area A as defined by the Arizona Legislature in 2001. Area A is larger than the one-hour ozone nonattainment area and includes portions of Maricopa, Pinal, and Yavapai counties. Also, the plan contains a negative declaration from the Maricopa County Environmental Services Department that there are no longer major sources of fiberglass boat manufacturing present in the Maricopa County area.

The draft document is available for review at the MAG Offices, third floor, from 8:00 a.m. to 5:00 p.m. Public comments are welcome at the hearing, or may be submitted in writing by 5:30 p.m. on March 1, 2004 to Lindy Bauer at the address below. After considering the public comments, the MAG Regional Council may take action on the redesignation request and maintenance plan on March 24, 2004. The ADEQ may then adopt the plan for submittal to the EPA.

Contact Person: Lindy Bauer, MAG (602) 254-6300
302 N. 1st Avenue, Suite 300
Phoenix, AZ 85003
Fax: (602) 254-6490

ORIGINAL

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

AND

MARICOPA ASSOCIATION OF GOVERNMENTS

PUBLIC HEARING

MAG One-Hour Ozone Redesignation Request
and Maintenance Plan
for the Maricopa County Nonattainment Area

Phoenix, Arizona
March 1, 2004
5:30 p.m.

Prepared For:

MARICOPA ASSOCIATION OF GOVERNMENTS
(Original)

Prepared By:

LORENA W. ELDER
Court Reporter

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

AND

MARICOPA ASSOCIATION OF GOVERNMENTS

PUBLIC HEARING

MAG One-Hour Ozone Redesignation Request

and Maintenance Plan

for the Maricopa County Nonattainment Area

commenced at 5:30 p.m. on March 1, 2004, at the offices of Maricopa Association of Governments, 302 North First Avenue, Suite 300, Phoenix, Arizona, before LORENA W. ELDER, a Court Reporter in and for the County of Maricopa, State of Arizona.

* * * * *

A P P E A R A N C E S

Arizona Department of Environmental Quality:
Nancy Wrona - Director of the Air Quality Division

Maricopa Association of Governments:
Gaye Knight - City of Phoenix
MAG Air Quality Technical Advisory Committee

STIPULATION

IT IS STIPULATED by and between counsel for the respective parties hereto that the hearing of

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

AND MARICOPA ASSOCIATION OF GOVERNMENTS

may be taken before LORENA W. ELDER, a court reporter in and for the County of Maricopa, State of Arizona.

IT IS FURTHER STIPULATED that the hearing is taken pursuant to the Rules of Civil Procedure relating to the taking and returning of hearings for use in the Superior Court of Arizona, County of Maricopa; and that notice of filing and other formalities required by law for the taking and returning of said hearing are waived.

Phoenix, Arizona
March 1, 2004
5:31 p.m.

* * * * *

PROCEEDINGS

MS. KNIGHT: I want to welcome all of you tonight for the public hearing. We're going to open it now.

This public hearing is being held jointly with the Arizona Department of Environmental Quality and the Maricopa Association of Governments to receive public comments on the Draft MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area.

My name is Gaye Knight. I will be the hearing officer tonight, and this is Nancy Wrona from the Arizona Department of Environmental Quality.

Those driving to the meeting who parked in the garage can have their tickets validated by MAG staff.

The agenda tonight is the public hearing process, followed by introductory remarks from Nancy Wrona, a presentation by Lindy Bauer on the plan

itself, and then public comment. We'll begin with the presentation and then follow with public comments. The public hearing will begin with introductory remarks by the Department of Environmental Quality and an overview presentation by MAG staff.

Following the presentation hearing, participants are invited to make comments for the public record. A court reporter is present to provide an official record of the hearing. Written comments are also welcome at the hearing.

For those participants wishing to speak, please fill out a form on the table and place it in the box outside the door.

If you need to speak early to meet a bus schedule or to make other arrangements, please tell the MAG staff, and we'll accommodate the request. As you come to the podium, please state some information for this formal record: Your name and who you represent.

I would like to note that we have a timer to assist the public with their presentations. We have a three-minute time limit. When two minutes have elapsed, a yellow light will come on notifying the speaker that they have one minute to sum up. At the end of the three-minute time period, the red light

will come on.

Now we're going to begin the introductory remarks by Nancy Wrona.

MS. WRONA: Thank you, Gaye.

For the record, my name is Nancy Wrona. I'm the Director of the Air Quality Division of the Arizona Department of Environmental Quality.

As you mentioned, this is a joint public hearing to receive comments on the proposed One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area.

It has been suggested that ADEQ participate here as part of this hearing because the proposed plan includes control measures that are implemented both within MAG and ADEQ air quality planning areas.

We believe the plan demonstrates that the Maricopa County Nonattainment Area has attained and will continue to attain the one-hour national ambient air quality standards for ozone.

And we appreciate the opportunity to join with our colleagues at MAG this evening.

MS. KNIGHT: Thank you, Nancy.

Now Lindy Bauer, MAG staff, will give a presentation on the plan.

MS. BAUER: Thank you very much.

I too would like to welcome you to our public hearing.

My name is Lindy Bauer. I'm the Environmental Director with MAG.

Tonight this public hearing is on the One-Hour Ozone Redesignation Request and Maintenance Plan.

Ozone is our summertime air-pollution problem. Ozone is not directly emitted from any source. Instead, it's formed by a chemical reaction that may occur between volatile organic compounds and nitrogen oxides in the presence of sunlight with minimal winds and high temperatures.

This region was designated as a serious nonattainment area for the One-Hour Ozone Standard effective February 13, 1998.

Now, over time, I'm pleased to report to you that there have been significant strides made to reduce the one-hour ozone pollution problem in this region.

This chart indicates a number of ozone exceedance days.

As you can see for the last seven years, there have been no exceedances of the One-Hour Ozone Standard within this region. Since there have been no

1 violations of the standard for several years, we are
2 now officially requesting that this region be
3 redesignated to attainment status for the One-Hour
4 Ozone Standard.
5 There are five steps toward redesignation to
6 attainment status.
7 The first step involves an EPA determination
8 that the one-hour standard has been attained. EPA has
9 made this determination. It was effective June 29,
10 2001.
11 Secondly, EPA approves this Revised Serious
12 Area Plan. EPA has not yet taken action on this plan.
13 It was submitted by the Arizona Department of
14 Environmental Quality December 14, 2000.
15 Thirdly, EPA has to determine that the air
16 quality improvement is due to permanent and
17 enforceable reductions in emissions.
18 Fourth, EPA has to make a finding that the
19 State has met all of the Clean Air Act requirements
20 for the plans.
21 And finally, EPA has to approve the
22 maintenance plan.
23 I might also add that, during this time
24 period, we need to stay clean at the monitor without
25 ozone violations.

1 The new maintenance plan demonstrates that
2 the One-Hour Ozone Standard will continue to be met
3 through 2015, and these are the existing measures that
4 are in place that we are relying upon through time to
5 maintain that standard through 2015.
6 In order to reduce this problem and maintain
7 the standard, we took a look at the impact of these
8 measures both on volatile organic compounds and
9 nitrogen oxides. The concentration prediction for our
10 plan for 2015 is .120 parts per million.
11 Now, in 2015, this is the impact of the
12 measures on volatile organic compounds, so you can
13 take a look at the percent reduction.
14 The largest measure is the clean-burning
15 gasoline program that's in place during the summer
16 months. Then we have coordinate traffic signal
17 systems, tougher enforcement of vehicle registration,
18 and one-time waiver from the Vehicle Emissions Test.
19 This is part of the vehicle emissions testing program.
20 Then we have Maricopa County Rule 348. This
21 reduces emissions coming from Aerospace Manufacturing
22 and Rework Operations.
23 Developing intelligent transportation
24 systems and phased-in Vehicle Emissions Test
25 cutpoints.

1 Again, these are existing measures that have
2 been in place, and they are helping maintain the
3 standard through 2015.
4 Secondly, we also take a look at the impact
5 of the measures in 2015 on nitrogen oxides, and this
6 chart indicates this impact.
7 As you can see at the top, the clean-burning
8 gasoline program, the summer formula, that's the
9 largest impact.
10 We are also required to have contingency
11 measures for the plan. Now, in our plan, the
12 contingency measures are existing measures that are
13 being implemented early, which is allowed according to
14 the EPA guidelines.
15 The first one is Expansion of Area A
16 Boundaries to the west. Now, the area A boundary,
17 which is defined by the Arizona Legislature, was
18 included in two places in the plan.
19 First, we had the Area A Boundary expansion
20 to the east, which is in the base of our plan.
21 Secondly, as a contingency measure, we're
22 taking the expansion of Area A Boundaries to the west.
23 Now, the Area A Boundaries apply to several
24 measures. Among them are the vehicle emissions
25 testing program, clean-burning gasoline as well, along

1 with a number of different transportation control
2 measures.
3 We want to point out to you that Area A
4 includes portions of Maricopa, Pinal, and Yavapai
5 counties.
6 Secondly, the Gross Emitter Waiver
7 Provision. This is a provision that is in the vehicle
8 emissions testing program.
9 And the third contingency measure is the
10 Increased Waiver Repair Limit.
11 Now, in addition to these measures, we also
12 are required to have a process to prevent future
13 violations of the One-Hour Ozone Standard.
14 The process that's outlined in this
15 maintenance plan is that if the fourth highest hourly
16 measurement over the past three years exceeds .12
17 parts per million at any one monitor, this will
18 trigger the need to consider additional measures to
19 help get the area back into attainment status and
20 maintenance of the standard.
21 We also want to show you what the emissions
22 look like in 2015 for volatile organic compounds and
23 nitrogen oxides.
24 Now, this pie chart assumes that the
25 standard is maintained in 2015. And then within that

1 standard, this is where the volatile organic compound
2 emissions will be coming from. These are the
3 different sources.
4 I want to call your attention to the
5 lavender piece, nonroad mobile piece, of the pie.
6 This will serve as the motor vehicle emissions budget
7 for transportation conformity.
8 Transportation conformity is a requirement
9 under the Clean Air Act to make sure that
10 transportation plans, programs, and projects will not
11 cause violations of the air quality standards. So
12 these budgets for motor vehicles are actually set by
13 the air quality plans. And for 2015, the budget will
14 be 48.7 metric tons per day. In addition, we set a
15 2006 interim budget of 71.9 metric tons per day.
16 And now for nitrogen oxides. Again, we see
17 the sources assuming that we are maintaining the
18 One-Hour Ozone Standard.
19 The lavender -- well, actually it's a little
20 bit different color there, sort of light brown on this
21 chart -- shows that the budget will be 53.6 metric
22 tons per day. And then for 2006, the motor vehicle
23 emission budget or the interim budget will be 104.8
24 metric tons per day.
25 And finally, I'd like to point out that this

maintenance plan includes a negative declaration that there are no longer major sources of fiberglass boat manufacturing in Maricopa County.

The schedule that we have set out for the maintenance plan tonight is we will have the public hearing, and then we will respond to comments. We will present any comments made along with the responses to the MAG Air Quality Technical Advisory Committee on March 4.

On March 10, the MAG Management Committee will consider the recommendation from the Advisory Committee.

And on March 25th, the MAG Regional Council is anticipated to take action on this plan, and then the plan will be submitted to the Arizona Department of Environmental Quality for official submittal to the Environmental Protection Agency.

I also would like to mention that we received a letter from the Arizona Center for Law in the Public Interest to be entered into the public hearing record.

Thank you very much.

MS. KNIGHT: Thank you, Lindy.

Now, we'll open the public comment period. Public comments are invited now.

If you would like to speak, please fill out a speaker form and place it in the box. Please adhere to the three-minute time limit.

Do we have any public comments?

We note that no forms have been received at this time, so we'll close the public hearing.

Now that we have no responses, the Maricopa Association of Governments appreciates your interest in regional air quality issues.

Your comments will be presented to the MAG Air Quality Technical Advisory Committee at the March 4th meeting at 1:30 in the afternoon here in this room. A response to comments will be prepared and included in the planned document.

Thank you for your participation this evening.

(WHEREUPON, the hearing concluded at 5:45 p.m.)

STATE OF ARIZONA )
) ss.
COUNTY OF MARICOPA )

BE IT KNOWN that the foregoing hearing was taken by me, LORENA W. ELDER, a Court Reporter in and for the County of Maricopa, State of Arizona; that the foregoing pages are a true and correct transcript of all proceedings had upon the taking of said hearing, all done to the best of my skill and ability.

I FURTHER CERTIFY that I am in no way related to any of the parties hereto, nor am I in any way interested in the outcome hereof.

DATED at Phoenix, Arizona, this 4th day of March, 2004.

Lorena W. Elder
COURT REPORTER

Date March 1, 2004

# PUBLIC HEARING ON THE ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

| Name | Agency |
|---|---|
| MARK WHITTEN | ADOT |
| Beverly Chenu | ADOT |
| NANCY WRONA | ADEQ |
| Bruce Friedl | ADEQ |
| Ruey-in Chion | MAG |
| J. Parkinson | PCAQCD |
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**RESPONSE TO PUBLIC COMMENTS ON THE DRAFT MAG ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

**MARCH 1, 2004 PUBLIC HEARING**

The Maricopa Association of Governments (MAG) appreciates the comments made during the public comment period for the Draft MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. An advertised public hearing was conducted by MAG on March 1, 2004. No verbal testimony was presented at the hearing. Written comments were submitted from one entity. The following represents the MAG response to the comments received.

COMMENTS FROM ARIZONA CENTER FOR LAW IN THE PUBLIC INTEREST (fax dated March 1, 2004)

Comment: Attainment of the standard. While we obviously do not dispute that the Phoenix area has not violated the one hour ozone standard for the past five years, and has not had an exceedance since 1996, we note that some of the monitoring sites continue to record some very high values. Over the past summer, for example, Maricopa County issued a significant number of ozone alerts. Thus, while the Valley has officially "attained" the standard, ozone continues to be a serious problem that requires vigilant attention.

Response: The Environmental Protection Agency determined that the serious ozone nonattainment area has attained the one-hour ozone standard, effective June 29, 2001. The ozone nonattainment area has continued to record clean data at the monitor. Figure 2-2 from the One-Hour Ozone Redesignation Request and Maintenance Plan, illustrates the downward trend between 1995 and 2002 for the fourth-highest concentration of one-hour ozone average values. In 2003, preliminary one-hour ozone monitor data (not presented in the One-Hour Ozone Maintenance Plan) continue to show a downward trend with the fourth-highest concentration of one-hour ozone average of 100 ppm recorded at the Blue Point monitor.

The introduction of the eight-hour ozone air quality forecasts conducted by the Arizona Department of Environmental Quality between April 1, 2003 and September 30, 2003 resulted in a combined 45 watches and warnings issued. By comparison, the final one-hour ozone air quality forecast in 2001 resulted in just three high pollution advisories. To coincide with the new forecasts, an Ozone Outreach Program was initiated in the nonattainment area to increase the public's awareness of the new eight-hour ozone standard and to promote alternative modes of transportation and flexible work schedules.

Comment: EPA Approval of the Nonattainment SIP. As acknowledged in the Draft Plan, EPA has not yet approved the Serious Area Ozone Plan that was submitted in December 2000. We reserve

any and all objections previously assert regarding that plan (see Letter of Jennifer Anderson dated April 25, 2000) and incorporate those objections herein.

Response: The April 25, 2000 letter from Jennifer Anderson, Arizona Center For Law In The Public Interest, has been incorporated as an attachment to this response to comments along with the December 14, 2000 Arizona Department of Environmental Quality "Responsiveness Summary to Testimony Taken at the Ozone Oral Proceeding and Written Comments Received on the Serious Area Ozone State Implementation Plan for Maricopa County."

Comment: Contingency Measures. We disagree that the Draft Plan properly includes contingency measures. The measures designated as "contingency measures" in the Draft Plan are already implemented. According to Section 175(d), the purpose of contingency provisions is to assure that the state will promptly correct any violation of the standard which occurs after the redesignation of the area as an attainment area. Obviously, if the so called "contingency measures" are already being implemented when a violation occurs, there is nothing to suggest that their continued implementation would ensure that the situation will be corrected. Rather, the Act clearly envisions *additional* measures which are automatically and immediately implemented if and when a violation occurs. The state's commitment to adopt nonspecific additional contingency measures over a 15-21 month period if the "trigger" of at least four .120+ ppm is met falls far short of the requirement of the Act.

Response: The three contingency measures included in the One-Hour Ozone Maintenance Plan are Area A Expansion, Gross Polluter Option for I/M Program Waivers, and Increased Waiver Repair Limit Options. As indicated in the Maintenance Plan, these measures were not included in the modeling maintenance demonstration. Each of these measures have already been implemented in the nonattainment area. It is important to note that each measure will continue to provide emissions reductions through the maintenance year of 2015.

The guidance issued in an August 13, 1993 EPA memorandum indicates that areas may implement contingency measures early to ensure attainment of air quality standards. EPA notes that "in cases of early implementation of State contingency measures, we do not feel that it is necessary now to adopt additional contingency measures to backfill for the early activation of contingency measures".

The One-Hour Ozone Maintenance Plan indicates that in order to ensure that violations of the one-hour ozone standard do not occur in the future, ambient air quality monitoring data will be examined to determine if additional contingency measures are needed. Contingency provisions will be triggered when the fourth highest daily maximum hourly measurement over the past three years exceeds 0.120 ppm at any ozone monitor. If this occurs, additional measures will be considered, which may include the strengthening of existing contingency measures. This trigger is more stringent than the standard and will serve to prevent the occurrence of future violations. When activated, additional control measures would be considered on the following schedule: (A) verification of the monitoring data to be completed three months after activation of the trigger; (B) applicable measure to be considered for adoption six months after date established in A above; and (C) resultant committed measure to be implemented within six to twelve months, depending upon the time needed to put the measure in place.

**ADDENDUM TO**
**RESPONSE TO PUBLIC COMMENTS ON THE**
**DRAFT MAG ONE-HOUR OZONE REDESIGNATION REQUEST AND**
**MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

COMMENTS FROM DIANNE BARKER (Received by e-mail from Ms. Barker, dated March 15, 2004)

Comment: Reviewing MAG documents on ozone and PM-10, there no reason to redesignate the MAG region, nor eliminate Pinal boundary from serious classification protective of the public's air quality.

Response: The Maricopa Association of Governments (MAG) One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area requests that the U.S. Environmental Protection Agency (EPA) redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred in the area since 1996. The nonattainment area for the one-hour ozone standard is located within Maricopa County only. Pinal County is not included in the one-hour ozone nonattainment area.

Comment: Certainly, MAG's Executive Summary on one-hour ozone redesignation neither justifies EPA attaining criteria listed at (ES-1) while VOC and NOx, both required measured pollutants by EPA (ES-3), doesn't support any simplistic statement such as the attachment of MAG's February 4, 2003 letter to ADEQ regarding any lifting of Pinal County Area A on information of "eight-hour values are derived from one-hour averages". It is understood that the eight hour evaluation are even more stringent than that of one hour ozone standard. Furthermore, actually there have been 40 ozone violations in the region in the past year, despite the fact EPA chooses to overlook all except two (2) exceedances. Further worrisome information is recorded on MAG minutes dated January 15, 2004, page 3, regarding ADEQ saying, "2002 was a worse than average year for PM-10".

Response: The One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area contains a list of the Clean Air Act criteria that must be met before an area can be redesignated by EPA to attainment. These criteria are:

- The EPA must fully approve the Serious Area Ozone State Implementation Plan (SIP) for Maricopa County submitted to EPA in December 2000 and any related SIP components.
- EPA must determine that the area has attained the one-hour ozone standard. This determination was made by EPA effective on June 29, 2001.
- EPA must determine that the improvement in air quality is due to permanent and enforceable reductions in emissions.

- The State must meet all applicable requirements for SIPs and Nonattainment Areas as defined in the Clean Air Act.
- EPA must approve a maintenance plan for the area. The plan must demonstrate maintenance of the one-hour ozone standard for a period of at least ten years following the redesignation to attainment by EPA.

It is important to recognize that there are two federal standards for ozone: the one-hour and the new eight-hour standard. The February 4, 2003 letter to Arizona Department of Environmental Quality (ADEQ) contains additional information to support the Governor's Recommendation and Exclusion of Pinal Area A from the Eight-Hour Ozone Nonattainment Area. This letter is not pertinent to the One-Hour Ozone Redesignation Request and Maintenance Plan. Pinal County is not included in the one-hour ozone nonattainment area.

Also, particulate matter is not pertinent to the request for redesignation of the Maricopa County nonattainment area to attainment for the one-hour ozone standard. The comment in the MAG Air Quality Technical Advisory Committee minutes dated January 15, 2004, was related to an emissions inventory in a study area for the proposed Salt River PM-10 State Implementation Plan Revision.

Comment: Finally, a speaker listed on these same minutes, Mr. Blue Crowley, polled the MAG's Air Quality Technical Advisory Committee "to determine the number of people who carpooled or used transit". This poll should be given and answered by our MAG Regional Council members and its' staff also.

Response: At the January 15, 2004 MAG Air Quality Technical Advisory Committee meeting, public comment was received from Mr. Blue Crowley during "Call to the Audience". Mr. Crowley did not comment on the One-Hour Ozone Redesignation Request and Maintenance Plan. He did comment on the Regional Transportation Plan, including fire walls and profitability. He mentioned the profitability of crosswalks and bike lanes and asked how much life is worth. Mr. Crowley polled the Committee to determine the number of people who carpooled or used transit.

MAG supports regional trip reduction and rideshare programs that encourage the use of alternative transportation modes to reduce congestion and improve air quality. There are a variety of ways to attend a MAG meeting. For example, MAG provides transit tickets for those using public transit. Also, for those using a bicycle, a bike rack is available in the garage to secure bicycles. Others may choose to attend via telephone conference call or by using the Regional Videoconferencing System.

COMMENTS FROM JOSEPH RYAN (Received from Mr. Ryan at the March 24, 2004 MAG Regional Council meeting)

Comment: It is necessary to differentiate between government and the real world. The consumer drives vehicles that are getting bigger and the area's population over the next 20-year period will increase by 100,000 population annually resulting in an increase in vehicles that consume gasoline. Why discuss the one-hour ozone standard when the standard is changing? We need to address congestion. The Regional Transportation Plan includes an elevated freeway with extra lanes. Folks

it is already full. Don't try to attract more traffic. The region needs a change in strategy to access Downtown Phoenix and the airport. The present plan will not get you conformity. The trolley car in front of stations will only add to congestion. It is time to mix things up and get new consultants.

Response: In a July 18, 1997 final rulemaking, the Environmental Protection Agency (EPA) described its decision to replace the current one-hour ozone air quality standard with the more stringent eight-hour ozone standard. EPA's proposed rules to implement the eight-hour ozone standard were published on June 2, 2003. However, no final decision has been announced by EPA on the implementation of the new standard, including the transition from the one-hour to the eight-hour ozone standard. More recently, EPA has indicated that there may be more flexibility for areas redesignated to attainment for the one-hour standard when addressing eight-hour ozone requirements.

The remainder of the comments address issues from the Regional Transportation Plan, not the MAG One-Hour Ozone Redesignation Request and Maintenance Plan.

COMMENTS FROM DIANNE BARKER (Received from Ms. Barker at the March 24, 2004 MAG Regional Council meeting)

Comment: Ms. Barker noted that her comments had been provided in an e-mail sent earlier to MAG. She extended a "thank you" for the information provided by MAG staff. An objection was made regarding the redesignation request for the one-hour ozone standard. I've been a school bus driver. People should be responsible. Why did I do this? We're moving to an eight-hour ozone standard. In reference to the March 9, 2004 letter to the EPA Administrator, she commented that air quality not only continues to be a top priority for elected officials, but for citizens, too. The air quality at Indian School Road and 33rd Avenue area had an effect on my mother and sister's health. The Arizona Center For Law In The Public Interest backs up what I've commented on concerning the number of alerts and this requires vigilant attention. Also, as mentioned in the Arizona Center For Law letter, the Maintenance Plan needs additional contingency measures. She mentioned personal responsibility and noted that Mr. Crowley took a poll in one of the Committee meetings to determine the number of people who carpooled or used transit.

Response: The MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area requests that the U.S. Environmental Protection Agency (EPA) redesignate the Maricopa County nonattainment area to attainment for the one-hour ozone standard. No violations of the federal one-hour ozone standard have occurred in the area since 1996. It is important to recognize that there are two federal standards for ozone: the one-hour and the new eight-hour standard. In 2003, a combined 45 watches and warnings were issued for the eight-hour ozone standard by the Arizona Department of Environmental Quality. The watches and warnings are designed to prevent ozone exceedances and violations from occuring.

In our response to the Arizona Center For Law In The Public Interest comment on the MAG One-Hour Ozone Redesignation Request and Maintenance Plan contingency measures, it was noted that guidance issued in an August 13, 1993 EPA memorandum indicates that areas may implement

contingency measures early to ensure attainment of air quality standards. EPA notes that "in cases of early implementation of State contingency measures, we do not feel that it is necessary now to adopt additional contingency measures to backfill for the early activation of contingency measures". Please refer to the full MAG response to the Arizona Center For Law on contingency measures above.

Also, as we have previously responded, at the January 15, 2004 MAG Air Quality Technical Advisory Committee meeting, public comment was received from Mr. Blue Crowley during "Call to the Audience". Mr. Crowley did not comment on the One-Hour Ozone Redesignation Request and Maintenance Plan.

ARIZONA CENTER FOR LAW IN THE PUBLIC INTEREST

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JOY E. HERR-CARDILLO
SENIOR STAFF ATTORNEY

March 1, 2004

VIA FACSIMILE (602)254-6490

Lindy Bauer,
302 N. 1 st Avenue, Suite 300
Phoenix, AZ 85003

Re: Draft MAG One-Hour Ozone Redesignation Request and Maintenance Plan

Dear Ms. Bauer,

Thank you for the opportunity to comment on the above-referenced draft Plan. We offer the following observations and concerns:

1. Attainment of the standard.

While we obviously do not dispute that the Phoenix area has not violated the one hour ozone standard for the past five years, and has not had an exceedence since 1996, we note that some of the monitoring sites continue to record some very high values. Over the past summer, for example, Maricopa County issued a significant number of ozone alerts. Thus, while the Valley has officially "attained" the standard, ozone continues to be a serious problem that requires vigilant attention.

2. EPA Approval of the Nonattainment SIP

As acknowledged in the Draft Plan, EPA has not yet approved the Serious Area Ozone Plan that was submitted in December 2000. We reserve any and all objections previously assert regarding that plan (see Letter of Jennifer Anderson dated April 25, 2000) and incorporate those objections herein.

March 1, 2004

3. Contingency Measures.

We disagree that the Draft Plan properly includes contingency measures. The measures designated as "contingency measures" in the Draft Plan are already implemented. According to Section 175(d), the purpose of contingency provisions is to assure that the state will promptly correct any violation of the standard which occurs after the redesignation of the area as an attainment area. Obviously, if the so called "contingency measures" are already being implemented when a violation occurs, there is nothing to suggest that their continued implementation would ensure that the situation will be corrected. Rather, the Act clearly envisions *additional* measures which are automatically and immediately implemented if and when a violation occurs. The state's commitment to adopt nonspecific additional contingency measures over a 15-21 month period if the "trigger" of at least four .120+ ppm is met falls far short of the requirement of the Act.

Sincerely,

Joy Herr-Cardillo
Senior Staff Attorney

## Dean Giles

**From:** Dianne Barker DD [dteam10@yahoo.com]
**Sent:** Monday, March 15, 2004 1:49 PM
**To:** dgiles@mag.maricopa.gov
**Cc:** lbauer@mag.maricopa.gov; bobmcknight@cox.net; TMCMRyan@aol.com; delasaux@inlynx.com
**Subject:** Citizen Barker's Objection Statement- EPA's Ozone (1 hr & 8hr) + PM 10 MAG Redesignation

Dear MAG REGIONAL COUNCIL & Staffmember Dean Giles:

Reviewing MAG documents on ozone and PM 10, there no reason to redesignate the MAG region, nor eliminate Pinal boundary from serious classification protective of the public's air quality.

Certainly, MAG's EX Summary on one-hour ozone redesignation neither justifies EPA attaining criteria listed at(ES-1) while VOC and NOx, both required measured pollutants by EPA (ES-3), doesn't support any simplistic statement such as the attachment of MAG's own Director, Mr. Dennis Smith's February 4, 2003 letter to ADEQ Director Steve Ownens regarding any lifting of Pinal County Area A on information of "eight-hour values are derived from one-hour averages". It is understood that the eight hour evaluation are even more stringent than that of one hour ozone standard. Furthermore, actually there have been 40 ozone violations in the region in the past year, despite the fact EPA chooses to overlook all except two(2) exceedences. Further worrisome information is recorded on MAG minutes dated January 15th, 2004, page 3, regarding ADEQ Mr. Ira Domsky's saying, " 2002 was a worse than average year for PM10".

Finally, a speaker listed on these same minutes, Mr. Blue Crowley, polled the MAG's Air Quality Technical Advisory Committee "to determine the numbre of people who carpooled or used transit". This poll should be given and answered by our our MAG Regional Council members and its' staff aslo.

Sincerely,
Dianne Barker,
Citizen advocate for cleaner
air/ better transportation

C: William Crowley, Citizen
Bob Mcknight, "
Joe Ryan "
John Delasaux "
Jay Boggs "

=====
D TEAM DIVERSIFIED
P.O. BOX 32275
Phoenix, AZ 85064-2275
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DD Barker, President

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April 25, 2000

Marcia Colquitt
Air Quality Planning Section, Mailcode T5109B
Arizona Department of Environmental Quality
3033 N. Central Avenue
Phoenix, AZ 85012

RE: Draft Serious Area Ozone State Implementation Plan for Maricopa County

Dear Ms. Colquitt:

Thank you for the opportunity to comment on the Draft Serious Area Ozone State Implementation Plan for Maricopa County ("Plan"). We have the following comments:

1. Failure to Meet Enhanced I/M Program Requirements

The Plan does not meet the enhanced vehicle inspection and maintenance ("I/M") program requirements of the Clean Air Act ("CAA" or "Act") and implementing regulations in at least two respects and therefore cannot be approved. *See* CAA § 182(c)(3).

First, the Plan incorrectly includes a remote sensing program as part of Arizona's enhanced I/M program. A.R.S. § 49-542.01, which formerly provided for a remote sensing program, was recently repealed by the Arizona Legislature. *See* H.B. 2004, Forty-fourth Legislature, Second Regular Session. EPA regulations require that an enhanced I/M program include an on-road testing program that provides for information about the emission of in-use vehicles through either remote sensing devices or roadside pullovers. 40 C.F.R. § 51.371. Arizona law currently does not provide for either type of program.

Second, the waiver program provided for under Arizona law and incorporated into the Plan does not comply with the Act and EPA regulations. Section 182(c)(3)(C) of the Act provides that enhanced I/M programs allowing waivers for emissions-related repairs not covered by warranty must require a minimum expenditure of $450 for such repairs. *See also* 40 C.F.R. § 51.360. A.R.S. § 49-542(L) allows waivers for expenditures of $200 and $300 for before-1974 model year and 1975-1979 model year vehicles, respectively, and actually prevents ADEQ from requiring higher expenditures for these model years. Thus, Arizona's waiver program does not meet the enhanced I/M requirements for such programs.

Arizona's I/M program may fail to meet the enhanced I/M requirements in other respects not noted here. Arizona's I/M program was approved by EPA in 1995; since then, numerous changes have been made to the program. The Plan should be revised to provide a thorough analysis of whether Arizona's I/M program currently meets all requirements of the Act and EPA regulations for enhanced I/M programs in serious ozone nonattainment areas.

2. Failure to Adopt RACT on All Major Stationary Sources

The Plan does not comply with the Act's reasonably available control technology ("RACT") requirements. Pursuant to CAA §§ 182(b)(2)(C) & 182(c), a SIP revision for a serious ozone nonattainment area must include the imposition of RACT on all major stationary sources of volatile organic compounds ("VOCs") that are located in the area. The SIP must provide for the implementation of RACT measures "as expeditiously as practicable but no later than May 31, 1995." Since this date has passed, the deadline is "as soon as possible." *Delaney v. EPA*, 898 F.2d 687 (9th Cir. 1990). Section 110(a)(2)(A) of the Act makes clear that a SIP cannot include a mere commitment to adopt control technology in the future; rather, the Plan must "include enforceable emission limitations and other control measures, means, or techniques…." The only exception allowed for under the Act is contained in the conditional approval provision of CAA § 110(k)(4), which states that EPA "may approve a plan revision based on a commitment of the State to adopt **specific enforceable measures** by a date certain, but not later than one year after the date of approval of the plan revision." (Emphasis added).

The Plan violates the requirements of CAA § 182(b)(2)(C) and CAA § 110(a)(2)(A) because it does not impose RACT on all major stationary sources. Specifically, the Plan fails to include RACT for four major sources of VOCs in three industrial categories: (1) polymeric foam products; (2) fiberglass boat manufacturing; and (3) fiberboard for expansion joints. Together, these four sources alone contribute 718.3 tons per year of VOCs. The Plan explains that "Maricopa County proposes to impose source-specific RACT standards in the Title V permits" for these sources. However, this mere "commitment" to impose unspecified RACT in the future does not suffice as an enforceable emission limitation, control measure means or technique. The Plan does not meet the conditional approval exception in CAA § 110(k)(4) because it does not specify the RACT measures that will be adopted. Since the Plan fails to include RACT for all major stationary sources, it is incomplete and cannot be approved.

3. Lack of Reasonable Further Progress Demonstration

The Plan is also legally defective because it fails to contain the post-1996 rate of progress ("post-1996 ROP") demonstration required under CAA § 182(c)(2)(B). This section states that serious area SIPs must include a demonstration that the plan will result in VOC emission reductions of at least 3 percent of baseline emissions each year averaged over three years, beginning with November 15, 1996 until the attainment date. Since the Plan omits this demonstration, it violates the Act.

ADEQ relies on a May 5, 1995 memorandum issued by EPA entitled "Reasonable Further Progress, Attainment Demonstration, and Related Requirements for Ozone Nonattainment Areas Meeting the Ozone National Ambient Air Quality Standard" ("1995 memo") for its omission of the post-1996 ROP demonstration. This memorandum sets forth EPA's policy that a nonattainment area with three consecutive years of monitored attainment of the ozone standard is not required to submit SIP revisions concerning reasonable further progress and attainment demonstrations and related requirements. ADEQ claims that Maricopa County falls within this policy because the County has not recorded a violation of the ozone standard in three summers.

ADEQ may not rely on the 1995 memo for two reasons. First, EPA's policy violates the plain language of the Clean Air Act. The Act specifically requires that serious ozone nonattainment areas submit attainment and reasonable further progress demonstrations, and contains no exception for areas that are potentially eligible for redesignation to attainment but have not yet met the requirements of CAA §§ 107(d)(3) and 175A. In fact, the Act specifically provides that until a nonattainment area is redesignated as attainment and a maintenance plan is approved, "the requirements of this part [i.e., Part D of the Act relating to plan requirements for nonattainment areas] shall continue in force and effect with respect to such area." The reason for this is simple – a state may have no monitored violations of the NAAQS, but the improvement in air quality may be a temporary one due to unusually favorable meteorological conditions rather than "permanent and enforceable reductions in emissions resulting from implementation of the applicable implementation plan and applicable Federal air pollutant control regulations and other permanent and enforceable reductions." CAA § 107(d)(3)(E)(iii). EPA's policy memorandum is an impermissible interpretation of the Act, which clearly requires that nonattainment areas continue to comply with all SIP requirements (including the RFP requirement) until they are formally redesignated as nonattainment.

The second reason why the State cannot rely on the 1995 memo is because the Plan does not even comply with the terms of EPA's policy as stated in that memorandum. Under the policy, a state can only avoid submission of the attainment and RFP demonstrations for a nonattainment area if EPA has specifically exempted the area via a rulemaking which finds that the area has attained the standard and need not make the submissions. Since no such rule has been promulgated or even proposed, the Plan does not qualify for a waiver under the 1995 memo.

We are pleased that Maricopa County has shown progress towards attaining the public health standard for ground-level ozone pollution. However, this is no reason for complacency. The monitored attainment of the ozone NAAQS during the past three summers was more likely due to favorable meteorological conditions rather than a reduction in ozone precursor emissions to a level needed for permanent attainment and maintenance of the 1-hour standard. Even with good weather, Maricopa County came dangerously close to violating the standard during the summers of 1998 and 1999. The modeling that ADEQ apparently failed to do for the attainment demonstration (see below) may well have shown that absent these unusually favorable meteorological conditions, Maricopa County would likely violate the ozone NAAQS. Moreover,

once the new 8-hour ozone NAAQS goes into effect, Maricopa County will almost certainly be in violation.

As a result, Maricopa County must continue to do everything it can to reduce ozone precursor emissions. There are a number of control measures that are currently available to meet the post-1996 ROP demonstration requirement, many of which are identified in the 1996 and 1998 reports of the Governor's Air Quality Strategies Task Force. These include but are not limited to the adoption of CARB diesel fuel standards, implementation of the California Low Emission Vehicle Program, and IM 240 testing of constant four-wheel drive vehicles. Other measures have been identified by STAPPA/ALAPCO, the Reanalysis of the Voluntary Early Ozone Plan. We urge ADEQ and the State to provide for the inclusion of all additional measures in the Plan needed to meet the post-1996 ROP requirement and achieve permanent attainment.

4. Lack of Attainment Demonstration

The Plan illegally fails to include a modeled attainment demonstration. Section 182(c)(2)(A) of the Act requires a serious area SIP to demonstrate that it will provide for attainment of the ozone NAAQS by the applicable attainment date, which was November 15, 1999. *See* CAA § 181(a)(1). Since that date has passed, under *Delaney v. EPA*, the deadline is as soon as possible.

ADEQ's reliance on the 1995 memo for the omission of the attainment demonstration from the Plan is invalid for the same reasons discussed in the section concerning the post-1996 ROP demonstration, above.

5. Lack of Contingency Measures

The Plan does not contain contingency measures as mandated by CAA §§ 172(c)(9) and 182(c)(9). Section 172(c)(9) requires state implementation plans for nonattainment areas to include contingency measures that will take effect if the area fails to make reasonable further progress. Section 182(c)(9) states that in addition to the contingency measures required under section 172(c)(9), serious area ozone plans shall include additional contingency measures that will take effect if the area fails to meet any applicable milestone. Because the Plan fails to contain either type of contingency measures, it violates the express requirements of the Clean Air Act.

ADEQ's reliance on the 1995 memo for the omission of contingency measures from the Plan is invalid for the same reasons discussed in the section concerning the post-1996 ROP demonstration, above.

6. Lack of Transportation Control Measures:

The Plan fails to comply with the requirements of CAA § 182(c)(5). This section requires states to "submit a demonstration as to whether current aggregate vehicle mileage,

aggregate vehicle emissions, congestion levels, and other relevant parameters are consistent with those used for the area's demonstration of attainment." Where they are not, the Act requires states to adopt additional transportation control measures that will reduce emissions to a level consistent with attainment. The Plan violates the Act because it neither makes the demonstration required in CAA § 182(c)(5), nor does it contain any additional transportation control measures.

ADEQ's reliance on the 1995 memo for the omission of transportation control measures from the Plan is invalid for the same reasons discussed in the section concerning the post-1996 ROP demonstration, above.

7. Failure to Comply with Severe Area Requirements

Absent action by the State, Maricopa County will be reclassified to a severe ozone nonattainment area by operation of law on November 14, 2000. Because Maricopa County is unlikely to avoid this reclassification before EPA acts on the Plan submittal, the Plan should comply with the provisions relating to severe ozone nonattainment areas, CAA § 182(d).

The legal basis for Maricopa County's impending reclassification is contained in CAA § 182(g) relating to emission reduction milestones. On November 15, 1999, the State was required to make its "milestone" determination regarding whether the Maricopa County nonattainment area had achieved the emission reductions required under the 15% rate-of-progress ("15% ROP") requirements of CAA § 182(b)(1) and the post-1996 ROP requirements of CAA § 182(c)(2)(B). Within 90 days after the milestone, or by February 15, 2000, the State was required to submit a demonstration to EPA that the milestone had been met.

The State failed to make this submittal, and in any event could not have shown that the milestone had been met because the State failed to even submit a post-1996 ROP plan. Section 182(g) provides that where a state fails to submit a milestone demonstration, the state must make an election within 90 days to (1) have the area reclassified to the next higher classification, (2) implement specific additional measures adequate to meet the next milestone, or (3) adopt an economic incentive program. CAA § 182(g)(3). If a state fails to make the election within the required 90-day period or within 6 months thereafter, the area is reclassified to the next higher classification by operation of law at the expiration of the 6-month period.

Arizona is required to make its election under CAA § 182(g)(3) by May 14, 2000. There is no indication in the Plan or elsewhere that the State intends to make this election. Thus, Maricopa County will be reclassified to a severe ozone nonattainment area by operation of law on November 14, 2000. The Plan should therefore include the requirements applicable to a severe nonattainment area contained in CAA § 182(d). Any failure to comply with the strict requirements of the Clean Air Act jeopardizes the State's ability to have Maricopa County reclassified to an attainment area, since in order for EPA to redesignate a nonattainment area to attainment, the State must demonstrate that it has "met all requirements applicable to the [nonattainment] area under section 7410 of this title [CAA § 110] and part D of this subchapter [CAA §§ 171-193]."

The State will undoubtedly rely on the 1995 memo to claim it is exempt from having to meet the milestone requirements of the Act. However, this reliance is invalid for the same reasons discussed in the section concerning the post-1996 ROP demonstration, above. Moreover, EPA's rationale for exempting monitored-attainment areas from additional RFP requirements does not apply to the milestone requirements of the Act. Section 182(g) does not contain additional RFP requirements per se; rather, it requires states to demonstrate to EPA whether those RFP requirements that are already applicable to the area have been achieved. Therefore, even if EPA is correct that the State need not submit the post-1996 ROP demonstration, the State must still demonstrate that it met the 15% ROP requirement. Since it has not done so and apparently will not do so by prior to November 14, 2000, it will automatically be redesignated to severe on that date.

8. Limited Number of Forecasted-Episode Days for Enhanced Monitoring

The section of the Plan relating to the PAMS operating schedule (Appendix D) is somewhat unclear. However, it appears that ozone precursor sampling from the Type 2 site will occur on "every other day" sample runs during the monitoring period, as well as on five additional forecasted-episode days during the peak ozone season.[1] A forecasted-episode day is defined in the Plan as a day when a peak value of 0.14 ppm ozone is anticipated to occur at one or more monitoring stations. *See* Appendix D, p. 10.

We believe the sampling procedure for the Type 2 site should be modified to allow for more forecasted-episode days on which sampling is performed. First, the threshold for defining a forecasted-episode day should be changed from a peak value of 0.14 ppm to a peak value of 0.12 ppm ozone. We are not sure why ADEQ chose a threshold of 0.14 ppm.[2] A threshold of 0.12 ppm is much more appropriate since it represents the NAAQS for ozone. Second, all forecasted-episode days should be sampled. Forecasting procedures are far from foolproof, and there is no reason to arbitrarily limit the number of sample days to five if more exceedances are expected. This will provide the most accurate and comprehensive scientific data regarding ozone precursor emissions and their contribution to violations of the ozone NAAQS. We understand that there are economic and logistical considerations to the type of enhanced monitoring to be performed with the PAMS network. However, these considerations are much less pronounced with respect to the Supersite, which already houses a large concentration of air sampling equipment and is within short driving distance from ADEQ.

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[1] The Plan states that "[f]orecasted-episode days will be sampled as stipulated in **3.3-A**." Since there is no section 3.3-A in Appendix D of the Plan, we assume this is a typographical error, and that the sentence should read "**3.4-A**."

[2] The 0.14 ppm threshold may be a reference to the peak ozone value of 0.14 ppm recorded on July 23, 1996 during the 1996 ozone field study. See Appendix D, p.3. However, this fails to explain why 0.14 ppm is an appropriate level to define a forecasted-episode day for purposes of sampling ozone precursor emissions, since ozone exceedances will occur on days where peak ozone levels fall below 0.14 ppm.

Thank you for the opportunity to comment on the Draft Serious Area Ozone State Implementation Plan for Maricopa County. Please feel free to call me if you have any questions

Sincerely,

Jennifer B. Anderson
Staff Attorney

JBA/jgm

Arizona Department of Environmental Quality
Air Quality Division

December 14, 2000

**RESPONSIVENESS SUMMARY**
**to**
**Testimony Taken at the Ozone Oral Proceeding and Written Comments Received on the Serious Area Ozone State Implementation Plan for Maricopa County**

The oral proceeding on the Serious Area Ozone State Implementation Plan for Maricopa County was held at 9:30 am, Wednesday, April 26, 2000, at the Arizona Department of Environmental Quality, Public Hearing Room 1706, 3033 N. Central Avenue, Phoenix, Arizona. No oral comments were received during the proceeding. The Arizona Department of Environmental Quality (ADEQ) received forty-seven written comments during the public comment period, which ended April 26, 2000. The public comments and ADEQ's responses are described below.

Comment 1:
Why was the moderate area ozone plan disapproved by the Environmental Protection Agency?

Response: The Plan was not disapproved; rather, EPA found the initial plan submitted to EPA by the Maricopa Association of Governments incomplete because it failed to include, in fully adopted and enforceable form, all the measures relied upon to meet the 15 percent rate of progress (ROP) requirement in the Clean Air Act (CAA) for moderate nonattainment areas. Additional submissions were made to EPA and the Plan was found to be complete in May 1995.

Comment 2:
How does this plan address whatever deficiencies were found in the moderate area plan?

Response: The moderate Plan deficiencies were resolved in the 15% ROP Federal Implementation Plan (FIP), which was effective in 1998.

Comment 3:
Does this plan address EPA's proposed new ozone standard if it should actually be adopted by EPA in the future?

Response: No. If EPA designates nonattainment areas for the 8-hour standard, a different plan may be necessary for the Maricopa County area.

Comment 4:
How high into the atmosphere does the ground level ozone reach from the valley floor in a worst case scenario in the Phoenix area?

Response: Ground level ozone can reach as high as 2,500 meters (8,250 feet) into the atmosphere, as indicated in the fact that exceedances of the 1-hour standard have been measured at Mt. Ord, which is at 7,000 feet.

Comment 5:
Where in the valley is the ozone problem most serious, what are the sources at this place and what is the peak population exposure at this location on a daily basis?

Response: Recently, the highest 1-hour ozone averages have been measured at the Fountain Hills monitoring site with the highest reading in 1998 of .123 ppm.

Comment 6:
... Do particulate matter, carbon monoxide and ozone always occur together in the Phoenix area...

Response: Carbon monoxide concentrations peak in November-January; hourly concentrations tend to be at their maximum between 6 p.m. and 12 midnight, and during morning rush hour. High ozone concentrations are a summer phenomenon, when sunlight and evaporative hydrocarbon emissions peak. Ozone concentrations are low to near zero at night, rise rapidly throughout the morning and peak in the afternoon. Particulate matter problems are twofold - 24-hour concentrations peak during high wind events, typically in the spring and summer. Chronic exposure to lower levels of particulates occur during stagnant air events in the November-January time period, similar to carbon monoxide.

Comment 7: How does the health effects of ozone compare to those of particulate matter and carbon monoxide?

Response: Ozone is a highly reactive form of oxygen; its powerful reactivity damages lung tissue, reduces lung function, and sensitizes the lungs to other irritants. Particulate matter less than 10 microns in diameter, are easily inhaled deep into the lungs and, as a result, the particles irrate lung tissue, causing respiratory damage, difficult breathing, and aggravation of existing respiratory diseases. Carbon monoxide enters the body through the lungs and affects the central nervous system by depriving the body of oxygen. Blood laden with carbon monoxide can weaken heart contractions, lowering the volume of blood distributed to various part of the body.

Comment 8:
Just how detrimental is the combined effect of two or more of the pollutants at a time on the human body, especially the respiratory system?

Response: ADEQ is unaware of any studies done on the combined effect of two or more of the pollutants at a time on the human body, especially the respiratory system.

Comment 9: How does Phoenix compare with other large Sunbelt communities with respect to the ozone problem?

Response: Other serious ozone nonattainment areas in the Sunbelt include Dallas-Fort Worth and El Paso, Texas; and Santa Barbara, California. Houston, Texas; Ventura County, Sacramento, and San Diego, California are designated severe nonattainment areas for ozone. In addition, the Los Angeles area is classified as an extreme nonattainment area.

Comment 10:
Is there the possibility that ozone pollution originating in the Phoenix area is having a negative impact on outlying communities...?

Response: Yes, sustained high concentrations have been measured in Tonto National Forest, Humboldt Peak and Mt. Ord. Some of the highest concentrations have also been measured at Blue Point Ridge.

Comment 11:
If this is the case, what damage could Phoenix's ozone pollution be causing to the natural-biomass in rural Arizona?

Response: The extent of any damage to natural-biomass is currently unknown.

Comment 12:
Why is ozone pollution more of a summertime problem than a winter time problem?

Response: Ozone is formed by the action of sunlight and heat as volatile organic compounds and nitrogen oxides mix. Typically, wintertime heat and sunlight are not intense enough to create unhealthy levels of ozone pollution.

Comment 13:
Which oxygenated fuels are used here in the Phoenix areas...and do they contain MTBE?

Response: The State of Arizona has implemented a state version of the federal reformulated gasoline program as an ozone control measure since 1998. Arizona's Cleaner Burning Gasoline (CBG) has, until recently, included an oxygenate requirement to be added to the gasoline at all times of the year. MTBE has been the primary oxygenate used during the summer months because the other primary oxygenate, ethanol, tends to enhance the formation of ozone in the extremely high summer temperatures experienced in Phoenix metropolitan area. On April 28, 2000, Governor Jane Dee Hull signed Senate Bill 1504, which became effective immediately. Among other things, the law provides for the removal of the oxygenate requirement in CBG during the summer months, and a phase-out of MTBE by mid 2003. Refiners are working toward meeting this deadline.

Comment 14:
What is DEQ doing to clean up MTBE from the State's groundwater and surface water resources?

Response: In 1998, ADEQ completed a report on MTBE to determine if MTBE has caused problems in any area's ground and surface water supplies.

The report is available at ADEQ's Web site (www.adeq.state.az.us).

Several actions are being taken to simultaneously maintain air quality benefits, enhance water quality protection, and assure a stable fuel supply at a reasonable cost. These actions include accelerated enforcement of replacement of existing UST systems which are not in compliance, evaluate field performance of UST system design and technology to improve systems and minimize leaks/releases, require monitoring and reporting of MTBE in groundwater at all UST release sites, and consider land-use in planning and permitting decisions for siting of new UST facilities

Comment 15:
Why doesn't the state mandate safer oxygenated fuels than MTBE?

Response: Potential negative affects from MTBE became a topic of concern at the State and national level in the last 3-4 years. The Arizona Legislature's and Governor's actions this past session in introducing and approving legislation to remove the oxygenate requirement from CBG was the first step necessary to remove MTBE from all sources of CBG in the state. Since 1995, Phoenix wintertime gasoline has been all ethanol, not MTBE.

Comment 16:
Does Arizona have legal authority to mandate how oxygenated fuels are formulated...?

Response: Yes. Regulating the type of fuel sold in Arizona, whether produced within or outside the State occurs through the Arizona Department of Weights and Measures (see Arizona Administrative Code, Title 20, Chapter 2, Article 7).

Comment 17:
What are the highest ozone readings recorded on the Phoenix areas freeway systems...?

Response: Although 31% of volatile organic compound emissions in Phoenix come from cars and trucks, highest concentrations tend to occur downwind away from freeway and less frequently in the central city. Monitoring sites are established according to standard EPA criteria.

Comment 18:
What are the highest ozone readings recorded on the surface streets in the Phoenix area...?

Response: The North Phoenix and South Phoenix monitoring sites, located at 601 E. Butler Street and 4732 S. Central Avenue, respectively, had the highest reading of .124 ppm during the period of 1996-1998.

Comment 19:
How many locations in the Phoenix area are ozone readings taken?

Response: There are 23 ozone monitoring site locations in Maricopa County.

Comment 20:
Are ozone readings taken in Yavapai and Pinal Counties?

Response: Yes, monitors are located at Hillside in Yavapai County and at the Apache Junction Highway Yard and Casa Grande Airport in Pinal County. These sites are outside the Maricopa County ozone nonattainment area.

Comment 21:
If the pollution control programs in the moderate area plan could not solve the ozone problem, why expect the serious area plan to solve the ozone problem?

Response: Implementation of the control measures contained in the moderate area plan and this plan have demonstrated attainment of the 1-hour national ambient air quality standard through the fact there have been no violations of the standard during the years 1997-2000.

Comment 22:
Are smaller towns ...being negatively impacted by ozone from sources outside of their jurisdiction?

Response: See Comment 10.

Comment 23:
What is the relationship of the reduction of ozone to particulate matter and carbon monoxide?

Response: The formation of ozone does not directly include CO or particulates. However, control measures that reduce inefficient combustion by vehicles will reduce CO emissions and also reduce VOC and NOx emissions, which are precursors to ozone formation.

Comment 24:
How many vehicles would have to be taken off the road to ensure a future ozone violation not occur again?

Response: It may not be necessary to remove vehicles from the roadways to maintain the 1-hour standard because of the availability of cleaner engines and fuels and tighter tailpipe emission standards. Development of a maintenance plan that will detail how the area will stay in attainment is underway.

Comment 25:
How much do air traffic and train traffic contribute to the local ozone problem?

Response: These two source categories are minor contributors to the ozone problem in Maricopa County. Aircraft activity contributes 1,413 tons of VOC, metro total of 123,370 tons per year (1.15%); and 3,954 tons of NOx, metro total of 126,290 tons per year (3.14%). Locomotives contribute 19.3 tons of VOC, metro total of 123,370 tons per year (0.02%); and 387 tons of NOx, metro total of 126,290 tons per year (0.31%).

Comment 26:
How much of a positive impact are the vehicle emission testing and smog dog program having on Phoenix's ozone problem?

Response: The Enhanced Arizona Vehicle Inspection and Maintenance Program that includes the remote sensing component, was approved by EPA in May 1995. This was the one of the most important control measures implemented by the State to help the area reach attainment. The smog dog program was repealed in April 2000 (H.B. 2104) and replaced by a study to determine how to improve the cost effectiveness of the program while controlling costs.

Comment 27:
What role does the vehicle licensing tax play in supporting the ozone pollution control program?

Response: The vehicle licensing tax (A.R.S. 28-5808) does not have a direct role in supporting the ozone control program. Rather, an air quality fee is collected from every person who registers a vehicle in Arizona (A.R.S. 49-551, section C.1 authorizes fees to be directed to the reduction of ozone.) $1.50 of the vehicle registration fee, assessed annually, is deposited into the Air Quality Fee Fund that is administered by ADEQ.

Comment 28:
Would increasing gasoline taxes or levying an automobile surtax be enough discentives to possibly indirectly reduce the number of vehicles....?

Response: Whether additional taxes on either the fuel or the vehicle would deter people from purchasing vehicles or use ones they now own is very difficult to project. Several factors, including the level of tax, available transportation alternatives, and ability to pay an additional tax, are just a few that would need to be included in such an estimation. The Legislature has consistently rejected this approach. In addition, sufficient emission reductions have occurred to get the area into attainment.

Comment 29:
Are the control measures adopted in House Bill 2001 similar to ozone reducing control measures in other nonattainment areas?

Response: Arizona's Enhanced Vehicle Emissions Inspection Program has been recognized as a model program by other states. Other House Bill 2001 type control measures implemented in other nonattainment areas (e.g., California's South Coast Air Quality Management District and Texas) include traffic signal synchronization and the Trip Reduction Program.

Comment 30:
What has the trend of bus ridership been over the last ten years and has bus ridership had a significant positive effect in reducing ozone pollution?

Response: Historical trends show from 1985 through 1998 the annual boardings have increased from 16.5 million to 36.4 million passengers, with an average of 2.5 passengers per mile of service. This includes the Phoenix area, Mesa, Scottsdale, and Tempe.

Comment 31:
Have all the local jurisdictions in the Phoenix area coordinated their traffic signals...?

Response: Synchronized traffic signals promote steady traffic flow, which helps reduce emissions because idling vehicles emit higher levels of pollution than moving vehicles. Synchronized traffic signals are required by A.R.S. 9-240 for areas throughout the nonattainment area.

Comment 32:
Why did the Clean Air Act require a Rate- of-Progress Demonstration in the ozone plan?

Response: Rate of progress is required in the Clean Air Act to create specific schedules for emission reductions. Because the Maricopa County nonattainment area was and currently is in attainment, no rate of progress demonstration is required by this Plan.

Comment 33:
Isn't the Countywide Travel Reduction Program voluntary?

Response: No. Major employers (those with 50 or more employees at any site in Area A) are required by Maricopa County Travel Reduction Program Ordinance No. P-7 to participate in the Trip Reduction Program. A voluntary participant is an employer that is not a major employer but still chooses to participate in a travel reduction program.

Comment 34:
With respect to alternate fuels, what is the target rate of conversion for government fleets...?

Response: ARS § 41-803 established timelines for the conversion of the state motor fleet to alternative fuel vehicles. For model year 2001 and all subsequent model years, 75% of new state fleet vehicles must be capable of operating on alternative fuels. In counties of populations of more than 1.2 million people (i.e., Maricopa), by model year 2003, 70% of new alternative fuel vehicles purchased must meet EPA's low emission vehicle standards. The conversion of fleets to alternative fuels is not a committed measure in the SIP.

Comment 35:
Could the state subsidize the bus fares for people who consistently use mass transit or give an income tax credit to people who carpool?

Response: Currently over 1200 employers subsidize bus fares 20% - 100% for employees who use mass transit. Arizona offers tax credits and exemptions through the Arizona Department of Revenue for alternative fueled vehicles. State employees can get one half price fare through a similar program.

Comment 36:
Is the reduced gasoline volatility control measure implemented statewide...?

Response: Gasoline volatility limits are 7.8 pounds per square inch (psi) outside of Area A where the volatility limits are 7.0 psi. Fuel supply and distribution is under the jurisdiction of the Arizona Department of Weights and Measures (ADWM).

Comment 37:
How can the state rely on the Enhanced Vehicle Inspection and Maintenance Program (VEIP) in light of recent problems?

Response: The VEIP is still mandated by legislation and continues to be a highly effective control measure.

Comment 38:
How were the repair threshold limits in House Bill 2001 determined?

Response: The limits, set by the Legislature, were based on an average cost of repair with consideration to the value of the vehicle. These meet the federal level repair threshold limits, in accordance with CFR 51.360(a)(7).

Comment 39:
Enhanced vehicle inspection and maintenance (I/M) programs must require vehicle owners to make a minimum expenditure of $450 for repairs to qualify for a waiver. The Arizona program establishes lower qualifying expenditure requirements for pre-1980 model years and therefore does not meet this requirement.

Response: ADEQ believes that the state I/M program satisfies the waiver requirements of the Clean Air Act (CAA) § 182(c)(3)(C)(iii) and 40 C.F.R. § 51.360(a). In arguing that the Arizona program fails to meet the minimum qualifying expenditure requirements of the CAA and EPA's implementing regulations for enhanced I/M programs, the commentor fails to take into account the time allowed to complete repairs. As the following side-by-side comparison demonstrates, the Arizona waiver provisions are in all respects more stringent than the minimum requirements of the federal enhanced I/M rule, when the timing of repairs is taken into account.

See Table A.

**Table A. Comparison of Waiver Provisions in Federal Enhanced I/M Regulation and Arizona Program**

| | Federal Enhanced I/M | Arizona I/M |
|---|---|---|
| **First test failure (after 1/1/1997):** | | |
| Relief allowed | Extension of time to repair for the period of one test cycle [40 C.F.R. § 51.360(a)(9)] | One-time waiver of requirement to meet standards; expires at the end of the next test cycle [A.R.S. § 49-542(D)] |
| Condition(s) for obtaining relief | "Economic hardship" [40 C.F.R. § 51.360(a)(9)] | Qualifying expenditure of $200 for pre-1975 model years, $300 for 1975-79 model years, $450 for 1980+ model years [A.R.S. § 49-542(L)]<br><br>Repairs must achieve emissions less than twice the applicable standards, regardless of cost [A.R.S. § 49-542(Y)]<br><br>Test failure must not be due to catalytic converter system [A.R.S. § 49-542(R)] |
| **Failure during subsequent test cycles:** | | |
| Relief allowed | Waiver of requirement to meet standards [40 C.F.R. § 51.360] | None: repair required regardless of cost [A.R.S. § 49-542(D)] |
| Condition(s) for obtaining relief | Qualifying expenditure of $450 + inflation since 1989 [40 C.F.R. § 51.360(a)(7)] | Not applicable |

As Table A indicates, the federal rule allows a vehicle to obtain an extension of the time for meeting the minimum expenditure requirement on the basis of "economic hardship." The extension may be as long as the period of the test cycle (i.e. one or two years, depending on the model year of the vehicle). EPA has provided the following explanation for this provision:

> The $450 minimum is not as significant an issue for newer vehicles which are more likely to be under warranty, fail less often, and have a high market value. It may, however, pose a greater hardship on owners of older vehicles.

> Therefore, the regulation allows states to offer a well-controlled, non-renewable, time extension beyond the scheduled compliance deadline, to give motorists additional time to pass the inspection or to sell the vehicle in the case of economic hardship. This time extension is not a waiver--the vehicle owner is not in compliance until the repairs are made--it is just a question of timing. Neither the Act nor the legislative history addresses the question of extensions, even though the Act does specify various details about waiver requirements. Historically, EPA's I/M guidance has provided for time extensions to allow vehicle owners to make repairs or test vehicles. Section 182(a)(2)(B) appears to ratify EPA's past I/M guidance.

See 57 Fed. Reg. 52950, 52964 (1992).

Under this reasoning, the Arizona waiver is in substance an extension of time to make repairs, rather than a waiver as that term is used in the federal rule. Like the federal extension, the Arizona waiver offers "a well controlled, non-renewable, time extension beyond the scheduled compliance deadline . . . ." On expiration of EPA's non-renewable extension, a waiver is available for the next test cycle and all succeeding test cycles, provided the motorist makes the minimum qualifying expenditures. When Arizona's non-renewable extension expires, no further relief is available. The vehicle must meet applicable standards regardless of cost.

Rather than conditioning its non-renewable extension of time on a vague requirement to establish "economic hardship," Arizona's program requires motorists to make specific minimum repair expenditures to qualify. Consistent with EPA's recognition that the burden of repairs is greatest on owners of older vehicles, the Arizona statute establishes graduated minimum expenditures that decrease with the age of the vehicle. Unlike the federal rule, the Arizona program will deny even a non-renewable extension to vehicles that (1) fail inspection due to the catalytic converter system or (2) have emissions more than twice the applicable standard. The Department therefore disagrees with this comment. The State's waiver provisions exceed federal requirements.

Comment 40:
The Plan does not include a remote sensing program element of the VEIP.

Response:
The State has met the remote sensing program requirements for the year 2000. For future years, as indicated in the response to Comment 26, the State plans to replace the previous remote sensing program with a more cost effective one. Specifics of the proposed program will be included in a separate VEIP SIP revision package currently under development and anticipated to go through the public review and comment period in early 2001.

Comment 41:
The Plan fails to include RACT for four major sources of VOCs in three industrial categories.

Response: Three of the four major sources listed in the County commitment were subject to rule requirements to demonstrate RACT or BACT in 1989 through 1993. These three sources implemented RACT shortly after their respective permits were revised or issued prior to May 31, 1995.

The section of the commitment letter entitled "RACT Determinations" describes the date RACT was applied to these sources and the basic control measures and techniques implemented by the sources. The County commitment letter also describes a legal mechanism by which these pre-existing County RACT determinations will be reviewed by EPA, revised if necessary and approved into the SIP. The major source operating permits will include the specific emission limitations, monitoring and recordkeeping requirements necessary for each of the sources to support the basic RACT control measures and techniques implemented. Maricopa County will also follow this administrative procedure for the fourth source. This process will provide for EPA review and action on the determination that RACT controls are infeasible, if that initial determination continues to stand up through the permitting process, or the RACT determination if it does not. Given EPA's standard timeline for acting on SIPs, the submittal of RACT for these sources to EPA will be completed by June 2000 prior to any final action by EPA on the Serious Area Ozone SIP. Under these circumstances, conditional approval would not be necessary.

RACT control for the fourth source, fiberboard saturation, is under development by the County and EPA. Non-stack emissions, approximately 415 tons per year for VOC, are expected to be reduced once an effective RACT strategy is developed, implemented and applied.

Comments 42- 45:
The Plan fails to comply with CAA requirements for rate of progress demonstration, modeled attainment demonstration, contingency measures and additional transportation control measures.

Response: ADEQ has followed the guidance set forth in the May 5, 1995, Environmental Protection Agency memorandum titled, "Reasonable Further Progress, Attainment Demonstration, and Related Requirements for Ozone Nonattainment Areas Meeting the Ozone National Ambient Air Quality Standard (NAAQS)." This memorandum details EPA's interpretation of CAA requirements related to nonattainment areas that have attained the ozone NAAQS. The memorandum reasonably concludes that the requirements of the CAA requiring emission reductions leading to attainment are inapplicable to an area that has already attained the ozone standard. Specifically, the memorandum states that a SIP for an area that has attained the standard need not contain a demonstration of attainment, provisions for reasonable further progress toward attainment, contingency measures or additional transportation control measures. The comment's assertion regarding the policy's inconsistency with the Clean Air Act is contradicted by the decision of the 10th Circuit Court of Appeals, which upheld the policy in *Sierra Club v. U.S. EPA*, 99 F.3d 1551 (10th Cir. 1996). ADEQ agrees with the court's conclusion that EPA's policy represents a reasonable interpretation of a state the agency is charged with administering. That interpretation will allow ADEQ to focus on the measures necessary to assure continued attainment in the future, rather than the somewhat artificial emissions reduction requirements of Title I, Part D, Subpart 2 of the CAA.

Comment 46:

The Plan fails to comply with severe area requirements. The Phoenix nonattainment area is subject to severe area requirements, because it failed to submit a demonstration that a "milestone" had been achieved within 90 days after November 15, 1999, as required by section 182(g)(2) of the CAA. Under CAA § 182(g)(3), a state that fails to submit a milestone demonstration must make an election within 9 months after the demonstration deadline is reclassified by operation of law to the next higher classification. Because the Phoenix nonattainment area was not likely to make an election by November 14, 2000, it is subject to reclassification under section 182(g)(3) and should comply with severe area requirements.

Response:

Section 182(g)(2) of the CAA is inapplicable to the Phoenix nonattainment area under the plain language of the CAA.

Section 182(b)(1) requires ozone nonattainment areas classified as moderate or worse to achieve reductions in the VOC emissions of 15 percent from a 1990 baseline by November 15, 1996. Section 182(c)(2)(B) and (C) require areas classified serious or worse to reduce VOC or, in some cases, $No_x$ emissions by an average of 3 percent per year over each succeeding 3-year period "until the attainment date."

Section 182(g)(1) requires states to make a determination that these emissions reductions, called "milestones," have occurred for each ozone nonattainment area classified as serious or worse. Because the Phoenix nonattainment area was still classified as moderate on November 15, 1996, it was not subject to the first milestone requirement, as the comment apparently recognizes. The comment argues that a milestone demonstration was required by February 15, 2000, 90 days after the November 15, 1999, milestone date.

Section 182(g)(2) requires states to submit "a demonstration that the milestone has been met" for:

> "each nonattainment area referred to in [section 182(g)(1)], not later than 90 days after the date on which an applicable milestone occurs *(not including an attainment date on which an applicable milestone occurs in cases where the standard has been attained)....*"

(Emphasis added.) The November 15, 1999 milestone date fits squarely within the italicized exclusion. November 15, 1999 was the attainment deadline for serious areas, and the Phoenix area achieved the ozone standard on that date. Under the plain language of section 182(g)(2), the state therefore was not required to submit a milestone demonstration, and the Phoenix area was never subject to reclassification under section 182(g)(3).

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Comment 47:
Sampling procedure for the Type 2 site should be modified to allow for more forecasted-episode days on which sampling is performed and the threshold for defining a forecasted-episode day should be .12 ppm.

Response: The State operates a PAMS sampling schedule that considers both operational logistics and the costs of sample analysis. The every other day sampling schedule, known as "trend" monitoring, will capture about one-half of the forecasted "episode days" during most ozone seasons. To date, the typical ozone season produces about five forecasted episode days, and with the every other day schedule likely to capture half of these episode days, it serves as a reasonable assessment. Monitoring on the five additional forecasted days in the PAMS monitoring plan is not an upper limit. The State, keeping in mind that this is an operational plan, will monitor more days as necessary and practicable. In 1999, six episode days were forecast. The design value of 0.14 ppm ozone, last measured in 1996, is not a cut off for episode forecasting purposes. Ozone episodes are forecast when the ozone concentration values on a given day might approach the 0.12 ppm NAAQS standard, taking meteorology and ozone data into consideration.

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**Edits to Final SIP:**

During its final review of the proposed SIP revision, ADEQ determined some clarifications were appropriate. The clarifications, described below, are included in the final SIP revision document.
1) Maricopa County Rule 347, Ferrous Sand Casting, approved effective August 11, 2000, is reference on page 2-5 (2.2.4.1) of the SIP

2) It was determined by EPA and ADEQ that the Arizona Photochemical Assessment Monitoring Stations (PAMS) Network Plan, being an ongoing operational planning document, be removed from the SIP to allow for continued design enhancement of the monitoring network. Regular updates of the document will be submitted to EPA.

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# APPENDIX C

# EXHIBIT 2:

# CERTIFICATION OF ADOPTION

# CERTIFICATION OF ADOPTION OF THE MAG ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA

## An Excerpt from the March 24, 2004 MAG Regional Council Meeting Minutes

Mayor Dunn moved to adopt the MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area. Mayor Thomas seconded, and the motion carried unanimously.

I certify that on March 24, 2004, the MAG Regional Council adopted the MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area.

Dennis Smith
MAG Executive Director

3/26/04
Date

**RESOLUTION TO ADOPT THE MAG ONE-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA COUNTY NONATTAINMENT AREA**

WHEREAS, the Maricopa Association of Governments (MAG) is a Council of Governments composed of twenty-five cities and towns within Maricopa County and the contiguous urbanized area, the County of Maricopa, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, Arizona Department of Transportation, and Citizens Transportation Oversight Committee; and

WHEREAS, the Governor of Arizona designated MAG as the regional air quality planning agency and metropolitan planning organization for transportation in Maricopa County; and

WHEREAS, the Maricopa County nonattainment area has been classified by the U.S. Environmental Protection Agency as a Serious Area for the one-hour ozone standard according to the Clean Air Act; and

WHEREAS, the Maricopa County nonattainment area has had no violations of the one-hour ozone standard since 1996; and

WHEREAS, MAG has prepared the One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area, including the modeling maintenance demonstration; and

WHEREAS, A.R.S. 49-406 H. requires that the governing body of the metropolitan planning organization adopt the maintenance area plan.

NOW THEREFORE, BE IT RESOLVED BY THE MARICOPA ASSOCIATION OF GOVERNMENTS REGIONAL COUNCIL as follows:

SECTION 1. That the MAG Regional Council adopts the MAG One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area and authorizes the submission of the plan to the Arizona Department of Environmental Quality and the U.S. Environmental Protection Agency.

SECTION 2. That the MAG Regional Council further requests that the U.S. Environmental Protection Agency redesignate the Maricopa County nonattainment area to attainment status for the one-hour ozone standard.

ADOPTED the twenty-fourth day of March 2004 by the MAG Regional Council.

Wendy Feldman-Kerr
Chair, MAG Regional Council
Mayor of Queen Creek

ATTEST:

Dennis Smith, Executive Director
Maricopa Association of Governments