

FRUITLAND OUTCROP MONITORING REPORT

LA PLATA COUNTY, COLORADO

MARCH 2006



Prepared for:
THE GROUP
Durango, Colorado



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EXECUTIVE SUMMARY

Since 1997, LT Environmental, Inc. (LTE) has conducted methane seep monitoring on the Fruitland Formation outcrop north of the Ute line in La Plata County, Colorado. The study area is located along the northern rim of the San Juan Basin (SJB), north of the Southern Ute Indian Reservation. The objectives of the monitoring program are to observe and document the relative change in methane seepage from the Fruitland Formation outcrop over time and space. The overriding goal of the program is to ensure the safety of the public and the environment.

The field methods of the monitoring program include methane seepage flow measurements from six gas flux chambers; periodic monitoring of gas concentration from 180 permanent monitoring probes; detailed mapping in known seep areas; and regional reconnaissance along the entire outcrop using infrared imagery (IR) and field verification (pedestrian survey). In 2005, this monitoring effort also incorporated a baseline survey of natural springs located on the Fruitland Formation outcrop. Results of each area of the monitoring program are presented below.

GAS FLUX CHAMBERS

Results of flux chamber monitoring indicate that gas flow rates recorded at the gas flux chambers are consistent with previous years. While some monitoring periods have reported higher flow rates in comparison to previous years, others reported lower flow rates as compared to previous years. Historic maximum flow rates were exceeded in the Florida River flux chamber and the East Pine Flux Chamber. There does not appear to be an increasing trend in gas flux data at any of the monitoring locations. Most data suggest gas flow rates are remaining the same or slightly decreasing. As discussed in previous reports, the highest flows are recorded in the Texas Creek area. The lowest flows are recorded in the East Pine area.

LTE recommends that monitoring of the gas flux chamber system be discontinued indefinitely. LTE has identified several factors in the gas flux chamber monitoring program that support the termination of this monitoring method including: 1) data have shown no conclusive upward or downward trends during eight years of operation; 2) equipment is highly susceptible to weathering and corrosion from the elements; 3) power supply requirements cause frequent discharge of battery system despite solar powered assistance; and 4) cost of performing frequent O&M activities and extensive data manipulation outweighs value of data obtained.

DETAILED SEEP MAPPING

The 2005 detailed mapping event was performed from June 8, 2005 through June 17, 2005. This is the fourth detailed seep mapping event conducted in these areas, with the exception of the Hoier Property and Texas Creek East, which have been mapped three times. Previous detailed mapping events were conducted in October 2002, May 2003, and May 2004. The Pine River mapping area, mapped by BP, Inc. (BP), was added to the detailed mapping program in 2005 at the request of the staff of the Colorado Oil and Gas Conservation Commission (COGCC). LTE employed a consistent mapping methodology during each of the four detailed mapping events conducted to date.

Results of the 2005 detailed mapping program typically showed that methane concentrations in historically active seep areas are higher than previously detected. The higher methane concentrations were most evident at the historical seep areas in Florida River, Texas Creek, and the upland areas of Carbon Junction. In general, the methane concentrations and/or seep extent at other locations across the study area appear to be relatively consistent with previous years.

In general, only one new area of methane seepage was identified by the 2005 detailed seep mapping event. Methane seepage was identified for the first time in the field located east of the Pine River however the 2005 mapping event was the first time access had been granted to the property.

PERMANENT MONITORING PROBES

LTE conducted a statistical analysis of the data collected by the Bureau of Land Management (BLM) from 152 of the 180 permanent monitoring probes located in the project area. The most recent data available from the Basin Creek probe line were collected in November 2002, so no new trends were calculated for this transect.

Statistical analysis of the 152 permanent monitoring probes indicated that 33 probes exhibit trends at the 90% significance level. Of the significant trends, 42% were upward and 58% were downward. This shows a slight decrease in the number of upward trends as compared to the previous statistical evaluation which reported 53% upward trends and 47% downward trends.

All the statistically significant trends from the Carbon Junction east and west transects are downward. The three statistically significant trends from the Pine River transect are upward. However, these trends poorly reflect the actual data set since probe 109 has only detected methane three times and probe 107 is highly variable in concentration ranging from no detectable methane to greater than 90% methane. Both upward and downward trends were calculated from the Florida River and Texas Creek east and west transects. No statistically significant trends were calculated at the East Pine River east and west and Edgemont Ranch transects.

REGIONAL RECONNAISSANCE

The regional reconnaissance continues to demonstrate the usefulness of the IR image evaluation in identifying suspect areas. The 2005 regional reconnaissance survey indicated several areas of methane seepage that were previously undefined. These areas include an upland area north of Basin Creek, an upland area west of Florida River, two upland areas in the Vosburg Pike mapping area, and an area in the field east of the Pine River.

LTE estimated the extent of detectable methane seepage using the data collected during the detailed mapping and the regional reconnaissance. Areas with detectable methane were defined using polygons in the Geographic Information System (GIS). The polygons were conservatively estimated and even grouped some non-contiguous seep areas into one polygon as part of the estimate. The total area of the polygons was calculated and compared to the total area of the Fruitland Formation outcrop based on the Colorado Geological Survey (CGS) geologic maps. The area of detectable methane seepage calculated using this method equates to less than three percent of the outcrop area.



NATURAL SPRING SURVEY

The natural spring survey was useful in collecting baseline flow rates and methane concentrations of the natural springs located on the Fruitland Formation outcrop north of the Ute line in La Plata County. The baseline data obtained in 2005 will help in assessing any future changes to the identified natural springs.

During LTE's literature and interview research, four potential natural springs were identified on the Fruitland Formation outcrop in La Plata County north of the Ute line. A total of three of the four identified springs were field-verified and sampled for analysis of dissolved methane. Results of the natural spring survey indicate dissolved methane at a concentration of 0.002 milligrams per Liter (mg/L) in a spring located on the Darwin Rather property in the Texas Creek mapping area. The concentration is relatively low; therefore, it appears that the risk of dissolved methane entering a drinking water well or piping system, or creating a hazardous situation in a confined space, is relatively low.

RECOMMENDATIONS

Based on the results of the gas flux chamber monitoring, the 2005 detailed seep mapping, the permanent monitoring probe data, the 2005 regional reconnaissance, and the natural spring survey, LTE recommends the following:

- Monitoring of the flux chamber system should be discontinued indefinitely;
- The next detailed mapping event should be performed in May 2006;
- The upland area north of Basin Creek, the upland area east of Edgemont Ranch, the upland areas in the Vosburg Pike mapping area, and the Ward Property should be added to the 2006 detailed mapping program;
- Discontinue or significantly reduce the frequency of monitoring the permanent monitoring probes;
- Conduct an updated IR aerial survey, suspect area identification, and field verification event (regional reconnaissance) in 2008; and
- An updated natural spring survey should be conducted during the next regional reconnaissance event in 2008 to assess any changes to flow rates and/or chemistry of natural springs in La Plata County north of the Ute line.

SECTION 1.0

INTRODUCTION

Since 1997, LT Environmental, Inc. (LTE) has conducted methane seep monitoring on the Fruitland Formation outcrop in La Plata County, Colorado (Figures 1A and 1B). The study area is located along the north rim of the San Juan Basin (SJB), north of the Southern Ute Indian Reservation.

This program is being conducted on behalf of BP, Inc. (BP); XTO Energy, Inc. (XTO); Chevron Production Company (Chevron); the Bureau of Land Management (BLM); the Colorado Oil and Gas Conservation Commission (COGCC); and La Plata County. These companies and governmental agencies are collectively referred to as “The Group”.

1.1 OBJECTIVES

The objectives of the monitoring program are to observe and document the relative change in methane seepage from the Fruitland Formation outcrop over time and space. The overriding goal of the program is to ensure the safety of the public and the environment.

1.2 ORGANIZATION OF REPORT

This report is organized into eight sections including this introduction, which presents the objective of the study and discusses background information related to the project. The field methods used to complete the scope of work are described in Section 2.0. Section 3.0 presents the results of the flux chamber monitoring. The results of the detailed mapping activities are summarized in Section 4.0. The evaluation of the BLM probe data is presented in Section 5.0. The results of the infrared (IR) imagery and field verification study (regional reconnaissance) are summarized in Section 6.0. The results of the natural spring survey are presented in Section 7.0. Section 8.0 presents the conclusions of this monitoring event and recommendations for continued monitoring. Tables, figures, and appendices follow the text in separate sections. Pertinent charts and photographs have been included in the text.

1.3 BACKGROUND INFORMATION

The study area consists of approximately 23 miles of the Fruitland Formation outcrop extending from the Southern Ute Indian Reservation northern boundary near Basin Creek (southwest of Durango) north and eastward to the La Plata County and Archuleta County border (Figure 1B). There have been a number of previous and ongoing studies, which support the overall methane seepage evaluation. Some of these studies include:

- Detailed mapping, methane seepage data collection, and mitigation in the Pine River area by BP between 1994 and 2004;
- Reconnaissance survey by BLM/Stonebrooke in 1995, which consisted of collection of over 1,100 surface and/or subsurface methane sample points. This survey identified four additional primary methane gas seepage areas besides Pine River

including Basin Creek, Carbon Junction, Florida River, and South Fork Texas Creek (Texas Creek);

- Installation of 162 permanent soil gas monitoring probes by LTE in 1997, with 18 additional probes installed at various locations since that time, and ongoing monitoring of the points by the BLM. The probes are sampled approximately six to eight times per year;
- Installation and ongoing monitoring of six flux chambers in the primary seepage areas. The gas flux chambers measure gas flow on 10-minute intervals. Data are downloaded from the flux chambers every 45 days;
- Annual pedestrian reconnaissance surveys of the outcrop by LTE from 1998 through 2001;
- Flux chamber system modifications, detailed seep mapping, and IR imagery pilot study performed in August 2002. The pilot study demonstrated that the IR imagery is useful in identifying suspect areas based on vegetation impacts, which can be subsequently field verified for the presence or absence of methane;
- Detailed seep mapping in the primary seep areas in October 2002, May 2003, May 2004, and June 2005;
- Regional reconnaissance of the 23-mile section of outcrop in the project area in July 2003 and September 2005; and
- Natural spring survey of the 23-mile outcrop north of the Ute line in La Plata County in September 2005.



SECTION 2.0

FIELD METHODS

This section describes the approach and procedures used during flux chamber monitoring, detailed seep mapping, permanent soil gas probe monitoring, regional outcrop reconnaissance, and natural spring survey.

2.1 GAS FLUX CHAMBER MONITORING

LTE continues data collection and operation and maintenance (O&M) activities at the six gas flux chambers located on the Fruitland Formation outcrop. The flux chamber at Basin Creek was removed in August 2003 to accommodate construction activities as part of the Animas-La Plata Project (ALP). Data are collected on 10-minute intervals and stored in a Datataker[®] remote datalogger. Data are downloaded from each of the dataloggers approximately every 45 days and transferred to a database for evaluation. LTE personnel regularly inspect each of the chambers for operational issues and makes the necessary adjustments to maximize data collection. Power supply issues and mechanical problems are remedied during each inspection, as required. The flux chamber locations are presented in Figure 1A. The data from the chambers are stored in a Microsoft[®] Access database to facilitate data retrieval using specified queries.

2.2 DETAILED METHANE GAS SEEP MAPPING

Detailed mapping is performed in the active seep areas on an annual basis. The detailed seep mapping was performed June 8, 2005 through June 17, 2005 in the areas of Basin Creek (also known as Ridges Basin), Carbon Junction, Florida River, Texas Creek, the Hoier Property, and Pine River.

The streambed in the Basin Creek area was not mapped due to ALP dam construction activities. The construction of the dam and removal of vegetation caused large quantities of sediment to accumulate in the stream bed, thus making the area inaccessible for seep mapping during 2004 and 2005. The areas adjacent to the stream bed were mapped as planned but based on recent observations, the construction area appears to be steadily increasing in size, reducing the observable seep features and further limiting access to map and monitor seep activity at Basin Creek. A photograph of the streambed at Basin Creek is provided below.

The Pine River mapping area, previously mapped by BP since 1994, was added to the mapping program during the 2005 detailed mapping event. The COGCC requested that LTE add Pine River to the mapping program in order to maintain consistent monitoring techniques over the Fruitland Formation outcrop in La Plata County north of the Ute line.

The LTE field crew was equipped with the aerial photographs (digital orthoquads), topographic maps, digital camera, sampling equipment (slide-hammer and probe), global positioning system (GPS), and a Mine Safety Appliances (MSA) GasPort[®] field meter capable of detecting methane, hydrogen sulfide (H₂S), oxygen (O₂), and carbon monoxide (CO).





Streambed at
Basin Creek,
view west.

The detailed seep mapping program involved walking the known seep areas and vicinity and noting dead, stressed, and non-vegetation areas. Areas where visible seeps were occurring within surface water bodies were also identified and mapped. LTE mapped the dead or stressed trees and areas of dead or stressed grass using the GPS. Subsurface measurements of methane, H₂S, CO, and O₂ were collected, where appropriate.

When the surface water flow was relatively low, LTE waded through the streams looking for methane seep bubbles and stressed/dead vegetation. Since this mapping event was performed during spring runoff, visible seeps within the surface water bodies were limited. If wading was not possible, the banks of each waterway were traversed. Pertinent features on each side of the waterway were mapped in areas where property access was granted.

2.2.1 Types of Features Observed

The types of features noted during the detailed mapping survey included the following:

- non-vegetated areas;
- dead trees;
- dead vegetation areas;
- pertinent live trees;
- stressed vegetation areas;
- stressed trees; and
- pertinent live vegetation areas;
- methane seeps within surface water bodies.

In the lowland areas, LTE focused on non-vegetation areas that were adjacent to live vegetation areas. These areas were commonly located in the valley lowlands and appear to have been vegetated in the past but have since died off. The dead vegetation areas were observed as patches of dead bushes and/or grass. Stressed vegetation areas were defined as co-mingled sparsely vegetated areas and non-vegetated areas. The small dead or non-vegetated areas were

mapped independently at each mapping area. Pertinent live vegetation features were mapped when they appeared as mappable surface areas coexisting with dead or non-vegetated areas.

The mapping results are discussed in Section 4.0 and presented in figures, which are contained in a separate section following the text. The subsurface methane measurement location symbols are graduated based on concentration. Trees and seeps are mapped as point features. Dead, stressed, and non-vegetation areas are mapped as polygon features.

2.2.2 Use of GPS

LTE used a Trimble GeoXT[®] GPS with a real-time correction processor to map each feature during the 2005 detailed seep mapping event. The methane measurements and other relevant field notes were stored as attributes in the GPS unit with the associated GPS mapped positions. The GPS data were later downloaded and grouped according to the type of feature, as points, lines, or polygons. The specification sheet for the GPS is included in Appendix A.

The data were collected with a GPS in the 1984 World Geodetic System (WGS 84) and projected into the Universal Transverse Mercator coordinate system using the 1983 North American Datum (NAD 83). The data are input into the ArcView[®] project file developed by LTE in 2001. On average, 20 GPS readings were collected for each point feature in order to obtain more accurate positioning. The perimeter of each mapped area was slowly traversed collecting positioning data at a rate of approximately one logged point per second.

2.2.3 Gas Measurement Collection

A slide hammer was used to advance a half-inch diameter steel rod (probe) to a depth of approximately 36 inches below ground surface (bgs) during the seep mapping. Some probe holes were shallower than 36 inches due to the density of the ground surface. One-quarter inch diameter polyethylene tubing, perforated at the bottom six inches, was inserted into each probe hole to collect subsurface gas measurements. The MSA GasPort[®] field meter was utilized to measure the concentration of methane, H₂S, CO, and O₂ in each probe hole. After recording the gas reading, the tubing was removed and the probe hole was backfilled with native soil.

The MSA GasPort[®] is capable of detecting methane in concentrations from 0.0 parts per million (ppm) to 100 percent (%) methane. The specification sheet for the MSA GasPort[®] is included in Appendix A. The field meter was calibrated to methane, H₂S, and CO each morning and again at midday to ensure the equipment was working properly.

2.3 PERMANENT PROBE MONITORING

As discussed in previous monitoring reports for this project, the BLM collects data from the 180 permanent monitoring probes installed at or near the primary seep areas within the project area. Approximately six times per year, the BLM measures methane concentration from these probes and inputs the data into a database.

Considerable fluctuation has been observed in the subsurface methane concentrations. In order to investigate whether any statistically significant trends have been observed, the data were analyzed using the Mann-Kendall test for trend. This non-parametric test is useful in

understanding time series data. It is also useful since missing values are allowed; it is not greatly affected by outliers; and no assumptions need to be made about the distribution of the data. The test is performed using the relative rankings of data points, rather than using their actual values. This report discusses the most recent results of the data that LTE acquired from the BLM database.

2.4 REGIONAL RECONNAISSANCE

The regional outcrop monitoring consists of IR imagery acquisition and evaluation followed by field verification of suspect areas identified in the imagery. A pilot test study was performed over a small portion of the outcrop in 2002 and the first regional reconnaissance study of the entire 23-mile outcrop was performed in 2003. This report discusses the results of the 2005 regional reconnaissance.

2.4.1 Aerial Photograph and Infrared Imagery Review

The purpose of the IR imagery is to assist in long term reconnaissance monitoring of the entire outcrop to identify changes in methane seepage over time and space. While the imagery cannot identify specific seep areas, it is useful in identifying areas of dead and/or stressed vegetation that may or may not be attributable to methane seepage. Therefore, LTE contracted Mr. Kevin Lee Hayes, a digital IR imaging expert from Colorado State University (CSU), to assist in identifying suspect areas along the outcrop.

Suspect areas are defined as areas observed within the IR image that appear anomalous when compared to the surrounding areas. For example, a light gray colored area surrounded by bright red colored areas would be considered a suspect area. The natural features that often produce such suspect areas include areas of dead vegetation, shadows, rock outcrops, and patches of stressed vegetation.

Through field verification processes, the suspect areas are inspected to determine the presence or absence of methane gas. In addition, the photo-documentation record and subsequent image acquisition will provide a method to monitor changes in vegetative conditions across the Fruitland Formation outcrop over time.

Acquisition of Aerial Imagery

Imagery acquisition by Agro Engineering (Agro) of Alamosa, Colorado, was selected based on image quality, availability, logistical considerations, and cost. Agro was able to follow the GPS flight path supplied by LTE accurately and completely. The flight was conducted on June 8, 2005.

The photo-mission traversed the 23-mile long project area three times, collecting three different resolutions (0.5 meters, 1.0 meters, and 1.5 meters). The flying altitude was approximately 15,000 feet above mean sea level (amsl) over rugged terrain with elevations between 6,400 and 8,400 feet amsl. The interpretation and analysis for the entire outcrop were performed using the 1.5 meter resolution images since they were determined to be useful for identifying suspect areas and also require fewer images to rectify and evaluate across the entire outcrop area. However,

the images captured at the 0.5 meter and 1.0 meter resolutions are readily available for future evaluations, if necessary.

A total of 44 images were captured in La Plata County at the 1.5 meter resolution covering approximately 23,950 acres of land area. The surface area of the Fruitland Formation outcrop in the project area is approximately 4,100 acres. The specification sheet for the IR camera used for this project is presented in Appendix A.

Image Georectification

In order to present the data and aerial IR imagery, it is first necessary to georectify the imagery. This process assigns a coordinate system to the IR imagery so that geographic features can be mapped and presented on the imagery as a map base.

LTE contracted Mr. Hayes to process and georectify the 44 images collected at 1.5 meter resolution during the June 8, 2005 flight of the Fruitland Formation outcrop in the project area. The images were tiled together into three groups and imported into the Geographic Information System (GIS) for the project area by Agro.

The accuracy of a georectified base map is proportional to the number of control points available and the time and effort exerted during the rectification process. Digital Orthophoto Quarter Quadrangles (DOQQs) were used as the reference map and the IR image was rectified to the DOQQ. Therefore, the accuracy of the IR base map image is limited but still provides a frame of reference for the field mapping data collected. In some cases the IR image is accurate to within one meter of the actual location because a control point is available nearby. In certain portions of the same image, accuracy can be skewed as much as 10 meters to 15 meters due to lack of geographic control. When viewing the data presented in this report, remember that GPS data are accurate to within one meter and the actual position of the feature mapped should be trusted over the position of the features observed within the IR image. Ultimately, we can obtain the required accuracy to perform the field verification activities but can also control project costs using this approach.

Analysis of Imagery

A variety of software imaging packages was used. Microsoft Photo Editor[®], Adobe Photoshop[®], Kodak Photo Imager[®], and ACDSee[®] proved helpful for cursory examination on a color computer monitor. All of these imaging packages are not appropriate for viewing pixel-level detail (i.e. zoomed in or enlarged).

Spectral analysis using ERDAS Imagine[®] software further refines the utility of the imagery but the effort involved in obtaining the data outweighs the usefulness of the result. Therefore, LTE decided that the "heads-up" method of image evaluation would be best suited to identify areas with significant vegetation mortality. Field verification of these suspect areas could then determine if the mortality was a result of methane seepage.

The images acquired within the study area were evaluated by Mr. Hayes using simple visual techniques. Based on professional experience in evaluating IR imagery and knowledge gained during previous mapping events, Mr. Hayes was able to identify suspect areas on the Fruitland

Formation outcrop across the 23-mile project area that appeared to contain vegetation mortality or, in some cases, stressed vegetation.

2.4.2 Field Verification

Field verification of the IR imagery was performed by LTE during the period from September 14, 2005 through September 22, 2005. Using a GPS, slide hammer, and methane meter, LTE visited each of the suspect areas, where accessible, and collected subsurface methane measurements within each polygon and outside the perimeter of each polygon. LTE also collected photographs of the area and described the features observed. The field verification data have been relayed to Kevin Hayes to refine future evaluations of IR imagery.

2.5 NATURAL SPRING SURVEY

Prior to investigating natural springs in the field, LTE conducted a literature search to identify natural springs that have already been mapped. LTE interviewed regulatory agencies including the BLM, United States Forest Service (USFS), Colorado Division of Wildlife (CDOW), and the Office of the State Engineer (SEO) to identify the locations of any known natural springs on the Fruitland Formation outcrop.

LTE prepared property boundary maps using aerial photography as a base map layer and the ownership parcel data from the La Plata County Assessor's office. The maps were sent to the landowners whose properties intersect the Fruitland Formation outcrop. A letter requesting information about natural springs on the property was included. Landowners were asked to draw in the location of natural springs on their property and return the maps to LTE. LTE compiled the data and digitized the locations into the GIS. This research method was, by far, the most useful in obtaining information on existing and historic springs.

During the field-verification activities, LTE inspected the natural springs, located the position and elevation with the GPS, measured a flow rate, and collected water quality measurements of pH, total dissolved solids (TDS), conductivity, oxidation-reduction potential (ORP), and temperature. Water samples from each spring identified were also collected and submitted to an analytical laboratory. The samples were delivered to Four Corners Geoscience (FCG) for analysis of dissolved methane in water by a method developed by the United States Geological Survey (USGS) and BLM.

Natural spring flow rate estimates were measured by capturing surface water into a graduated container. The time to fill the container was recorded using a stop-watch. The flow rate was reported in gallons per minute and recorded in the GPS.

LTE understands that the BLM is currently conducting a natural spring survey of the outcrop area. LTE requested a copy of the data collected as part of this survey but had not received any response from the BLM at the time of publication of this report.

2.6 LIMITATIONS

Generally, readings collected with the GPS unit can be located within one-meter radius of accuracy. But the type of terrain that exists along the Fruitland Formation outcrop can present

difficulties for both the GPS unit and collection of subsurface methane samples with the slide hammer. North-facing slopes and heavily wooded areas are difficult to obtain accurate positioning by the GPS, therefore, the GPS accuracy decreases. Satellite signals are frequently bounced among the trees or lost completely. When satellite signals are limited, positioning accuracy decreases. In some cases, the GPS unit can not obtain a signal. In these situations, LTE field personnel took subsurface methane measurements and noted the results on the maps.

Soil probing in consolidated materials along the outcrop was limited. LTE used the slide hammer to probe to a maximum depth of 36 inches bgs. In some cases, probing depths of 18 inches bgs were laborious to achieve. If refusal occurred, measurements were taken at the depth bored. All probe holes were advanced to a depth ranging from 6 inches to 36 inches bgs depending on the type of surface cover present.

Finally, LTE was restricted by property owners from accessing several areas within the project area. These areas are noted on the maps presented in this report.



SECTION 3.0

FLUX CHAMBER MONITORING RESULTS

This section summarizes the data collected and describes the O&M conducted at each of the flux chamber locations from July 2004 through September 2005. Flux chamber data are presented in Appendix B. Flux chamber monitoring locations are illustrated on Figure 1A.

3.1 BASIN CREEK

As previously reported, the flux chamber formerly located at Basin Creek has been removed and stored in a Durango storeroom during construction of the ALP, a dam construction and water storage project. No data have been collected at this gas flux chamber location since August 2003.

3.2 CARBON JUNCTION

No data were collected from the Carbon Junction chamber during the first half of 2005. LTE noted serious equipment failure during a February 2005 visit and began to troubleshoot the problem. The flow meter was sent to the manufacturer and recalibrated and returned to the site. Upon further inspection of the chamber, LTE noted severe weathering and corrosion of the data cable and internal cable connections on the data logger. LTE purchased a replacement logger and re-wired the entire system for startup in late July 2005. Following restart, the system appears to be operating correctly.

Despite modifications to the radius of capture and relocation of this chamber in close proximity to the Animas River, flow rates observed range from 150 standard cubic centimeters per minute (scm) to 400 scm. This is consistent with the flows recorded in February 2004.

3.3 FLORIDA RIVER

The flux chamber located within the pond recorded flow rates during the initial half of 2005 that were consistent with the latter half of 2004 ranging from 100 to 300 scm. During the period from June 2005 to July 2005, flow rates appear to have increased by approximately 100 scm. Peak flow rates in July and August of 2005 are approximately 400 scm.

3.4 TEXAS CREEK

The Texas Creek area has two flux chamber units, one set directly within the creek and another approximately 100 yards to the west on land. Flows recorded from the unit within the creek in 2005 are similar to previous years ranging from 400 scm to approximately 5,000 scm.

No usable data were collected from the Texas Creek land flux chamber during 2005. The system has experienced several technical difficulties, which LTE is addressing at this time. The technical difficulties have included: weathering and corrosion of cables and the battery, data bias during high wind storm events; communication errors with the data logger; calibration issues and power supply issues with flow meter; and obstructed flowline pathways.

3.5 PINE RIVER

Flow recorded at Pine River remains sporadic in nature and the magnitude recorded is significantly lower than its counterpart (BP's pyramids within the Pine River). Flow rates appear to be approximately half of the flow recorded during 2004 with peak flows slightly over 550 sccm.

3.6 EAST PINE

The flow rates recorded at the East Pine flux chamber appear to be consistent with previous measurement periods. Flow rates typically range between 25 and 50 sccm. It is not certain that this unit is actually measuring methane gas seepage since the unit is located high atop a hillside and is susceptible to ambient air flow from around the base of the chamber. However, methane gas is occasionally detected within the chamber during O&M visits at concentrations ranging from 100 to 250 ppm.

3.7 WEATHER STATION DATA COMPARISON

LTE compared the flow data collected from the chambers to the barometric pressure data and temperature data for the Durango area, publicly available from the National Oceanic and Atmospheric Administration (NOAA). LTE prefers these weather data over the data collected by the onsite weather station because the data are cheaper to obtain and the sensors are calibrated more frequently and with a higher degree of precision. The weather station used for our comparison is located at the La Plata County Airport.

As shown with previous comparisons to the gas flow data, there are no consistent trends between barometric pressure and/or temperature to gas seepage. Gas flow data with temperature and barometric pressure data are presented in Appendix B.

3.8 FLUX CHAMBER MONITORING SUMMARY

Overall, gas flow rates recorded at the gas flux chambers are consistent with previous years. While some monitoring periods have reported higher flow rates in comparison to previous years, others reported lower flow rates as compared to previous years. There does not appear to be an increasing trend in gas flux data at any of the monitoring locations. Most data suggest gas flow rates are remaining the same or slightly decreasing.

SECTION 4.0

DETAILED SEEP MAPPING RESULTS

The following sections summarize the observations made during the detailed seep mapping conducted from June 8, 2005 through June 17, 2005. This is the fourth detailed seep mapping event conducted, with the exception of the Hoier Property and Texas Creek East which have been mapped three times. Previous detailed mapping events were conducted in October 2002, May 2003, and May 2004.

The mapping activities followed the procedures outlined in Section 3.0. The report sections are grouped by study area and frequently reference figures for illustration purposes. Figures are included in a separate section following the text. For each figure reference, LTE has designated a text reference label to easily identify the location discussed. Each label consists of a two-letter abbreviation for the mapping area followed by a number (i.e. BC-1). Aerial photographs used as the base map in the figures for this report are dated September 1993. The aerial photos do not depict physical changes that may have occurred since that date, such as the ALP dam construction at Basin Creek. An IR image taken of the Basin Creek area in June 2005 indicates the changes that have occurred due to the ALP dam construction since 1993 (Figure 33). The geologic contacts depicted on the aerial photographic maps were derived from geologic maps prepared by the Colorado Geological Survey (CGS) and digitized at a scale of 1:25,000. Accuracy of the formation contact location is reduced when aerial photographs are viewed at a smaller scale.

4.1 BASIN CREEK

The detailed seep mapping for Basin Creek was completed on June 17, 2005. The stream bed was not mapped during this mapping event due to access issues as discussed in Section 2.2. The mapping area was centered on Basin Creek and was approximately 0.12 miles in the east-west direction and 0.09 miles in the north-south direction. Figure 2 illustrates the results of the mapping in the Basin Creek area.

4.1.1 Observed Methane Seeps in Surface Water

Visible methane seeps were noted within a small portion of the creek in the area correlating to the lower portion of the Fruitland Formation based on surface geology as mapped by the CGS (shown in red on Figure 2). Due to the severe sedimentation of the alluvial valley, much of the creek did not contain surface water, so identifying visible seeps was difficult. In addition, most of the creek area could not be accessed due to construction activities.

4.1.2 Lowland Areas

Due to the construction activities and severe sedimentation in the alluvial valley of Basin Creek, there were no features mapped in lowland areas during this mapping event. A photograph of the Basin Creek lowland area is presented below.

4.1.3 Upland Areas

LTE collected 31 subsurface methane measurements in the upland area located south of Basin Creek. Eleven of the 31 measurements reported detectable methane concentrations. The highest methane concentration reported was 24%. In general, the highest concentrations of methane were recorded along the top of a ridge bordered by rock outcrops to the southeast (BC-1, Figure 2).



Construction activities at Basin Creek, view north.

The majority of the upland area and surrounding hillsides in the Basin Creek area were dominated by stressed scrub oak typical of the region during drought conditions. One stressed pine tree, one dead pine tree, and one dead cottonwood tree were mapped in the upland area.

The upland area located north of Basin Creek was mapped during the 2005 regional reconnaissance. This area will be added to future detailed mapping events.

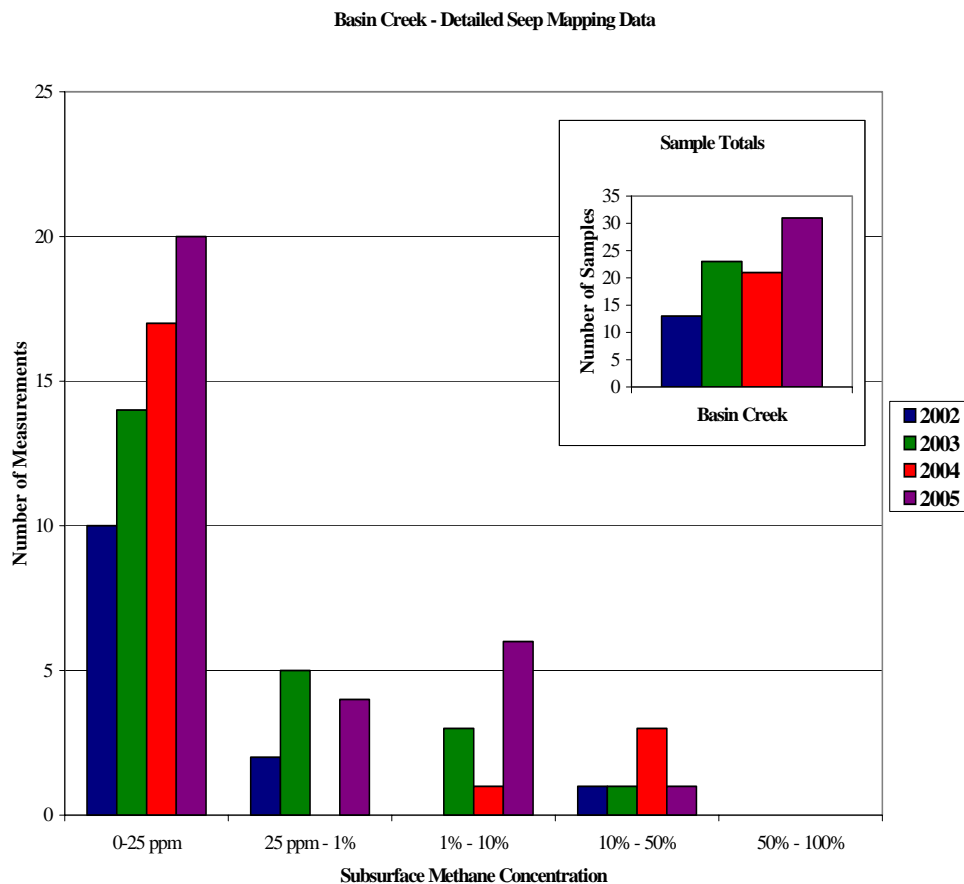
4.1.4 Comparison to Previous Surveys

Based on the subsurface methane measurements collected annually since 2002 as part of the Basin Creek detailed mapping program, the most active seep areas appear to be south of the creek. One area is located in the lowland valley near the contact between the Pictured Cliffs Formation and the Fruitland Formation and in the vicinity of the dead cottonwood tree and the former gas flux chamber (BC-2, Figure 2). Methane has been detected in this area during the 2002, 2003, and 2004 mapping events. However, methane was not detected next to the dead cottonwood tree nor was it detected near the former gas flux chamber location during the most recent mapping event.

The other main seep area is located approximately 300 feet south of the cottonwood tree, along the top of a ridge (BC-1, Figure 2). Methane has been detected in this area during the previous

three mapping events. Historically, the highest methane concentration detected in this area is 31% and was recorded in 2004.

The number of subsurface methane measurement locations at Basin Creek has increased since detailed mapping commenced in 2002. When comparing concentrations collected from previous years to those collected in 2005, the highest concentrations detected are relatively similar and occur in the same areas in Basin Creek. The most recent data do not indicate the presence of new seep areas in the Basin Creek mapping area. The following chart illustrates the number of samples collected during each detailed mapping event and the distribution of the concentration values. Figure 3 illustrates the historical subsurface methane concentration data for Basin Creek.



No stressed/dead vegetation areas were mapped in 2004 or 2005, due to access issues in the mapping area. Dead vegetation previously observed north of the creek is now gone due to excavation activities. Based on the data, there appears to be several stressed/dead vegetation areas in 2003 that were not mapped in 2002. According to historical data, 21 stressed/dead trees were mapped in 2002 with approximately 10 additional stressed/dead trees mapped in 2003. One new stressed/dead tree was mapped in 2004. A total of two additional stressed/dead trees (one dead pine tree and one stressed pine tree) were mapped in 2005. No methane was detected in the subsurface at the base of the two additional stressed/dead trees. In general, it appears that the majority of the stressed/dead vegetation in the Basin Creek mapping area is most likely the result of drought conditions. Figure 4 illustrates the distribution of stressed/dead trees and vegetation areas over time.

The ability to map visible seeps in surface water is strongly dependent on water levels within the surface water body at the time of mapping. Historical data indicate that more seeps were present in 2003 than in 2002 but water levels in 2002 were very low or not present whereas more water was noted in the creek in 2003. In 2004, the creek was filled with sediment from dam construction activities, therefore seeps could not be observed in the creek. Due to the absence of water in the majority of the streambed, only four methane seeps were observed during 2004. In 2005, further sedimentation from dam construction continued to prohibit methane seeps from being observed in the creek. As a result of sedimentation, only two methane seeps were noted in surface water in 2005. Figure 5 illustrates the historical distribution of visible methane seeps in surface waters at Basin Creek. As described earlier, the base photograph was taken in 1993, prior to the ALP dam construction activity. The IR image used for the base photograph on Figure 33 was taken in June 2005 and depicts changes in the vicinity of the Basin Creek mapping area.

4.2 CARBON JUNCTION

The mapping area at Carbon Junction is centered on the Animas River near the Wal-Mart shopping center on Highway 160 and extends approximately one-mile in the east-west direction and 0.25 miles in the north-south direction. The detailed mapping activities occurred on June 8, 2005 and June 9, 2005. The 2005 field data are illustrated on Figures 6 and 7.

4.2.1 Observed Methane Seeps in Surface Water



Animas River at Carbon Junction, view south.

The Animas River is a major river in Colorado, and therefore, only the visible seeps along the banks were mapped due to the high water flow rates within the river at the time of mapping. Observable methane seeps were sparsely distributed along both banks of the river downstream from the boat launch area for a distance of approximately 650 feet. Subsurface measurements were not recorded along the banks of the river due to the high water levels.

4.2.2 Lowland Areas

Tree stumps along with stressed/dead cottonwood, pine, aspen, juniper and scrub oak trees were noted along the banks of the Animas River during the detailed seep mapping conducted in June 2005. A total of seven areas of stressed/dead vegetation were mapped in the lowland area east of the Animas River. The maximum methane concentration reported along the east side of the Animas River was 24%, recorded near a cluster of dead scrub oak, located approximately 80 feet northeast of the gas flux chamber (CJ-1, Figure 6).

In the area between the shooting range and the west bank of the Animas River, approximately 23 stressed/dead vegetation areas and 19 stressed/dead trees were noted. Many of these areas recorded elevated concentrations of methane ranging between 1,000 ppm (0.1%) and 83% (CJ-2, Figure 6). Methane concentrations ranging between 5% and 45% were most frequently reported in this area. The highest methane concentrations were recorded along a hillside west of La Posta Road and east of the shooting range. This area has been noted as an active seep area during previous detailed mapping events and is dominated by stressed/dead sage brush.

4.2.3 Upland Areas

Five stressed/dead vegetation areas and six stressed/dead trees were mapped west of the shooting range (CJ-3, Figure 6). Dead scrub oak had been noted in previous detailed mapping events in the area west of the shooting range. Detectable methane concentrations ranged between 12,000 ppm (1.2%) and 78% in this area. Six of the 10 measurements obtained reported methane concentrations of 24% or greater.

In the southern upland area east of Highway 3, LTE mapped four stressed/dead vegetation areas and two stressed/dead trees (CJ-4, Figure 7). During the 2003 regional reconnaissance, LTE determined that this area of mortality was due to beetle infestation. No methane was detected in these stressed/dead vegetation areas during the 2004 or 2005 detailed mapping events.



Dead scrub oak west of shooting range, text reference CJ-3, view west.

The other upland areas east of Highway 3 contain large areas of stressed/dead and non-vegetation areas, many stressed/dead trees, and very high concentrations of methane in the subsurface (CJ-5, Figure 7). This area is a known active seep area and contains two permanent monitoring probe lines. A total of 52 sample points were collected in the upland area east of Highway 3. Nineteen of the 52 sample points reported detectable concentrations of methane and the maximum concentration reported was 94%. Ten of the 19 detectable concentrations were greater than 40%. The highest methane concentrations were recorded near the bottom of the drainage in the northern portion of the mapping area.

4.2.4 Comparison to Previous Surveys

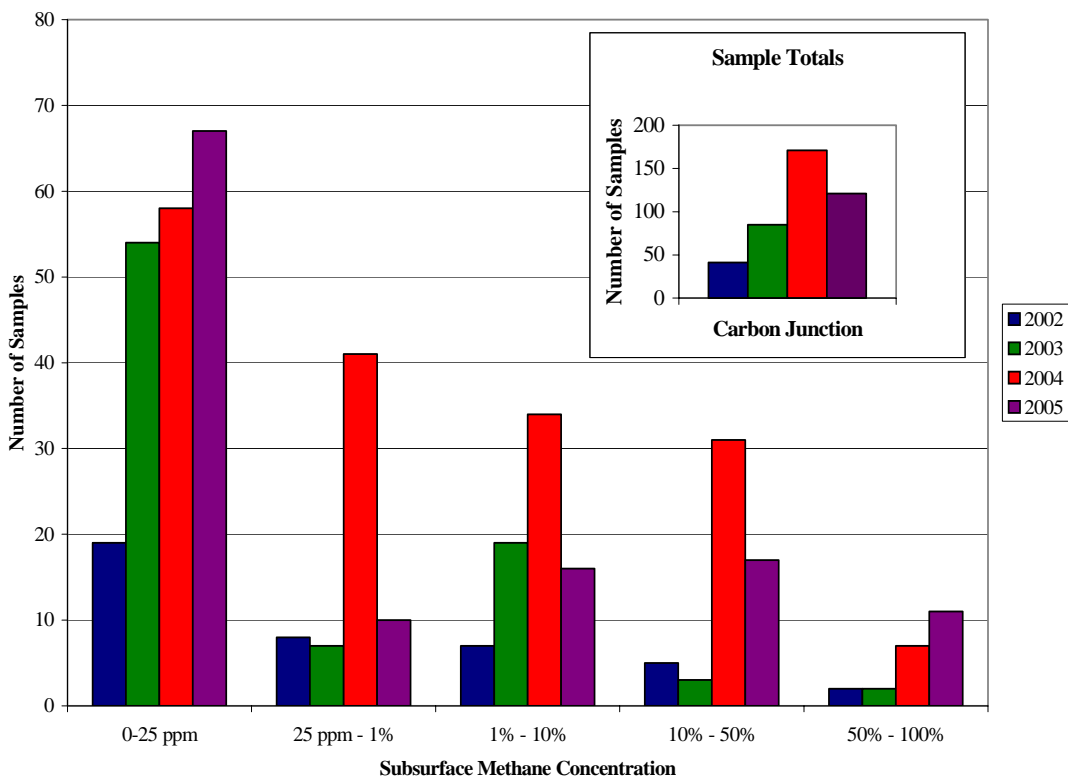
Fewer subsurface methane measurements were collected in 2005 than were collected in 2004. This is primarily due to a 50% decrease in the number of dead/stressed trees mapped during the most recent event compared to previous events. The methane concentrations collected in the lowland areas along the Animas River during 2005 appear to be consistent with previous mapping events. When comparing the methane concentrations collected in the upland areas of Carbon Junction during 2005 to previous years, data suggest an increase in the methane concentrations from previous years. The chart below summarizes the concentration distribution of the subsurface methane measurements at Carbon Junction. Figure 8 illustrates the historical data comparison of subsurface methane measurements at Carbon Junction.

Fewer vegetation features were mapped during 2005 than in previous years. In 2002, several trees were mapped in the southwestern portion of the mapping area that were not mapped between 2003 and 2005 due to activities at the shooting range. Additionally, several clusters of trees were mapped individually during previous years that were mapped as stressed/dead areas during 2005, therefore, decreasing the total number of individual features mapped. In general, the areal extent of stressed/dead vegetation areas appears to be consistent with previous years. Figure 9 illustrates the historical data comparison of stressed/dead vegetation at Carbon Junction.

Mapping of visible seeps in surface water appears to be related to stream flow conditions. In 2002, there were significantly more visible seeps mapped within the Animas River in comparison to the number of seeps identified between 2003 and 2005. Water levels in the Animas River were at historic lows in 2002. Moreover, 2002 mapping was performed in late fall whereas 2004 and 2005 mapping was performed during spring runoff conditions. The extent of visible seeps identified during the most recent mapping event appears to be most consistent with the 2003 and 2004 mapping event. The seeps identified during each of the mapping events are located along known seep trends. Figure 10 illustrates the historical data comparison of visible methane seeps in the Animas River at Carbon Junction.

H₂S was detected at two locations east of the Animas River and at two locations west of the Animas River. The maximum concentration of H₂S detected at the Carbon Junction mapping area was 10 ppm. Similar concentrations of H₂S have been detected at Carbon Junction during previous mapping events.

Carbon Junction - Detailed Seep Mapping Data



4.3 FLORIDA RIVER

The Florida River mapping area is approximately 0.40 miles in the east-west direction by 0.22 miles in the north-south direction from where the river transects the Fruitland Formation outcrop. The mapping area also included mapping of visible seeps within the Florida River from the County Road 234 bridge crossing northward to the Florida Farmers Canal head gate. The head gate is located upstream of the Fruitland Formation outcrop and stratigraphically lower in geologic section within the Lewis Formation (K1). The Florida River mapping event occurred on June 16, 2005. Figures 11 and 12 illustrate the results of the detailed seep mapping performed at the Florida River mapping area.

4.3.1 Observed Methane Seeps in Surface Water

Numerous visible methane seeps were noted in the private pond located at Terry Palmer Ranch. Methane seeps were also identified in the Florida River east and north of the private pond. Methane seeps were noted for approximately 0.10 mile upstream (north) of the private pond.

Water was observed in the bar ditch along the east and west sides of County Road 234. Visible seeps were mapped in the ditch over an extent of approximately 350 feet (FR-5, Figures 11 and 12). Seeps were not observed in the two irrigation canals west of County Road 234.





Florida River,
view north.

4.3.2 Lowland Areas

Stressed/dead and non-vegetation areas were mapped in the vicinity of the private pond on the Terry Palmer Ranch. The majority of the stressed vegetation areas were comprised of stressed grasses and were located northwest of the pond. A maximum subsurface methane concentration of 100% was reported in these areas (FR-1, Figure 11).

Several elevated methane concentrations (>50%) and stressed/dead vegetation areas were reported in the vicinity of the residence north of the pond (Turner Property). A non-vegetation area was mapped south of the pond with relatively low methane concentrations reported. Based on observations made during field activities, it appears that the absence of vegetation in the area south of the pond is most likely due to the use of the area to graze horses.

On December 13, 2005, LTE conducted an interior methane survey of the structures on the Turner Property. LTE inspected the main residential structure, the crawlspace, attic area, and the garage and utility shed. No methane was detected within any of the structures on the Turner Property.

4.3.3 Upland Areas

Due west of the Terry Palmer Ranch pond and canal system, numerous stressed/dead pine trees and stressed/dead vegetation areas were observed (FR-2, Figure 11). A total of 25 gas measurements were collected in this area and 13 of the measurements reported detectable concentrations of methane. The detectable concentrations of methane ranged between 500 ppm (0.05%) and 93% with six of the 13 concentrations greater than 10% methane. Existing permanent probes monitored by the BLM are also located in this area.

Approximately 0.15 miles southwest of location FR-2, a second cluster of stressed/dead pine trees and stressed/dead and non-vegetation areas were observed in a small open meadow bordered mostly by pine trees (FR-3, Figure 12). A total of 36 gas measurements were collected in the vicinity of the meadow and eight of the measurements reported detectable concentrations of methane ranging between 10,000 ppm (1%) and 53%. Five of the eight measurements obtained reported subsurface methane concentrations in this area of 18% or greater.

LTE mapped one stressed/dead vegetation area east of the Florida River (FR-4, Figure 11). This area was predominately stressed/dead scrub oak and tree stumps located near the top of a ridge. The maximum methane concentration recorded in this area was 24%. All other methane concentrations recorded in this area were below 10%.

4.3.4 Comparison to Previous Surveys

More subsurface methane measurements were collected during the 2005 mapping event than in previous years. This is partly due to an apparent increase in the areal extent of the stressed/dead vegetation area in the upland area northeast of the pond (FR-4, Figure 11). In addition, the area north of the pond was mapped in greater detail during 2005 due to a concern of elevated methane concentrations in the vicinity of the Turner residence. Finally, drier ground conditions enabled a greater number of methane measurements to be collected in the vicinity of the pond in 2005 as compared to previous years.

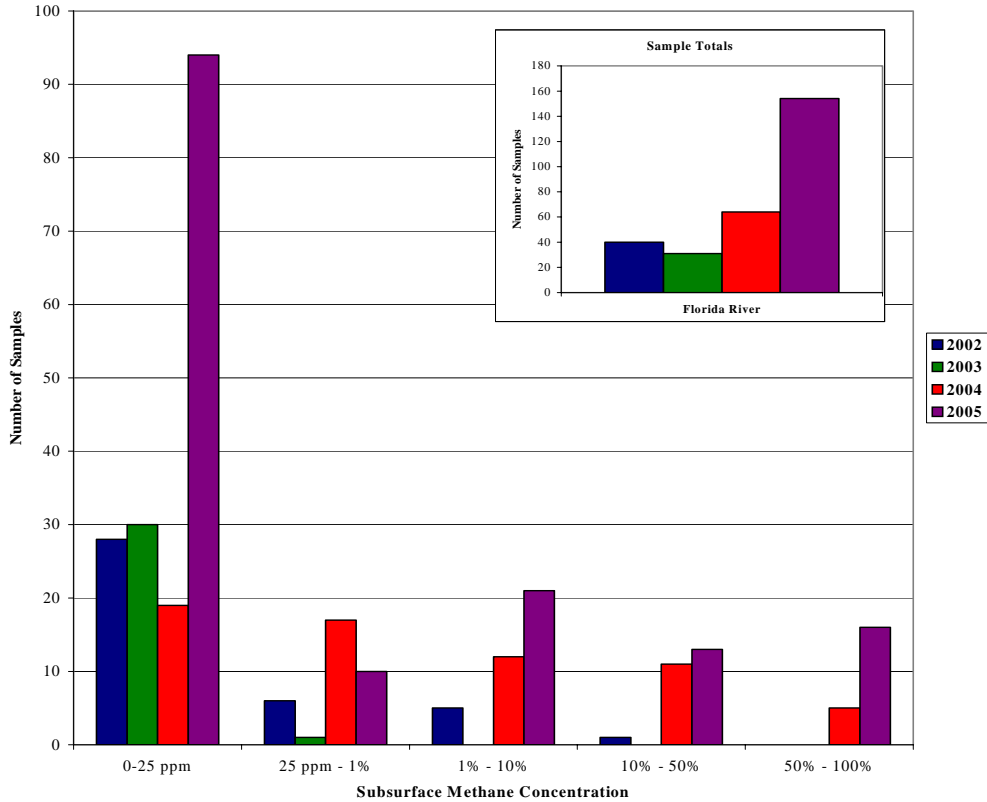
The total number of methane concentrations exceeding 1% is greater than in previous years. Figure 13 illustrates the historical data comparison of subsurface methane measurements at Florida River. The chart below illustrates the distribution of the subsurface methane measurement data.

In general, more stressed/dead vegetation areas were mapped in 2004 than in 2003. During 2005, the stressed/dead vegetation areas west of County Road 234 appear to be consistent with the stressed/dead areas mapped in 2004. The areal extent of the upland area of stressed/dead scrub oak located east of the Florida River appears to have increased in 2005 from 2004. Figure 14 illustrates the historical data comparison of stressed/dead vegetation at the Florida River mapping area.

The number of visible methane seeps noted in the Florida River during 2002 was greater than during the following three years. The greater number of visible seeps during 2002 may be due to the lower water level in the river at the time of the mapping events. In general, the 2005 data indicate that the northern and southern extents of methane seeps in the Florida River have remained relatively consistent with previous years.

The number of visible seeps noted in the pond during 2005 is relatively consistent with the number of visible seeps noted during 2002 and 2004. It appears that fewer visible methane seeps were noted in the pond during the 2003 mapping event. Figure 15 illustrates the historical data comparison of visible methane seeps at the Florida River mapping area.

Florida River - Detailed Seep Mapping Data



4.4 SOUTH FORK TEXAS CREEK

The Texas Creek mapping area is located where the south fork of Texas Creek transects the Fruitland Formation. A large alluvial grass covered valley parallels the strike of the outcrop and eventually turns northward and transects the contact between the Fruitland Formation and Pictured Cliffs Formation. The detailed mapping area covers approximately 1.5 miles in the east to west direction and 0.2 miles in the north to south direction (Figures 16 and 17). The seep area located approximately 0.25 miles east of the creek has been labeled as Texas Creek East (Figure 18). The most recent detailed seep mapping at the Texas Creek area occurred on June 12, 2005. The ground was relatively saturated due to heavy rainfall from the night prior to field activities. The field data from the 2005 detailed mapping event are illustrated on Figures 16 through 18.

4.4.1 Observed Methane Seeps in Surface Water

The water level within the South Fork of Texas Creek was relatively high but not turbulent which made methane seeps within the creek more visible. Numerous methane seeps were noted in the creek surrounding the gas flux chamber for approximately 200 feet north and south of the flux chamber (TC-1, Figure 17).

4.4.2 Lowland Areas

Stressed/dead and non-vegetation patches were mapped throughout the valley floor of the Texas Creek study area. The patches of stressed/dead vegetation form linear trends in the east-west direction, paralleling the strike of the Fruitland Formation (TC-3, Figure 16).

The largest stressed/dead and non-vegetation areas were noted in the center of the mapping area where the creek transects the Fruitland Formation and Pictured Cliffs Formation contact (TC-1, Figure 17). A total of 74 gas measurements were collected in this area and 43 of the measurements reported detectable concentrations of methane. The detectable methane concentrations ranged between 500 ppm (0.05%) and 100% in the stressed/dead and non-vegetation areas surrounding the gas flux chambers. Methane concentrations were greater than 10% in 39 of the 43 measurements reporting detectable concentrations of methane. Six of these measurements reported a concentration of 100% methane.



Non vegetation area, text reference TC-1, view south.

Stressed/dead vegetation areas and dead scrub oak were mapped where the valley floor extends south (TC-2, Figure 17). Two of the 14 measurements in this area were greater than 50% methane. These measurements are aligned in a predominantly southeast-northwest trend line parallel to the strike of the Fruitland Formation.

An active seep area was noted on the western end of the mapping area (TC-3, Figure 16). Several stressed/dead and non-vegetation areas were noted in a line and most were associated with elevated methane concentrations. A total of 23 gas measurements were recorded in this area and 16 of the measurements reported detectable concentrations of methane. Detectable methane concentrations in this area ranged between 3,000 ppm (0.3%) and 91%. Fourteen of the 16 detectable methane concentrations were 10% or greater.

4.4.3 Upland Areas

Access issues prevented mapping of upland areas in the vicinity of the valley during the 2005 detailed seep mapping event. The Ward property, located east of the main seep area, was mapped during the IR imagery regional reconnaissance activities in September 2005 once access was granted and is discussed in Section 6.2.6.

An upland area, now referred to as Texas Creek East, was first included in the mapping program during 2004 (Figure 18). This area was identified as a seep area during the 2003 IR imagery regional reconnaissance activities. Several stressed/dead vegetation areas, all containing elevated methane concentrations, were noted during the most recent mapping event (TC-4 and TC-5, Figure 18). A total of 28 gas measurements were collected in this area and 15 of the measurements reported detectable concentrations of methane. Where methane was detected, concentrations ranged between 3,500 ppm (0.35%) and 100%. Ten of the 15 detectable methane concentrations were greater than 10%.

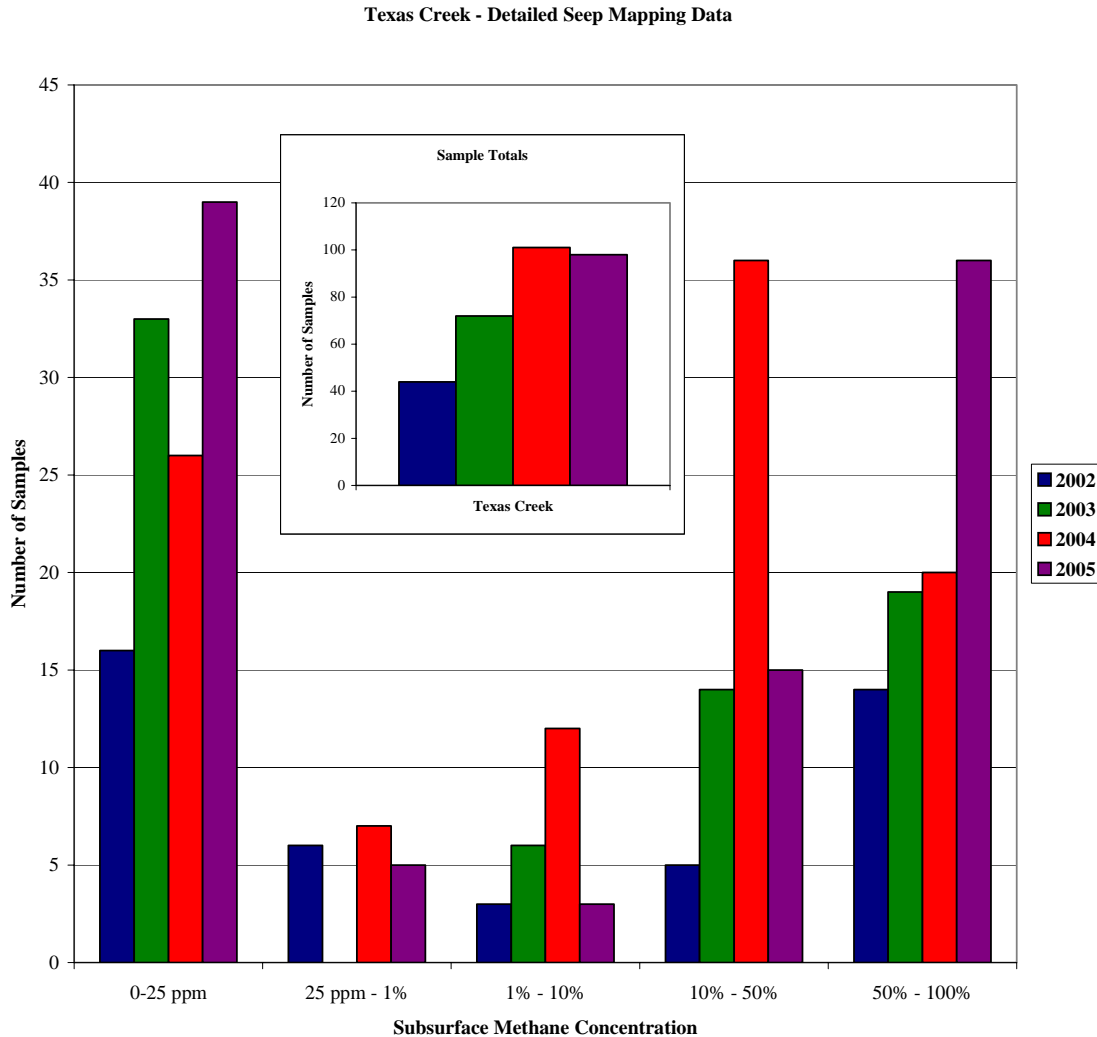


Text reference
TC-5, view
northeast.

The highest concentrations of methane were detected in the stressed/dead vegetation area on the western portion of Texas Creek East (TC-5, Figure 18). All methane concentrations in this area were 26% or greater. Dead scrub oak and pine trees and a strong H₂S odor were noted in this area during field activities. H₂S was detected at a concentration of 2 ppm in this area.

4.4.4 Comparison to Previous Surveys

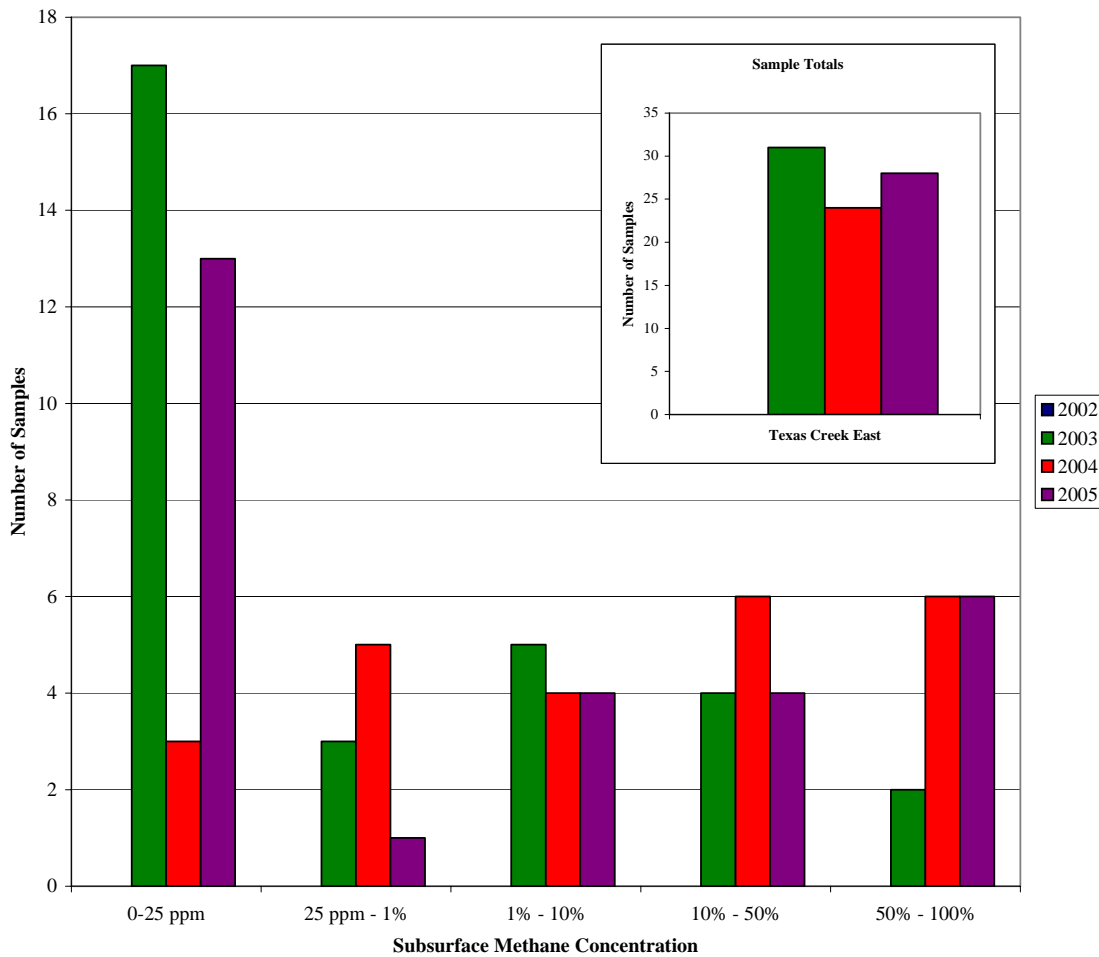
The number of subsurface methane measurements collected at Texas Creek in 2005 is relatively consistent with the number of measurements collected in 2004. However, data from the most recent mapping event indicate an increase in the number of locations with methane concentrations ranging between 50% and 100%. A chart illustrating the distribution of historical mapping data at Texas Creek is presented below.



The number of subsurface methane measurements collected at Texas Creek East in 2005 is relatively consistent with the number collected during previous mapping events. In general, the methane concentration measurements collected at Texas Creek East during 2005 appear to be consistent with concentration measurements collected from previous mapping events. A chart illustrating the distribution of historical mapping data at Texas Creek East is presented below. Figures 19 and 20 illustrate the distribution of historical subsurface methane measurements at Texas Creek and Texas Creek East.

When comparing stressed/dead vegetation areas over time, the areal extent of most known seep areas in Texas Creek and Texas Creek East has remained relatively unchanged. There are several cases where stressed/dead vegetation areas noted in 2002 and 2003 were not noted in 2004 or 2005. However, several stressed/dead vegetation areas mapped in 2005 were not mapped in previous monitoring events. Figures 21 and 22 illustrate the historical data comparison for stressed/dead vegetation at Texas Creek and Texas Creek East.

Texas Creek East - Detailed Seep Mapping Data



The visible seeps mapped in 2003, 2004, and 2005 remain relatively consistent. The number of visible seeps mapped in 2002 was low because the creek was relatively dry. However, several seeps were noted to the northeast of the main seep area during the 2002 mapping event (blue circles on Figure 23). This area around the visible seeps was not mapped during the 2003, 2004, or 2005 mapping events due to restricted access. Figure 23 illustrates the historical data comparison of visible methane seeps.



In 2006, LTE will have access to the Ward property located southeast of the primary Texas Creek seep area (TC-1, Figure 17). This access will make it possible to define the extent of the primary seep area in the southeastern direction and monitor the change of this extent over time.

4.5 HOIER PROPERTY

The Hoier Property was added to the detailed seep mapping program following the completion of the IR imagery regional reconnaissance mapping in 2003. The Hoier Property is an upland area west of Pine River. According to Mr. Hoier, they have noted an increase in areas of dead vegetation over the past several years and have also complained about methane in one of their water supply wells, which is completed in the Fruitland Formation. The field data from the 2005 detailed mapping event are illustrated on Figure 24.

4.5.1 Observed Methane Seeps in Surface Water

There is only one surface water body in the Hoier mapping area. A small pond is located approximately 500 feet east of the residence. No visible seeps were noted within the pond during the 2005 mapping event or during previous mapping events.

4.5.2 Lowland Areas

Relative to the topography of the other mapping areas included in this project, there are no lowland areas on the Hoier Property.

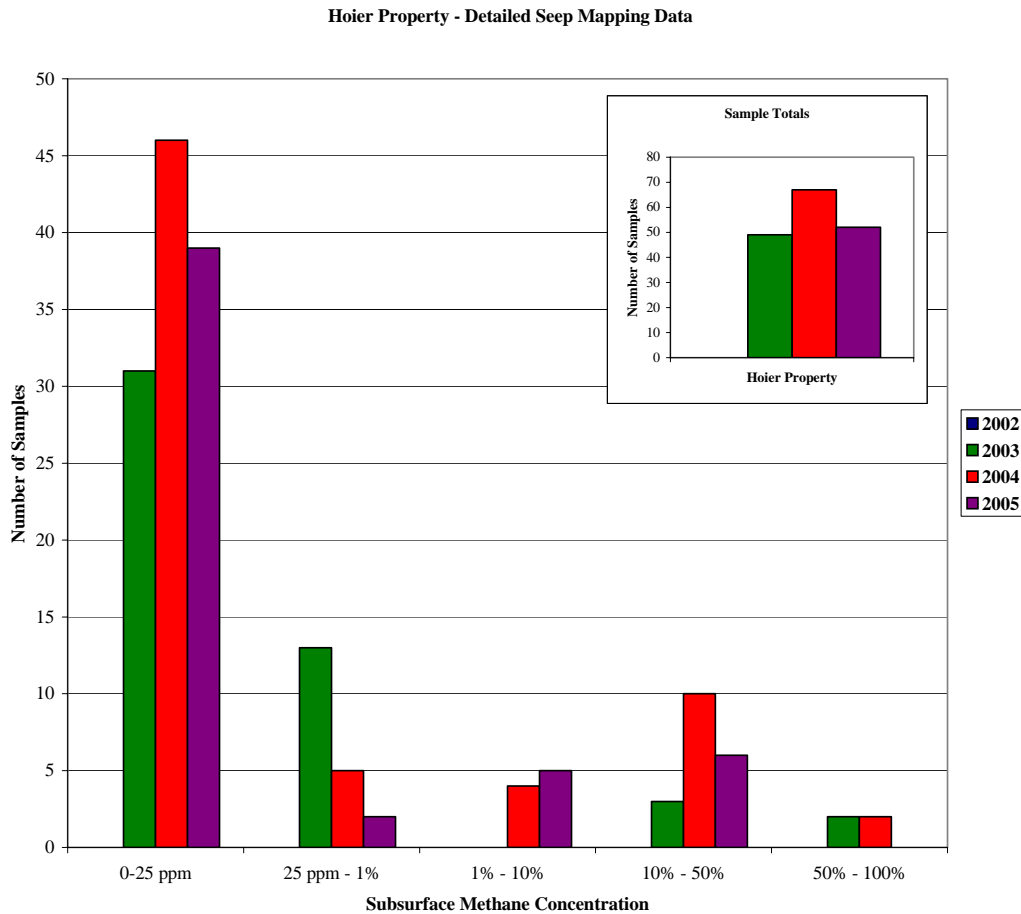
4.5.3 Upland Areas

Several stressed/dead and non-vegetation areas were mapped in the area north of the pond on the Hoier property. A total of 52 gas measurements were collected at the Hoier property and 13 of the measurements reported detectable concentrations of methane. The detectable methane concentrations in this area ranged between 500 ppm (0.05%) and 43%. Six of the 13 detectable methane concentrations were 10% or greater. Three areas of stressed/dead vegetation were mapped to the east of the residence, south of the pond, and along the driveway east of the pond. However, no methane was detected in these areas.

4.5.4 Comparison to Previous Surveys

Methane concentrations collected from 2003, 2004, and 2005 appear relatively unchanged. More subsurface methane measurements were collected during 2004 than in 2005. Data suggest that the areal extent of the stressed/dead vegetation area along the driveway east of the pond has increased. However, methane was not detected in this area during the 2005 mapping event, even though methane was reported in this area in 2004.

The areal extent of the stressed/dead vegetation area on the northern portion of the mapping area also appears to have increased. However, no methane was detected in the newly mapped portion of the area. Figure 25 illustrates the historical data comparison for the subsurface methane measurements. The chart below illustrates the distribution of the concentrations for the samples. Figure 26 illustrates the historical data comparison for the stressed/dead vegetation areas at the Hoier Property.



4.6 PINE RIVER

The Pine River mapping area is located where the Pine River transects the Fruitland Formation (Figure 1A). The mapping area, monitored by BP was added to the detailed mapping program in 2005 in order to maintain consistent mapping procedures across all areas of the outcrop in La Plata County north of the Ute line. This mapping event augments the mapping conducted by BP. The mapping area covers approximately one mile in the east-west direction and 0.5 miles in the north-south direction. The 2005 detailed mapping event occurred between June 13, 2005 and June 15, 2005. Figures 27 and 28 illustrate the results of the detailed seep mapping performed at the Pine River mapping area.



4.6.1 Observed Methane Seeps in Surface Water

Both primary seep and secondary seep trends were observed south of the bridge (Figure 27). High flow made it difficult to observe methane seeps in the middle of the river. Methane seeps were also observed in areas of standing water in the field east of Pine River, along a ditch east of the gas flux chamber, and in a small pond west of the Pine River and north of Ludwig Drive.



Methane seeps in field located east of Pine River, text reference PR-2, view east.

4.6.2 Lowland Areas

Several areas of stressed/dead vegetation, tree stumps, stressed/dead cottonwood trees, stressed/dead pine trees, and non-vegetated areas were observed in the lowland areas on both sides of the Pine River (Figure 27). This is a known area of methane seepage and contains two gas flux chambers and a row of permanent gas monitoring probes. A total of 107 sample points were collected in this area and 43 of the sample points reported detectable concentrations of methane. Detectable methane concentrations in this area ranged from 500 ppm (0.05%) to 100%. A total of four methane concentrations greater than 75% were recorded in a non-vegetated area on the eastern bank of the Pine River. Of the 11 measurements within the methane concentration range of 76% to 100%, eight reported a methane concentration of 100%. Several stressed/dead vegetation areas were noted within the mapping area but did not have detectable methane in the subsurface.

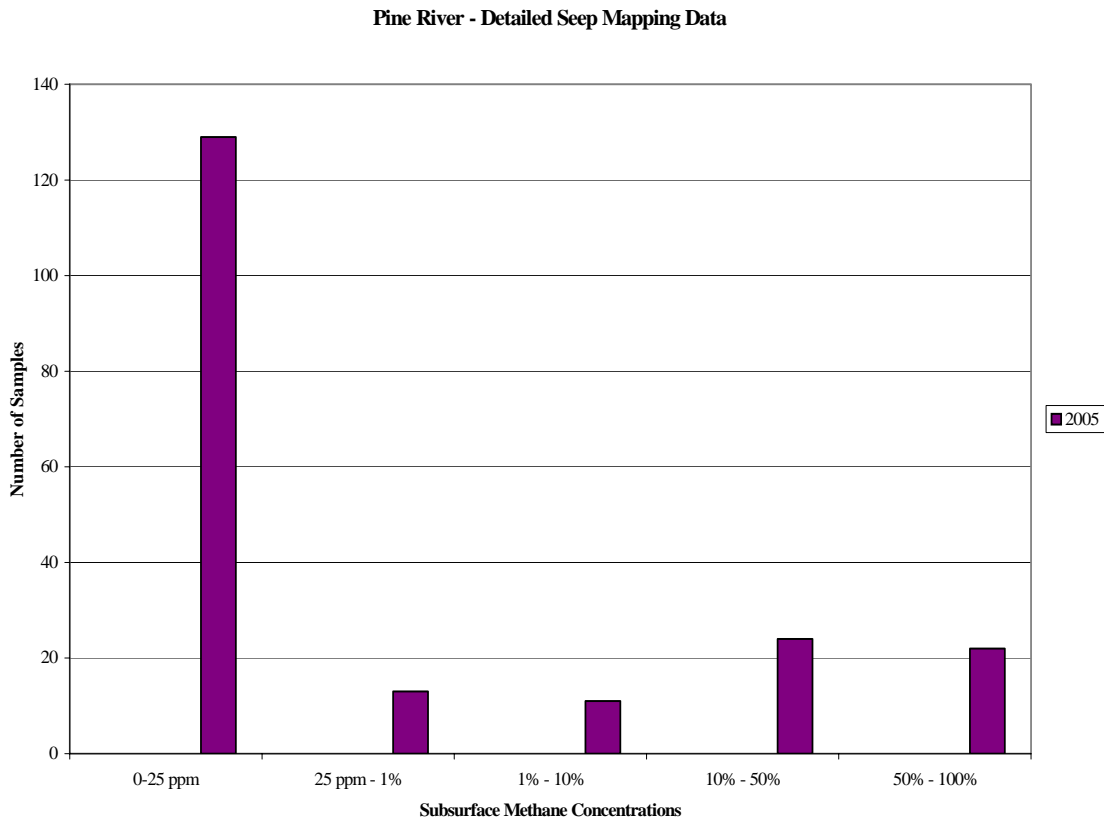
Six areas of stressed/dead grasses were observed in the field located east of Pine River (PR-2, Figure 27). Detectable methane concentrations in this area ranged from 1,000 ppm (0.1%) to 42%. In general, methane was detected within the stressed/dead vegetation areas but was not detected outside the stressed/dead vegetation areas.

4.6.3 Upland Areas

Several stressed/dead vegetation areas, stressed/dead pines, and tree stumps were observed in the upland area located west of Pine River. Three of the stressed/dead areas were located in a topographically low area between two ridges (PR-1, Figure 27). While LTE observed evidence

of beetle infestation in the majority of the dead trees in this area, methane was also detected at a concentrations ranging from 16% to 50% in two sample points. A strong H₂S odor was noted in this area and H₂S was detected at a concentration of 4 ppm in the subsurface.

Methane was detected at a concentration of up to 90% near a cluster of stressed pine trees on top of a ridge (PR-3, Figure 27). A total of six measurements were collected on the Pictured Cliffs Formation north of PR-1 and nine measurements were collected on the Kirtland Formation south of PR-1 and PR-3. Concentrations of methane were non-detectable for both areas located stratigraphically above and below the Fruitland Formation.



4.7 DETAILED MAPPING SUMMARY

The 2005 detailed mapping event was performed during the period from June 8, 2005 through June 17, 2005. The Pine River mapping area, monitored by BP, was added to the LTE mapping program in 2005 in order to maintain consistent mapping techniques throughout the project area.

Since this mapping event was performed in the spring, vegetation was in full bloom and the general landscape appeared relatively green, making stressed/dead vegetation areas more easily visible. Water levels in surface water bodies were noted to be at high levels. This facilitated the identification of gas seeps in water bodies that are usually dry at the end of the summer. However, the high water also made it difficult to observe seeps in some of the fast moving waters of the Animas River and the Pine River.



In Basin Creek, construction activities during 2005 limited access to large portions of the previous mapped area. Data collected during this mapping event noted the presence of methane seeps in areas consistent with previous mapping events. No new areas of methane seepage or vegetation stress were identified during the most recent detailed mapping event. However, the changing surface in the Basin Creek mapping area makes it difficult to map consistently the areas in the creek and area north of the creek. LTE recommends incorporating the upland area north of Basin Creek into future detailed mapping events.

Due to a decrease in the number of vegetation features mapped in 2005, LTE collected fewer methane measurements at Carbon Junction as compared to the 2004 mapping event. A slight increase in methane concentrations were observed in the upland areas both east and west of the Animas River. However, the methane concentrations along the banks of the river appear to be relatively consistent with previous years. No new areas of methane seepage or vegetation stress were identified during the 2005 detailed mapping event.

At Florida River, data suggest that several of the stressed/dead vegetation mapped in 2005 appear larger than areas mapped in previous years, especially the upland area east of the Florida River. The 2005 data suggest a slight increase in methane concentrations from the 2004 data, where comparable data exist. No new seep areas were identified during the most recent detailed mapping event.

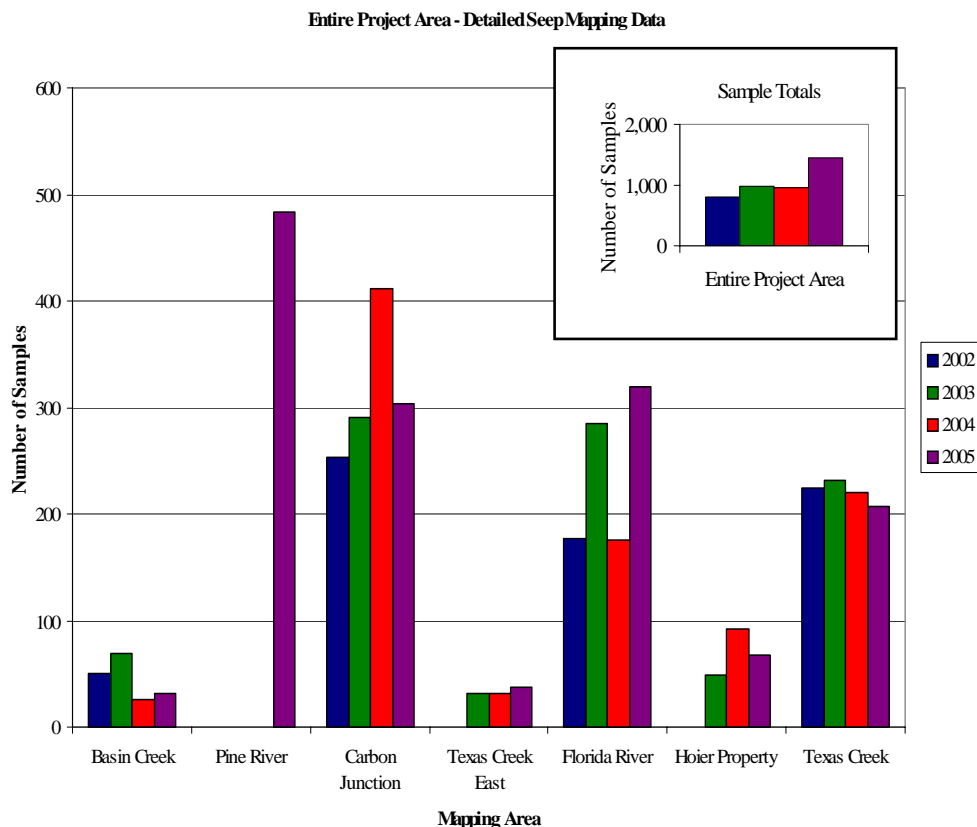
At Texas Creek, no significant change in the extent of stressed/dead areas was noted in 2005. In the main seep area and the valley west of the main seep area, an increase in the number of methane concentrations ranging from 50% to 100% was observed. The methane concentrations at Texas Creek East appear to be consistent with the concentrations from the previous mapping event. No new areas of methane seepage were identified during the 2005 mapping event.

Data collected from the Hoier Property indicate an increase in the areal extent of many of the stressed/dead vegetation areas. However, methane was not detected in newly mapped portions of these areas. In the area on the eastern portion of the property, methane was detected during previous mapping events, but not during the 2005 detailed seep mapping. In general, methane concentrations recorded during 2005 appear relatively consistent with previous years. No new areas of methane seepage were identified during the 2005 detailed seep mapping event.

At Pine River, relatively large seep areas were noted with evidence of vegetation stress/mortality and elevated methane concentrations. The locations of the seeps are consistent with historic trends in the area mapped by BP in 1996, 1997, 1998, 2000, 2002, and 2006. In the field located east of Pine River and north of Ludwig Drive, methane was detected in patches of stressed/dead vegetation and methane was not detected in adjacent areas of relatively normal vegetation.

The total number of features mapped (including visible seeps, trees, vegetation areas, and subsurface methane measurements) over the entire project area is higher than the previous mapping events. LTE collected 805 total measurements in 2005, 980 in 2004, 956 in 2003, and 1449 in 2002. This is primarily due to the addition of Pine River to the mapping area. If Pine River is excluded from the comparison, the number of features mapped over the entire mapping project area during 2005 is consistent with 2003 and 2004. On a site by site basis, the largest differences in the number of features mapped were noted at Carbon Junction and Florida River.

The number of features mapped during 2005 at Carbon Junction was less than the number mapped during 2004, but consistent with the number mapped during 2002 and 2003. At Florida River, the number of features mapped during 2005 increased from 2004, but was consistent with 2003. A chart summarizing the number of sampling points collected across the study area since 2002 is presented below.



Methane seepage has been mapped to be most evident in the lowland areas where a river or other surface water drainage transects the Fruitland Formation outcrop in La Plata County north of the Ute line. At Pine River, these seeps appear to be discharge seeps. However, the 2004 and 2005 detailed mapping events indicate the presence of methane seepage in topographic low areas within upland areas (i.e. a small valley near the top of a hill). This can be observed in the upland drainage located east of the Animas River at Carbon Junction (CJ-5, Figure 7), an upland area at Texas Creek East (TC-5, Figure 18), the Hoier property, and an upland area west of the Pine River (PR-1, Figure 27). These topographically low areas on the upland portions of the Fruitland Formation outcrop correlate as small-scale representations of larger stream valleys in the project area where methane seepage appears most prominent.

In general, only one new area of methane seepage was identified by the 2005 detailed seep mapping event. Methane seepage was identified for the first time in the field located east of the Pine River. This area has not been mapped in previous detailed seep mapping events due to access constraints. Therefore, it is likely that the condition existed prior to 2005 but was not mapped until recently. Recent data indicate that H₂S was detected in isolated areas at Carbon

Junction, Texas Creek East, and the upland area west of Pine River. The maximum concentration of H₂S detected was 10 ppm and was recorded at Carbon Junction. H₂S has been detected at Carbon Junction and Texas Creek East during previous mapping events, however, H₂S has not been detected in the upland area west of Pine River. The upland area west of Pine River has only limited historical mapping events for comparison.

SECTION 5.0

PERMANENT MONITORING PROBES

5.1 BACKGROUND INFORMATION

The BLM has been collecting subsurface methane concentrations from 180 permanent monitoring probes located along 12 transects running perpendicular to the Fruitland Formation outcrop. Data collection began in September 1997, and measurements have been collected approximately every other month. The most recent data available to LTE at the time of this report were collected in August 2005.

Data collected prior to November 1998 were obtained using a different field instrument to measure methane concentration. The original instrument could not measure concentrations greater than 10,000 ppm, therefore under-reporting those concentrations which exceeded the maximum detection limit of the original field meter. Only measurements obtained since November 1998 have been included in this analysis. For a discussion and analysis of trends based on the earlier data, see the previous *Fruitland Outcrop Monitoring Report* (LTE, October 2004). The first and last dates contained in the current data set for each transect are shown on Table 1 included at the end of this report.

5.2 STATISTICAL METHOD

LTE's analysis was performed using the Mann-Kendall test and Sen's Slope Estimates for detecting trends in time series data, the same tests used during the BLM's analysis in the report entitled *Coal Bed Methane Development in the Northern San Juan Basin of Colorado* (December 1999). For this study we used the Excel[®] template application MAKESENS. This template is documented in *Publications on Air Quality, No. 31*, Finnish Meteorological Institute, 2002, by Salmi, Maatta, Anttila, Ruoho-Airola, and Amnell. The template and the documentation were downloaded from the web at http://www.fmi.fi/organization/contacts_25.html. For this study, we tested the hypothesis that the data would demonstrate a monotonic trend (data consistently increases or decreases but do not oscillate in relative value) without considering any type of cyclical (seasonal) fluctuations. While there may be seasonal variations, the data do not conclusively show this, and the method used assumes a monotonic trend.

5.3 2005 STATISTICAL EVALUATION

The statistical evaluation was performed on 168 of the 180 permanent monitoring probes. The most recent data available from the Basin Creek probe line were collected in November 2002, so no new evaluation was performed for this transect.

The 2005 statistical evaluation used all the measurements collected since November 1998. Approximately 30 to 40 measurements were available at most locations. In most cases, concentrations remain low, or fluctuate without revealing an obvious trend.

Table 1 lists the number of probes on each transect, probes where trends could be calculated, and sampling events since November 1998. The level of significance tested was 90% on a two-tailed

test. The number of probes where significant upward or downward trends were then calculated. The number of significant upward and downward trends previously calculated using the data series from November 1998 through September 2003 is included for comparison purposes. For a trend statistic indicating a 90% level of significance, there is a 90% chance that the estimated trend is indicative of a real trend in the data, and not an artifact of random scatter in the data.

5.4 PERMANENT MONITORING PROBE SUMMARY

A summary of the results of the trend analysis is included on Table 1. Trends could be calculated at 59 of the 152 (39%) probe locations (excludes Basin Creek probes). The remaining 93 probes did not have enough detectable methane readings to make the calculation possible. Only 56% of the observable trends were statistically significant at the 90% significance level. Of these, 42% reported upward trends and 58% reported downward trends at the 90% significance level. The statistical analysis performed in 2003 identified 52% upward trends and 48% downward trends at the 90% significance level. Results of the statistical analysis for each probe are presented in Table 2.

All the statistically significant trends from the Carbon Junction east and west transects are downward. The three statistically significant trends from the Pine River transect are upward. However, these trends poorly reflect the actual data set since probe 109 has only detected methane three times and probe 107 is highly variable in concentration ranging from no detectable methane to greater than 90% methane. Both upward and downward trends were calculated from the Florida River and Texas Creek east and west transects. No statistically significant trends were calculated from the East Pine River east and west and Edgemont Ranch transects.

SECTION 6.0

REGIONAL RECONNAISSANCE

The regional outcrop monitoring programs have evolved during the past eight years from a pedestrian survey with the collection of surface methane concentration and qualitative observations of vegetative condition to an IR imagery aerial reconnaissance, image evaluation, followed by field verification including the collection of subsurface methane measurements in identified suspect areas.

The goal of this periodic reconnaissance is to provide long term monitoring across the 23-mile project area in an effort to quantify changes in methane seepage over time and space. The initial IR imagery aerial reconnaissance of the entire outcrop was performed in August 2002. The most current IR imagery aerial reconnaissance was performed in June 2005. The following sections discuss the image evaluation and field verification activities performed in 2005. Figure 32 illustrates the IR imagery across the Fruitland Formation outcrop and provides a map key for specific areas inspected during the field verification activities.

6.1 IMAGE EVALUATION

Following geo-rectification of the IR images across the outcrop area, the images were evaluated to identify suspect areas containing disturbed, stressed, or dead vegetation.

A total of 105 suspect areas were identified across the outcrop area using heads-up digitizing techniques. In most cases, the dead or stressed vegetation was readily identifiable within the image. In some instances, it was difficult to determine the exact identity of the anomalous feature. The suspect areas are illustrated on Figures 33 through 45 as blue polygon features.

Some of the suspect areas correspond to impacted areas identified during the detailed seep mapping. In general, suspect areas identified by the image evaluation that were mapped during the detailed seep mapping were not remapped during the field verification mapping event. Additionally, suspect areas identified by the image evaluation that were not located on the Fruitland Formation outcrop were not mapped during the field verification mapping event.

6.2 FIELD ACTIVITIES

Results of the field verification activities are illustrated on Figures 33 through 45 using graduated symbols to present the concentration of methane measured at each subsurface measurement location in and around the suspect area. Specific areas discussed in the text are noted on the maps with a designation of "M05" followed by a number (i.e. M05-1). The results are discussed by geographic location in the following subsections.

6.2.1 Basin Creek

2005 Regional Reconnaissance Results

A large suspect area located south of Basin Creek was most likely identified due to the presence of stressed scrub oak (M05-1, Figure 33). This area was mapped during the detailed mapping program and again during the field verification. Methane was detected over the central portion of the suspect area. The stressed scrub oak indicated die back typical of scrub oak during dry conditions. The majority of the vegetation stress in this area is most likely due to drought conditions, variation in soil moisture content, and/or soil type.

Two relatively large suspect areas were identified north of Basin Creek. Rocky soil and evidence of beetle infestation was observed over the majority of both suspect areas. In an upland portion of the eastern suspect area (M05-2, Figure 33), methane was detected at a relatively high concentration (>50%) in one sample point and several dead pine trees were observed. In general, the juniper trees in the vicinity of the dead pine trees appeared healthy.



Dead pine trees,
text reference
M05-2, view
northwest.

Comparison to Previous Surveys

When comparing the most recent image evaluation and field verification to previous surveys, it appears that the suspect area located south of Basin Creek (M05-1, Figure 33) was identified as an area of concern by both the 2003 image evaluation and the 2005 image evaluation. During both the 2003 field verification and the 2005 field verification, it appeared that the area was selected because of the presence of stressed scrub oak. During both mapping events, methane was detected at relatively similar concentrations over the same portion of the suspect area, but not over the entire suspect area. Based on the two mapping events, it appears that methane is seeping from the subsurface from a relatively small area within the suspect area, but the majority of the stressed/dead vegetation is most likely typical die back of scrub oak in the region.

The suspect areas identified north of Basin Creek (M05-2, Figure 33) during the 2005 image evaluation were different than the suspect areas identified during the 2003 image evaluation. Therefore, different areas were mapped in 2005 than in 2003. However, during both mapping

events, methane was detected in upland areas north of Basin Creek. Methane in the upland areas was detected at higher concentrations during the 2005 mapping event than during the 2003 mapping event.

6.2.2 Carbon Junction

2005 Regional Reconnaissance Results

Three suspect areas located on the Fruitland Formation were identified on the IR images west of the Animas River near Carbon Junction. No methane was detected in the western-most suspect areas on the Fruitland Formation (M05-3, Figure 34) with the exception of one location, which reported a concentration of 500 ppm (0.05%). Rocky soil and dead pine trees with evidence of beetle infestation were observed in this suspect area.

A suspect area near the shooting range noted a large area of dead scrub oak (M05-4, Figure 34). This is a known area of methane seepage and was mapped during the 2005 detailed mapping event. As discussed in Section 4.2.3, methane was detected in this area at a maximum concentration of 78% during the 2005 detailed seep mapping event.

An upland suspect area was identified on a hillside containing two permanent monitoring probe lines (M05-5, Figure 34). This is an area of known methane seepage and was mapped during the 2005 detailed mapping program. The soil is extremely rocky in this area and the topography has a steep gradient. Dead scrub oak and dead pine trees are abundant in this area. As discussed in Section 4.2.3, methane was detected in this area at a maximum concentration of 94% during the 2005 detailed seep mapping event.



Text
reference
M05-6,
view west

Three suspect areas were identified adjacent to the gravel quarry east of Carbon Junction. Two of the suspect areas are located stratigraphically on the Pictured Cliffs Formation based on surface geology. No methane was detected in these areas. One of the suspect areas is located on the Fruitland Formation based on surface geology (M05-6, Figure 34). A strong H₂S odor was

observed in a portion of this area though no H₂S was detected in the subsurface. Several clusters of dead pine trees with evidence of beetle infestation were observed in this area. In general, the juniper trees appeared healthy in areas where the pine trees were dead. Methane was detected in this area at concentrations ranging between 2,500 ppm (0.25%) and 10,500 (1.05%).

A large suspect area was identified directly east of the Wal-Mart, east of US Highway 160 (M05-7, Figure 34). Dead pine trees, the majority of which indicated no evidence of beetles, were observed in this area. The soil in the suspect area appeared to be extremely rocky with a steep gradient. No methane was detected in this area during the field verification activities.

Comparison to Previous Surveys

When comparing the 2003 and 2005 IR image evaluations and field verifications, it appears that the area of dead scrub oak close to the shooting range was identified by both the 2003 and 2005 image evaluations. A portion of the suspect area identified in 2005 was not identified in 2003, but no methane was detected in the newly identified area.

The area east of Highway 3 that includes the permanent monitoring probes was identified as a suspect area in the 2003 and 2005 image evaluations (M05-5, Figure 34). Methane was detected in this area at a maximum concentration of 94% during the 2005 detailed seep mapping event. In general, it appears that methane concentrations have increased slightly in this area from previous years. This is not supported by the statistical analysis of the permanent monitoring probes which reported downward trends for all probes with significant trends.

6.2.3 Northwest of Florida Mesa

2005 Regional Reconnaissance Results

Nine suspect areas were identified in the upland areas along the Fruitland Formation between Carbon Junction and the Florida River (Figure 35). Upon inspection, these areas predominantly consisted of scattered pine tree mortality, scrub oak die back, and rock outcrops. Much of the pine tree mortality was associated with beetle infestation. The scrub oak mortality appeared to be associated with natural die back common to scrub oak, especially in dry years.

Comparison to Previous Surveys

Methane was not detected in this area during the 2005 field verification or during the 2003 field verification. In general, similar vegetation conditions were observed during both mapping events.

6.2.3 Florida River

2005 Regional Reconnaissance Results

A total of six suspect areas were identified east of the Florida River (M05-8 through M05-11, Figure 36). As discussed in Section 4.3.3, methane was detected at a concentration of 24% during the 2005 detailed mapping event in an area of stressed/dead scrub oak on a hillside located immediately west of Florida River (M05-8, Figure 36). LTE collected additional

methane measurements during the 2005 field verification in order to cover the entire suspect area, but no additional methane was detected.

LTE did not detect methane seeps at any of the remaining suspect areas identified immediately east of the Florida River except for one sample location, which reported a methane concentration of 1,000 ppm (M05-10, Figure 36).

A suspect area was identified in close proximity to the house and barns on the Terry Palmer Ranch south of County Road 234. LTE investigated these areas during the field verification activities and determined that methane was detected in one location at a concentration of 10,000 ppm (1%) (M05-11, Figure 36). Based on observations made during mapping, it appears that the suspect area is a result of overgrazing of the vegetation by livestock in the field.

Eight suspect areas were identified in the upland areas west of County Road 234. One of the areas was located stratigraphically on the Pictured Cliffs Formation. Massive outcrops were identified in this area. Approximately 70% of the vegetation in this area was pine trees, 25% of which were dead. Methane was not detected in this area during the field verification activities.

One of the suspect areas identified west of County Road 234 was stratigraphically located along the contact of the Fruitland Formation and the Pictured Cliffs Formation (M05-12, Figure 36). The scrub oak in this area appeared stressed, however the pine trees and juniper trees appeared healthy. A coal seam was observed in this area and methane was detected at a concentration of 3,000 ppm (0.3%) in the vicinity of the coal seam.

Five of the suspect areas identified west of County Road 234 were stratigraphically located on the upper portion of the Fruitland Formation and/or on the Kirtland Formation based on surface geology (M05-13, Figure 36). No methane was detected in these areas.

One suspect area was located in a small open meadow stratigraphically positioned on both the Fruitland Formation and the Pictured Cliffs Formation (M05-14, Figure 36). This area, discussed previously in Section 4.3.3, was mapped during the 2005 detailed mapping event and is a known area of methane seepage. Several stressed/dead pine trees, stressed/dead scrub oak, and stressed/dead/non vegetated areas were observed during the detailed mapping activities. The maximum methane concentration detected in the meadow was 53%.

Comparison to Previous Surveys

When comparing the 2003 and 2005 IR image evaluations and field verifications, it appears that more suspect areas were identified in 2005 than in 2003. Several of these additional areas identified in 2005 but not in 2003 did not report detectable concentrations of methane. The western-most suspect area (M05-12, Figure 36) was identified for the first time by the 2005 IR image evaluation and also had indications of methane.

6.2.4 Edgemont Ranch

2005 Regional Reconnaissance Results

Figure 37 illustrates the location of suspect areas identified east of the Edgemont Ranch area. A total of 11 suspect areas were identified during the 2005 IR image evaluation. Many of the features identified in the IR image consisted of shrub mortality, rocky soil, and/or coal seams. Methane was not detected in any of these areas during the 2005 field verification.

Comparison to Previous Surveys

When comparing the 2003 and 2005 IR image evaluation and field verification, it appears that methane was detected at concentrations ranging from 500 ppm (0.05%) to 5% in an upland area on the western portion of the mapping area during 2003, but no methane was detected in this same area during 2005 (M05-15, Figure 37).

6.2.5 Vosburg Pike

2005 Regional Reconnaissance Results

This upland area of the outcrop is approximately half way between the Florida River seep area and the Texas Creek seep area. A total of nine suspect areas were identified through the IR image evaluation. A coal seam was identified in the southwestern portion of the mapping area, however, no methane was detected in the vicinity of the coal seam.

In an upland area that correlates with the basal portion of the Fruitland Formation, methane was detected in one location at a relatively low concentration of 2,000 ppm (0.2%) (M05-16, Figure 38). This area was most likely identified due to the presence of stressed scrub oak, typical of the vegetation in the area during drought conditions. The pine trees and other vegetation in this suspect area appeared relatively healthy.



Coal seam and stressed scrub oak, text reference M05-17, view east.

In an upland area on the eastern portion of the Vosburg Pike mapping area, methane was detected along a north-south trending drainage at concentrations ranging from 500 ppm (0.05%) to 34,000 ppm (3.4%) (M05-17, Figure 38). Stressed/dead scrub oak, beetle infestation of pine trees, and a coal seam were identified in this area. The methane seepage is most likely associated with the coal seam. Methane was not detected outside of the drainage in this suspect area.

Comparison to Previous Surveys

When comparing the 2003 and 2005 survey, it appears that two areas of methane seepage were identified in 2005 that were not identified in 2003 (M05-16 and M05-17, Figure 38). LTE did not collect methane measurements in these areas during 2003 because they were not identified by the IR image evaluation. Additionally, one relatively small suspect area was identified in 2003 but was not identified in 2005. Methane was detected at this location in 2003 at a maximum concentration of 5,000 ppm (0.5%). LTE did not collect methane measurements at this location during the 2005 field verification activities because it was not identified by the image evaluation.

6.2.6 Texas Creek

2005 Regional Reconnaissance Results

On the western end of the Texas Creek mapping area, five suspect areas were identified in the valley. Methane was not detected in any of these areas during the field verification activities. The impacts to the vegetation in these areas appear to be the result of livestock grazing (M05-18, Figure 39).

Five suspect areas were noted north of County Road 550. Due to access restrictions, LTE was not permitted to investigate the three westernmost areas (M05-19, Figure 39). It is difficult to determine the cause of mortality and/or stress in vegetation without field verification. However, based on the absence of methane seepage in the immediate surrounding areas, it is likely that the three suspect areas are not locations of methane seepage.

One of the suspect areas located north of the road is stratigraphically positioned on the Pictured Cliffs Formation (M05-20, Figure 39). Rock outcrops were identified during field verification activities in this area and no methane was detected. A second suspect area located north of the road is located on the Fruitland Formation. Field observations indicated several burned pine trees in the area. No methane was detected in this area during field verification activities.

Several small suspect areas located within a larger suspect area were identified in the valley west of the main Texas Creek seep area (M05-21, Figure 40). This is an area of known methane seepage and a portion of this area was mapped during the 2005 detailed mapping event. This area was most likely selected due to patches of non-vegetation areas. As discussed in Section 4.4.2, methane was detected in this area at a maximum concentration of 91%.



Suspect area with elevated methane concentrations, text reference M05-21, view southwest.

In the central area of Texas Creek, several suspect areas were identified through the IR image evaluation (M05-22, Figure 41). This is a known area of methane seepage that was mapped during the 2005 detailed mapping event and is discussed in detail in Section 4.4.2. Methane was detected at a maximum concentration of 100% during the June 2005 mapping event. The area contains several non-vegetation areas as a result of methane seepage at elevated concentrations.

Two suspect areas were identified on the Ward property through the IR image evaluation. One suspect area was identified as a wooded-area between two meadows, southwest of the main Texas Creek seep area. Methane was detected in the northwest portion of this area at a concentration of greater than 76% (M05-23, Figure 41). Several dead pine trees with evidence of beetle infestation were also observed in this area.

Methane was also detected in the vicinity of the Ward residence (M05-24, Figure 41). Methane concentrations of 8,000 ppm (0.80%), 9%, and 100% were recorded at distances from the Ward residence of approximately 20 feet (ft), 75 ft, and 110 ft, respectively. In general, the vegetation in the immediate vicinity of the Ward property appeared relatively healthy.

On December 12, 2005, LTE personnel conducted a methane survey on the interior of the Ward residence. LTE has reported methane concentrations within the Ward residence as a percentage of the Lower Explosive Limit (LEL) given the fact that the survey was performed within a residential structure and is being performed to assess the potential for the presence of a hazardous atmospheric condition. The survey identified the presence of methane at a concentration of 3% LEL (1,500 ppm methane) in the first floor bedroom and garage. Methane was detected in the upper level areas at concentrations ranging from 1% LEL (500 ppm methane) to 2% LEL (1,000 ppm methane). LTE is currently designing a methane detection system for the interior of the residence at the request of the COGCC.

A suspect area was identified in the valley south of the Ward residence (M05-25, Figure 41). Several areas of stressed grasses were observed and methane was detected in these areas at concentrations ranging from 5% to 26%.



Tree mortality in area of elevated methane concentrations, text reference M05-23, view east.

A suspect area was identified east of the Ward property (M05-26, Figures 41 and 42). Stressed scrub oak and pine trees with evidence of beetle infestation were observed. A permanent monitoring probe line is also located in this area. Methane was detected at relatively low concentrations of 2,000 ppm (0.2%) and 7,000 ppm (0.7%) in this area. LTE believes that this is an area to monitor closely because it is located between two prominent seep areas, Texas Creek and Pine River.

A large suspect area in an upland location was identified in the area referred to as Texas Creek East (M05-27, Figure 42). This area was mapped during the 2005 detailed mapping program and is discussed in Section 4.4.3. The field observations indicate the presence of abundant pine tree and scrub oak mortality along with elevated concentrations of methane. The portion of the suspect area in the meadow was mapped during the 2005 field verification activities and the grasses appeared to be relatively healthy. No methane was detected in the meadow during the 2005 field verification activities.

Three suspect areas in upland locations were identified between Texas Creek East and the Hoier property (M05-28, Figure 43). LTE observed stressed scrub oak displaying die back typical of the vegetation in the area during drought conditions. No methane was detected in these areas.

Comparison to Previous Surveys

When comparing the 2003 and 2005 IR image evaluations and field verifications for the Texas Creek area, it appears that a greater number of suspect areas were identified during the 2005 IR image evaluation than in 2003. However, no new methane seep areas were discovered during the 2005 field verification activities in these newly identified areas.

Methane was detected on the Ward property in 2005, but this area was not mapped due to access issues in 2003. However, methane had been detected in this area during mapping events prior to the 2003 regional reconnaissance.

6.2.7 Hoier Property

2005 Regional Reconnaissance Results

One suspect area was identified on the Hoier property during the 2005 IR image evaluation (M05-29, Figure 43). This suspect area was mapped during the 2005 detailed seep mapping event and is discussed in Section 4.5.3. The suspect area is comprised of several non-vegetated areas in an upland meadow and an area of scrub oak mortality north of the meadow. Elevated concentrations of methane were detected in the area during both the 2005 detailed seep mapping and the field verification activities. The maximum methane concentration recorded at the Hoier property during 2005 was 43%. Methane was not detected in other areas on the Hoier property during the 2005 detailed seep mapping or field verification activities.

Comparison to Previous Surveys

When comparing the 2003 and 2005 IR image evaluations, the main suspect area was identified by both image evaluations. This area of dead vegetation on the Hoier property appears to have increased since 2003. In general, results of the 2005 regional reconnaissance suggest a slight increase in methane concentrations and vegetation stress at the Hoier property. However, methane was detected in an area north of the Hoier residence during 2003, but methane was not detected in the same area during 2005.

6.2.8 Pine River

2005 Regional Reconnaissance Results

Three suspect areas were identified west of the Pine River. In an upland area adjacent to the entrance for the Hoier property, dead ponderosa trees, dead pine trees, and stressed scrub oak were observed along with evidence of beetle infestation (M05-30, Figure 43). A coal seam was observed in this area during field verification activities and methane was detected within the coal seam at a concentration of 2,500 ppm (0.25%).



Dead pine tree and coal at base of outcrop, text reference M05-30, view west.

In another upland area located between two ridges, LTE observed pine tree and scrub oak mortality along with evidence of beetle infestation (M05-31, Figure 44). This area was mapped during both the 2005 detailed seep mapping and field verification activities and is discussed in Section 4.6.3. Methane was detected in this area at concentrations ranging from 1,000 ppm (0.1%) to 35%. The highest concentration of methane in this location was recorded in the area with the greatest vegetation mortality.



Vegetation mortality in area of elevated methane concentrations, text reference M05-31, view south.

A relatively large suspect area was identified east and west of the Pine River (M05-32, Figure 44). This area is the primary seep at Pine River and was mapped during the 2005 detailed seep mapping (Sections 4.6.2 and 4.6.3). Several stressed/dead and non-vegetation areas were observed in the lowland and upland areas. The vegetation of concern included pine trees, cottonwood trees, and scrub oak mortality along with non-vegetated patches bordered by areas of abundant grasses. Evidence of beetle infestation was observed in several of the trees in the area. The large area south of the main road is part of the Williams property. Access to this property for methane survey work has not been granted.

Relatively small patches of non-vegetated areas were observed in the field located east of the Pine River and north of Ludwig Drive (M05-33, Figure 44). These areas indicated elevated concentrations of methane and are discussed in Section 4.6.2. In the relatively lush areas surrounding the non-vegetated patches, methane was not detected.

Two suspect areas were identified east of CR 501 in an upland location, but methane was not detected within these suspect areas (Figure 45).

Comparison to Previous Surveys

When comparing the 2003 and 2005 regional reconnaissance events, it appears that the majority of the areas mapped during 2005 were not mapped during 2003 due to access restrictions. In general, similar suspect areas are noted between the two image capture events. New seep areas north of the main road were identified as suspect areas in 2003 but not confirmed to contain methane until 2005. Similar concentrations have been noted in the known seep areas between 2003 and 2005.

6.3 VEGETATION SUMMARY

The major types of vegetation observed during the 2005 regional reconnaissance include piñon pine trees, ponderosa pine trees, juniper trees, narrow leaf and plains cottonwood trees, elm trees, willow trees, scrub oak, aspen trees, cheatgrass, and box elder/maple trees. Die back was observed in the majority of the scrub oak areas identified during the field activities. Die back is typical of the scrub oak in the project area during drought conditions. In several cases, juniper trees appeared healthy where pine tree mortality was observed.

In general, stress and mortality associated with vegetation over the entire mapping area were most likely a result of several different conditions. Based on field observations and previous biological studies over the project area, these conditions appear to include, but are not limited to, Ips and Borer beetles, black stain root disease, drought, forest fires, varying soil conditions, agricultural activities, and methane seepage.

6.4 SUBSURFACE HYDROGEN SULFIDE SUMMARY

Subsurface H₂S was not detected in any of the mapping areas during the 2005 regional reconnaissance. Subsurface H₂S was detected during the 2005 detailed mapping program in the areas of Carbon Junction, Texas Creek East, and an upland area west of Pine River. Because these areas were mapped during the 2005 detailed seep mapping event, these areas were not mapped during the 2005 regional reconnaissance.

6.5 REGIONAL RECONNAISSANCE SUMMARY

The IR imagery of the Fruitland Formation outcrop has been viewed and evaluated, and the images have been incorporated into LTE's ongoing GIS project. A total of 105 suspect areas were identified in the vicinity of the outcrop based on vegetative conditions or other chromatic anomaly observed in the imagery. LTE's field crew visually inspected and manually collected subsurface methane measurements at 95 of the 105 suspect polygons. The remaining 10 suspect polygons were not inspected because they were either not located on the Fruitland Formation or access issues prohibited LTE's inspection. Of the 95 areas visited, 32 suspect areas contained subsurface methane above 25 ppm. Nine of 32 suspect areas containing methane were located outside the previous detailed seep mapping study areas performed in October 2002, May 2003, and June 2005. The majority of these nine new suspect areas were either not identified by the 2003 IR image evaluation or located where access had not been granted to LTE in the past. During the regional reconnaissance activities in 2003, 12 suspect areas containing subsurface methane above 25 ppm were identified outside of the detailed seep mapping study areas performed in October 2002 and May 2003.

The majority of the suspect areas identified in the imagery contained stress/dead vegetation that was not associated with subsurface methane. The predominant cause of mortality and/or stress observed at these areas was related to natural die back as a result of drought conditions or beetle infestation. Several suspect areas were identified due to the presence of rock outcrops and/or rocky soil conditions. One suspect area was identified due to the presence of burned vegetation.

The IR imagery was effective in identifying relatively small and isolated areas of dead vegetation that were confirmed to exhibit methane seepage through field verification. Additionally, it

appears that several of the suspect areas identified by the 2005 IR imagery were also identified by the 2003 IR imagery. The consistency in identifying suspect areas observed during the two previous monitoring events supports the effectiveness of the IR imagery technology for use in conducting a regional reconnaissance of the Fruitland Formation outcrop.

The IR imagery from 2003 and 2005 has been useful in identifying previously unknown areas of methane seepage. The 2003 IR image evaluation indicated the presence of methane seepage at the Hoier Property. Based on data collected during the 2005 regional reconnaissance, the newest previously undefined areas which contain methane are the upland area north of Basin Creek (M05-2, Figure 33), the upland area west of Florida River (M05-12, Figure 36), and two upland areas in the Vosburg Pike mapping area (M05-16 and M05-17, Figure 38).

It is difficult to estimate the percentage of the Fruitland Formation outcrop that is experiencing methane seeps given the ability to detect all methane seeps, particularly in upland areas. In addition, seep activity appears to be strongly influenced by flow pathways. At the request of the BLM, LTE has attempted to quantify the areal extent of detectable methane seeps along the Fruitland Formation outcrop in La Plata County north of the Ute Line. This estimation was made using the GIS software by creating a polygon around areas of detectable methane seepage on the Fruitland Formation outcrop as defined during detailed mapping and regional reconnaissance surveys. This method over-estimates the extent of seepage because it also incorporates areas within polygons where methane has not been detected. Based on our delineation of the extent, no more than 3% of the Fruitland Formation outcrop exhibits detectable concentrations of methane gas.

SECTION 7.0

NATURAL SPRING SURVEY RESULTS

During LTE's literature and interview research, four potential natural springs were identified on the Fruitland Formation outcrop in La Plata County north of the Ute line. Two of the springs were located in the valley of Texas Creek, one of the springs was located in the Edgemont Ranch mapping area, and one spring was located in the area west of Florida River. All four natural springs identified through research were located in accessible areas. However, LTE was only able to field-verify three of the four natural springs. The spring located in the area west of Florida River was noted to be completely dry during field activities. Locations of the three identified natural springs are noted on Figures 46 and 47.

A total of three water samples were collected by LTE. Two water samples were collected at the Darwin Rather property in the vicinity of the Texas Creek valley. The third water sample was collected at the Rancho Durango LTD property near the Edgemont Ranch mapping area.

The COGCC currently uses 2 milligrams per liter (mg/L) as the action level guideline for methane in water systems. The COGCC guideline for water systems containing dissolved methane concentrations above 2 mg/L is that there is an increased risk to desorb methane from the water and create potentially explosive conditions in confined spaces. Analytical results indicate that one of the water samples collected from the Darwin Rather property (Darwin Rather Spring #2) located near Texas Creek contained dissolved methane at a concentration of 0.002 mg/L. The dissolved methane concentrations in the other two water samples collected were below the laboratory method detection limits. Field measurements for temperature, pH, conductivity, ORP, TDS, and flow as well as the reported methane concentration from the springs identified on the Fruitland Formation outcrop in La Plata County north of the Ute line are summarized in Table 3.

The BLM is currently conducted a survey of natural springs in La Plata County north of the Ute line, however, the results of the survey were not available to the public at the time of this report

It is likely that additional natural springs exist on the Fruitland Formation in La Plata County north of the Ute line, but were not identified during LTE's research and interview process. Additional natural springs may not have been present during LTE's regional reconnaissance activities due to recent drought conditions in La Plata County. It is also possible that LTE was not notified of natural springs by landowners and/or was not granted access to land where natural springs exist.

SECTION 8.0

CONCLUSIONS AND RECOMMENDATIONS

8.1 GAS FLUX CHAMBERS

Gas flux chambers have shown sporadic flow but no discernable increasing or decreasing trends have been noted since 1998. LTE recommends that monitoring of the flux chambers be discontinued indefinitely. LTE has identified several factors in the gas flux chamber monitoring program that support the termination of this monitoring method including: 1) data have shown no conclusive upward or downward trends during eight years of operation; 2) expensive equipment is highly susceptible to weathering and corrosion from the elements; 3) power supply requirements cause frequent discharge of battery system despite solar powered assistance; and 4) cost of performing frequent O&M activities and extensive data manipulation outweighs value of data obtained.

The gas flux chambers have been in operation for eight years. To date, no conclusive trend upward or downward in gas flow rate has been noted even though changes in magnitude and extent of seepage have been observed in several areas on the Fruitland Formation outcrop. One reason for this is that the flow rates captured by the flux chambers are very small relative to the seep area. Using equipment with accuracy and precision to detect such small values is generally more successful in controlled environments such as a laboratory or closed loop system. Since these flux chamber systems are exposed to the elements, our measurements experience several layers of interference thereby limiting the ability of the equipment to operate within the specifications. Another reason may be that many of the flux chambers are being significantly influenced by dispersion in the vadose zone thereby limited effective seep flow measurement.

Outlying factors such as wind, rain, snow, extreme heat, and extreme cold put undue stress on the equipment despite our best efforts to insulate and/or shield them. To date, LTE has had to replace the initial six data loggers with more modern loggers and has replaced two of the more modern data loggers that became corroded from excess moisture. The flow meters in use are constantly requiring recalibration because of the environment they are in and the power consumption of the flow meters in cold weather puts a strain on the battery that ultimately exceeds the capacity of the solar panel to keep it charged, especially during periods of bad weather when sunlight is limited. To date, LTE estimates that the upkeep of the 12-volt marine batteries alone has exceeded \$4,000 during the life of the project.

Since the data are generated on 10-minute intervals (more than 360,000 data records per year for the seven chambers), the data are required to be downloaded every 45 days in order to not exceed the capacity of the data logger. Therefore, over the past eight years we have accumulated nearly 3 million data points that must be stored and evaluated and reported. While the use of the database expedites the evaluation and reporting, the flux chambers require a significant effort to operate, maintain, repair, replace, evaluate, and report. The expended effort may be considered worthwhile if the data are providing reasonable and usable information to help assess the changes in methane seepage over time. To date, LTE would argue that the detailed mapping,

regional reconnaissance, and pedestrian surveys have been far more effective in accomplishing this goal.

8.2 DETAILED SEEP MAPPING

Since this mapping event was performed in the late spring/early summer, LTE found it much easier to identify dead and stressed vegetation as compared to several previous mapping events. Vegetation was in full bloom and the general landscape appeared much greener and wetter than in years past. Water levels in surface water bodies were noted to be at high levels. This facilitated the identification of gas seeps in water bodies that are usually dry at the end of the summer. However, the high water also made it difficult to observe seeps in some of the fast moving waters of the Animas River.

In comparing the detailed mapping data from 2002 through 2005, LTE noted both increases and decreases in subsurface methane concentrations and areal extent of historical methane gas seeps. However, the general comparisons of historic active seeps from year to year show slight increases in methane concentrations more frequently than decreases. The increases in methane concentrations are most evident at the historical seeps located at Florida River, Texas Creek, and the upland areas of Carbon Junction. The areal extent of methane gas seepage appears relatively consistent with previous years with the exception of the upland area east of the Florida River.

It is evident that the sample population for a given mapping event affects the general appearance of trends. It is important to only compare proximal data when evaluating trends. LTE's detailed mapping program focuses on vegetation features and other indicators of active seeps. Therefore, by practice, there is some validity to the fact that an increase in the number of features mapped suggests an increase in areal extent of methane seepage. However, the sample populations collected during detailed seep mapping events are not considered a random sample population and therefore, have the potential to bias the interpretation of the results.

LTE believes that the methodology used for the detailed seep mapping program and the regional reconnaissance mapping program are adequate tools to allow end-users to make land-use decisions in areas affected and/or potentially affected by methane seepage. The monitoring program is effective at monitoring spatial and concentration changes over time at existing seep areas. The methodology also appears to be effective in identifying and mapping new seep areas as they occur. As seep areas occur near potential receptors, the mapping activities can assess the risk to exposure and identify areas requiring further assessment.

When comparing methane seepage to topography, historical data indicate that methane seepage is most commonly observed in the lowland areas (discharge areas) and stream valleys where the Fruitland Formation is overlain by alluvium in La Plata County. However, recent data also indicate the presence of methane seepage in topographically low areas of upland areas. These areas, similar to the stream valleys, are most likely at topographic lows due to variation in the subsurface bedrock, stratigraphy, or underlying fracture and/or fault systems providing preferential flow paths.

8.3 PERMANENT MONITORING PROBES

The most recent data available from the Basin Creek probe line were collected in November 2002, so no new trends were calculated for this transect. All the statistically significant trends from the Carbon Junction east and west transects are downward. All the statistically significant trends from the Pine River transect are upward. Both upward and downward trends were calculated from the Florida River and Texas Creek east and west transects. No statistically significant trends were calculated from the East Pine River east and west and Edgemont Ranch transects. More than half of all the permanent monitoring probes do not exhibit methane gas at consistent levels that allow statistical trend analysis. Only 33 of the 152 probes evaluated exhibited trends at the 90% confidence level.

LTE recommends discontinuing or significantly reducing the frequency of monitoring the permanent monitoring probes. These limited number of fixed point monitoring probes are not sufficient to monitoring the dynamic nature of the seep activity observed during detailed mapping along the Fruitland Formation outcrop. In fact, many of these probes do not contain elevated levels of methane gas. LTE advises against fixed point monitoring probe systems for methane seep surveys unless they are spatially distributed to account for changes in the lateral extent of seepage (i.e. grid pattern monitoring network). Advances in GPS technology over the past 10 years has diminished the usefulness of the the existing permanent monitoring probe network. More reliable and dynamic data can be obtained using temporary boreholes to measure methane concentration in the shallow subsurface. As subsequent monitoring events occur, field personnel can modify the sampling locations in the field based on the data obtained at the time of the survey. This allows for better delineation of seep activities without the need for excessive infrastructure and unsightly monitoring tubes. Should the permanent monitoring program continue, LTE will maintain the data from the probe monitoring program as delivered by the BLM and statistically evaluate the data on a periodic basis.

8.4 REGIONAL RECONNAISSANCE

The regional reconnaissance continues to indicate the usefulness of the IR image evaluation in identifying suspect areas. The most recent regional reconnaissance indicated several areas of methane seepage that were previously undefined. These areas include the upland area north of Basin Creek (M05-2, Figure 33), the upland area west of Florida River (M05-12, Figure 36), and two upland areas in the Vosburg Pike mapping area (M05-16 and M05-17, Figure 38).

A total of nine areas of methane seepage were identified through the regional reconnaissance outside of the previous detailed seep mapping study areas performed in October 2002, May 2003, and June 2005. The majority of these nine new suspect areas were either not identified by the 2003 IR image evaluation or located where access had not been granted to LTE in the past. During the regional reconnaissance activities in 2003, 12 suspect areas containing subsurface methane above 25 ppm were identified outside of the detailed seep mapping study areas performed in October 2002 and May 2003.



8.5 NATURAL SPRING SURVEY

Methane was detected at a spring on the Darwin Rather property located in Texas Creek, at a concentration of 0.002 mg/L. The methane concentration detected in this spring is relatively low. In fact, there is insufficient gas in the water to conduct isotopic analyses to determine if the gas is biogenic or thermogenic. The COGCC has established a methane concentration of 2.0 mg/L as the threshold limit for which there is an increased risk of creating a hazardous atmosphere in a water well or residential water piping system. The methane concentrations currently detected in the three natural springs sampled are below the 2.0 mg/L threshold limit.

The natural spring survey was useful in collecting baseline flow rates and methane concentrations of the natural springs located on the Fruitland Formation outcrop in La Plata County north of the Ute line.

8.6 STRUCTURE RECEPTOR EVALUATION

LTE has identified at least 14 residential structures located on the Fruitland Formation outcrop. Many of these landowners do not allow methane survey work to be performed on their property, particularly in the Texas Creek and Pine River valleys. LTE recommends that these property owners be informed of the potential risk of exposure for methane gas to accumulate to explosive levels inside structures. If possible, LTE recommends annual interior methane surveys of structures on the Fruitland Formation outcrop to assess the risk for the accumulation of explosive vapors. LTE is currently in the process of installing a methane detection system at the Ward residence near Texas Creek.

8.7 RECOMMENDATIONS

Based on the results of the gas flux chamber monitoring, the 2005 detailed seep mapping, the permanent monitoring probe data, the 2005 regional reconnaissance, and the natural spring survey, LTE recommends the following:

- Monitoring of the flux chamber system should be discontinued indefinitely;
- The next detailed mapping event should be performed in May 2006;
- The upland area north of Basin Creek, the upland area east of Edgemont Ranch, the upland areas in the Vosburg Pike mapping area, and the Ward Property should be added to the 2006 detailed mapping program;
- Discontinue or significantly reduce the frequency of monitoring the permanent monitoring probes;
- Conduct an updated IR aerial survey, suspect area identification, and field verification event in 2008; and
- An updated natural spring survey should be conducted during the next regional reconnaissance event in 2008 to assess any changes in the number of springs, the flow

rates, and/or the chemistry of natural springs on the Fruitland Formation outcrop in La Plata County north of the Ute line.



TABLES



TABLE 1

**STATISTICAL ANALYSIS SUMMARY
FRUITLAND OUTCROP PERMANENT MONITORING PROBE DATA
LA PLATA COUNTY, COLORADO**

THE GROUP

Transect Name	No. of Probes	No. of Probes with Trends	First Data	Last Data	Total No. of Sampling Events	90% Significance			
						Up 11/98-9/03	Down 11/98-9/03	Up 11/98-8/05	Down 11/98-8/05
Carbon Junction - East transect	15	9	Nov-98	Aug-05	37	3	2		6
Carbon Junction - West transect	15	10	Nov-98	Aug-05	37	1	2		6
East Pine River - West transect	15	0	Nov-98	Aug-05	32				
East Pine River - East transect	15	1	Nov-98	Aug-05	35				
Edgemont Ranch	16	1	Nov-98	Aug-05	34		1		
Florida River	17	9	Nov-98	Aug-05	34	4	2	5	2
Pine River	13	8	Nov-98	Aug-05	33	4	3	5	
Texas Creek - West transect	25	11	Nov-98	Aug-05	29	5	6	1	1
Texas Creek - East transect	21	10	Nov-98	Aug-05	30	4	3	3	4
Totals	152	59			302	21	19	14	19

TABLE 2

**STATISTICAL ANALYSIS OF TRENDS IN FRUITLAND OUTCROP
PERMANENT MONITORING PROBE DATA
LA PLATA COUNTY, COLORADO**

THE GROUP

Site ID	First Data	Last Data	No. of Months	Maximum Conc (ppm)*	Percent months with LEL <3	Data Series from 11/98 - 9/03				Data Series from 11/98 - 8/05			
						Z2	SignZ2	Q2	Significance	Z3	SignZ3	Q3	Significance
Basin Creek													
BC-GP-101	Nov-98	Nov-02	23	500	97%	0.72	up	0.00		No new data			
BC-GP-102	Nov-98	Nov-02	24	2,500	94%	2.92	up	0.00	^^	No new data			
BC-GP-103	Nov-98	Nov-02	21	50,000	0%	-0.03	down	0.00		No new data			
BC-GP-104	Nov-98	Nov-02	24	500	97%					No new data			
BC-GP-105	Nov-98	Nov-02	21	16,000	25%	-3.97	down	-0.50	vvvv	No new data			
BC-GP-106	Nov-98	Nov-02	24	3,000	81%	-0.06	down	0.00		No new data			
BC-GP-107	Nov-98	Nov-02	24	2,000	84%	-0.28	down	0.00		No new data			
BC-GP-108	Nov-98	Nov-02	24	500	100%					No new data			
BC-GP-109	Nov-98	Nov-02	26	500	100%					No new data			
BC-GP-110	Nov-98	Nov-02	21	2,000	56%	3.35	up	0.06	^^^^	No new data			
BC-GP-111	Nov-98	Nov-02	21	910,000	0%	1.53	up	9.23		No new data			
BC-GP-112	Nov-98	Nov-02	21	44,500	6%	2.25	up	0.78	^^	No new data			
BC-GP-113	Nov-98	Nov-02	24	500	100%	1.24	up	0.00		No new data			
BC-GP-114	Nov-98	Nov-02	24	0	100%					No new data			
BC-GP-115	Nov-98	Nov-02	24	500	100%					No new data			
BC-GP-116	Nov-98	Nov-02	23	0	100%					No new data			
Carbon Junction (East transect)													
CJ-GP-101	Nov-98	Aug-05	37	230,000	50%	1.17	up	0.33		-1.12	down	-0.05	
CJ-GP-102	Nov-98	Aug-05	37	160,000	70%	-3.01	down	-0.07	vvv	-2.59	down	0.00	vvv
CJ-GP-103	Nov-98	Aug-05	37	960,000	4%	-0.89	down	-10.91		-3.59	down	-35.34	vvvv
CJ-GP-104	Nov-98	Aug-05	37	70,000	46%	-3.99	down	-1.52	vvvv	-4.41	down	-0.74	vvvv
CJ-GP-105	Nov-98	Aug-05	38	6,000	98%	-2.08	down	0.00	vv				
CJ-GP-106	Nov-98	Aug-05	33	1,030,000	2%	-2.17	down	-5.05	vv	-3.58	down	-4.94	vvvv
CJ-GP-107	Nov-98	Aug-05	34	1,030,000	0%	-2.63	down	-17.53	vvv	-2.95	down	-22.63	vvv
CJ-GP-108	Nov-98	Aug-05	37	60,000	20%	1.03	up	0.75		-1.66	down	-0.47	v
Carbon Junction (East transect)													
CJ-GP-109	Nov-98	Aug-05	37	810,000	0%	-1.56	down	-6.38		1.36	up	6.12	
CJ-GP-110	Nov-98	Aug-05	35	31,000	57%	0.35	up	0.05		-2.07	down	-0.20	vv
CJ-GP-111	Nov-98	Aug-05	38	500	100%								
CJ-GP-112	Nov-98	Aug-05	37	1,000	100%								
CJ-GP-113	Nov-98	Aug-05	38	500	100%								
CJ-GP-114	Nov-98	Aug-05	36	500	100%								
CJ-GP-115	Nov-98	Aug-05	38	1,000	100%								

TABLE 2

**STATISTICAL ANALYSIS OF TRENDS IN FRUITLAND OUTCROP
PERMANENT MONITORING PROBE DATA
LA PLATA COUNTY, COLORADO**

THE GROUP

Site ID	First Data	Last Data	No. of Months	Maximum Conc (ppm)*	Percent months with LEL <3	Data Series from 11/98 - 9/03				Data Series from 11/98 - 8/05			
						Z2	SignZ2	Q2	Significance	Z3	SignZ3	Q3	Significance
Carbon Junction (West transect)													
CJ-GP-201	Nov-98	Aug-05	32	0	100%								
CJ-GP-202	Nov-98	Aug-05	38	1,440,000	20%	-3.72	down	-64.25	vvvv	-4.65	down	-29.17	vvvv
CJ-GP-203	Nov-98	Aug-05	39	1,020,000	0%	-0.10	down	0.00		-2.55	down	-7.14	vv
CJ-GP-204	Nov-98	Aug-05	43	1,220,000	7%	-2.91	down	-37.03	vvv	-3.73	down	-27.07	vvvv
CJ-GP-205	Nov-98	Apr-05	40	760,000	0%	-1.72	down	-12.00	v	-3.46	down	-23.30	vvvv
CJ-GP-206	Nov-98	Aug-05	37	380,000	4%	-1.68	down	-6.15	v	-3.36	down	-9.56	vvvv
CJ-GP-207	Jan-99	Aug-05	40	460,000	38%	-1.07	down	-0.33		-0.92	down	-0.13	
CJ-GP-208	Nov-98	Aug-05	42	1,350,000	0%	-3.54	down	-22.05	vvvv	-0.85	down	-5.00	
CJ-GP-209	Nov-98	Aug-05	37	460,000	2%	-1.23	down	-2.81		-1.68	down	-2.76	v
CJ-GP-210	Nov-98	Aug-05	33	160,000	0%	-0.53	down	-0.45		1.12	up	1.00	
CJ-GP-211	Nov-98	Aug-05	41	870,000	9%	1.13	up	0.62		-0.33	down	-0.11	
CJ-GP-212	Nov-98	Aug-05	38	500	100%								
CJ-GP-213	Nov-98	Aug-05	38	2,000	98%								
CJ-GP-214	Nov-98	Aug-05	36	500	100%								
CJ-GP-215	Nov-98	Aug-05	38	500	100%								
East Pine (West transect)													
EP-GP-101	Nov-98	Aug-05	35	1,000	100%								
EP-GP-102	Nov-98	Aug-05	36	500	100%								
EP-GP-103	Nov-98	Aug-05	29	500	100%								
EP-GP-104	Nov-98	Aug-05	35	500	100%								
EP-GP-105	Nov-98	Aug-05	35	500	100%								
EP-GP-106	Mar-99	Aug-05	33	500	100%								
EP-GP-107	Nov-98	Aug-05	36	500	100%								
EP-GP-108	Nov-98	Aug-05	28	500	100%								
EP-GP-109	Nov-98	Aug-05	34	1,000	98%								
EP-GP-110	Nov-98	Aug-05	35	500	98%								
EP-GP-111	Nov-98	Aug-05	30	1,000	97%								
EP-GP-112	Nov-98	Aug-05	27	500	97%								
EP-GP-113	Nov-98	Aug-05	33	500	98%								
EP-GP-114	Nov-98	Aug-05	30	500	100%								
EP-GP-115	Mar-99	Aug-05	31	500	100%								

TABLE 2

**STATISTICAL ANALYSIS OF TRENDS IN FRUITLAND OUTCROP
PERMANENT MONITORING PROBE DATA
LA PLATA COUNTY, COLORADO**

THE GROUP

Site ID	First Data	Last Data	No. of Months	Maximum Conc (ppm)*	Percent months with LEL <3	Data Series from 11/98 - 9/03				Data Series from 11/98 - 8/05			
						Z2	SignZ2	Q2	Significance	Z3	SignZ3	Q3	Significance
East Pine (East transect)													
EP-GP-201	Nov-98	Aug-05	33	500	100%								
EP-GP-202	Nov-98	Aug-05	35	500	100%								
EP-GP-203	Nov-98	Aug-05	37	500	100%								
EP-GP-204	Nov-98	Aug-05	37	1,000	100%								
EP-GP-205	Nov-98	Aug-05	34	500	100%								
EP-GP-206	Nov-98	Aug-05	36	500	100%								
EP-GP-207	Nov-98	Aug-05	30	500	100%								
EP-GP-208	Nov-98	Aug-05	37	500	100%								
EP-GP-209	Nov-98	Aug-05	36	500	100%								
EP-GP-210	Nov-98	Aug-05	36	12,000	98%								
EP-GP-211	Nov-98	Aug-05	37	500	100%								
EP-GP-212	Nov-98	Aug-05	35	50,000	70%					0.61	up	0.00	
EP-GP-213	Nov-98	Aug-05	35	500	100%								
EP-GP-214	Nov-98	Aug-05	37	500	100%								
EP-GP-215	Nov-98	Aug-05	36	500	100%								
Edgemont Ranch													
ER-GP-101	Nov-98	Aug-05	33	1,000	100%								
ER-GP-102	Nov-98	Aug-05	38	1,000	100%								
ER-GP-103	Nov-98	Aug-05	38	500	100%								
ER-GP-104	Nov-98	Aug-05	35	500	100%								
ER-GP-105	Nov-98	Aug-05	38	1,000	100%								
ER-GP-106	Nov-98	Aug-05	38	1,000	100%								
ER-GP-107	Nov-98	Aug-05	35	430,000	65%	-0.53	down	0.00		0.80	up	0.00	
ER-GP-108	Nov-98	Aug-05	37	2,500	95%								
ER-GP-109	Nov-98	Aug-05	33	1,000	100%								
ER-GP-109A	Nov-00	Sep-03	14	500	100%								
ER-GP-110	Nov-98	Aug-05	38	500	100%								
ER-GP-111	Nov-98	Aug-05	26	500	100%								
ER-GP-112	Nov-98	Aug-05	35	1,000	100%								
ER-GP-113	Nov-98	Feb-05	32	500	100%								
ER-GP-114	Nov-98	Dec-04	31	3,000	97%								
ER-GP-115	Nov-98	Aug-05	35	500	100%								

DRAFT

TABLE 2

STATISTICAL ANALYSIS OF TRENDS IN FRUITLAND OUTCROP
PERMANENT MONITORING PROBE DATA
LA PLATA COUNTY, COLORADO

THE GROUP

Site ID	First Data	Last Data	No. of Months	Maximum Conc (ppm)*	Percent months with LEL <3	Data Series from 11/98 - 9/03				Data Series from 11/98 - 8/05				
						Z2	SignZ2	Q2	Significance	Z3	SignZ3	Q3	Significance	
Florida River														
FR-GP-101	Nov-98	Aug-05	38	5,300,000	93%									
FR-GP-103	Nov-98	Aug-05	36	1,500	95%									
FR-GP-104	Nov-98	Aug-05	36	260,000	11%	-0.61	down	-0.25		1.00	up	0.32		
FR-GP-104A	Nov-98	Aug-05	41	1,070,000	13%	4.20	up	33.56	^^^	2.60	up	35.25	^^	
FR-GP-105	Nov-98	Aug-05	32	960,000	8%	-0.58	down	-7.46		-2.63	down	-29.73	vvv	
FR-GP-105A	Nov-00	Sep-03	14	25,000	45%	0.00	horizontal	0.00		No new data				
FR-GP-106	Nov-98	Aug-05	37	40,000	59%	3.91	up	0.43	^^^	0.47	up	0.00		
FR-GP-107	Nov-98	Aug-05	41	340,000	37%	1.81	up	0.40	^	2.87	up	2.11	^^	
FR-GP-108	Nov-98	Aug-05	42	580,000	29%	2.46	up	1.34	^^	-1.65	down	-0.16	v	
FR-GP-109	Nov-98	Aug-05	40	30,000	51%	3.85	up	0.40	^^^	3.36	up	0.31	^^^	
FR-GP-110	Nov-98	Aug-05	38	150,000	93%	0.81	up	0.00						
FR-GP-111	Nov-98	Aug-05	36	190,000	63%	3.31	up	0.24	^^^	2.37	up	0.07	^^	
FR-GP-112	Nov-98	Aug-05	37	8,000	98%	0.77	up	0.00						
FR-GP-113	Nov-98	Aug-05	32	9,000	63%	4.17	up	0.23	^^^	2.44	up	0.09	^^	
FR-GP-114	Nov-98	Aug-05	38	1,000	100%	0.71	up	0.00						
FR-GP-115	Nov-98	Dec-04	30	60,000	95%	2.25	up	0.00	^^					
Pine River														
PR-GP-101	Jan-99	Aug-05	32	500	100%	-0.79	down	0.00						
PR-GP-102	Jan-99	Aug-05	33	1,000	100%	-0.64	down	0.00						
PR-GP-103	Nov-98	Aug-05	34	39,000	84%	2.69	up	0.05	^^	1.67	up	0.00	^	
PR-GP-104	Nov-98	Aug-05	31	920,000	15%	0.91	up	10.79		-1.28	down	-15.65		
PR-GP-105	Nov-98	Aug-05	33	490,000	17%	-1.13	down	-0.80		-0.85	down	-0.42		
PR-GP-106	Nov-98	Aug-05	31	990,000	13%	2.00	up	21.33	^^	2.57	up	28.88	^^	
PR-GP-107	Nov-98	Aug-05	34	925,000	23%	2.66	up	29.29	^^	2.66	up	26.32	^^	
PR-GP-108	Nov-98	Aug-05	35	1,000	93%	2.47	up	0.00	^^					
PR-GP-109	Nov-98	Aug-05	37	490,000	89%	5.04	up	0.06	^^^	3.18	up	0.02	^^	
PR-GP-110	Nov-98	Aug-05	36	1,030,000	0%	1.92	up	6.79	^	2.66	up	12.36	^^	
PR-GP-111	Nov-98	Aug-05	19	1,500	89%	0.32	up	0.00						
PR-GP-112	Nov-98	Aug-05	36	1,500	95%									
PR-GP-113	Jan-99	Aug-05	32	17,500	88%	0.49	up	0.00		-0.52	down	0.00		

TABLE 2

**STATISTICAL ANALYSIS OF TRENDS IN FRUITLAND OUTCROP
PERMANENT MONITORING PROBE DATA
LA PLATA COUNTY, COLORADO**

DRAFT

THE GROUP

Site ID	First Data	Last Data	No. of Months	Maximum Conc (ppm)*	Percent months with LEL <3	Data Series from 11/98 - 9/03				Data Series from 11/98 - 8/05			
						Z2	SignZ2	Q2	Significance	Z3	SignZ3	Q3	Significance
Texas Creek (West transect)													
TC-GP-101	Nov-98	Aug-05	37	1,000	100%								
TC-GP-102	Nov-98	Aug-05	36	21,000	77%	3.18	up	0.07	^^^	3.20	up	0.07	^^^
TC-GP-103	Nov-98	Aug-05	33	129,500	27%	0.49	up	0.26		-0.70	down	-0.19	
TC-GP-105	Nov-98	Aug-05	29	365,000	8%	1.57	up	5.00		1.62	up	4.00	
TC-GP-106	Nov-98	Aug-05	37	4,500	91%								
TC-GP-107	Nov-98	Aug-05	36	220,000	32%	-1.78	down	-0.63	v	-2.13	down	-0.38	vv
TC-GP-108	Jan-99	Aug-05	34	410,000	10%	1.17	up	4.62		-0.06	down	0.00	
TC-GP-109	Jan-99	Aug-05	35	14,500	67%	2.78	up	0.15	^^^	0.35	up	0.00	
TC-GP-110	Nov-98	Aug-05	37	5,500	89%	2.08	up	0.00	^^				
TC-GP-111	Nov-98	Aug-05	37	2,500	93%	1.78	up	0.00	^				
TC-GP-112	Nov-98	Aug-05	26	1,500	88%	-1.04	down	0.00					
TC-GP-112A	Nov-00	Sep-03	8	0	100%					No new data			
TC-GP-113	Nov-98	Aug-05	35	12,000	49%	2.61	up	0.43	^^^	0.36	up	0.00	
TC-GP-114	Nov-98	Aug-05	33	3,000	98%	-0.63	down	0.00					
TC-GP-115	Nov-98	Aug-05	33	1,500	98%								
TC-GP-116	Nov-98	Aug-05	33	1,000	100%								
TC-GP-117	Nov-98	Jul-03	10	0	100%								
TC-GP-118	Nov-98	Aug-05	32	860,000	18%	-0.65	down	-0.94		0.58	up	0.30	
TC-GP-119	Jan-99	Aug-05	30	4,500	95%								
TC-GP-120	May-99	Jun-05	25	500	100%								
TC-GP-121	May-99	Aug-05	31	500	100%								
TC-GP-122	Jan-99	Aug-05	32	500	100%								
TC-GP-123	Sep-01	Jun-04	12	1,160,000	0%	-1.25	down	-13.33		-0.34	down	-7.50	
TC-GP-124	Sep-01	Jun-04	12	850,000	0%	1.25	up	40.00		0.62	up	15.14	
Texas Creek (East transect)													
TC-GP-201	Jan-99	Aug-05	33	2,500	93%								
TC-GP-202	Jan-99	Aug-05	33	500	100%								
TC-GP-203	Nov-98	Aug-05	19	790,000	7%	-3.47	down	-22.60	vvvv	-1.79	down	-20.00	v
TC-GP-204	Jan-99	Aug-05	35	350,000	12%	1.08	up	5.33		0.17	up	0.25	
TC-GP-205	Nov-98	Aug-05	36	1,000	100%								
TC-GP-206	Jan-99	Aug-05	34	24,500	35%	-0.31	down	0.00		-1.49	down	-0.15	
TC-GP-207	Jan-99	Aug-05	34	12,500	64%	-0.49	down	0.00		-2.34	down	-0.04	vv
TC-GP-208	Nov-98	Aug-05	32	13,000	38%	0.14	up	0.00		-1.79	down	-0.36	v
TC-GP-209	Jan-99	Aug-05	33	2,500	68%	3.73	up	0.12	^^^	1.31	up	0.00	
TC-GP-210	Jan-99	Aug-05	35	0	86%								
TC-GP-211	Jan-99	Aug-05	33	1,000	98%	-0.45	down	0.00					

TABLE 2

STATISTICAL ANALYSIS OF TRENDS IN FRUITLAND OUTCROP
 PERMANENT MONITORING PROBE DATA
 LA PLATA COUNTY, COLORADO

DRAFT

THE GROUP

Site ID	First Data	Last Data	No. of Months	Maximum Conc (ppm)*	Percent months with LEL <3	Data Series from 11/98 - 9/03				Data Series from 11/98 - 8/05			
						Z2	SignZ2	Q2	Significance	Z3	SignZ3	Q3	Significance
Texas Creek (East transect)													
TC-GP-213	Nov-98	Aug-05	32	6,000	86%	2.42	up	0.00	^^	2.66	up	0.00	^^^
TC-GP-214	May-99	Jun-05	26	1,200,000	25%	1.82	up	11.05	^	3.56	up	47.22	^^^^
TC-GP-214A	May-01	Sep-03	10	450,000	0%	0.09	up	9.00		No new data			
TC-GP-215	Mar-99	Aug-05	12	5,000	86%					1.92	up	0.00	^
TC-GP-215A	Nov-00	Sep-03	12	0	100%								
TC-GP-216	Jan-99	Aug-05	33	2,000	98%								
TC-GP-217	Jan-99	Aug-05	32	500	100%								
TC-GP-218	Jan-99	Aug-05	32	500	100%								
TC-GP-219	Jan-99	Aug-05	33	500	100%								

Notes:

Z: Mann-Kendall test statistic

Max conc = Max LEL * 500

Slope: Sen slope of trend

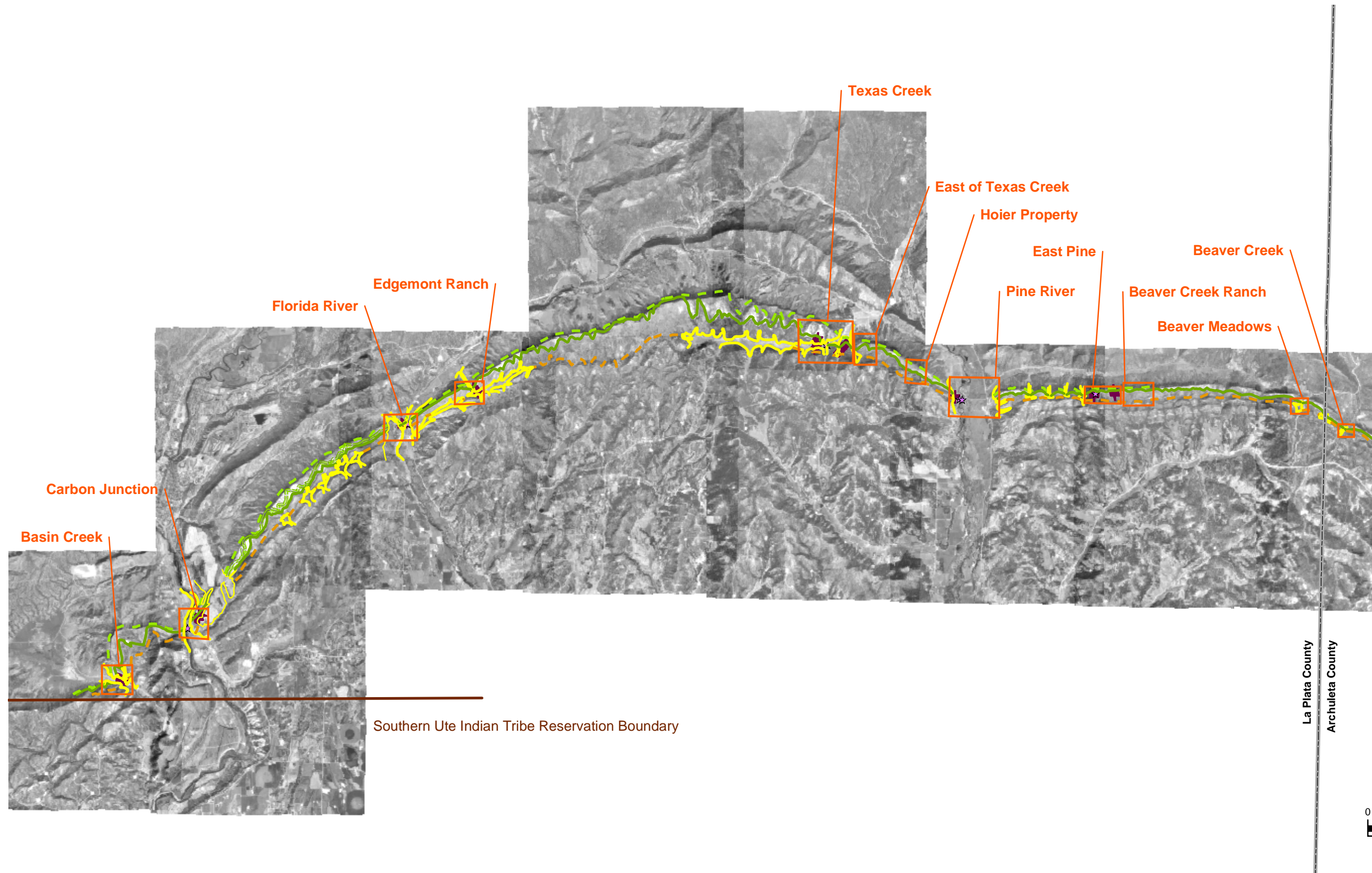
Direction: direction of trend (up or down)

Significance: Level of significance of trend (one tailed test)

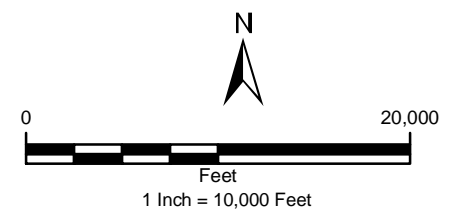
- ^ or v 90%
- ^^ or vv 95%
- ^^^ or vvv 99%
- ^^^^ or vvvv 100%

FIGURES





- Legend**
- ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

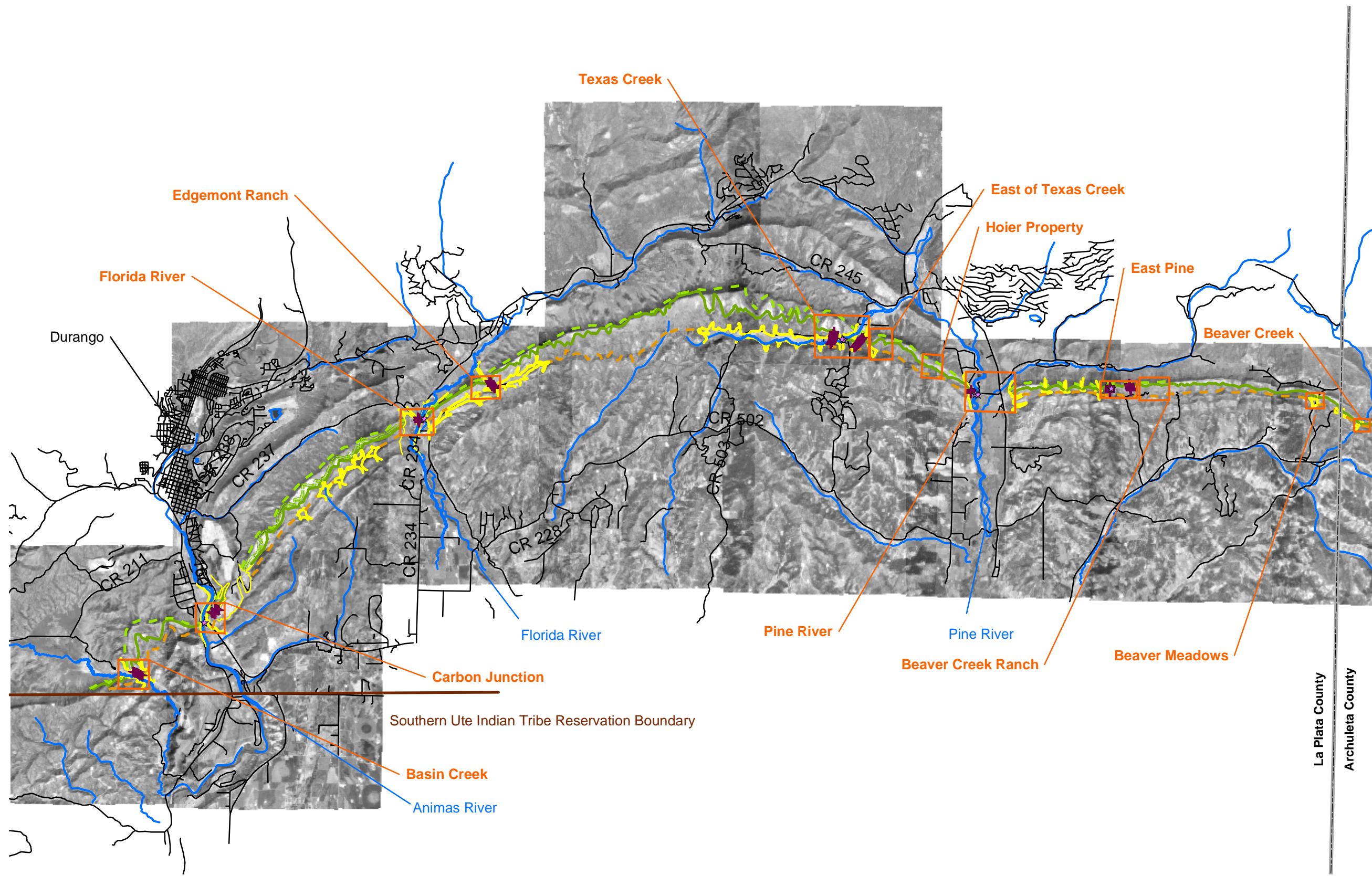


**FIGURE 1A
PROJECT AREA MAP
LA PLATA COUNTY, CO**



THE GROUP

Aerial photos on subsequent maps have been faded to highlight data features



- Legend**
- ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - Roads
 - Rivers
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

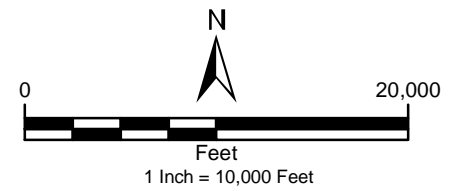
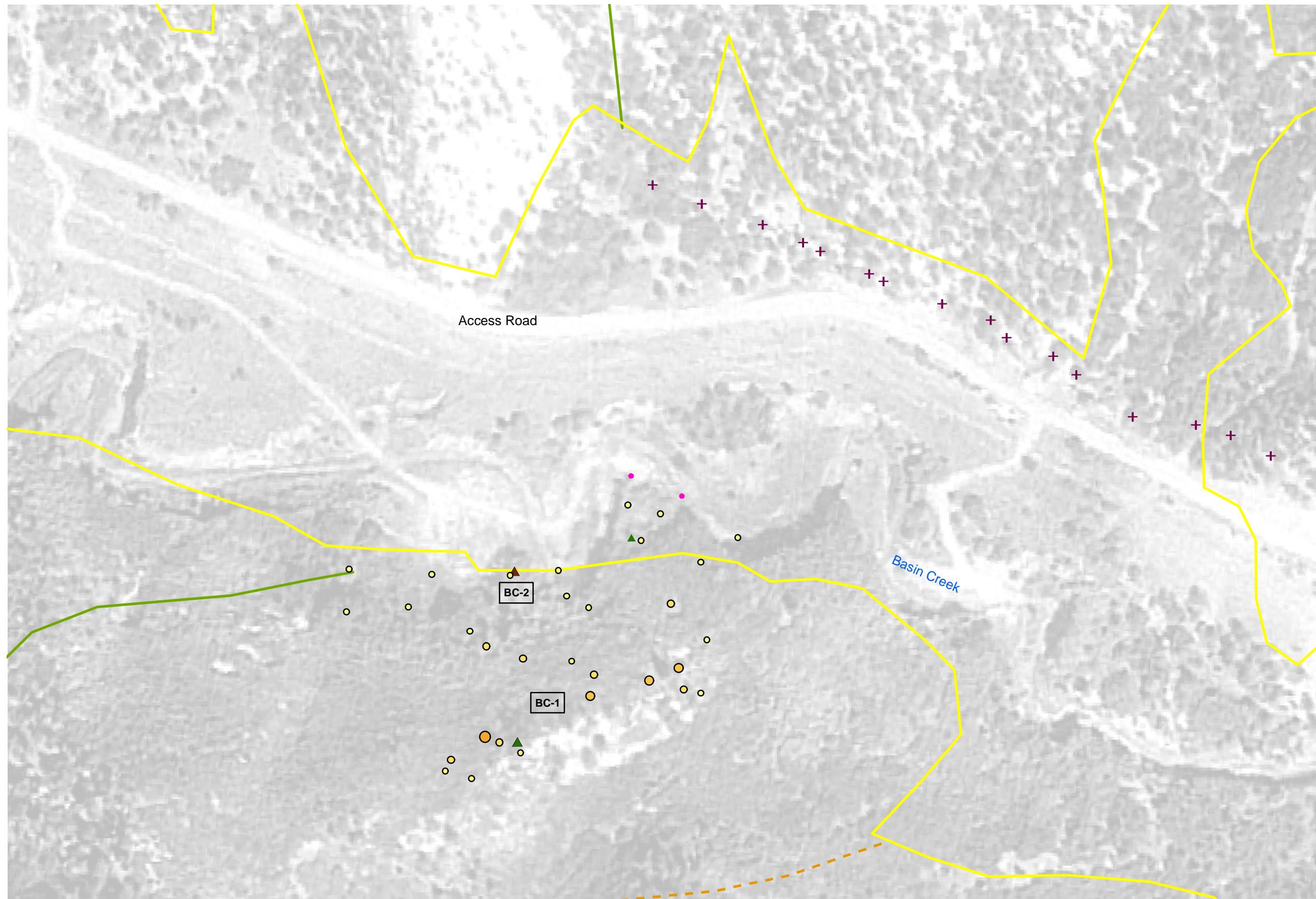


FIGURE 1B
PROJECT AREA MAP (detail)
LA PLATA COUNTY, CO

Aerial photos on subsequent maps
 have been faded to highlight data features

THE GROUP





- LEGEND**
- + Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - Stressed/Dead Vegetation
 - Non-Vegetative Area
 - Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - BC-1 Text Reference

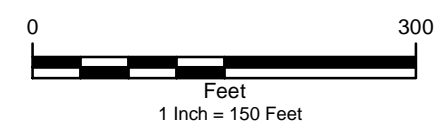


FIGURE 2
2005 DETAILED SEEP MAPPING
BASIN CREEK

THE GROUP





- LEGEND**
Subsurface Methane Measurements
- 2005**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- 2004**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- 2003**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- 2002**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

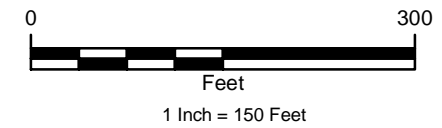
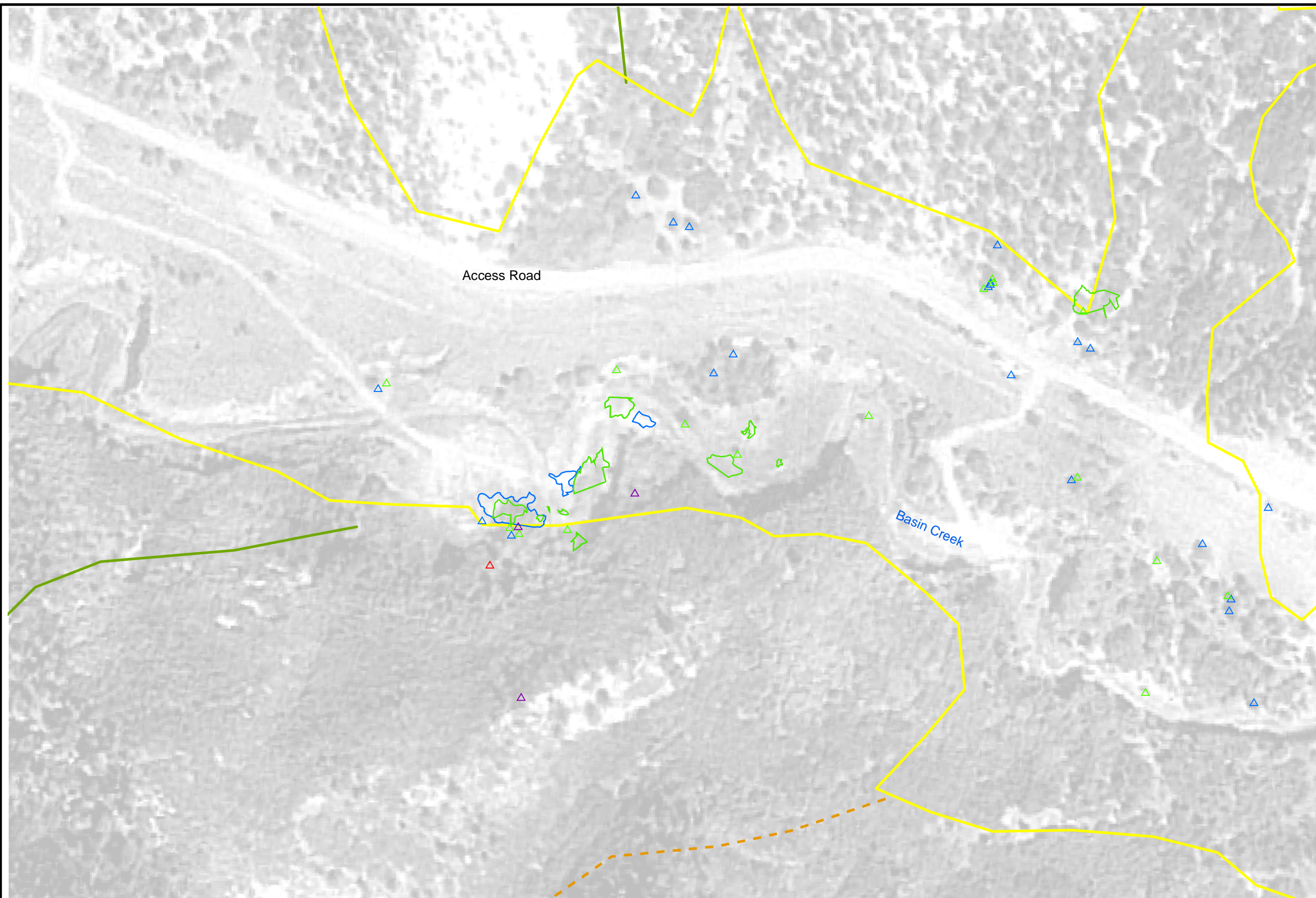


FIGURE 3
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
BASIN CREEK

THE GROUP





- Legend**
- Stressed/Dead Trees**
- ▲ Stressed/Dead Trees 2005
 - ▲ Stressed/Dead Trees 2004
 - ▲ Stressed/Dead Trees 2003
 - ▲ Stressed/Dead Trees 2002
- Stressed/Dead Vegetation**
- Stressed/Dead Veg 2005
 - Stressed/Dead Veg 2004
 - Stressed/Dead Veg 2003
 - Stressed/Dead Veg 2002
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

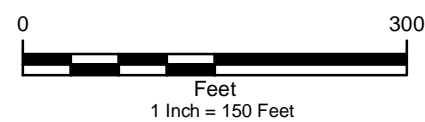
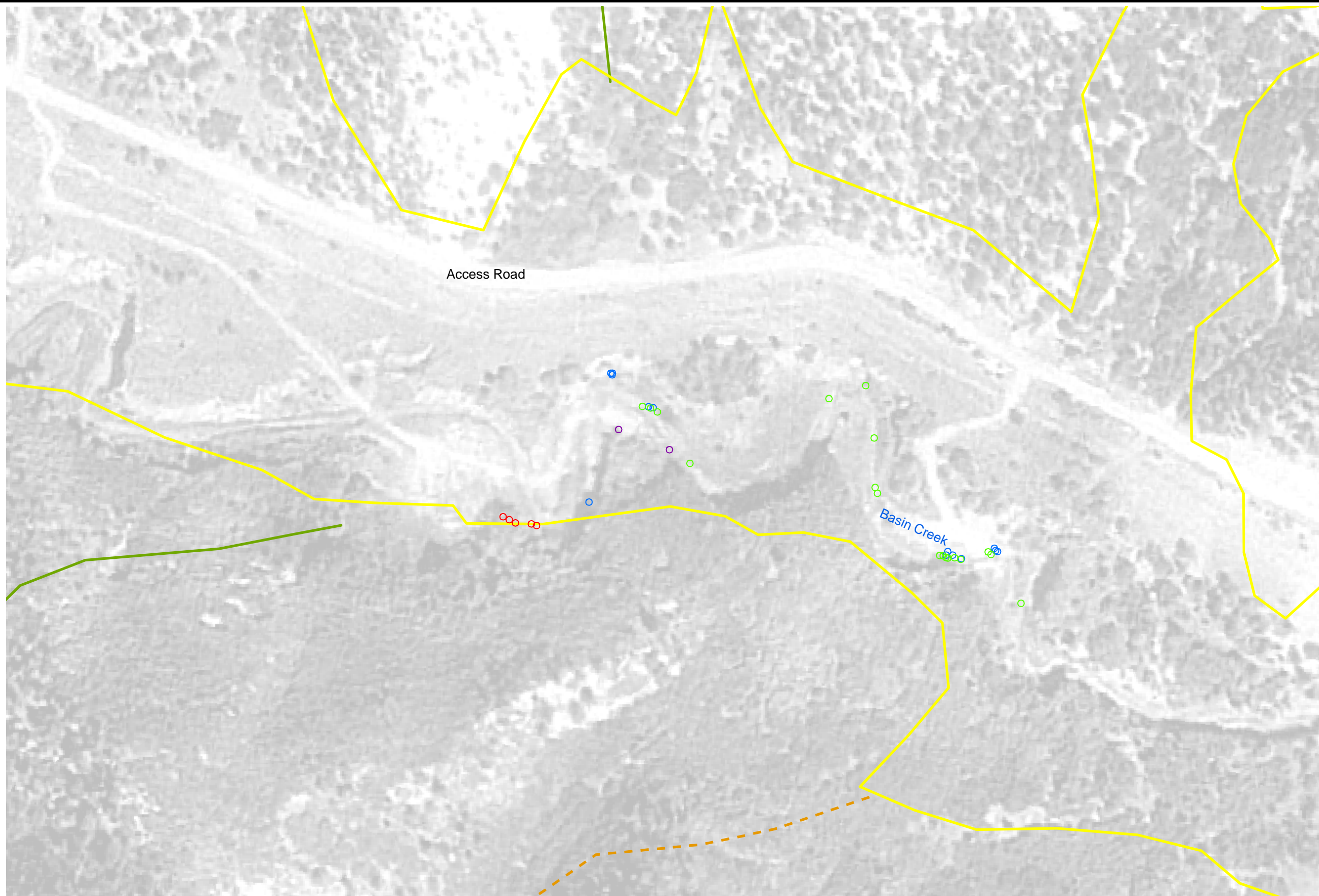


FIGURE 4
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
BASIN CREEK

THE GROUP





- Legend**
- Visible Methane Seeps in Surface Water
- Methane Seeps 2005
 - Methane Seeps 2004
 - Methane Seeps 2003
 - Methane Seeps 2002
- Geology
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

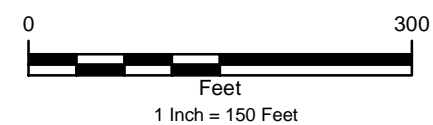
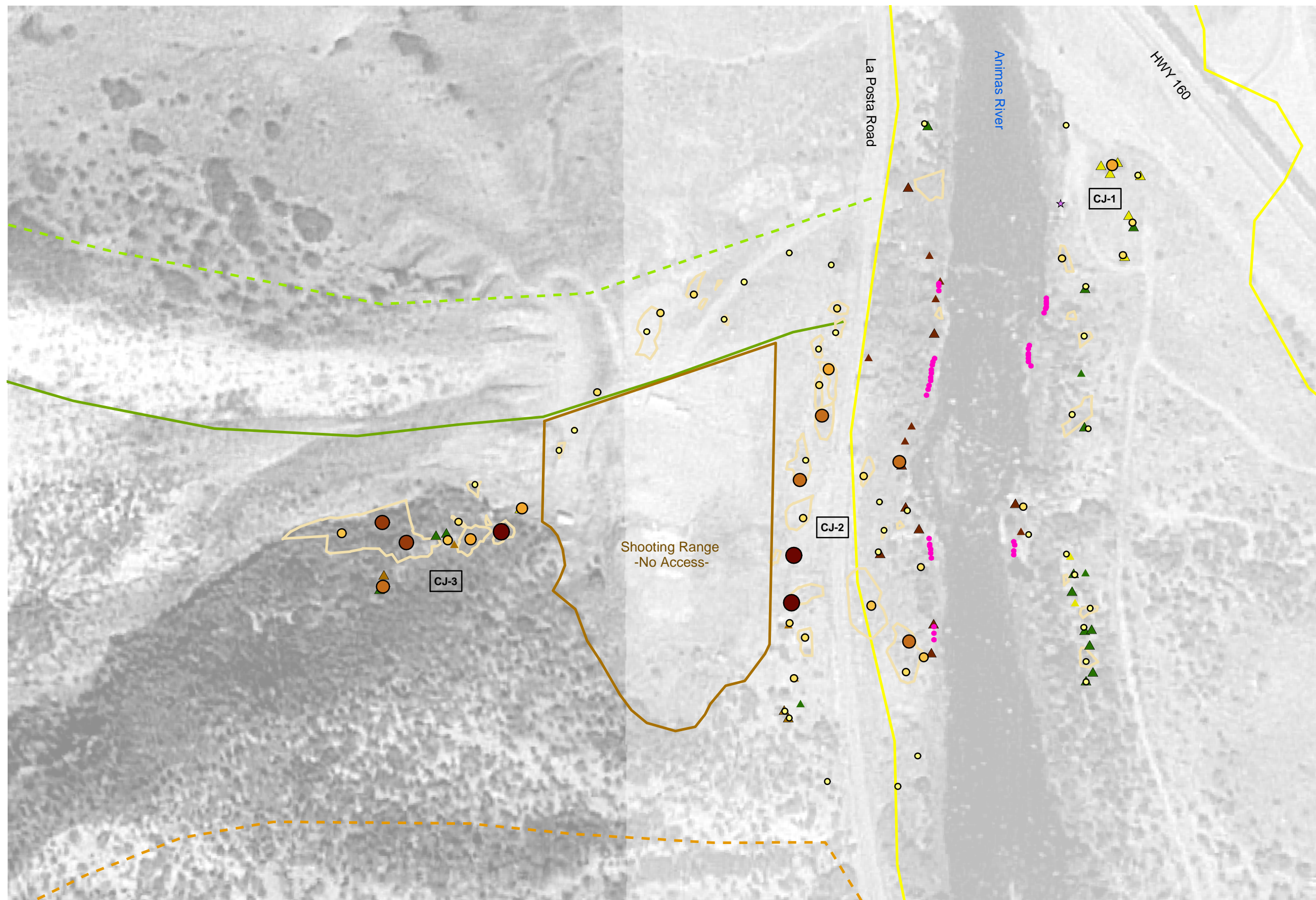


FIGURE 5
HISTORICAL DATA COMPARISON
VISIBLE METHANE SEEPS IN SURFACE WATER
BASIN CREEK

THE GROUP





- LEGEND**
- ✦ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - Stressed/Dead Vegetation
 - Non-Vegetative Area
 - Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - [CJ-1] Text Reference

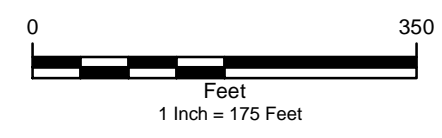
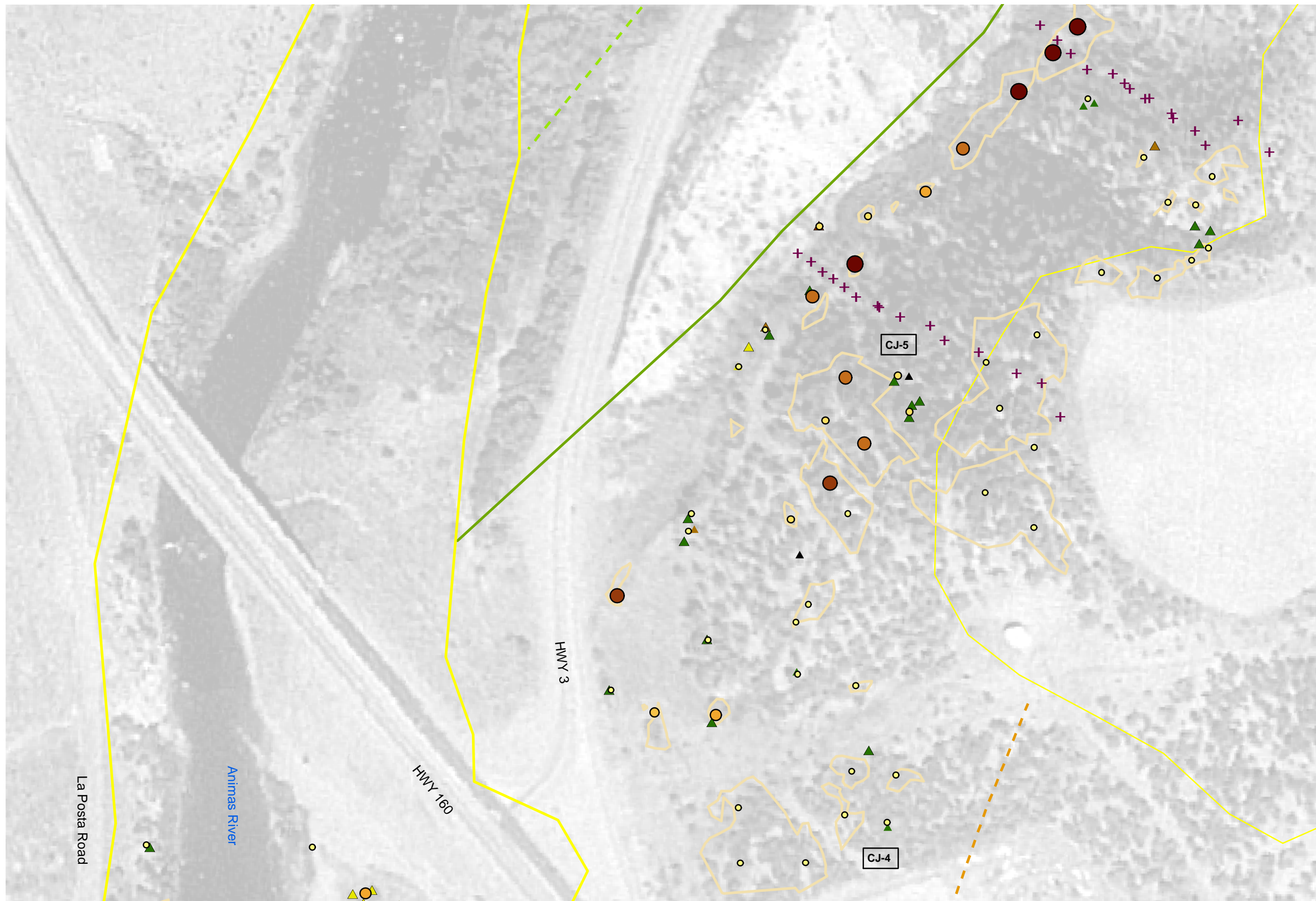


FIGURE 6
2005 DETAILED SEEP MAPPING
CARBON JUNCTION WEST

THE GROUP





- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Methane Seeps
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - ▭ Stressed/Dead Vegetation
 - ▭ Non-Vegetative Area
 - ▭ Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - ▭ CJ-4 Text Reference
 - ▭ CJ-5 Text Reference

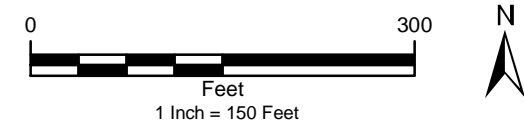


FIGURE 7
2005 DETAILED SEEP MAPPING
CARBON JUNCTION EAST

THE GROUP





LEGEND
Subsurface Methane Measurements

2005

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2004

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2003

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2002

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

Geology

- Fruitland Formation (Kf)
- - - Fruitland Formation Tongue (Kft)
- - - Kirtland Formation (Kk)
- - - Pictured Cliffs Formation (Kpc)
- - - Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)

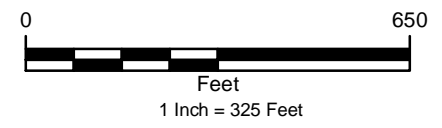
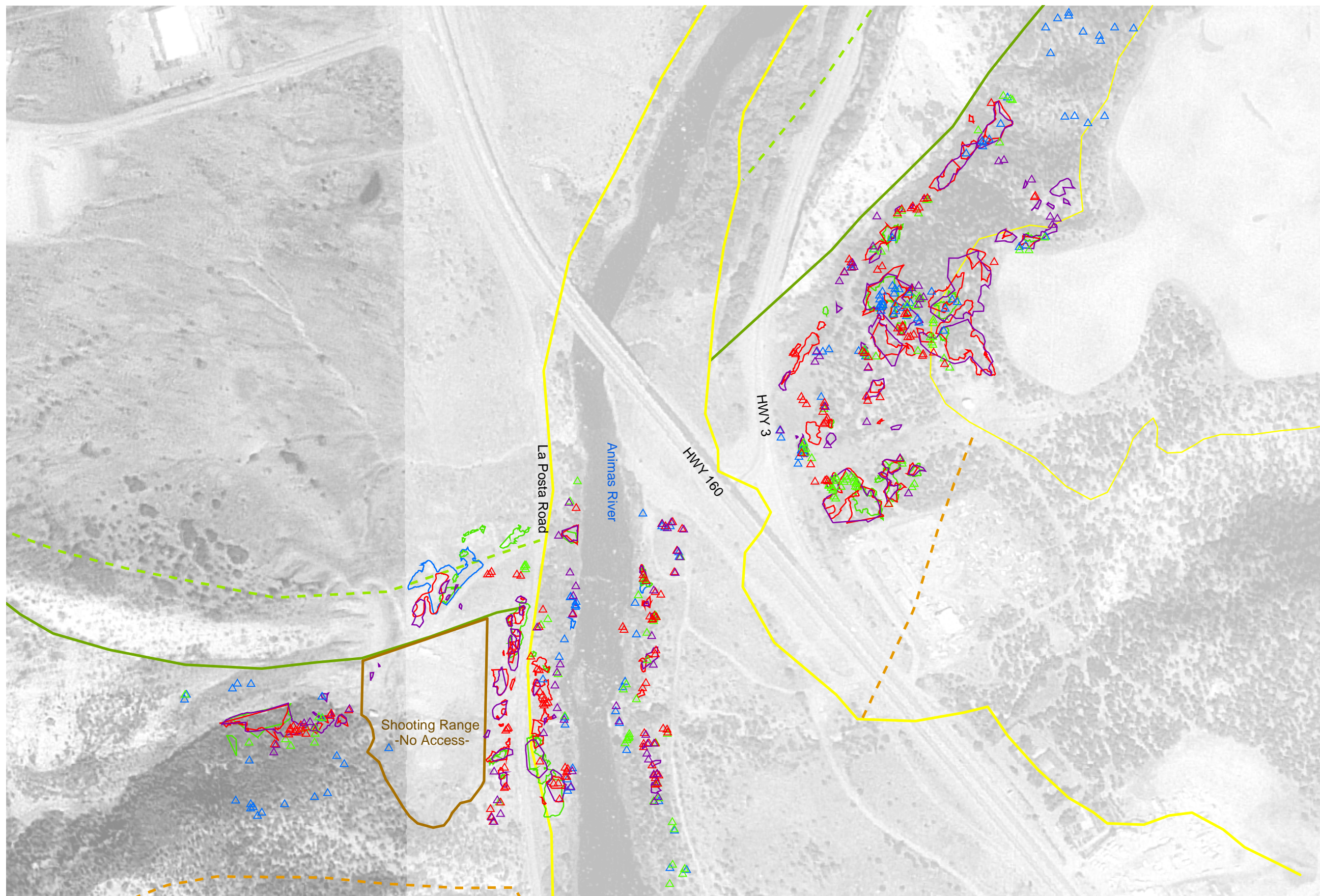


FIGURE 8
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
CARBON JUNCTION



THE GROUP



- Legend**
- Stressed/Dead Trees**
- △ Stressed/Dead Trees 2005
 - △ Stressed/Dead Trees 2004
 - △ Stressed/Dead Trees 2003
 - △ Stressed/Dead Trees 2002
- Stressed/Dead Vegetation**
- Stressed/Dead Veg 2005
 - Stressed/Dead Veg 2004
 - Stressed/Dead Veg 2003
 - Stressed/Dead Veg 2002
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

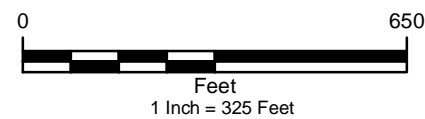


FIGURE 9
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
CARBON JUNCTION

THE GROUP





- Legend**
- Visible Methane Seeps in Surface Water
- Methane Seeps 2005
 - Methane Seeps 2004
 - Methane Seeps 2003
 - Methane Seeps 2002
- Geology
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

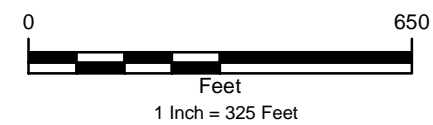
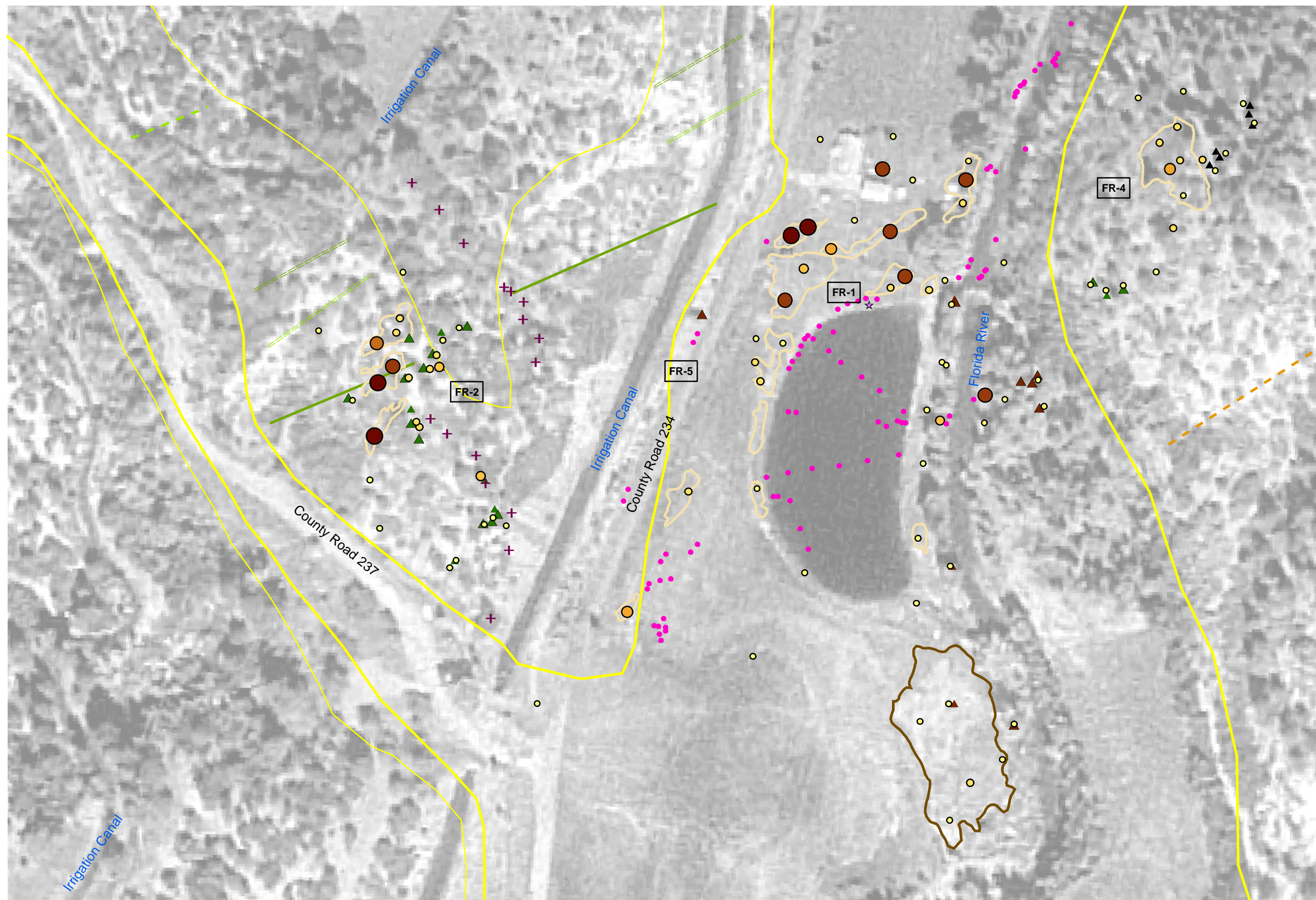


FIGURE 10
HISTORICAL DATA COMPARISON
VISIBLE METHANE SEEPS IN SURFACE WATER
CARBON JUNCTION

THE GROUP





LEGEND

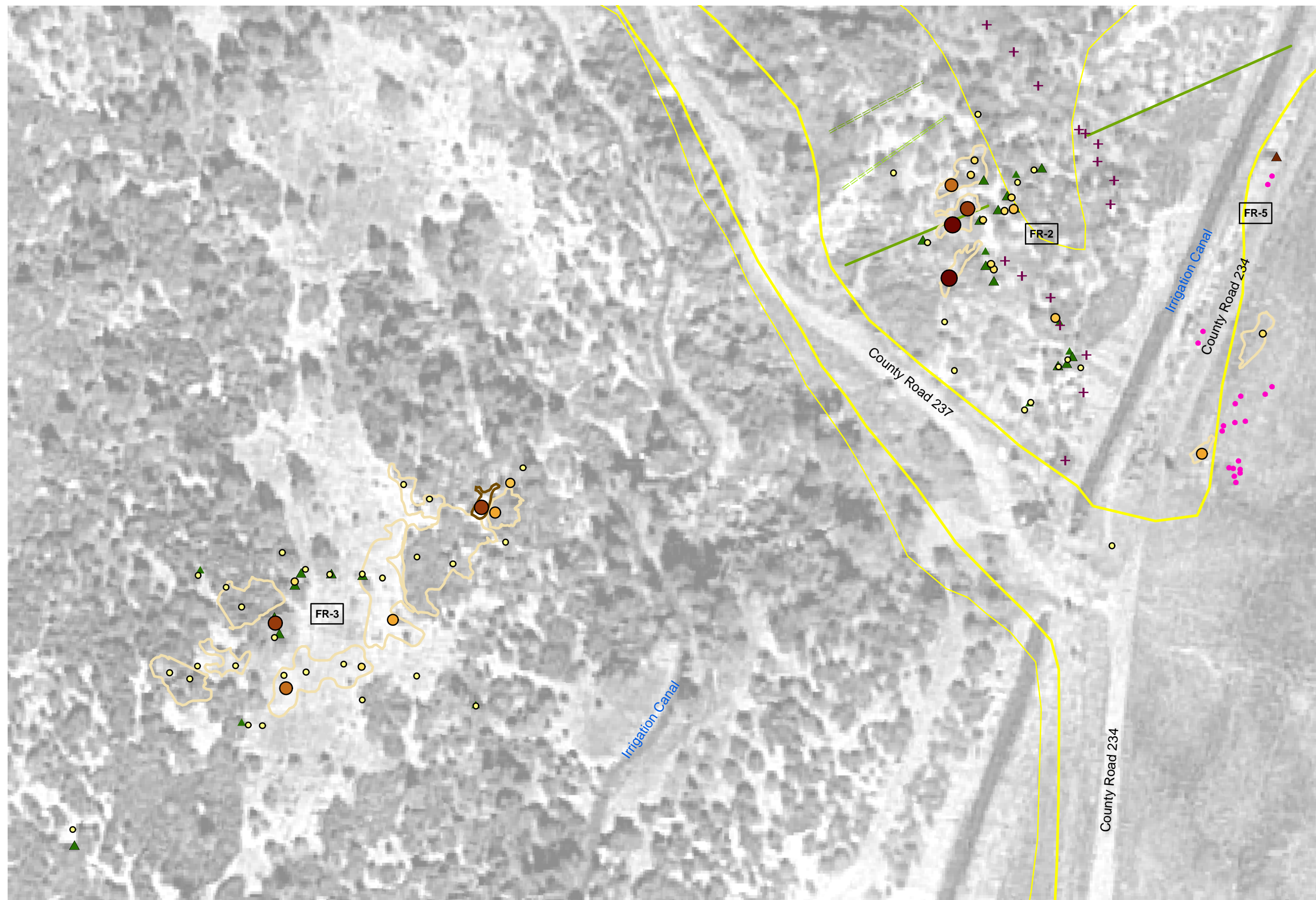
- ✦ Gas Monitoring Probes
- ☆ Gas Flux Chambers
- Visible Methane Seeps in Surface Water
- Subsurface Methane Measurements
- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%
- Trees
- ▲ Dead Cottonwood
- ▲ Dead Juniper
- ▲ Dead Pine
- ▲ Dead Scrub Oak
- ▲ Stressed Cottonwood
- ▲ Stressed Juniper
- ▲ Stressed Pine
- ▲ Stressed Scrub Oak
- ▲ Tree Stump
- Vegetation
- ▭ Stressed/Dead Vegetation
- ▭ Non-Vegetative Area
- ▭ Live Aspen Grove
- Geology
- Fruitland Formation (Kf)
- Fruitland Formation Tongue (Kft)
- Kirtland Formation (Kk)
- Pictured Cliffs Formation (Kpc)
- Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)
- FR-1 Text Reference



FIGURE 11
2005 DETAILED SEEP MAPPING
FLORIDA RIVER EAST

THE GROUP





- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - ▭ Stressed/Dead Vegetation
 - ▭ Non-Vegetative Area
 - ▭ Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - FR-3 Text Reference

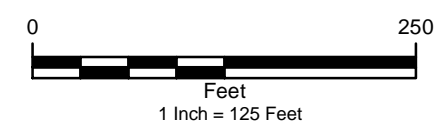


FIGURE 12
2005 DETAILED SEEP MAPPING
FLORIDA RIVER WEST



THE GROUP



LEGEND
Subsurface Methane Measurements

2005

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2004

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2003

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2002

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

Geology

- Fruitland Formation (Kf)
- Fruitland Formation Tongue (Kft)
- Kirtland Formation (Kk)
- Pictured Cliffs Formation (Kpc)
- Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)

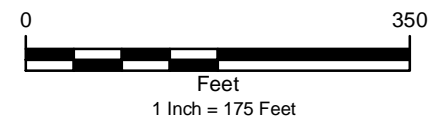
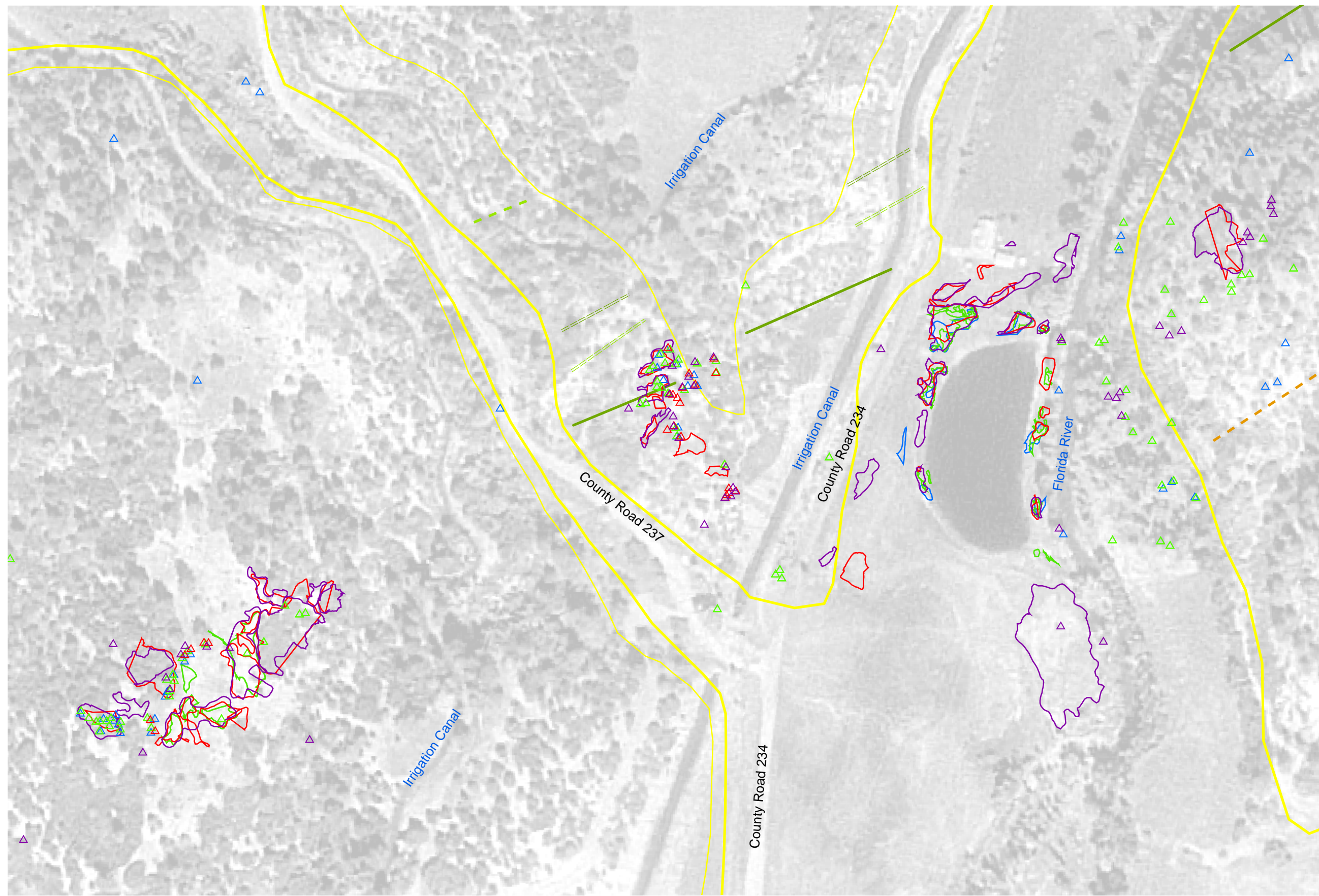


FIGURE 13
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
FLORIDA RIVER



THE GROUP



- Legend**
- Stressed/Dead Trees**
- ▲ Stressed/Dead Trees 2005
 - ▲ Stressed/Dead Trees 2004
 - ▲ Stressed/Dead Trees 2003
 - ▲ Stressed/Dead Trees 2002
- Stressed/Dead Vegetation**
- Stressed/Dead Veg 2005
 - Stressed/Dead Veg 2004
 - Stressed/Dead Veg 2003
 - Stressed/Dead Veg 2002
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

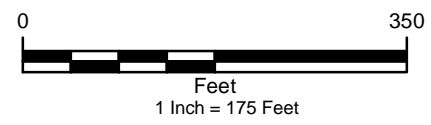


FIGURE 14
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
FLORIDA RIVER

THE GROUP





- Legend**
- Visible Methane Seeps in Surface Water
- Methane Seeps 2005
 - Methane Seeps 2004
 - Methane Seeps 2003
 - Methane Seeps 2002
- Geology
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

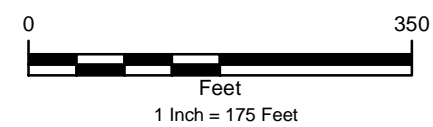
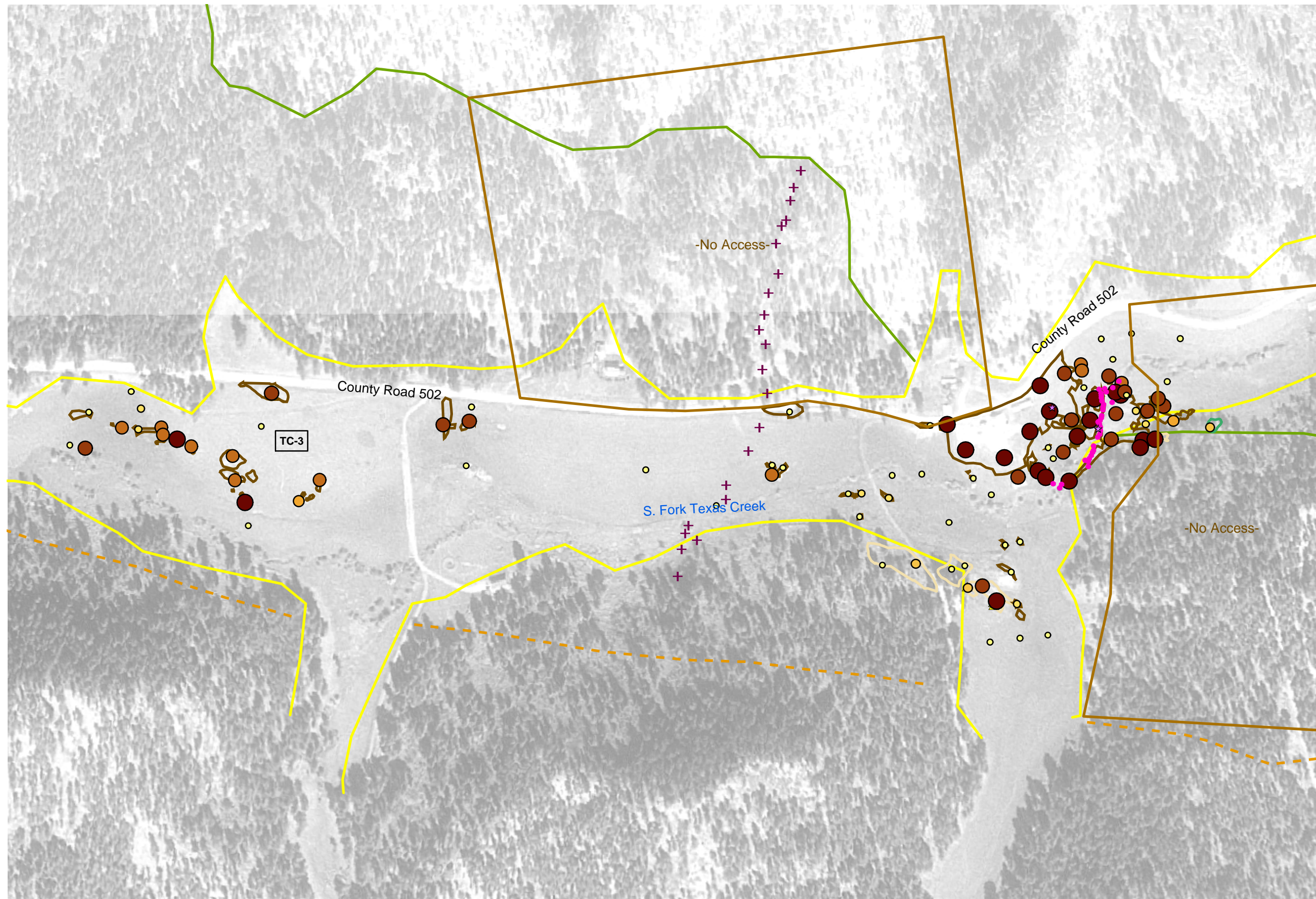


FIGURE 15
HISTORICAL DATA COMPARISON
VISIBLE METHANE SEEPS IN SURFACE WATER
FLORIDA RIVER

THE GROUP





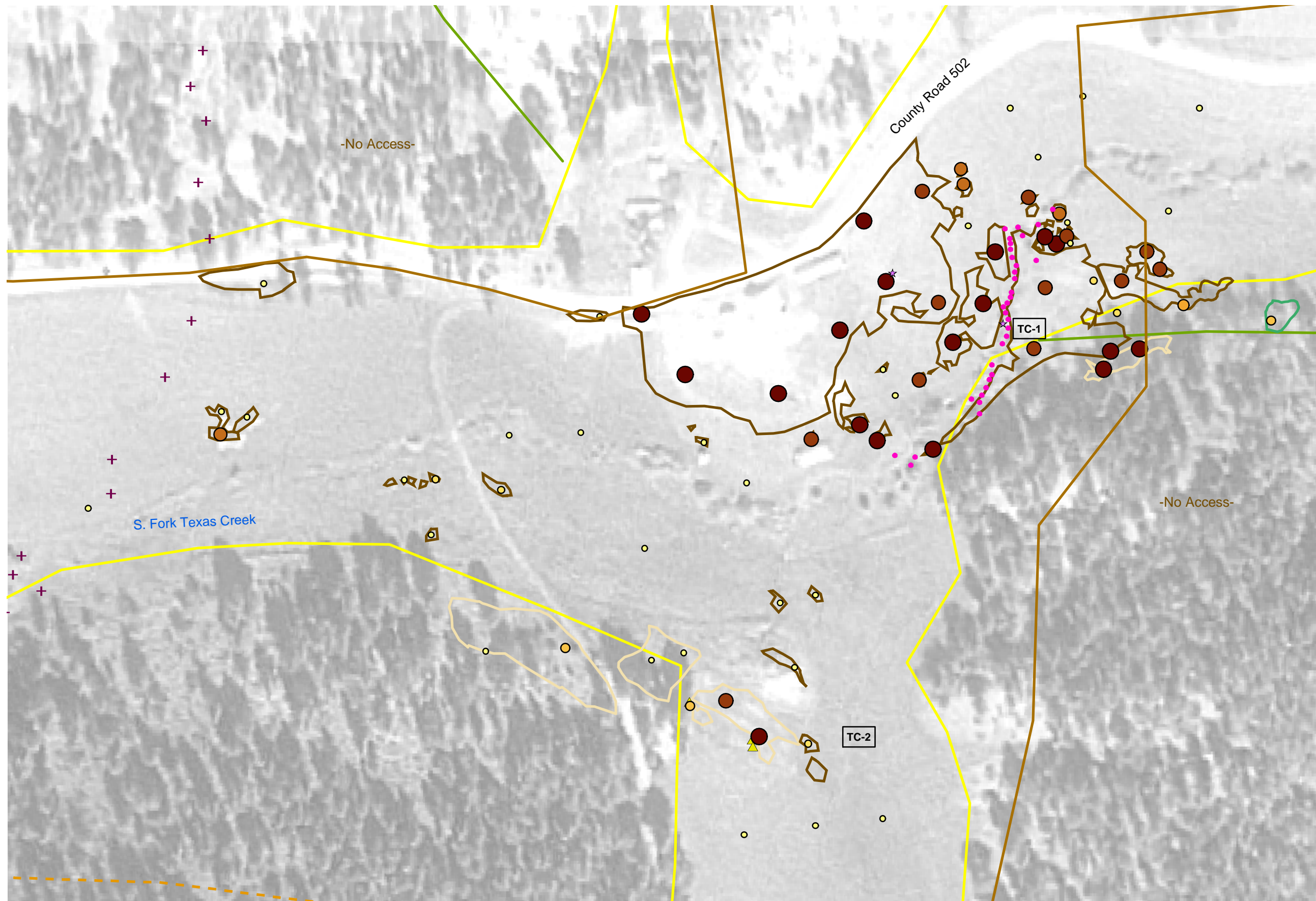
- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - Stressed/Dead Vegetation
 - Non-Vegetative Area
 - Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - TC-3 Text Reference



FIGURE 16
2005 DETAILED SEEP MAPPING
TEXAS CREEK WEST

THE GROUP





- LEGEND**
- ✚ Gas Monitoring Probes
 - ★ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - ▭ Stressed/Dead Vegetation
 - ▭ Non-Vegetative Area
 - ▭ Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - TC-1 Text Reference

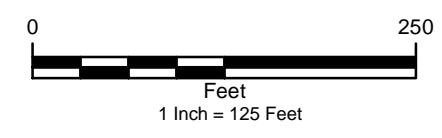
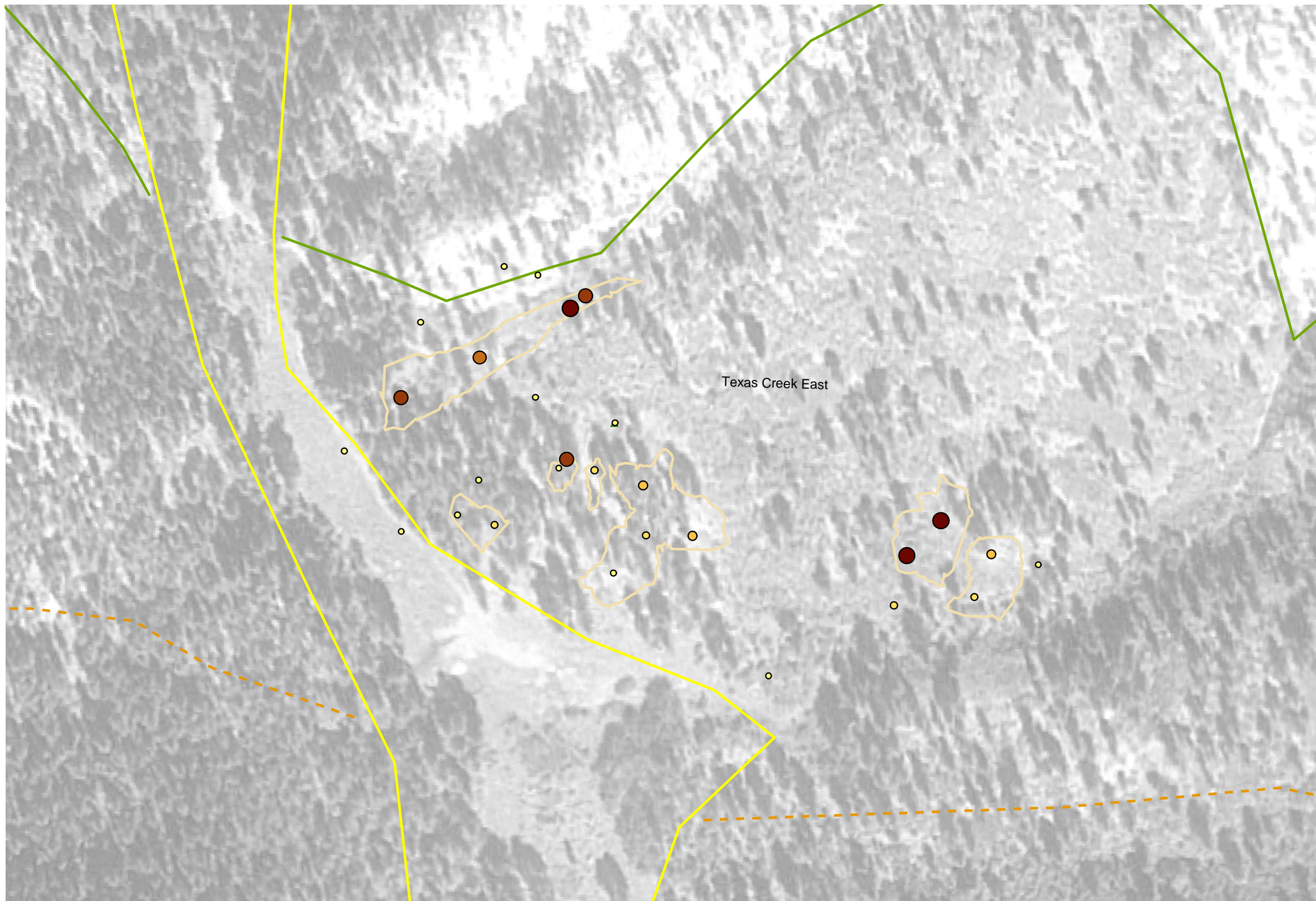


FIGURE 17
2005 DETAILED SEEP MAPPING
TEXAS CREEK (detail)

THE GROUP





- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - Stressed/Dead Vegetation
 - Non-Vegetative Area
 - Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - TC-4 Text Reference

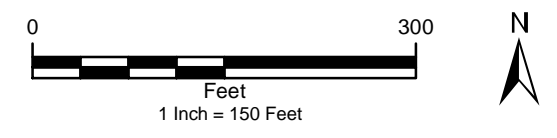
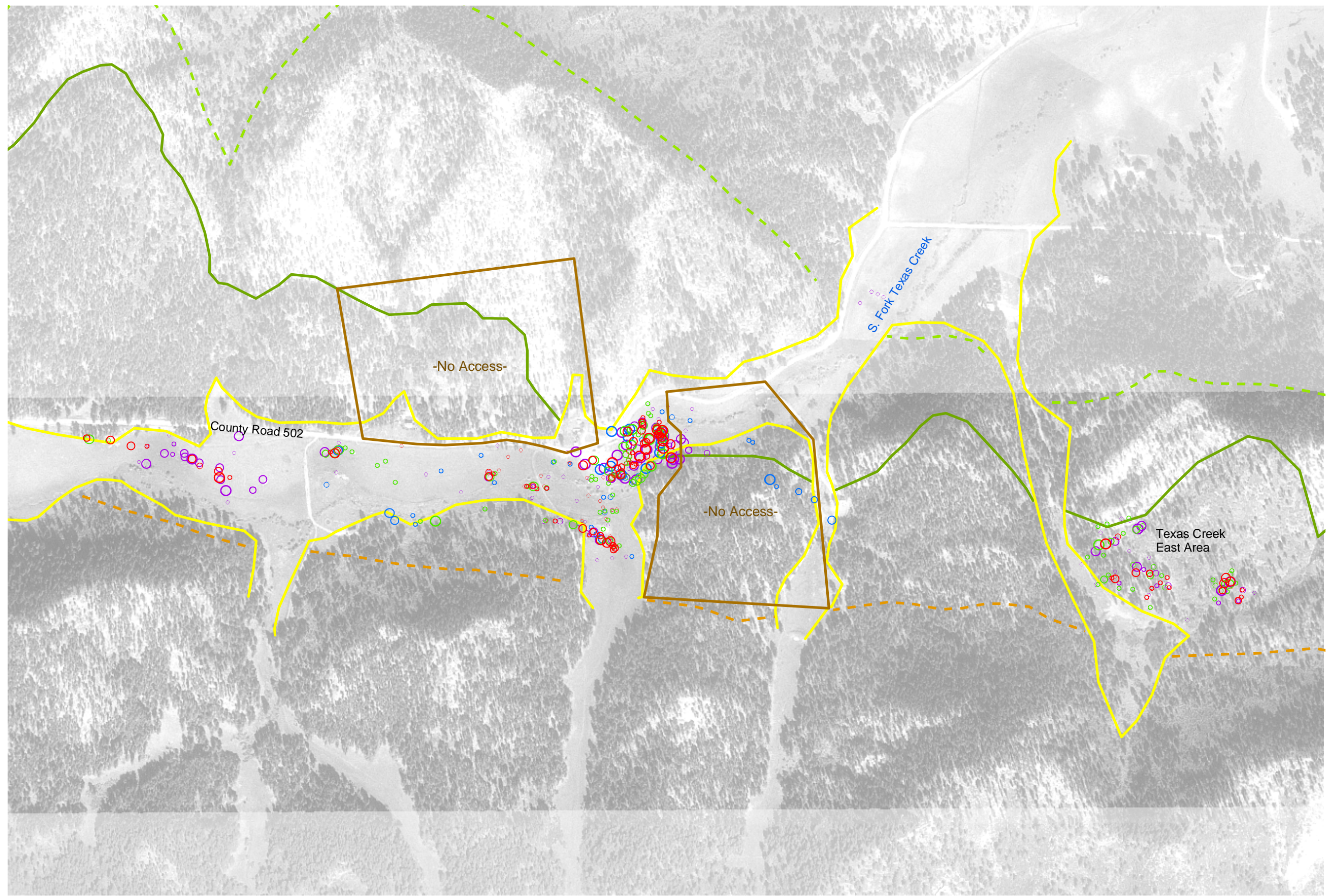


FIGURE 18
2005 DETAILED SEEP MAPPING
TEXAS CREEK EAST

THE GROUP





LEGEND
Subsurface Methane Measurements

2005

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2004

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2003

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2002

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

Geology

- Fruitland Formation (Kf)
- Fruitland Formation Tongue (Kft)
- Kirtland Formation (Kk)
- Pictured Cliffs Formation (Kpc)
- Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)

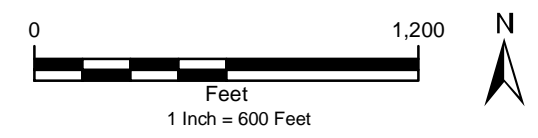
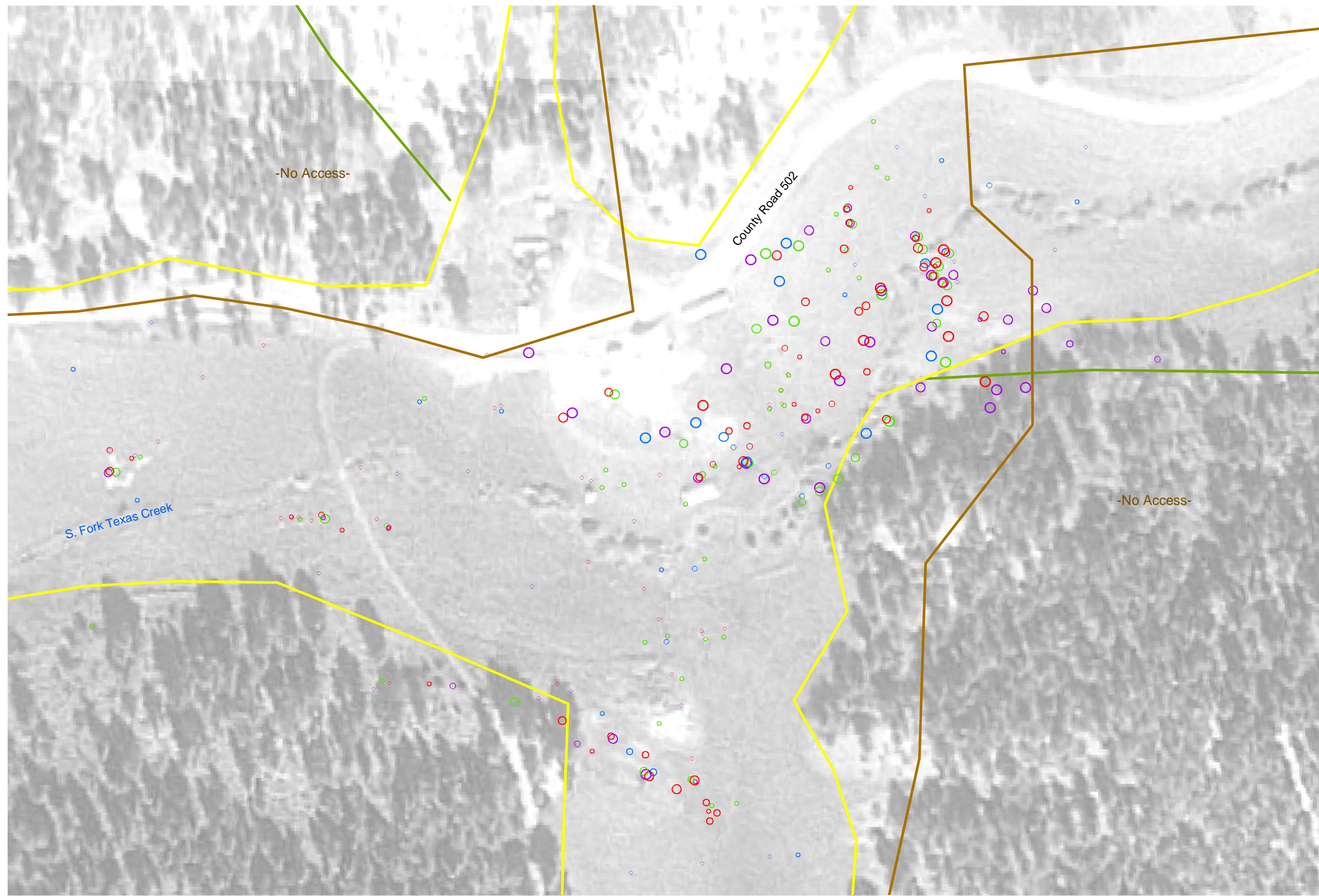


FIGURE 19
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
TEXAS CREEK

THE GROUP





LEGEND
Subsurface Methane Measurements

2005

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2004

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2003

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2002

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

Geology

- Fruitland Formation (Kf)
- Fruitland Formation Tongue (Kft)
- Kirtland Formation (Kk)
- Pictured Cliffs Formation (Kpc)
- Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)

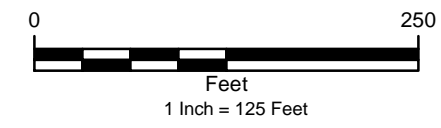
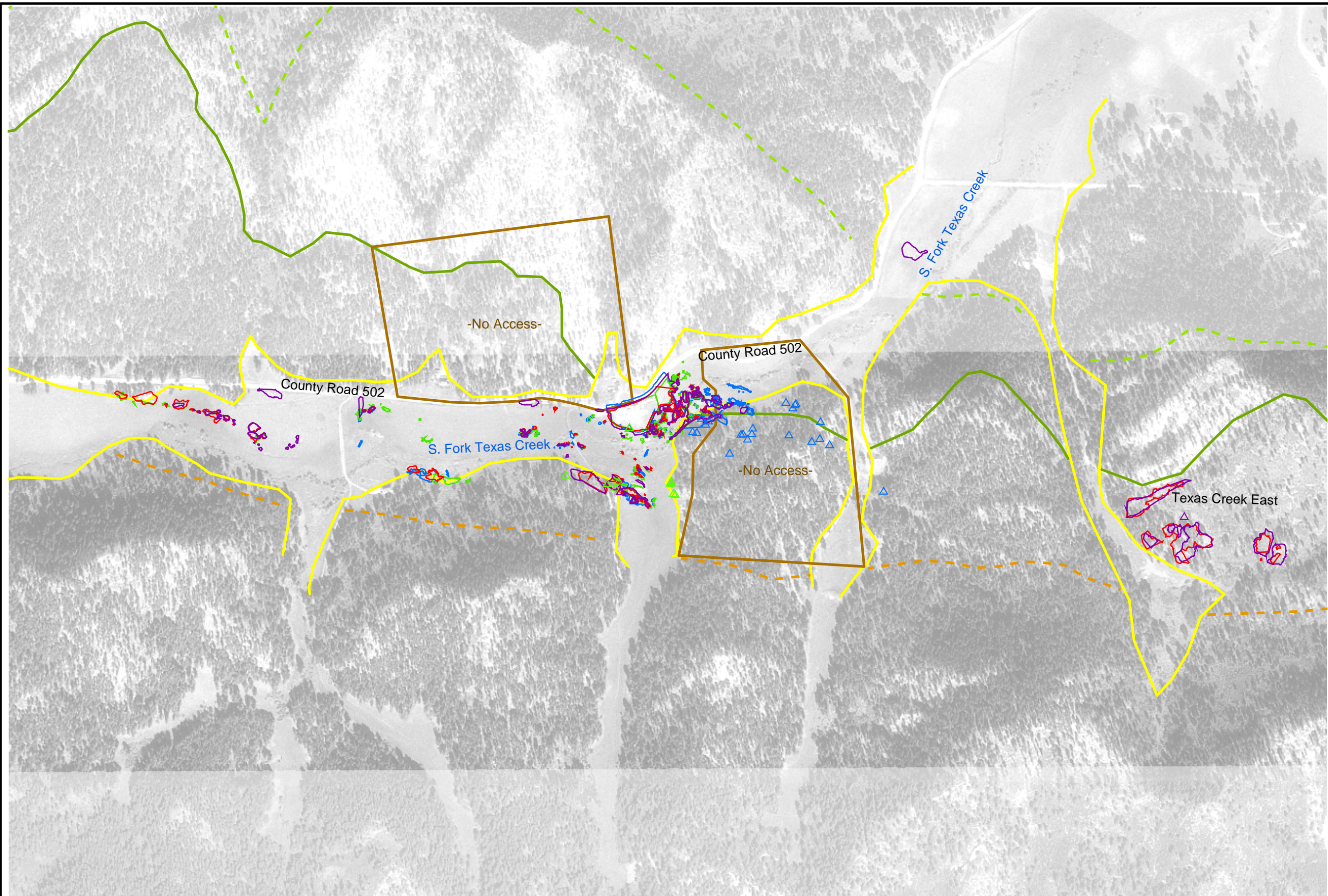


FIGURE 20
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
TEXAS CREEK (detail)

THE GROUP





- Legend**
- Stressed/Dead Trees**
- △ Stressed/Dead Trees 2005
 - △ Stressed/Dead Trees 2004
 - △ Stressed/Dead Trees 2003
 - △ Stressed/Dead Trees 2002
- Stressed/Dead Vegetation**
- Stressed/Dead Veg 2005
 - Stressed/Dead Veg 2004
 - Stressed/Dead Veg 2003
 - Stressed/Dead Veg 2002
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

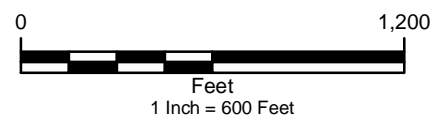
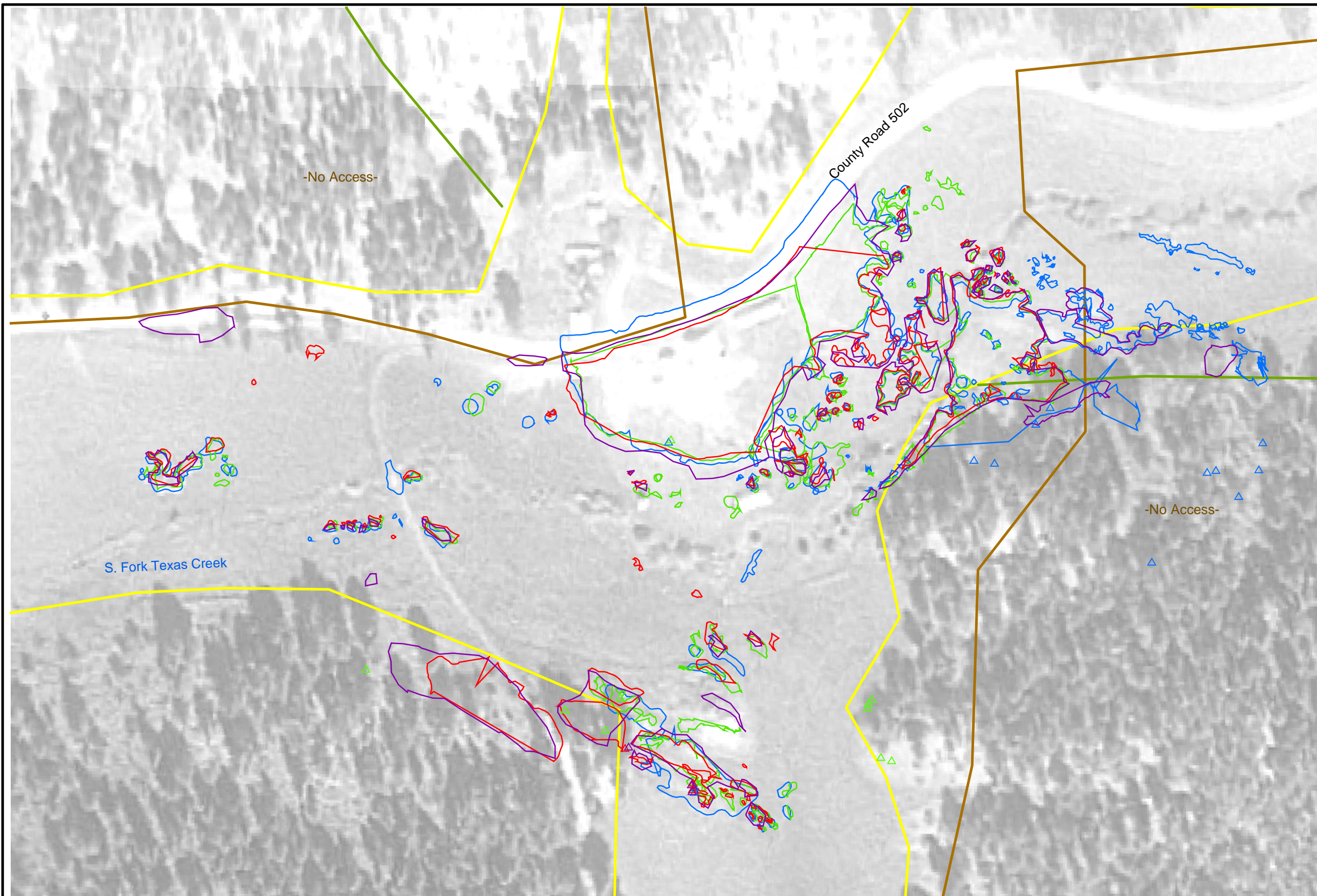


FIGURE 21
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
TEXAS CREEK

THE GROUP



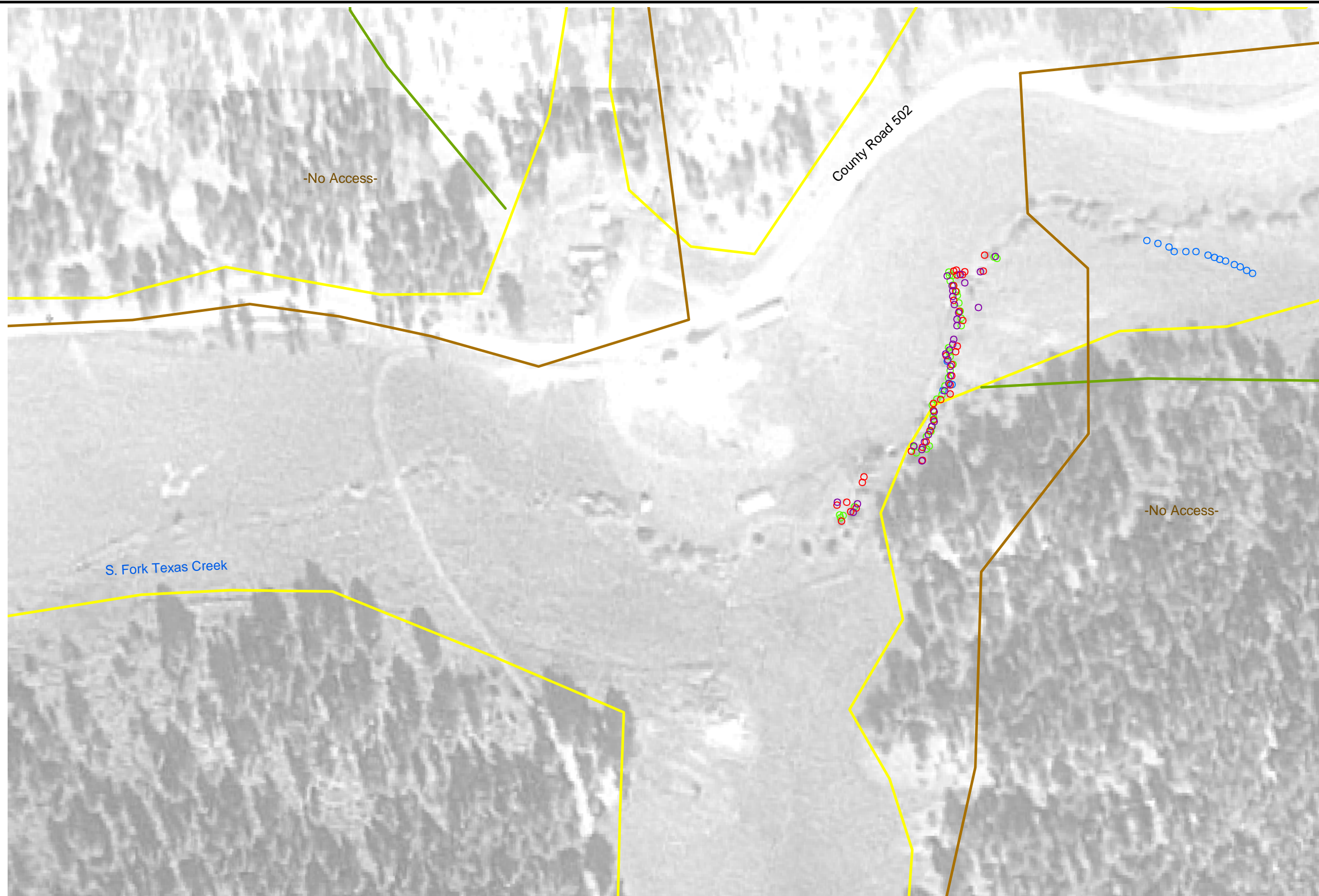


- Legend**
- Stressed/Dead Trees**
- △ Stressed/Dead Trees 2005
 - △ Stressed/Dead Trees 2004
 - △ Stressed/Dead Trees 2003
 - △ Stressed/Dead Trees 2002
- Stressed/Dead Vegetation**
- Stressed/Dead Veg 2005
 - Stressed/Dead Veg 2004
 - Stressed/Dead Veg 2003
 - Stressed/Dead Veg 2002
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)



FIGURE 22
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
TEXAS CREEK (detail)





- Legend**
- Visible Methane Seeps in Surface Water
- Methane Seeps 2005
 - Methane Seeps 2004
 - Methane Seeps 2003
 - Methane Seeps 2002
- Geology
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

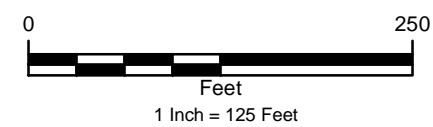
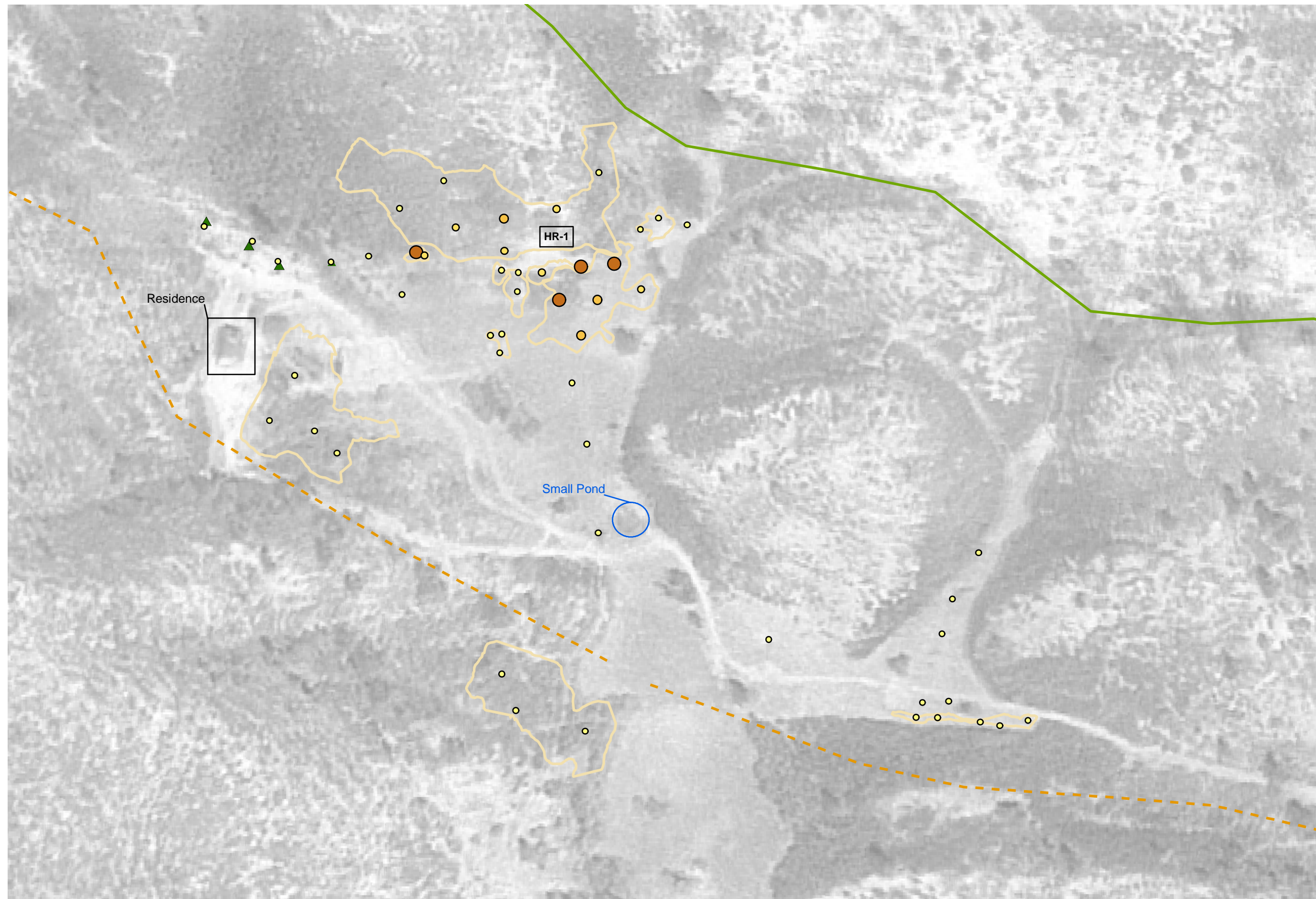


FIGURE 23
HISTORICAL DATA COMPARISON
VISIBLE METHANE SEEPS IN SURFACE WATER
TEXAS CREEK (detail)

THE GROUP





- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - ▭ Stressed/Dead Vegetation
 - ▭ Non-Vegetative Area
 - ▭ Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - HR-1 Text Reference

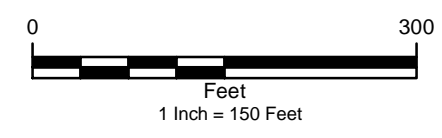


FIGURE 24
2005 DETAILED SEEP MAPPING
HOIER PROPERTY



THE GROUP



LEGEND
Subsurface Methane Measurements
2005

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2004

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2003

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

2002

- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

Geology

- Fruitland Formation (Kf)
- Fruitland Formation Tongue (Kft)
- Kirtland Formation (Kk)
- Pictured Cliffs Formation (Kpc)
- Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)

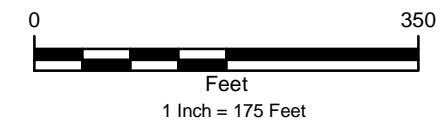
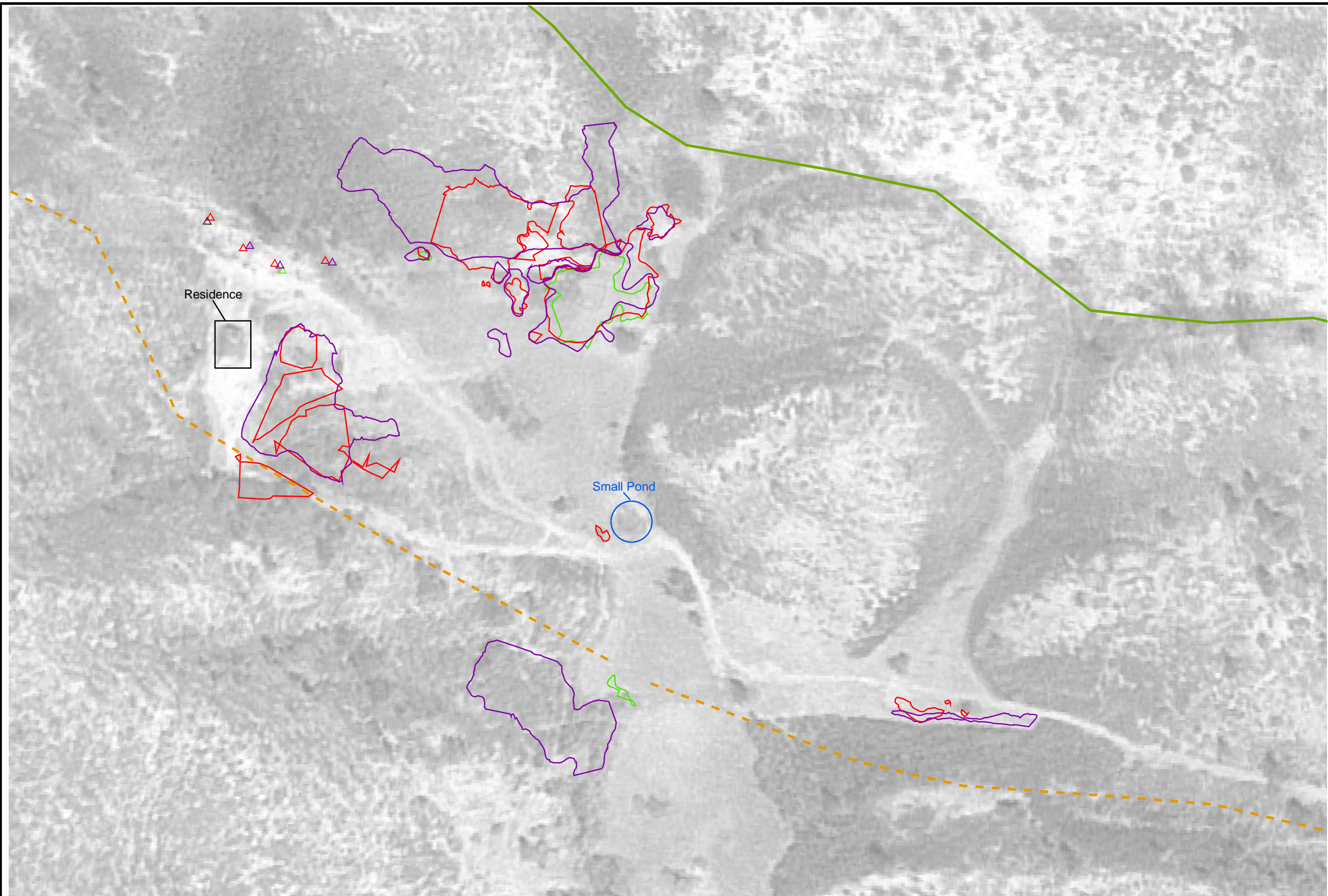


FIGURE 25
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
HOIER PROPERTY

THE GROUP





- Legend**
- Stressed/Dead Trees**
- △ Stressed/Dead Trees 2005
 - △ Stressed/Dead Trees 2004
 - △ Stressed/Dead Trees 2003
 - △ Stressed/Dead Trees 2002
- Stressed/Dead Vegetation**
- Stressed/Dead Veg 2005
 - Stressed/Dead Veg 2004
 - Stressed/Dead Veg 2003
 - Stressed/Dead Veg 2002
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

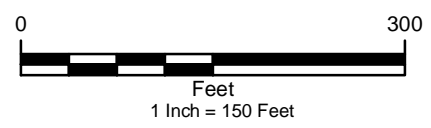
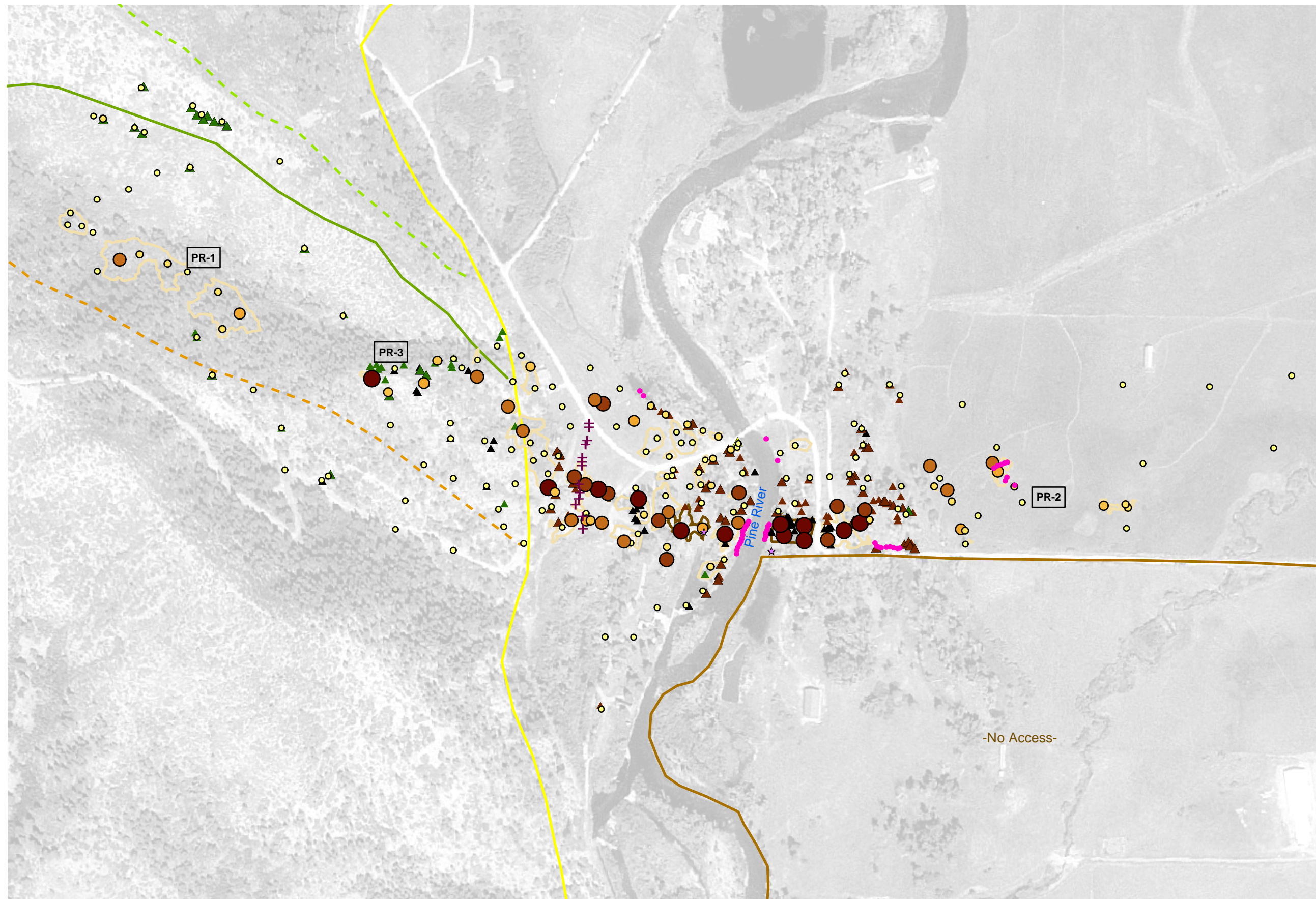


FIGURE 26
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
HOIER PROPERTY

THE GROUP





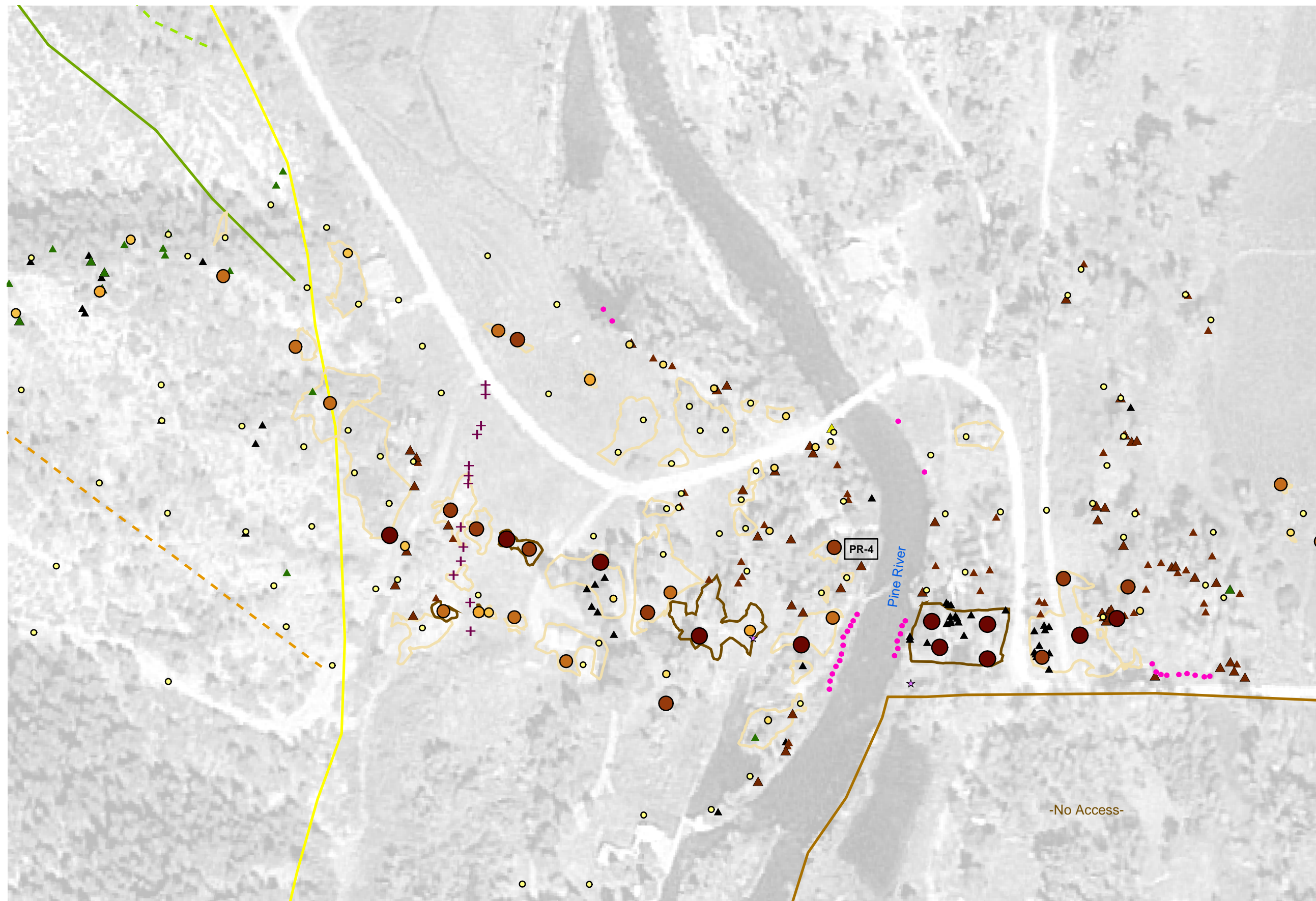
- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - Stressed/Dead Vegetation
 - Non-Vegetative Area
 - Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - PR-1 Text Reference



FIGURE 27
2005 DETAILED SEEP MAPPING
PINE RIVER

THE GROUP





- LEGEND**
- ✚ Gas Monitoring Probes
 - ☆ Gas Flux Chambers
 - Visible Methane Seeps in Surface Water
 - Subsurface Methane Measurements
 - 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
 - Trees
 - ▲ Dead Cottonwood
 - ▲ Dead Juniper
 - ▲ Dead Pine
 - ▲ Dead Scrub Oak
 - ▲ Stressed Cottonwood
 - ▲ Stressed Juniper
 - ▲ Stressed Pine
 - ▲ Stressed Scrub Oak
 - ▲ Tree Stump
 - Vegetation
 - Stressed/Dead Vegetation
 - Non-Vegetative Area
 - Live Aspen Grove
 - Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - PR-4 Text Reference

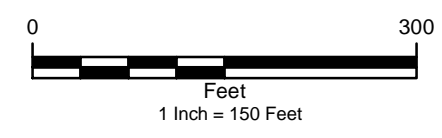


FIGURE 28
2005 DETAILED SEEP MAPPING
PINE RIVER (detail)

THE GROUP





- Legend**
- Visible Methane Seeps in Surface Water
- Methane Seeps 2005
- Geology
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

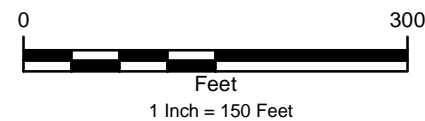
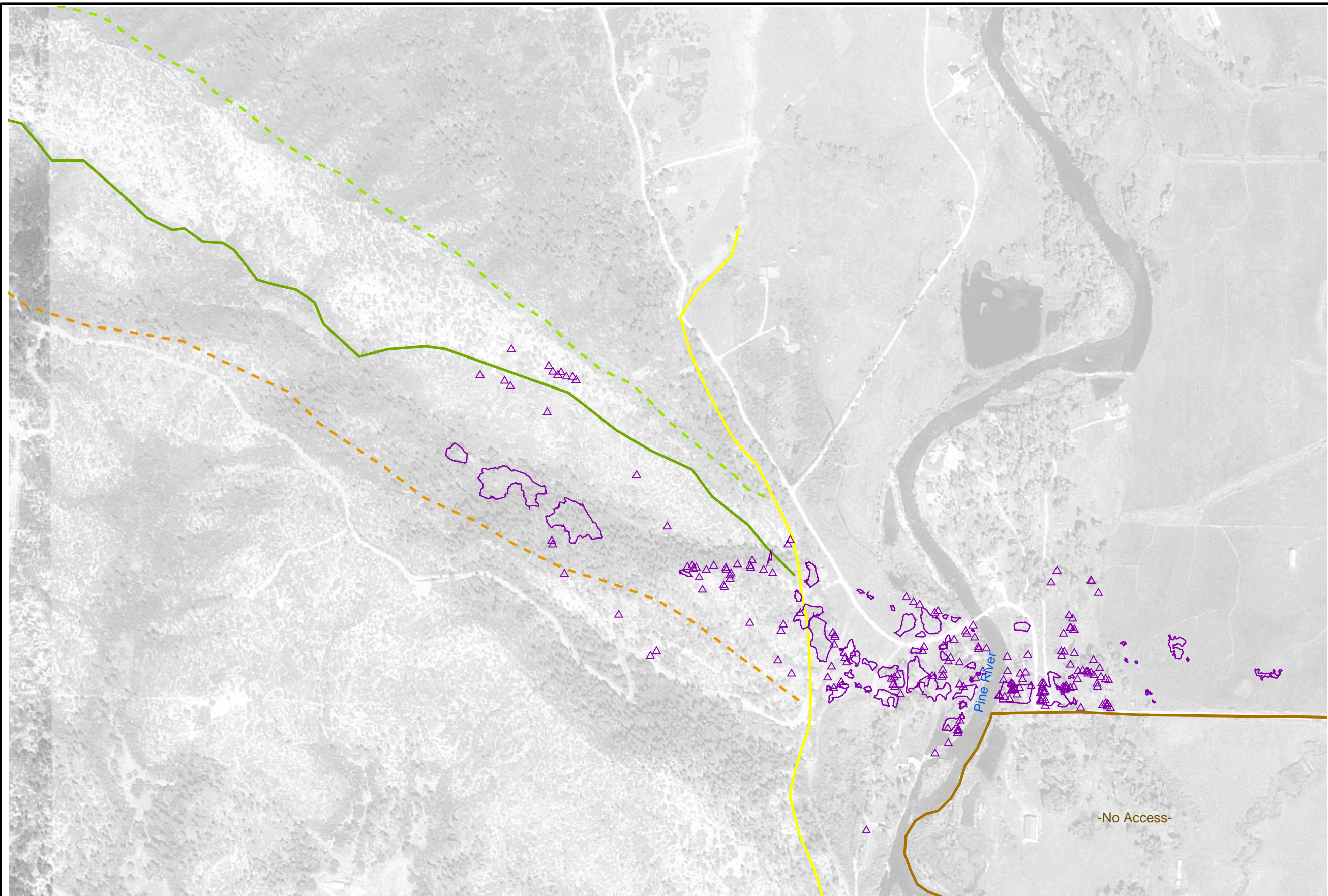


FIGURE 29
HISTORICAL DATA COMPARISON
VISIBLE METHANE SEEPS IN SURFACE WATER
PINE RIVER (detail)

THE GROUP





- Legend**
- Stressed/Dead Trees
 ▲ Stressed/Dead Trees 2005
- Stressed/Dead Vegetation
 □ Stressed/Dead Veg 2005
- Geology
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

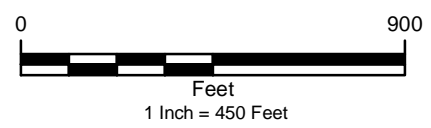
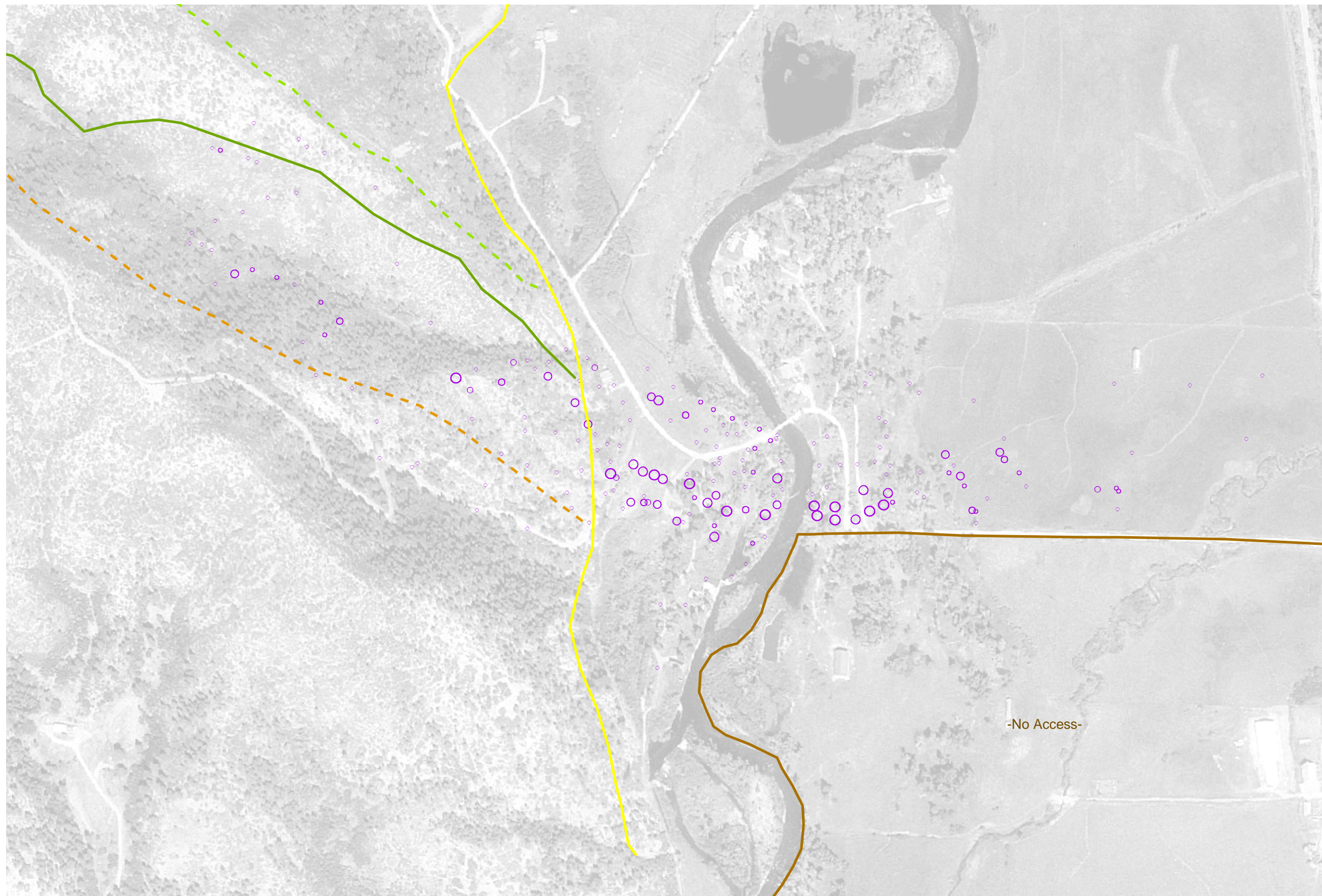


FIGURE 30
HISTORICAL DATA COMPARISON
STRESSED/DEAD VEGETATION
PINE RIVER

THE GROUP





- LEGEND**
- Subsurface Methane Measurements
2005
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

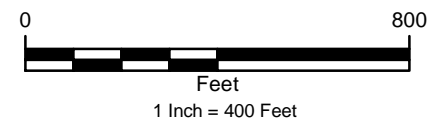
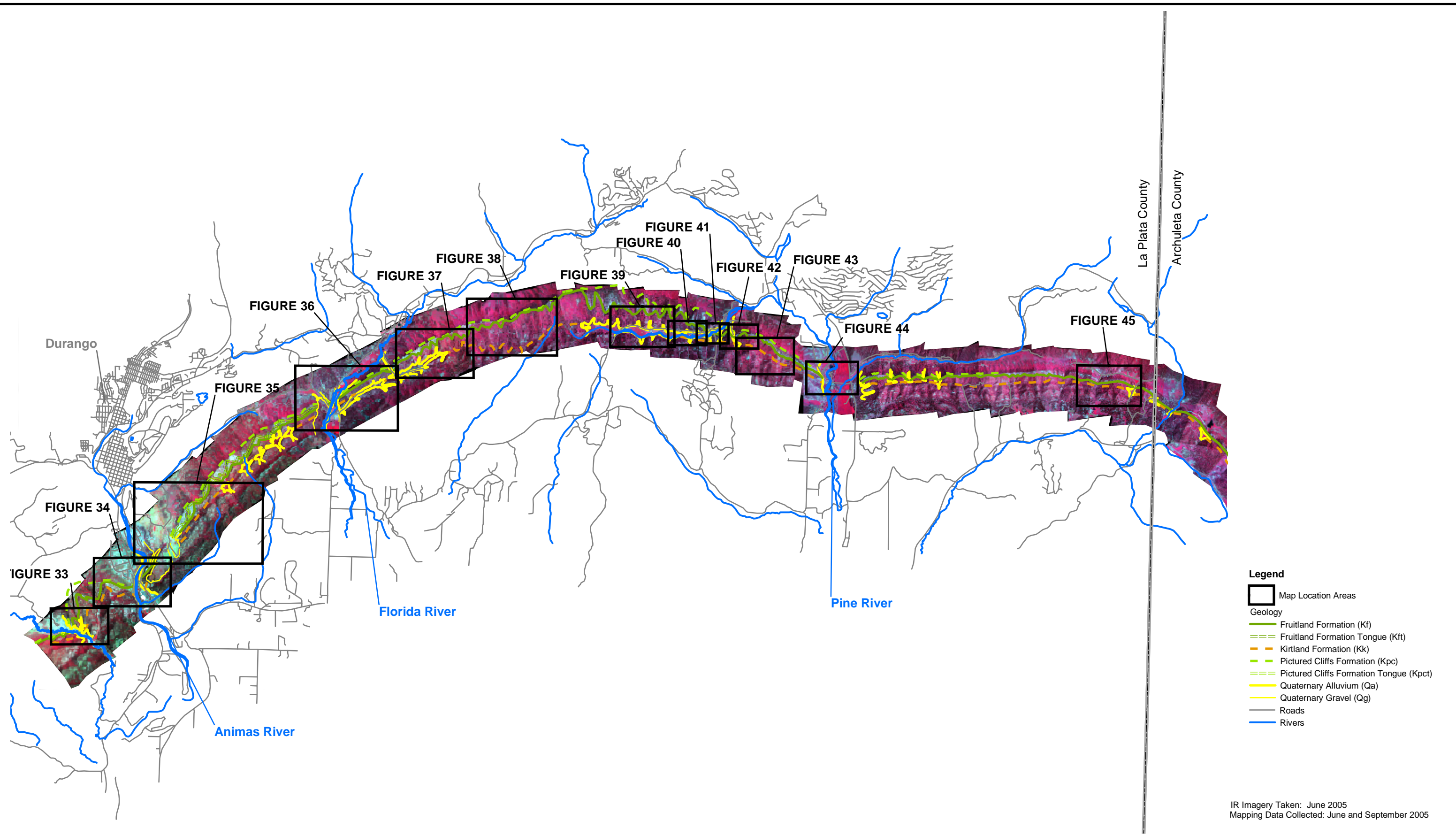


FIGURE 31
HISTORICAL DATA COMPARISON
SUBSURFACE METHANE MEASUREMENTS
PINE RIVER

THE GROUP





IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

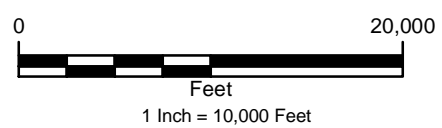
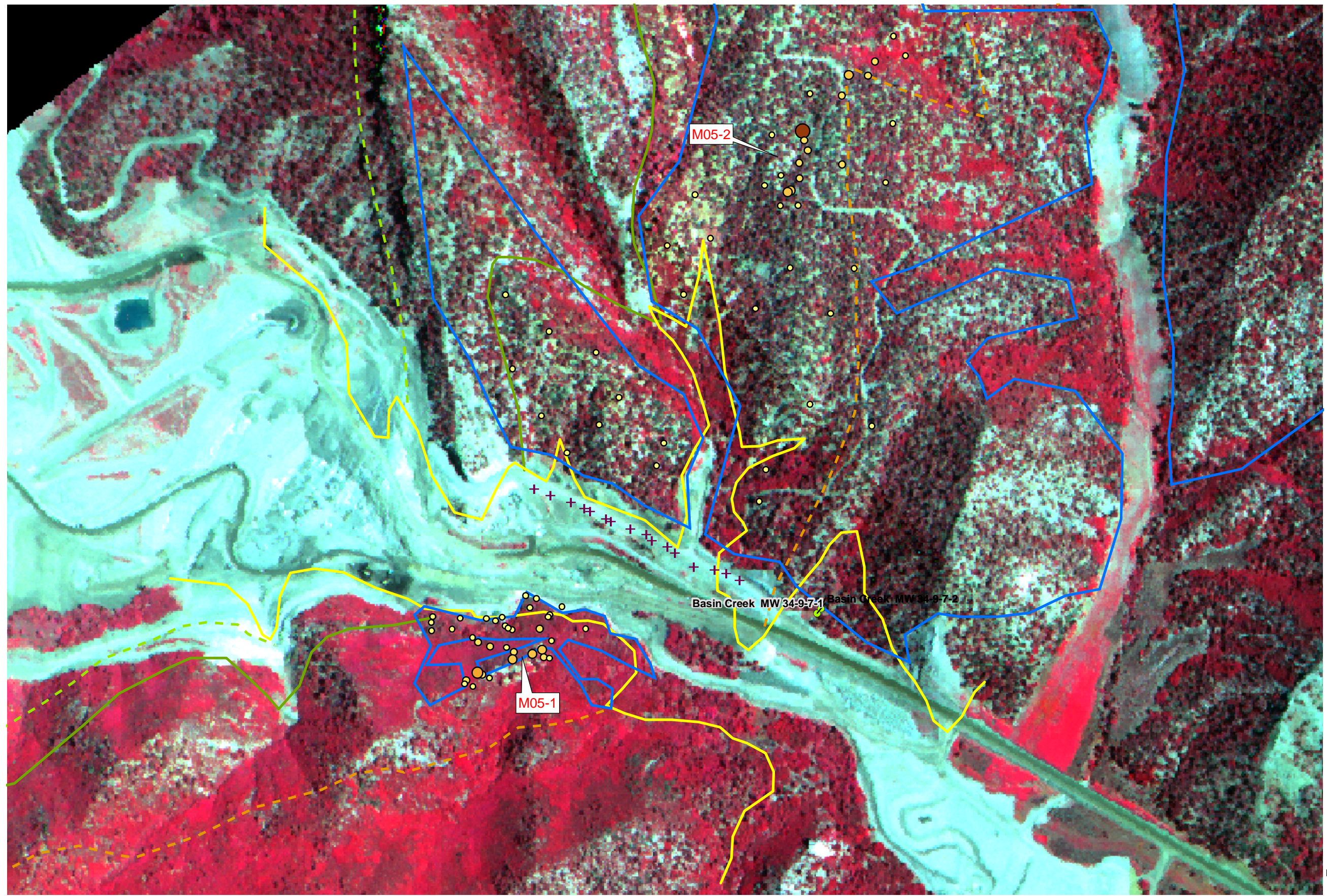


FIGURE 32
2005 REGIONAL RECONNAISSANCE
MAPPING LOCATION AREAS

THE GROUP



- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-1 Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

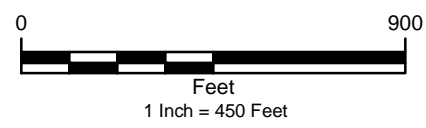
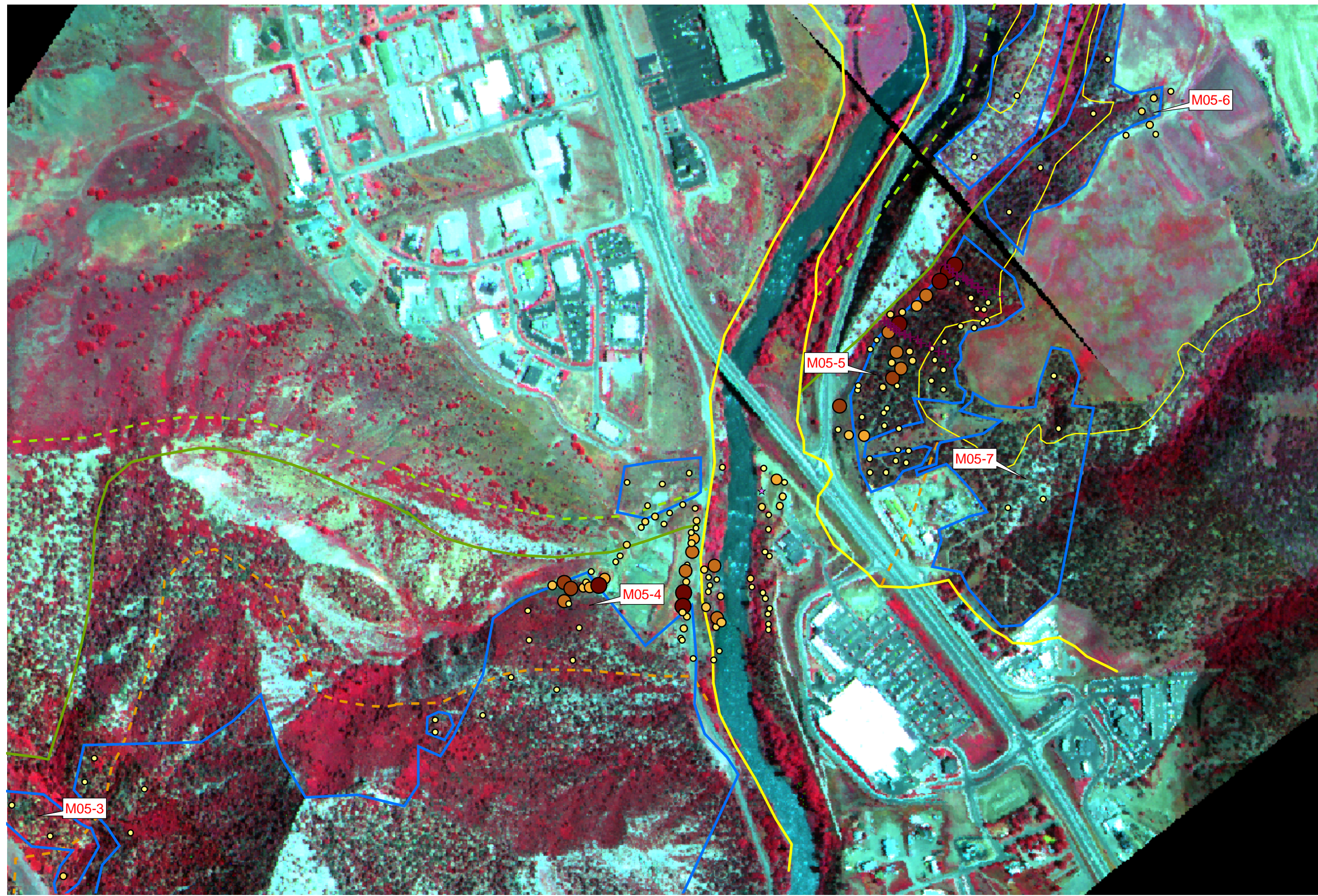


FIGURE 33
2005 REGIONAL RECONNAISSANCE
BASIN CREEK



THE GROUP



- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬢ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-7** Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

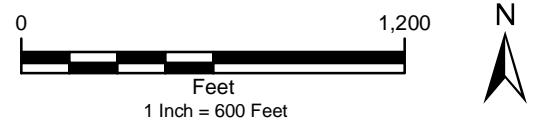
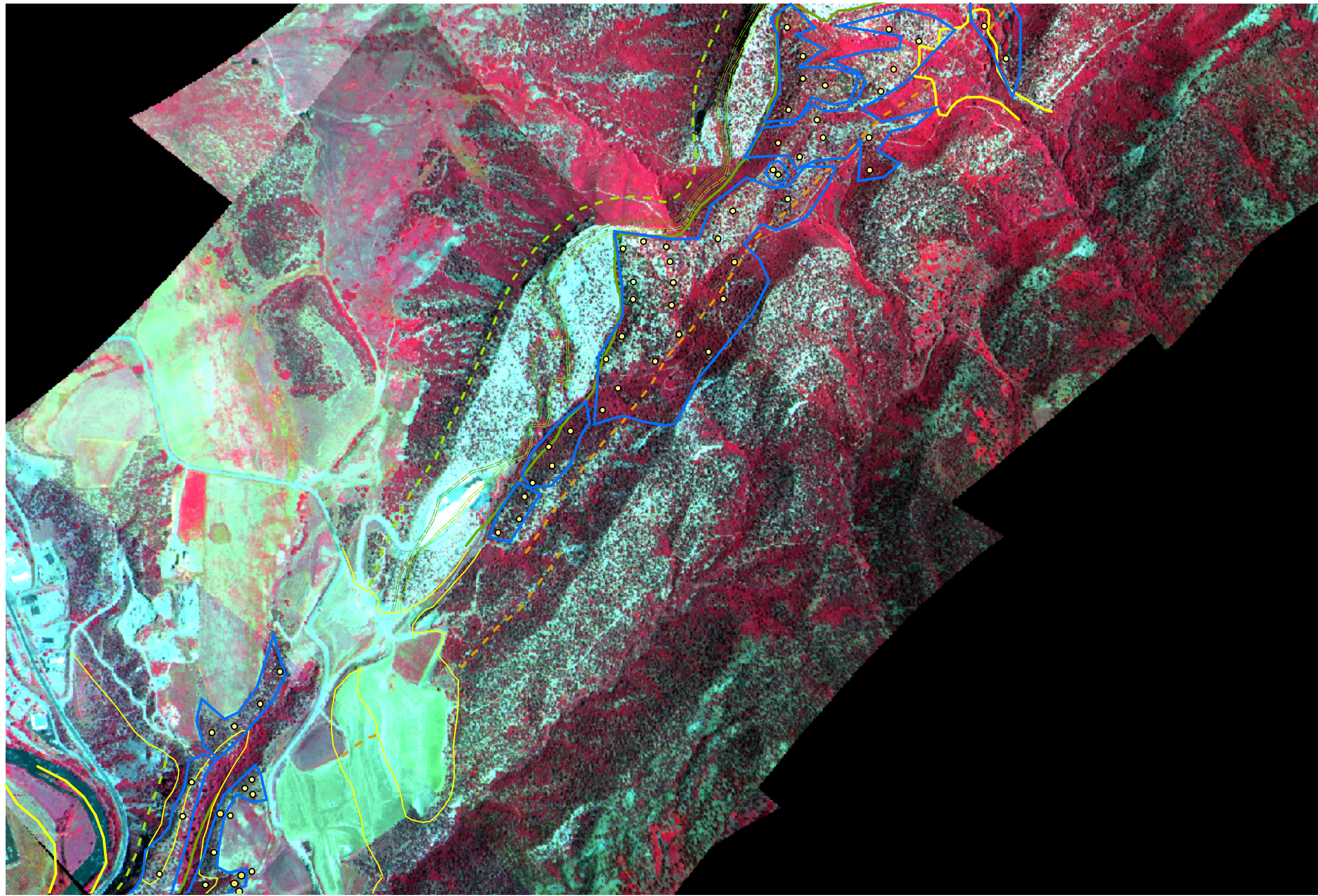


FIGURE 34
2005 REGIONAL RECONNAISSANCE
CARBON JUNCTION

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ★ Gas Flux Chambers
 - + Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - = Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - = Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - - - Quaternary Gravel (Qg)

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

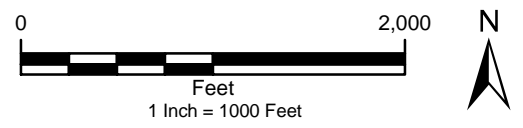
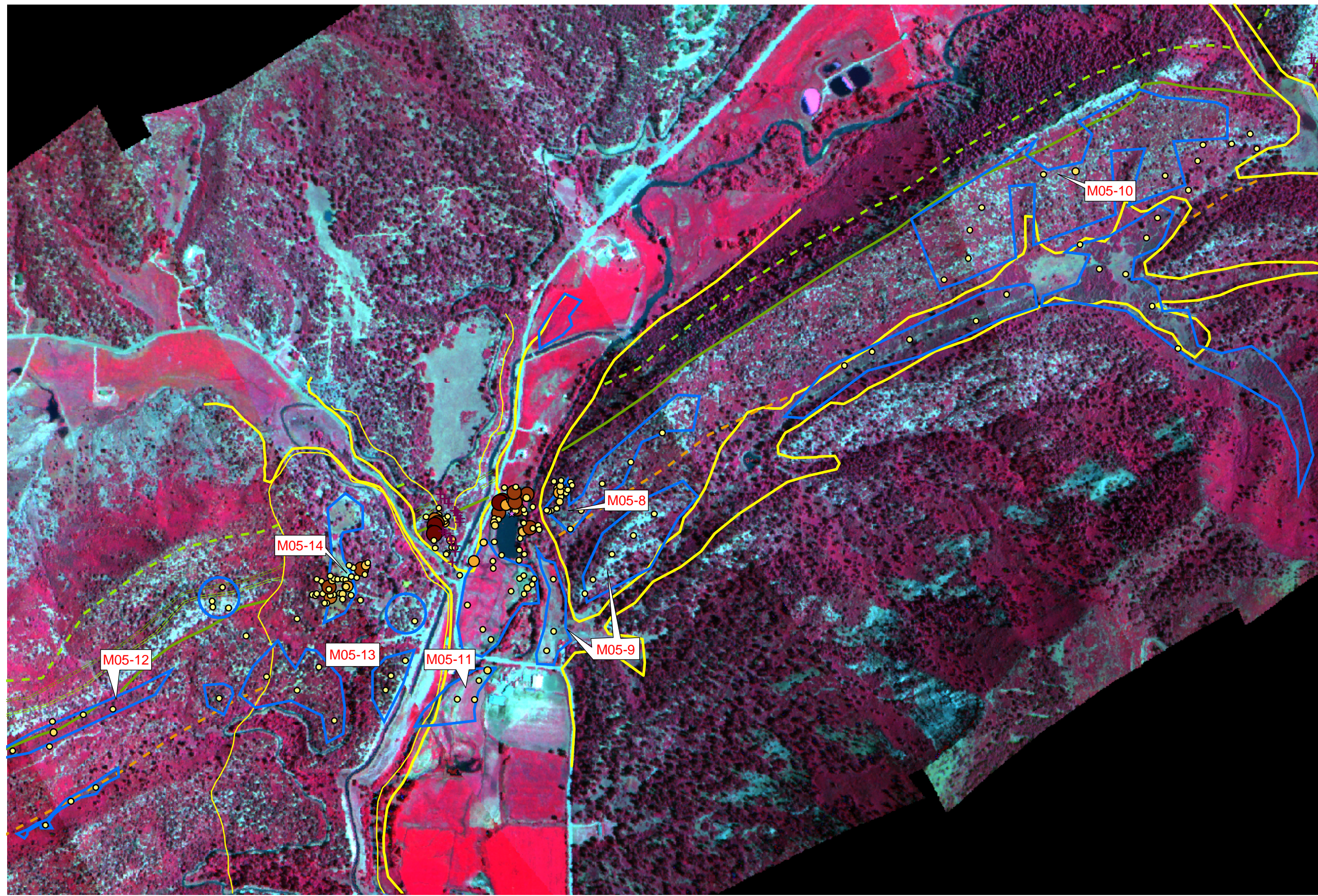


FIGURE 35
2005 REGIONAL RECONNAISSANCE
NORTHWEST OF FLORIDA MESA

THE GROUP





Legend

- COGCC Monitoring Wells
- ☆ Gas Flux Chambers
- ⊕ Gas Monitoring Probes
- ⬭ Suspect Areas
- Subsurface Methane Measurements
- 0 ppm
- 500 ppm - 5%
- 6% - 15%
- 16% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%
- Geology
- Fruitland Formation (Kf)
- Fruitland Formation Tongue (Kft)
- Kirtland Formation (Kk)
- Pictured Cliffs Formation (Kpc)
- Pictured Cliffs Formation Tongue (Kpct)
- Quaternary Alluvium (Qa)
- Quaternary Gravel (Qg)
- M05-10 Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

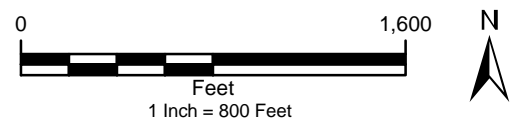
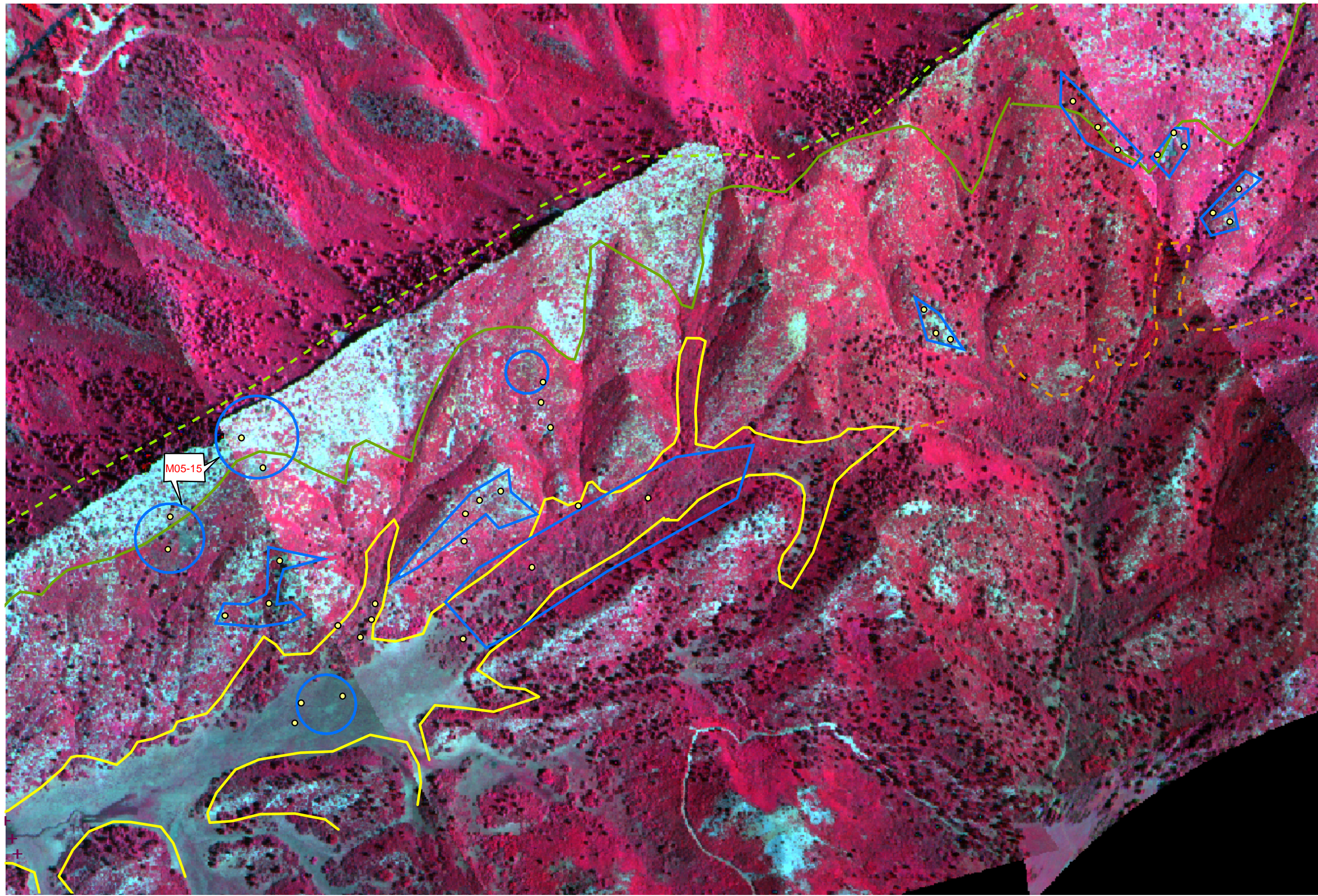


FIGURE 36
2005 REGIONAL RECONNAISSANCE
FLORIDA RIVER

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-15** Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

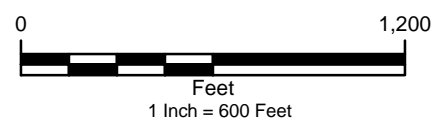
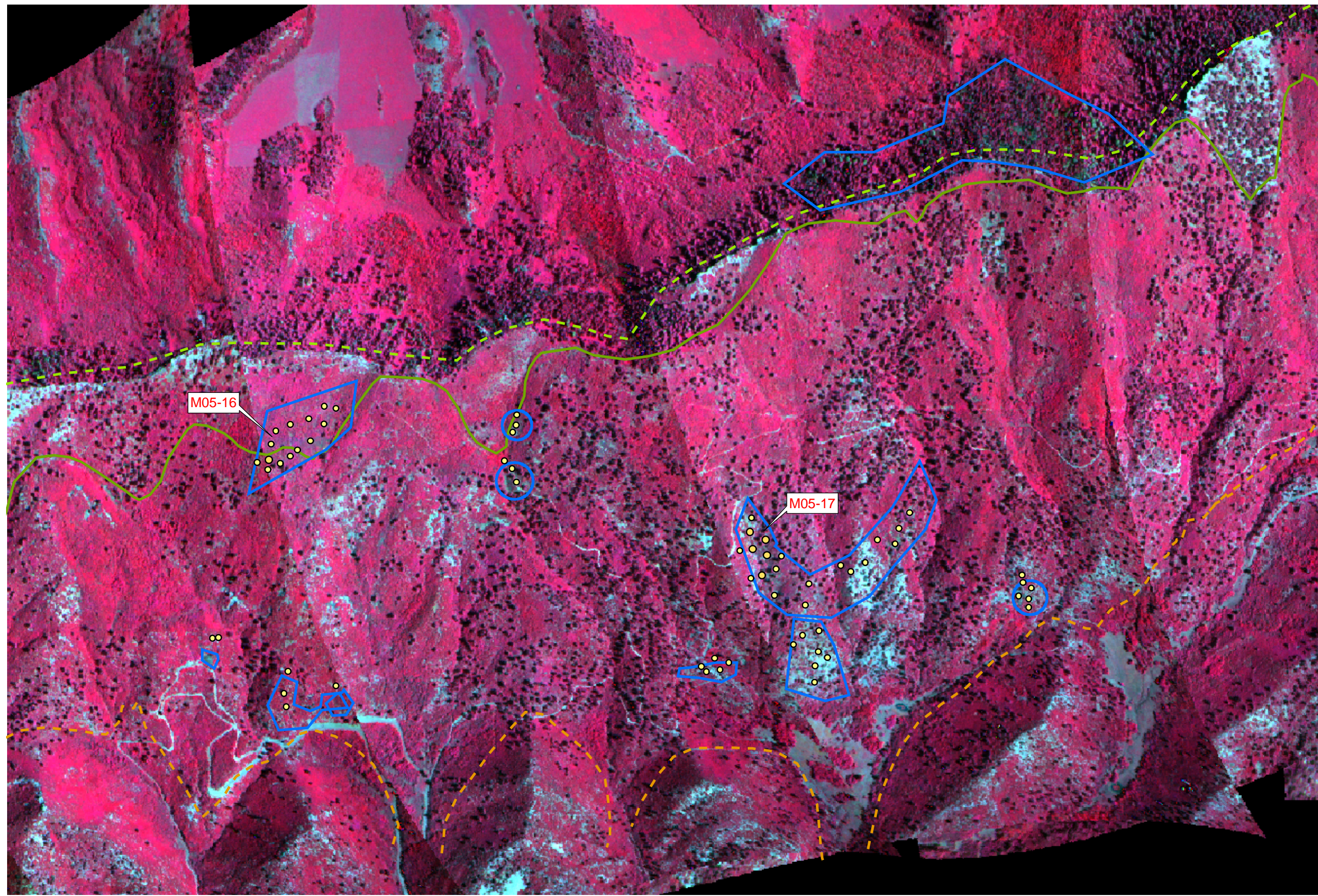


FIGURE 37
2005 REGIONAL RECONNAISSANCE
EDGEMONT RANCH



THE GROUP



- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - - - Quaternary Alluvium (Qa)
 - - - Quaternary Gravel (Qg)
- M05-16** Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

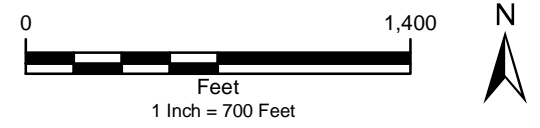
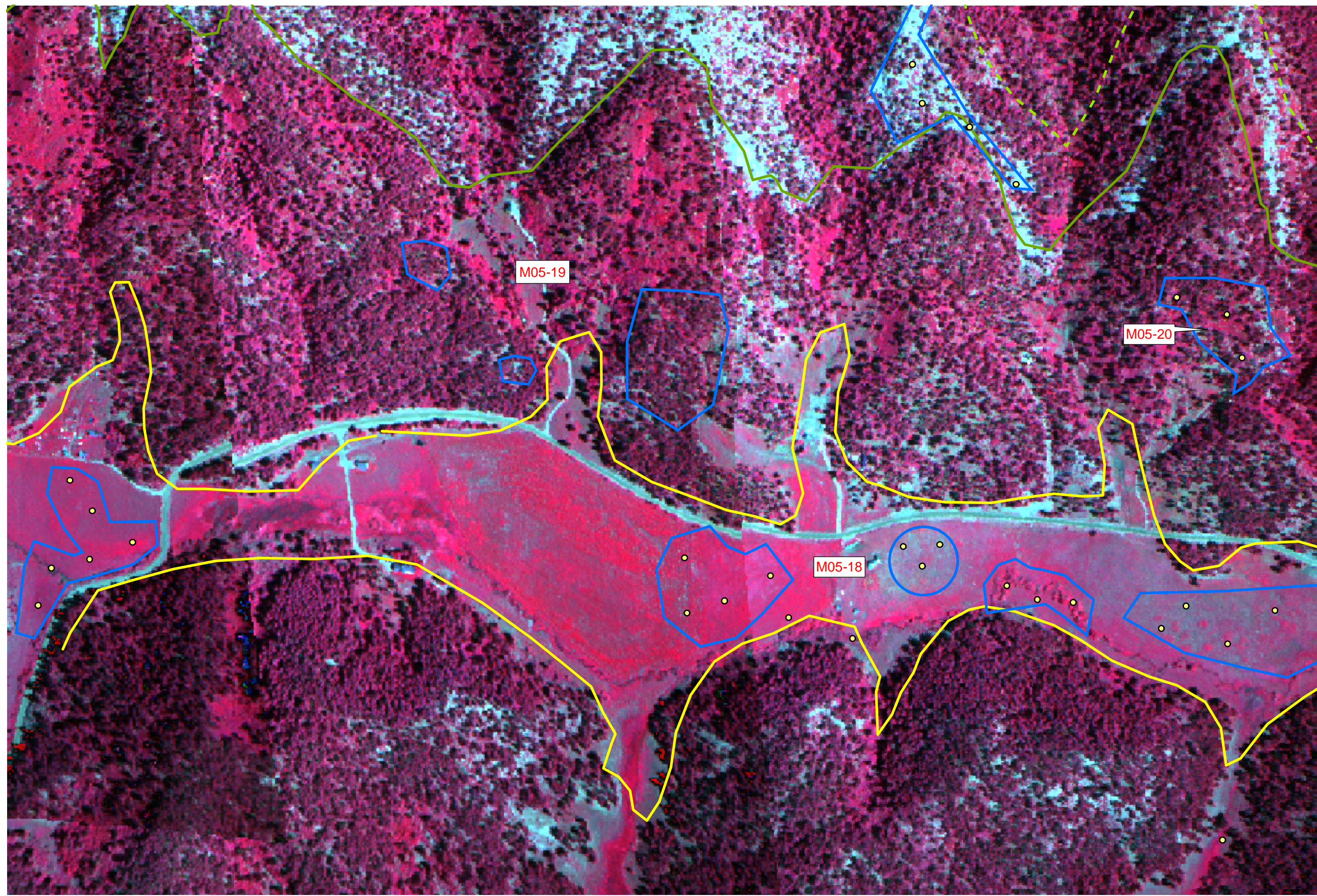


FIGURE 38
2005 REGIONAL RECONNAISSANCE
VOSBURG PIKE

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬡ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-18** Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

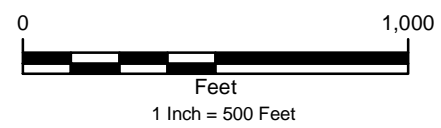
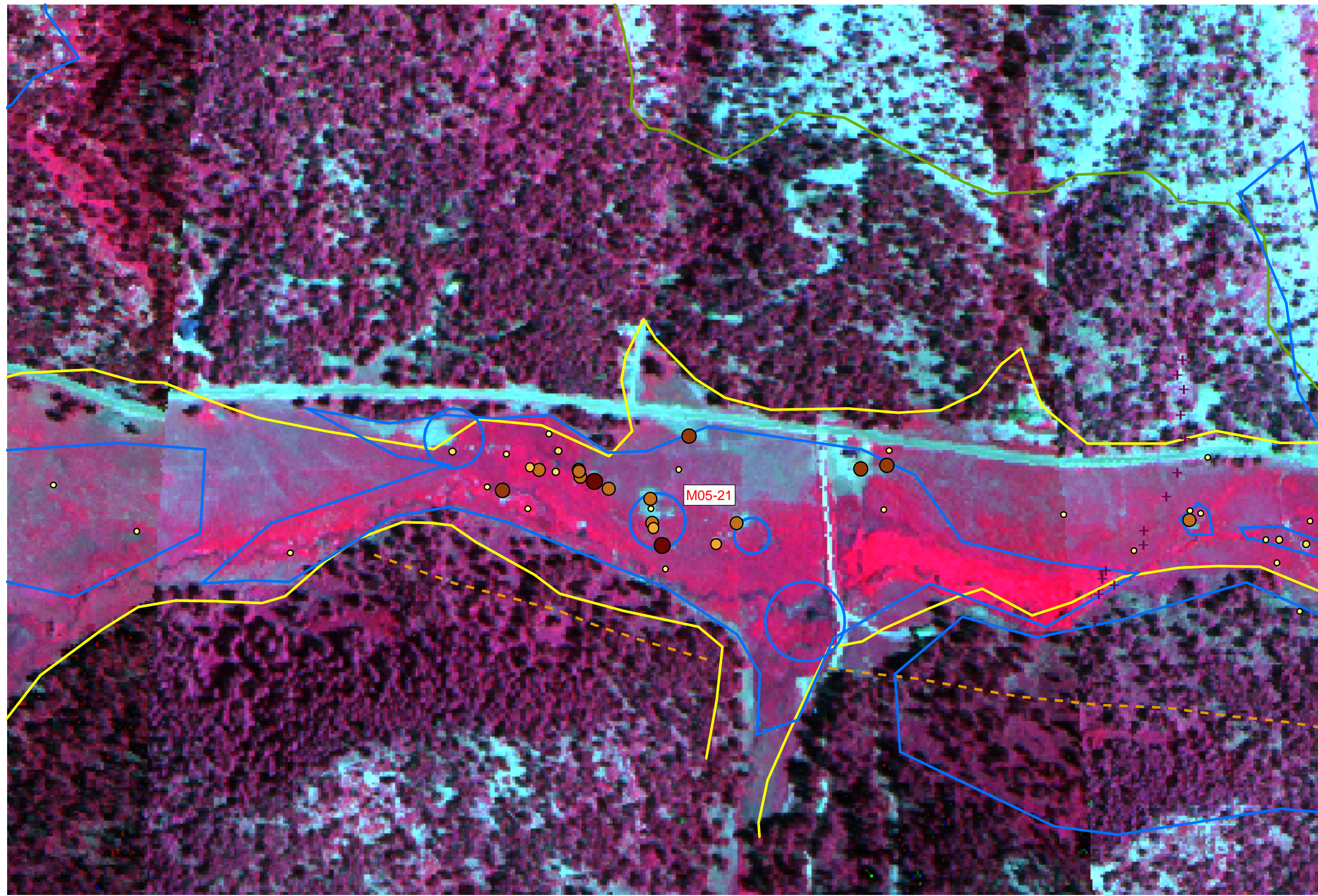


FIGURE 39
2005 REGIONAL RECONNAISSANCE
TEXAS CREEK WEST A

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - + Gas Monitoring Probes
 - Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-21** Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

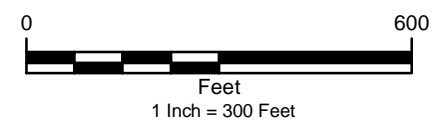
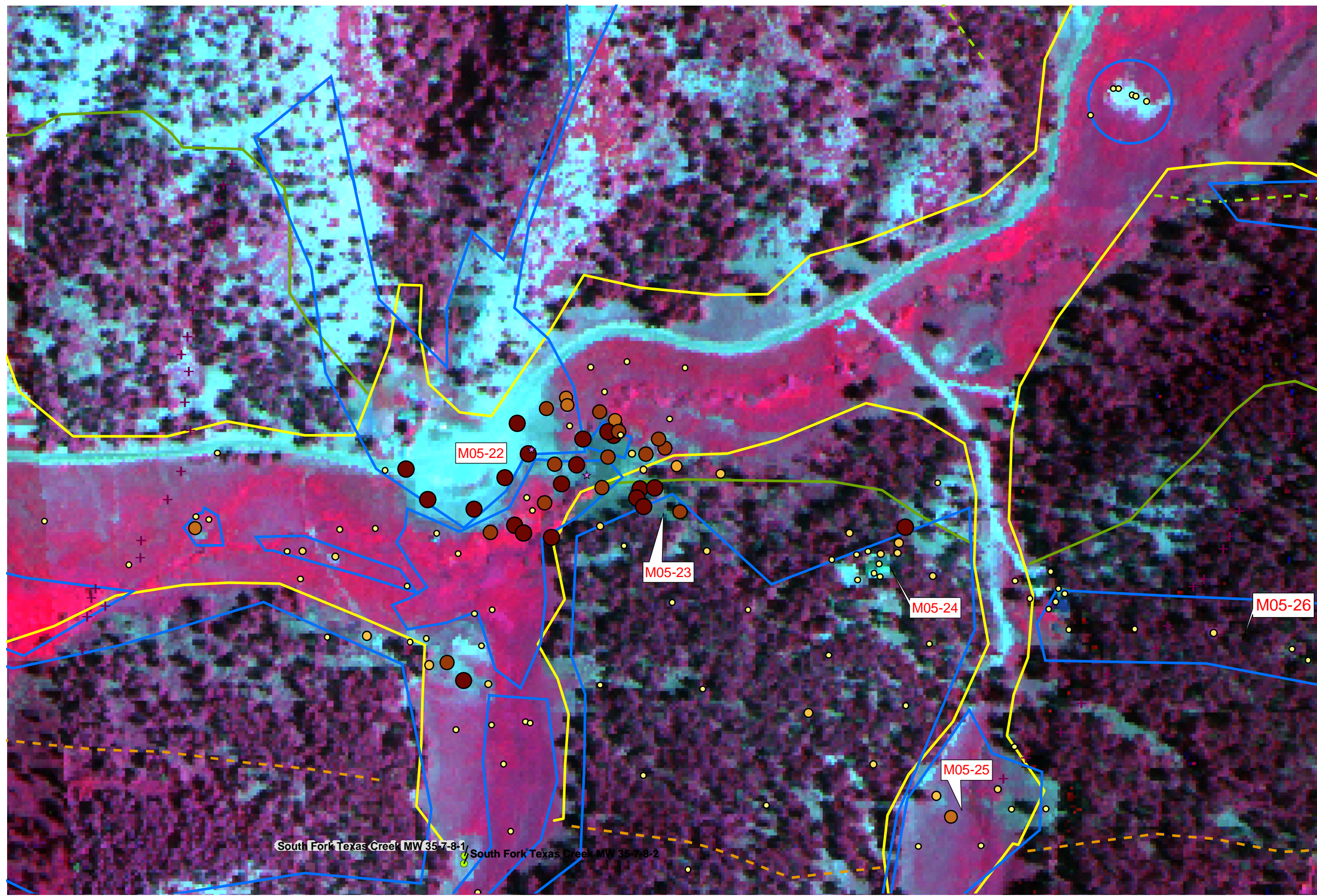


FIGURE 40
2005 REGIONAL RECONNAISSANCE
TEXAS CREEK WEST B

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ★ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
 - ☐ M05-25 Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

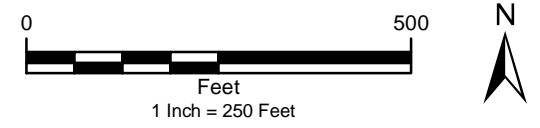
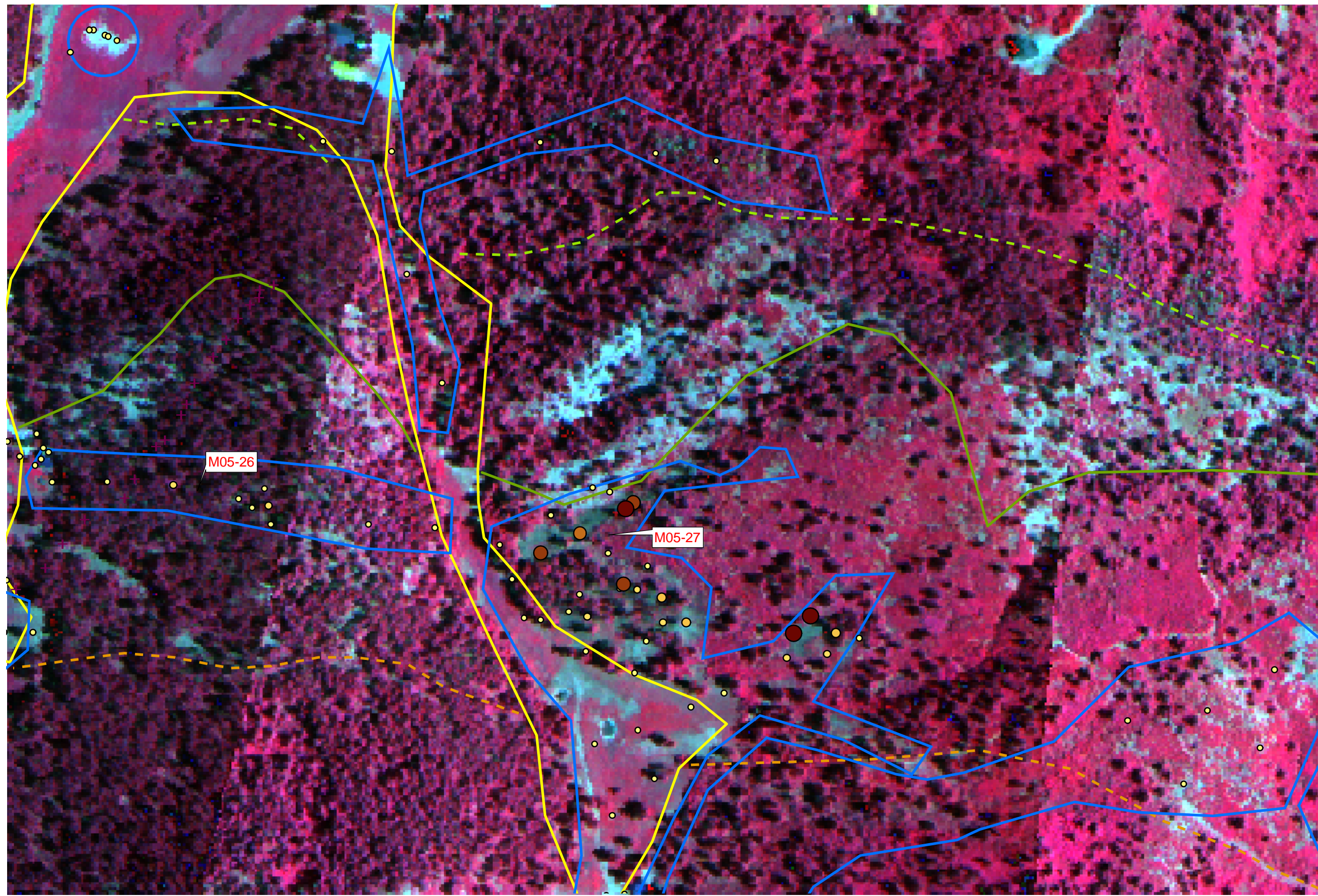


FIGURE 41
2005 REGIONAL RECONNAISSANCE
TEXAS CREEK CENTRAL

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-27 Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

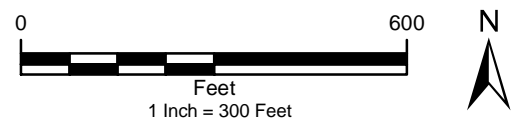
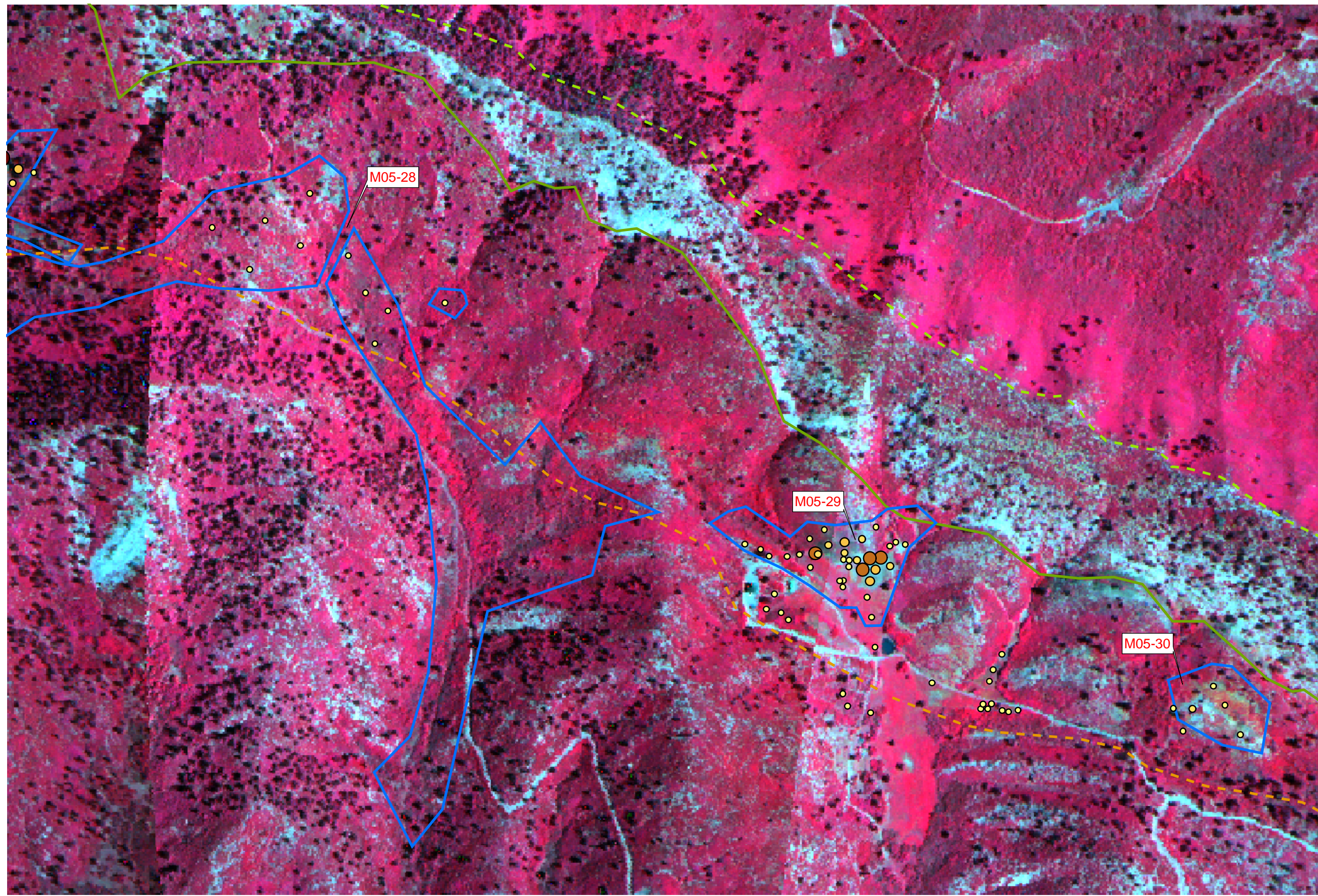


FIGURE 42
2005 REGIONAL RECONNAISSANCE
TEXAS CREEK EAST

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-29** Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

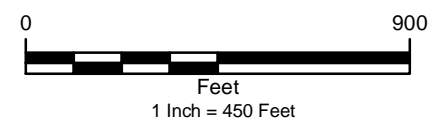
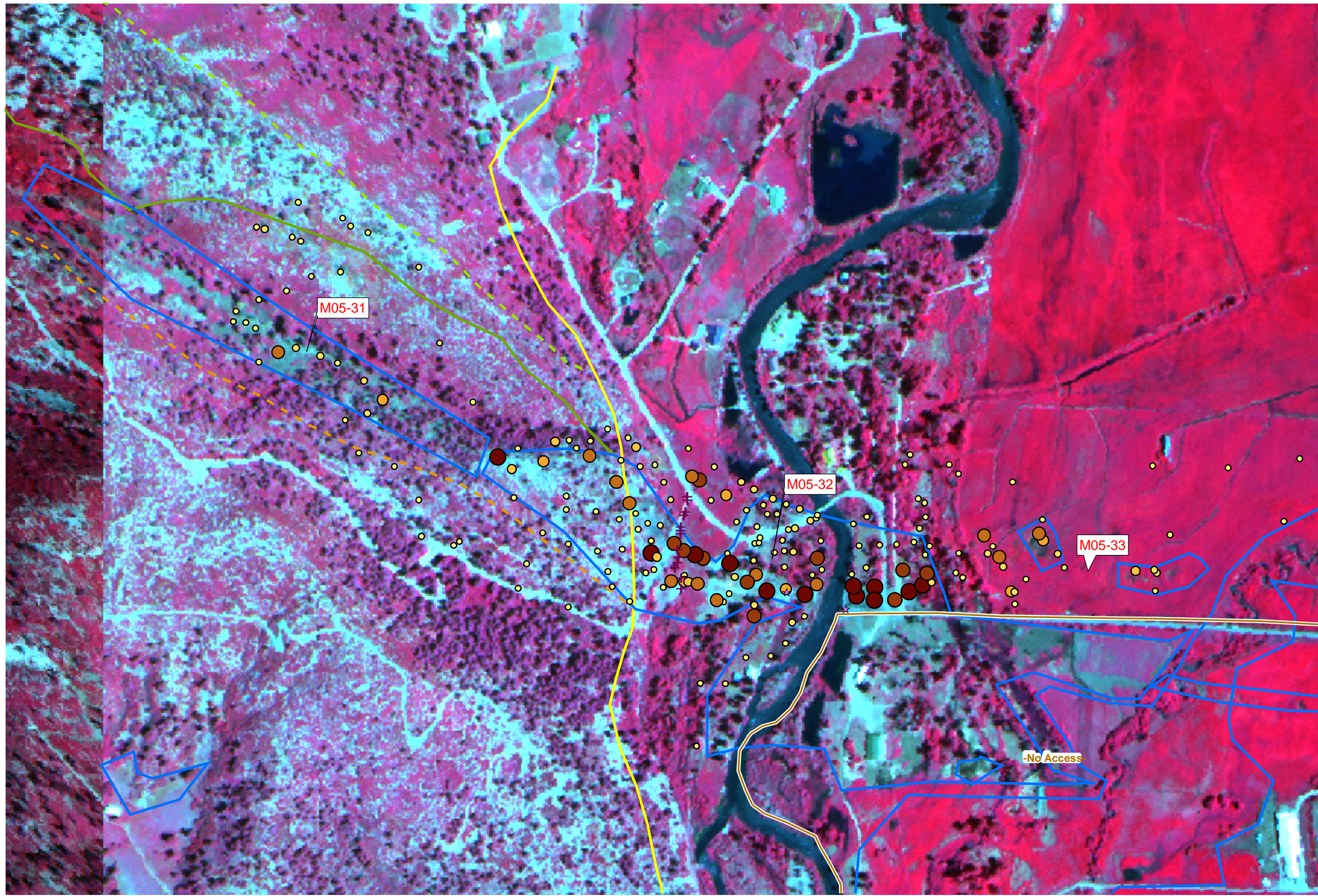


FIGURE 43
2005 REGIONAL RECONNAISSANCE
HOIER PROPERTY

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - - - Fruitland Formation Tongue (Kft)
 - - - Kirtland Formation (Kk)
 - - - Pictured Cliffs Formation (Kpc)
 - - - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- M05-33 Text Reference

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

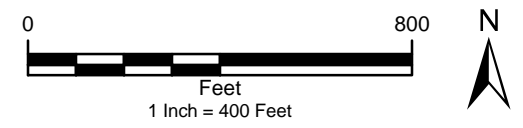
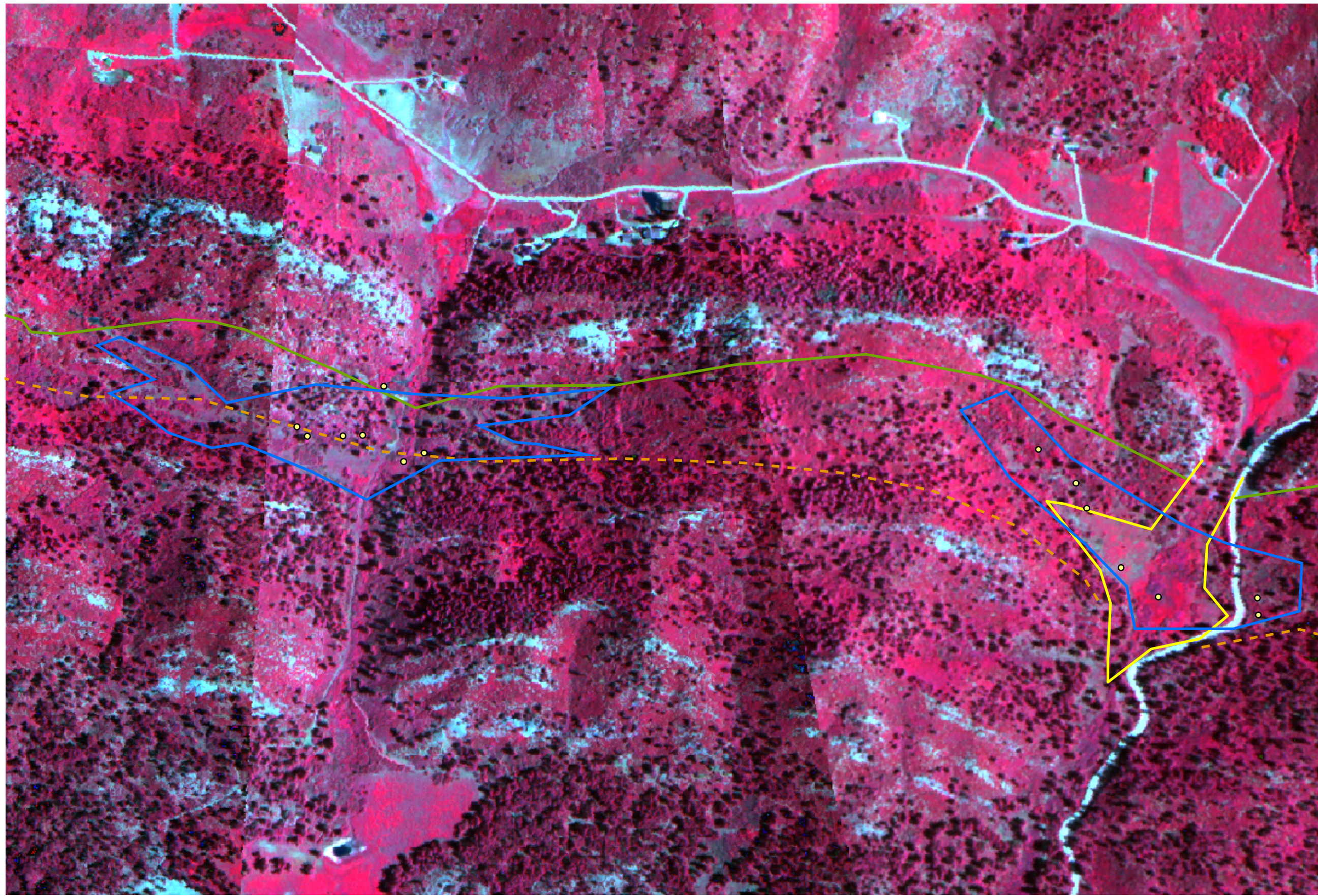


FIGURE 44
2005 REGIONAL RECONNAISSANCE
PINE RIVER

THE GROUP





- Legend**
- COGCC Monitoring Wells
 - ☆ Gas Flux Chambers
 - ⊕ Gas Monitoring Probes
 - ⬭ Suspect Areas
- Subsurface Methane Measurements**
- 0 ppm
 - 500 ppm - 5%
 - 6% - 15%
 - 16% - 25%
 - 26% - 50%
 - 51% - 75%
 - 76% - 100%
- Geology**
- Fruitland Formation (Kf)
 - == Fruitland Formation Tongue (Kft)
 - - Kirtland Formation (Kk)
 - · - Pictured Cliffs Formation (Kpc)
 - · · Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)

IR Imagery Taken: June 2005
 Mapping Data Collected: June and September 2005

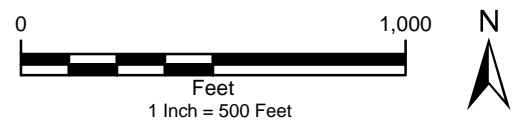
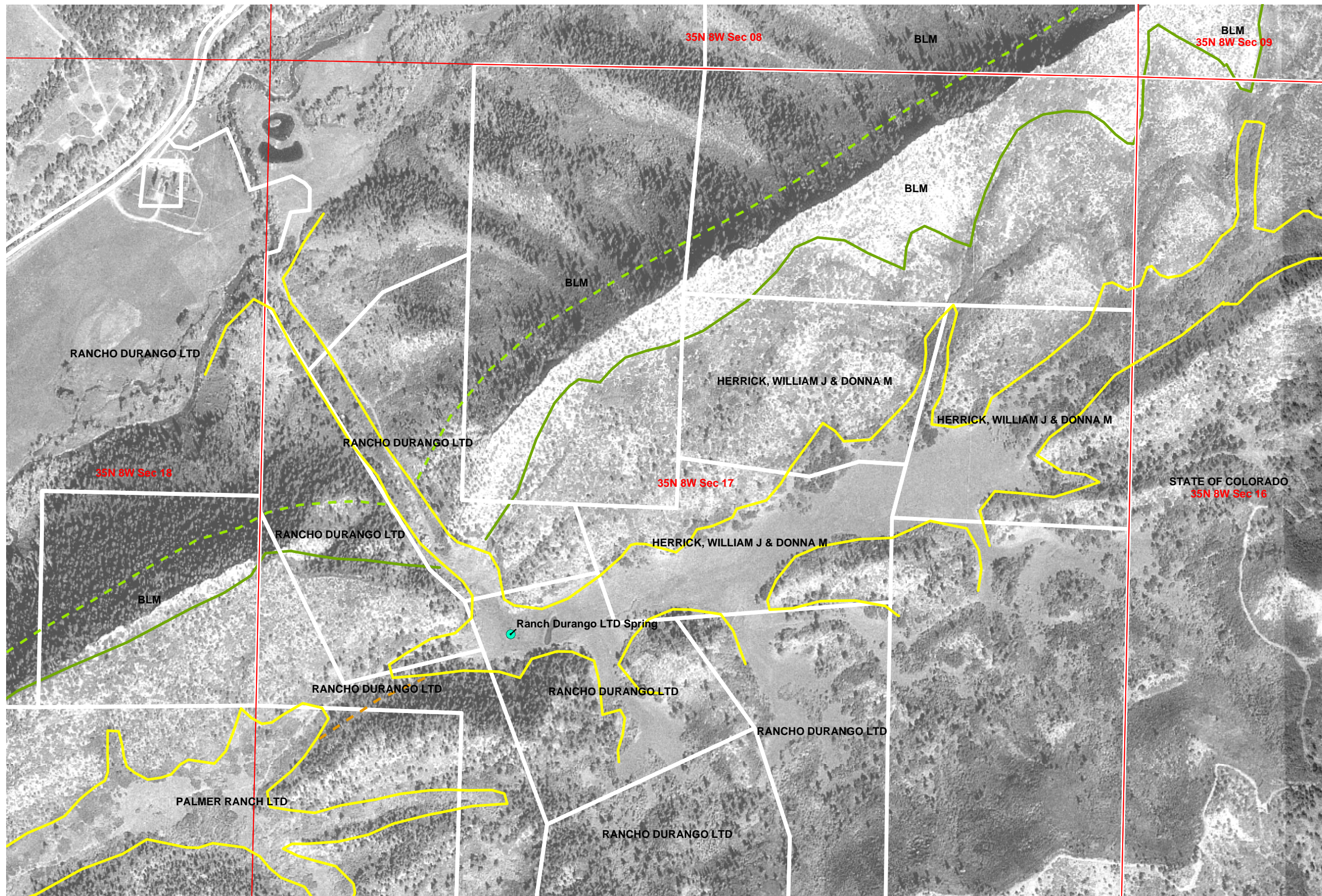


FIGURE 45
2005 REGIONAL RECONNAISSANCE
EAST PINE

THE GROUP





LEGEND

- Spring
- Township Range Section
- Geology
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- Property Boundaries Outlined in White

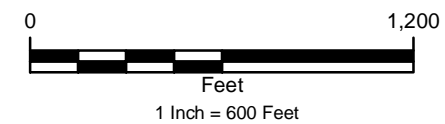
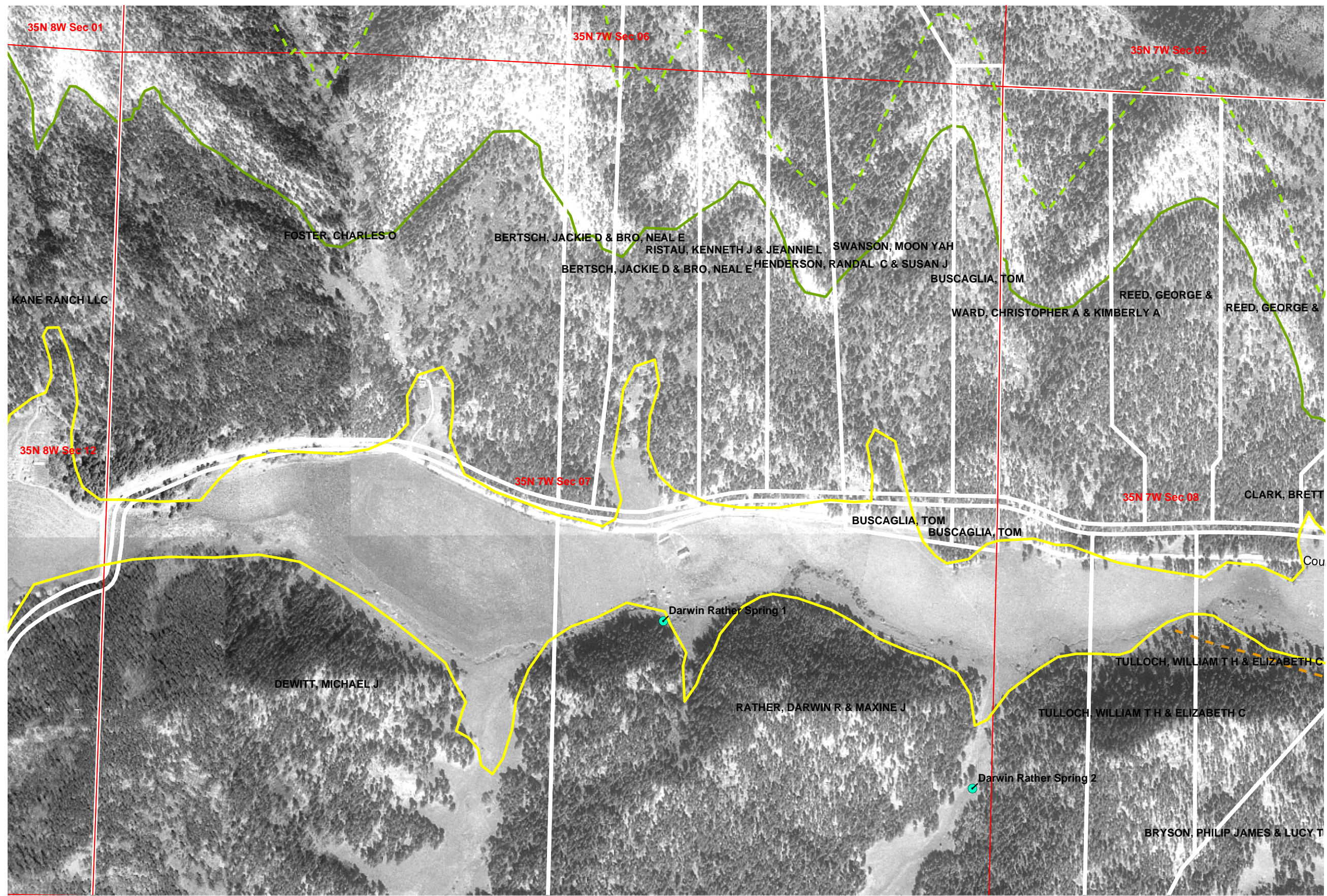


FIGURE 46
2005 NATURAL SPRING SURVEY
EDGEMONT RANCH

THE GROUP





LEGEND

- Spring
- Township Range Section
- Geology**
 - Fruitland Formation (Kf)
 - Fruitland Formation Tongue (Kft)
 - Kirtland Formation (Kk)
 - Pictured Cliffs Formation (Kpc)
 - Pictured Cliffs Formation Tongue (Kpct)
 - Quaternary Alluvium (Qa)
 - Quaternary Gravel (Qg)
- Property Boundaries Outlined in White

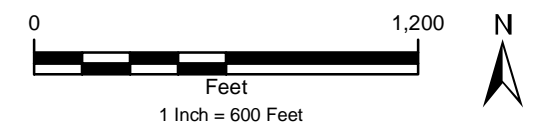


FIGURE 47
2005 NATURAL SPRING SURVEY
TEXAS CREEK WEST

THE GROUP



APPENDIX A
EQUIPMENT SPECIFICATIONS



The Gasport Gas Tester is designed for gas utility workers to detect methane and certain toxic gases. It is a reliable, simple, versatile tool to help your service technicians get the job done quickly! With multiple ranges and sensing capabilities built into one rugged housing, the Gasport Tester simplifies your work by reducing the number of meters you have to carry on the job.



Applications

The Gasport Tester's poison-tolerant methane sensor provides three measurement ranges for your daily service needs:

- Open air, safety sampling
- Small, in-home leak detection
- Street/outdoor service line leak detection



Features and Benefits

- **Proven in field use—rugged and reliable**
Less costly to maintain, less time in repair
- **Multiple functions in one instrument**
No need to buy, carry & maintain multiple instruments
- **New, poison-tolerant combustible gas sensor**
Reduces meter ownership costs
- **User-selectable, “silent” operation mode**
Reduces customer disturbances and worries
- **Fast warm up time**
Fastest warm up time in industry saves time
- **Can monitor up to four gases at a time**
Fewer instruments to carry
- **Show all gas concentrations simultaneously**
Eliminates guesswork on what reading is displayed
- **Autoranging methane sensor**
Automatically switches between 0-5% and 5-100% methane ranges
- **Gas readings recorded for later retrieval**
Can double check readings after job is done
- **Simple manual or automated calibration options**
Reduces training time and helps ensure accuracy
- **Intrinsically safe**
Meets safety standards for work in hazardous areas
- **Lifetime warranty on case and electronics**
Reduced maintenance and lifetime costs

Specifications

Gas	Range	Resolution
Methane	0–5000 ppm	50 ppm
Methane	0–100% LEL or 0–5% CH ₄	1 % LEL or 0.1% CH ₄
Methane	5–100% CH ₄	1% CH ₄
Oxygen	0–25%	0.1%
Carbon Monoxide	0–1000 ppm	1 ppm
Hydrogen Sulfide	0–100 ppm	1 ppm

- Battery types:** NiCd and Alkaline
- Case material:** Impact resistant, stainless-steel-fiber-filled polycarbonate
- Operating temperature:** normal -10 to 40°C; extended -20 to 50°C
- Operating humidity:** Continuous: 15-95% RH, non-condensing
Intermittent duty: 5-95% RH, non condensing
- Warm up time:** Less than 20 seconds to initial readings
- Datalog capacity:** 12 hours
- Input:** 3 clearly marked, metal domed keys
- Warranty:** Case and Electronics: Lifetime
Sensors and consumable parts: 1 year

The answer for gas utilities' gas detection needs

Ordering Information

Battery Chargers

Part No.	Description
494716	Omega 120 VAC 50/60Hz
495965	Omega 220 VAC 50/60Hz
801759	Omega 110/220 VAC, Five Unit, 50/60Hz
800525	Omega 8 - 24VDC for vehicle use

Battery Packs

Part No.	Description
496990	Standard NiCd Rechargeable
800526	Alkaline, Type C
711041	Alkaline, with Thumbscrews
800527	Heavy Duty NiCd Rechargeable

Sensors

Part No.	Description
813693	Combustible Gas
480566	O ₂
812389	CO
812390	H ₂ S

Protective Boots

Part No.	Description
804955	Black, for NiCd Battery Packs
802806	Orange, for NiCd Battery Packs
806751	Black, for Alkaline Battery Packs
806750	Orange, for Alkaline Battery Packs
806749	Black, for HD NiCd Battery Packs
806748	Orange, for HD NiCd Battery Packs
812833	Yellow Soft Carrying Case with Harness
711022	Black padded Vinyl Carrying Case with Harness

Sampling Equipment

Part No.	Description
800332	Probe - 1 ft., plastic
800333	Probe - 3 ft., plastic
803561	Probe - 3 ft., plastic (holes 2" from end) (bar hole probe)
803962	Probe - 3 ft., plastic (holes 2" from handle) (solid probe)
803848	Probe - Hot Gas Sampler
710465	Sampling Line - 5 ft., coiled
497333	Sampling Line - 10 ft.
497334	Sampling Line - 15 ft.
497335	Sampling Line - 25 ft.

Sampling Accessories

Part No.	Description
801582	Replacement Filter, Probe, pkg. of 10
801291	External Filter Holder
014318	Charcoal Filter
711039	Line Scrubber Filter Holder
711059	Line Scrubber Replacement Cartridges, Box of 12
808935	Dust Filter, Pump Module
802897	Water Trap (Teflon) Filter, Pump Module

Calibration Check Equipment

Part No.	Description
477149	Calibration Kit Model RP with 0.25 lpm Regulator
491041	Calibration Gas - methane, 2.5%
473180	Calibration Gas - 300 ppm CO
813718	Calibration Gas - methane, 2.5% oxygen, 15% 60 ppm CO
813720	Calibration Gas - methane, 2.5% oxygen, 15% 300 ppm CO 10 ppm H ₂ S
710288	Gasmiser™ Demand Regulator 0 - 3.0 lpm

Accessories

Part No.	Description
804679	Data Docking Module Kit. Includes the Data Docking Module, MSA Link Software and Instruction Manual

Approvals

The Gasport Gas Tester has been designed to meet intrinsic safety testing requirements in certain hazardous atmospheres.

The Gasport Gas Tester is approved by MET (an OSHA Nationally Recognized Testing Laboratory [NRTL]) for use in Class I, Division I, Groups A, B, C, D; Class II, Division I, Groups E, F, G; and Class III Hazardous locations. Gasport tGas Testers sold in Canada are approved by CSA for use in Class I, Division I, Groups A, B, C, and D locations.

Contact MSA at 1-800-MSA-2222 for more information or with questions regarding the status of approvals.

Gasport Gas Tester Kits

	LEL Display	O ₂	CO	H ₂ S	Alarms Always	Alarms Optional	Leak Detect Page Peak	Alkaline Battery	NiCd Battery	5ft Coiled Line	1ft Probe	Part No.
4-Gas, Selectable, NiCd	•	•	•	•	•	•	•	•	•	•	•	711489
4-Gas, Selectable, Alkaline	•	•	•	•	•	•	•	•	•	•	•	711490
3-Gas, Selectable, NiCd	•	•	•		•	•	•	•	•	•	•	711493
3-Gas, Selectable, Alkaline	•	•	•		•	•	•	•	•	•	•	711494
2-Gas, Selectable, NiCd	•		•		•	•	•	•	•	•	•	711495
2-Gas, Selectable, Alkaline	•		•		•	•	•	•	•	•	•	711496
4-Gas, Alarms On, NiCd	•	•	•	•	•	•	•	•	•	•	•	711491
4-Gas, Alarms On, Alkaline	•	•	•	•	•	•	•	•	•	•	•	711492

Assemble-to-Order (ATO) System: You Make the Choices

The ATO System makes it easy to "custom order" the Gasport Gas Tester, configured exactly the way you want it. You can choose from an extensive line of base instrument components and accessories. To obtain a copy of the "ATO System and Price Information for the Gasport Gas Tester," call toll-free 1-800-MSA-2222, and request Bulletin 0804-28. To obtain a copy of the ATO via FAX, call MSA QuickLit Information Service at 1-800-672-9010. At the prompt, request QuickLit Document #2345 (ATO for Gasport Gas Tester).

Note: This Data Sheet contains only a general description of the products shown. While uses and performance capabilities are described, under no circumstances shall the products be used by untrained or unqualified individuals and not until the product instructions including any warnings or cautions provided have been thoroughly read and understood. Only they contain the complete and detailed information concerning proper use and care of these products.

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For further information:



Trimble

GPS Pathfinder Systems

GPS systems for better data management and decision-making

Key features and benefits

- Fast map display
- Easy to use graphical interface
- High-performance DGPS receivers
- Better accuracy with postprocessing
- Rugged and field proven

Trimble's GPS Pathfinder® Systems are effective tools for data collection, update, and processing. This versatile family offers a variety of software, data collector, and GPS receiver options that are powerful, easy to use, and integrate seamlessly with industry-standard GIS databases. With a GPS Pathfinder System, you'll have the most accurate, current, and reliable data you need to make the best decisions.

Productive field software

Timesaving field software is essential for productive GIS data collection and data maintenance.

With Trimble's field software options, you can quickly and easily collect point, line, and area features, along with customized attribute information. Our field software makes it easy to take existing data from your GIS into the field for verification and update. In the field, your productivity will be enhanced by better graphics. A fast map display allows you to display background data and imagery, to ensure you're working in the right location, with the right data. And flexible map symbology enables you to tailor your data display to match your GIS.

Trimble offers two field software solutions for collecting and maintaining quality data:

TerraSync™ software operates on Trimble's rugged GIS TSCe™ field device, or any Windows field computer.

Asset Surveyor® software runs on Trimble's rugged, field-proven TSC1™ data collector.



Trimble GPS Pathfinder Systems are rugged and field-proven

Accurate and reliable data

Trimble's GPS Pathfinder System receivers offer real-time differential GPS (DGPS) and postprocessing options. Real-time DGPS provides you with immediate results in the field—great for navigation, and relocation of existing assets. Postprocessing enables you to improve the reliability and accuracy of your data when you're back in the office.

The **GPS Pathfinder Power** receiver integrates GPS, real-time satellite differential, and Wide Area Augmentation System (WAAS) capabilities into a single, lightweight unit.

The **GPS Pathfinder Pro XR** system integrates GPS, real-time beacon, and WAAS capabilities.

The **GPS Pathfinder Pro XRS** system integrates GPS, real-time beacon, satellite differential, and WAAS capabilities.

The best data for your GIS

The GPS Pathfinder Office software gives you the tools to manage your GPS projects from start to finish. With it, you can define your field data collection requirements and control the quality of your data. The result is more consistent, reliable, and accurate data for your GIS.

The GPS Pathfinder Systems family offers you a variety of software, data collector, and GPS receiver options. Choose the solution that meets your requirements, and realize the benefits of better decisions based on better data.

GPS Pathfinder Systems

Versatile GIS data collection and maintenance

FEATURES AND OPTIONS

GPS Pathfinder Systems Standard Features

- GPS Pathfinder Office software
- Choice of GPS receiver
- Choice of field software
- Ergonomic backpack carrying system
- Rechargeable system batteries (provide 8 hours of field use)
- Battery charger and AC power supply

Optional Receiver Accessories

- Vehicle kit: includes cigarette lighter power adapter, quick release, 2 quick-release adapters, and magnetic mount
- GPS Pathfinder Centimeter Processing option

Available Receivers and Standard Features

- GPS Pathfinder Pro XRS receiver
- GPS Pathfinder Pro XR receiver
- GPS Pathfinder Power receiver

- 12-channel GPS receiver
- EVEREST™ multipath rejection technology
- WAAS differential correction capabilities

Available Field Software

- Asset Surveyor software for Trimble TSC1 data collector
- TerraSync software for Trimble GIS TSCe field device, and Windows field computers

GPS PATHFINDER POWER RECEIVER/ANTENNA SPECIFICATIONS

- Integrated GPS/Satellite Differential receiver and antenna
- RTCM input

General:	12 channel, L1/CA code tracking with carrier phase filtered measurements.
Update rate:	1 Hz
Power:	3.1 Watts, 9 to 32 VDC
Accuracy (RMS) (Note A):	
MCORR400 differential correction:	Submeter + 1 ppm on a second-by-second basis (horizontal) Submeter + 2 ppm on a second-by-second basis (vertical)
Carrier phase processing:	30 cm + 5 ppm with 5 minutes tracking satellites 20 cm + 5 ppm with 10 minutes tracking satellites 10 cm + 5 ppm with 20 minutes tracking satellites 1 cm + 5 ppm with 45 minutes tracking satellites (with Centimeter Processing option)
RTCM satellite differential correction:	Better than 1 meter (Note B)
Time to first fix:	30 seconds (typical)
Size:	15.2 cm diameter x 12.7 cm high (6" x 5")
Weight:	0.625 kg (1.38 lbs)
Temperature:	-30°C to +60°C (-22°F to +140°F) (operating) -40°C to +80°C (-40°F to +176°F) (storage)
Humidity:	100% fully sealed
Casing:	Fully sealed, dustproof, waterproof, shock resistant

GPS PATHFINDER PRO XR AND PRO XRS RECEIVER & ANTENNA SPECIFICATIONS

GPS Pathfinder Pro XR

- Integrated GPS/Beacon receiver
- Integrated GPS/Beacon antenna
- RTCM input/output
- 3 meter antenna cable
- Base datalogging mode

GPS Pathfinder Pro XRS

- Integrated GPS/Beacon/Satellite Differential receiver
- Integrated GPS/Beacon/Satellite Differential antenna
- RTCM input/output
- 3 meter antenna cable
- Base datalogging mode

GPS Pathfinder Pro XR receiver

General:	12 channel, L1/CA code tracking with carrier phase filtered measurements and multibit digitizer
Update rate:	1 Hz
Power:	6 Watts (maximum), 10 to 32 VDC
Accuracy (RMS) (Note A):	
MCORR400 differential correction:	50 cm + 1 ppm on a second-by-second basis (horizontal) Submeter + 2 ppm on a second-by-second basis (vertical)
Carrier phase processing:	30 cm + 5 ppm with 5 minutes tracking satellites 20 cm + 5 ppm with 10 minutes tracking satellites 10 cm + 5 ppm with 20 minutes tracking satellites 1 cm + 5 ppm with 45 minutes tracking satellites (with Centimeter Processing option)
RTCM beacon radio transmissions:	Better than 1 meter (Note B)
Time to first fix:	30 seconds (typical)
Size:	11.1 cm × 5.1 cm × 19.5 cm (4.4" × 2.0" × 7.7")
Weight:	0.76 kg (1.68 lbs)
Temperature:	-30°C to +65°C (-22°F to +149°F) (operating) -40°C to +85°C (-40°F to +185°F) (storage)
Humidity:	100% fully sealed
Casing:	Dustproof, splashproof, shock resistant; sealed to 5 psi

GPS Pathfinder Pro XRS receiver

Specifications for the Pro XRS receiver are the same as for the Pro XR receiver with the following exceptions:

Power:	7 Watts (maximum), 10 to 32 VDC
Accuracy (RMS) (Note A):	
RTCM satellite differential correction:	Better than 1 meter (Note B)

GPS Pathfinder Pro XR antenna

General:	Right-hand, circular polarized; omnidirectional; hemispherical coverage
Size:	15.5 cm diameter × 10.8 cm high (6.1" × 4.2")
Weight:	0.49 kg (1.08 lbs)
Temperature:	-30°C to +65°C (-22°F to +149°F) (operating) -40°C to +85°C (-40°F to +185°F) (storage)
Humidity:	100% fully sealed
Casing:	Dustproof, waterproof, shock resistant

GPS Pathfinder Pro XRS antenna

Specifications for the Pro XRS antenna are the same as for the Pro XR antenna with the following exceptions:

Size:	15.5 cm diameter × 14 cm high (6.1" × 5.5")
Weight:	0.55 kg (1.2 lbs)

TRIMBLE GIS TSCe FIELD DEVICE SPECIFICATIONS

Screen:	320 x 240 color touch screen: 1/4 VGA reflective color TFT
Size:	25.8 cm x 13 cm x 5.2 cm (10.2" x 5.1" x 2.1")
Weight:	0.99 kg including internal battery
Temperature:	-20°C to +60°C (+14°F to +140°F) (operating) (Note C) -30°C to +60°C (-22°F to +140°F) (storage)
Environmental:	Meets IEC 68, EN61000, MIL-STD-810E standards for temperature, moisture and immersion, dust and sand, drop test, shock, vibration and altitude. IP 67 sealed against temporary immersion.
COM ports:	9-Pin serial port: RS232 (COM 1) 26-Pin MultiPort: (COM 2, Ethernet, USB client, power in/out, and audio in/out) Infrared: IrDA Type 1 (COM 3)
Memory:	128 MB (storage) 64 MB (RAM)
Batteries:	NiMH rechargeable pack, 3800 mAh gives continuous operation for over 30 hours recharges to 90% of capacity in 1 hour (Note D)

TRIMBLE TSC1 DATA COLLECTOR SPECIFICATIONS

Screen:	240 x 200 extended temperature graphics STN LCD monochrome display
Size:	26.7 cm x 11.7 cm x 4.2 cm (10.5" x 4.6" x 1.65")
Weight:	0.85 kg including internal battery
Temperature:	-30°C to +65°C (-22°F to +149°F) (operating) -30°C to +80°C (-22°F to +176°F) (storage)
Environmental:	100% fully sealed against sand, dust and moisture, buoyant, waterproof against accidental immersion
COM ports:	Two RS232 7-pin lemo ports
Memory:	2 MB (storage), memory extension through user accessible Type II ATA PC card slot (Note E)
Batteries:	The internal Li-ion battery will last for at least 10 hours. In the field the TSC1 will draw power from the GPS receiver's power source when possible.

(footnotes)

Note A: At least 5 satellites, PDOP ≤ 6, signal to noise ratio ≥ 6, satellite elevation mask at 15 degrees

Note B: RTCM SC-104 standard format broadcast from a Trimble reference station.

Note C: Frontlight has an operation temperature of >0°C.

Note D: 30 hours of operation is achievable without using the frontlight.

Note E: Memory extension through user-accessible Type II PC card slot. 16 MB PCMCIA Data Cards are available (33050-16).

Trimble follows a policy of continuous product improvement. Specifications are therefore subject to change without prior notice.

For further information, contact your nearest Trimble Authorized Distributor or Trimble Office. Please visit our web site at www.trimble.com



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Singapore
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011-65-348-2232 Fax



TRIMBLE AUTHORIZED DEALER



MS3100

3-CCD Camera
1392(H) x 1040(V) Pixels

HIGH RESOLUTION 3-CCD DIGITAL MULTISPECTRAL CAMERA

**High Resolution
3-Chip Digital Smart
Camera Available in
Multiple Spectral
Configurations:**

Color-Infrared
RGB
RGB/CIR
Multispectral

The MS3100 acquires three channels of crisp 1392 x 1040 images for your most demanding applications.

A common aperture and accurate alignment provide true color fidelity and optimum image quality.

Multispectral configuration options, smart camera features, and DirectView analog preview complete this unbeatable instrument.



FEATURES

- Color separating prism with three CCD imaging sensors
- 1392(H) x 1040(V) resolution (x3) for 4.3 Million pixels of data
- Image 3-5 spectral bands from 400-1100 nm
- Standard models for RGB, CIR, and RGB/CIR
- Custom multispectral configuration to meet your needs
- Frame rates up to 7.5 fps
- "Smart Camera" features for advanced control and processing
- Display composite, false color, or individual color plane images
- Digital Image Output - EIA-644 or RS-422
- Compact, rugged package
- Independent gain, offset, and exposure control for each channel
- External trigger input with three operating modes
- RS-232 input for configuration and control
- Optional *DirectView* video preview via NTSC/PAL or Progressive Scan
- Optional on-board image processing
- OEM Customization Available

APPLICATIONS

- Machine Vision
 - Food Processing
 - Textiles
 - Plastics
 - Lumber
 - Pharmaceuticals
- Remote Sensing
 - Precision Agriculture
 - Environmental Assessment
 - Archaeology
 - Geology
 - Oceanography
- Reconnaissance
- Advanced Surveillance
- Medical/Scientific Imaging
- Robotics



SPECIFICATIONS - MS3100

Image Device:	(3-ea) 1/2 inch Interline Transfer CCD
Picture Elements:	1392(H) x 1040(V)
Pixel Size:	4.65 x 4.65 micron
Pixel clock rate:	14.318 MHz Max
Sensing Area:	7.6 x 6.2 mm (1/2 inch format)
Frame Rate:	7.5 frames per second max
Digital Image Output:	8 bits x 4 taps or 10 bits x 3 taps (32 bits max). EIA644 or RS422
Signal/Noise:	60 dB
Lens Mount:	F-Mount or Canon ENG
Electronic Shutter:	Independent shutter time per channel. Range: 1/8,000 - 1/7.5 sec
Gain Selection:	Independent gain per channel. 0-36 dB
Offset Selection:	Independent offset per channel. 0-127 counts
External Trigger Input	Edge or level, Three modes
External Trigger Source:	Optically isolated BNC or Frame Grabber
Command/Control Input:	RS-232 port
Operating Temperature:	0-50 C
Operating Voltage:	12 VDC
Power Consumption:	10 Watts
Weight:	1.62 kg
Programmable Functions:	Offset, gain, exposure time, multiplexing, trigger modes, custom
Options:	processing.
Analog Video Output:	NTSC/PAL and Progressive Scan RGB (1280x1024 max display resolution)
Signal Processing	Thresholding, Ratios, Multipliers, Look up Tables, False Color Mapping, Custom Firmware Available

SPECTRAL CONFIGURATIONS

DuncanTech's multispectral cameras use a beam splitting prism and three CCD sensors to acquire images in 3-5 spectral bands within the 400-1100 nm sensitivity of the sensors. Standard configurations are available for RGB, CIR, and RGB/CIR. Custom spectral configurations are available to meet customer requirements. For more information on spectral configuration, ask for our *Spectral Configuration Guide*.

RGB RGB CONFIGURATION

Acquires separate Red, Green, and Blue image planes for outstanding color fidelity.

CIR CIR CONFIGURATION

Color Infrared imaging acquires Red, Green and Near Infrared bands approximating Landsat satellite bands. These images are mapped to the Blue, Green, and Red color planes to create false color images similar to color-infrared film for remote sensing applications.

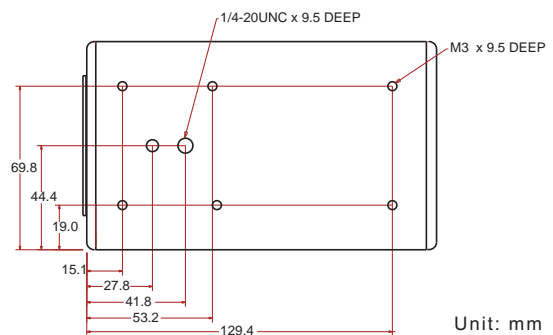
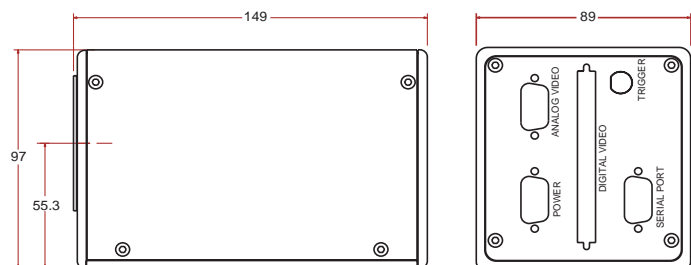
RGB/CIR RGB/CIR CONFIGURATION

Acquires red, green, blue, and near infrared bands which can be displayed as standard color, color infrared, or single color images.

MS CUSTOM MULTISPECTRAL

Specify the wavelengths and bandwidths required for your application. This configuration is tailored to meet your needs.

DIMENSIONS

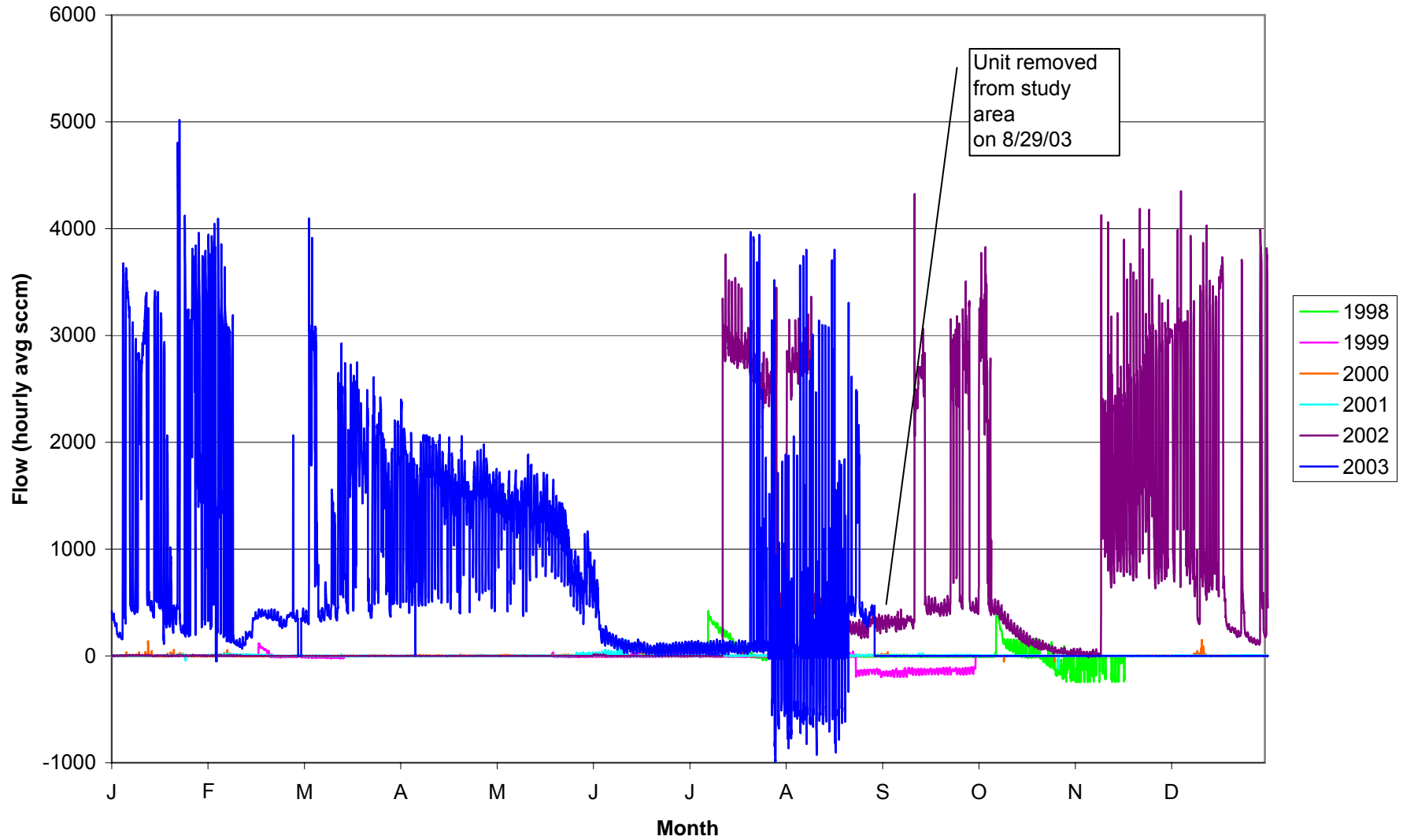


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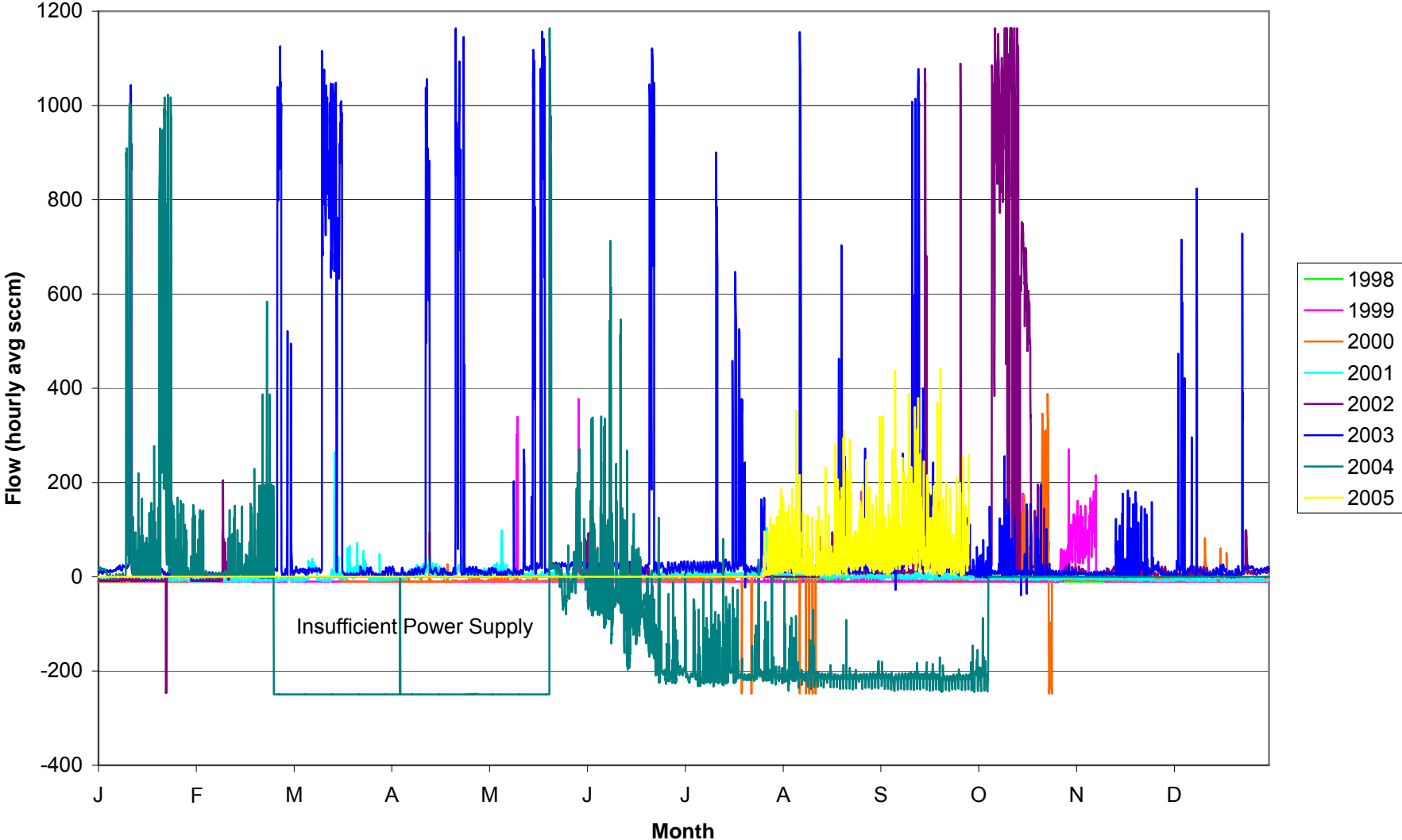
APPENDIX B
FLUX CHAMBER DATA



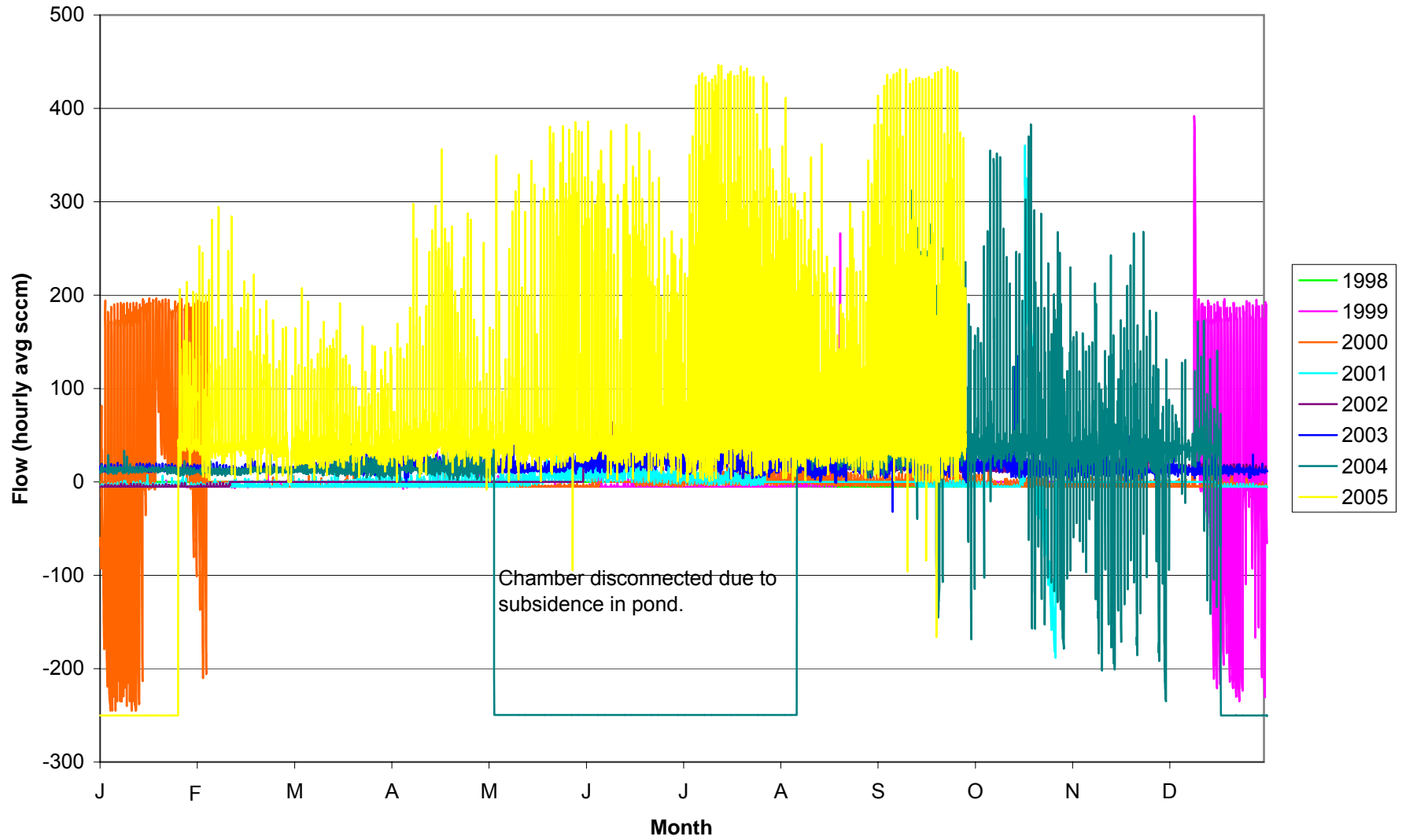
Basin Creek Gas Flux



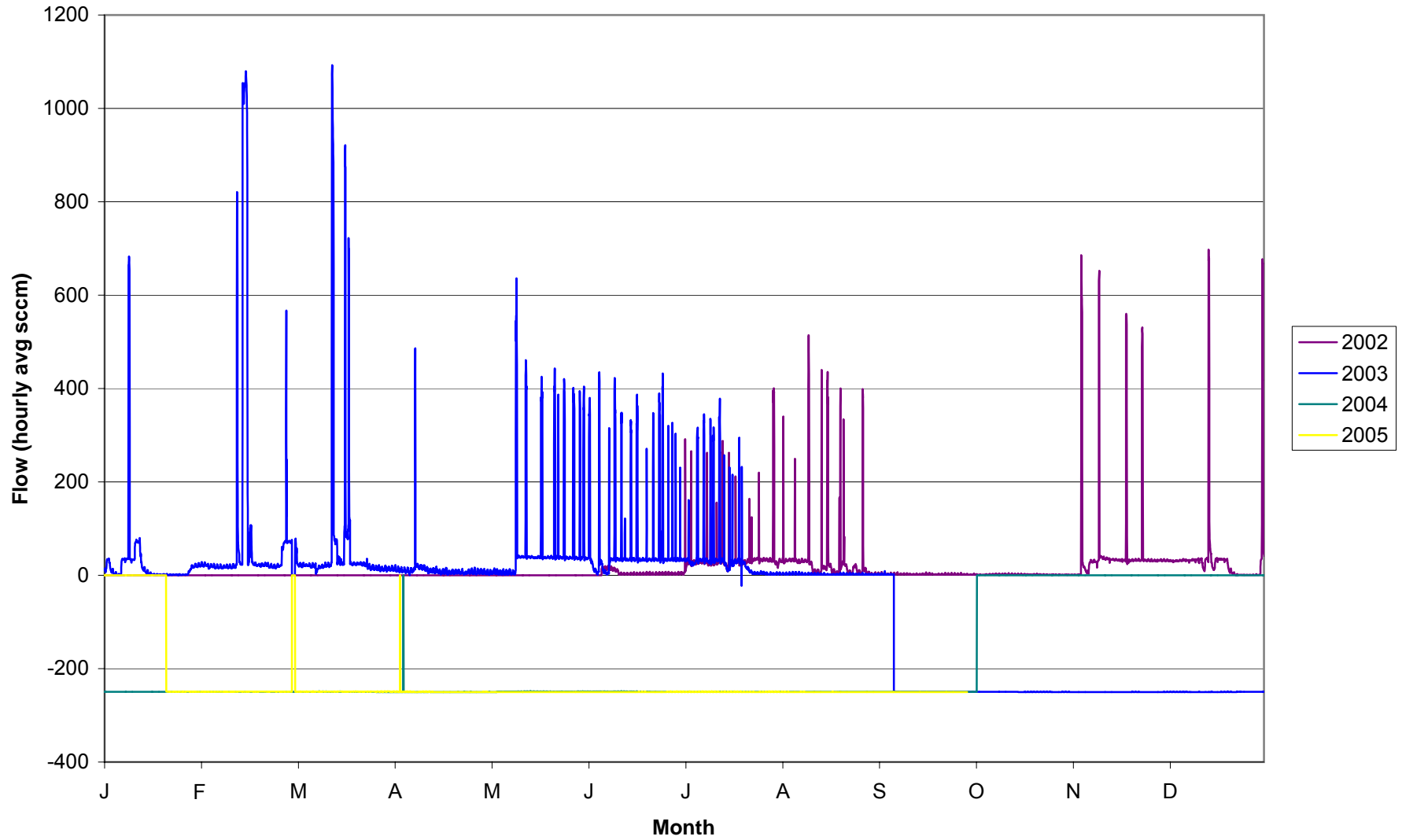
Carbon Junction Gas Flux



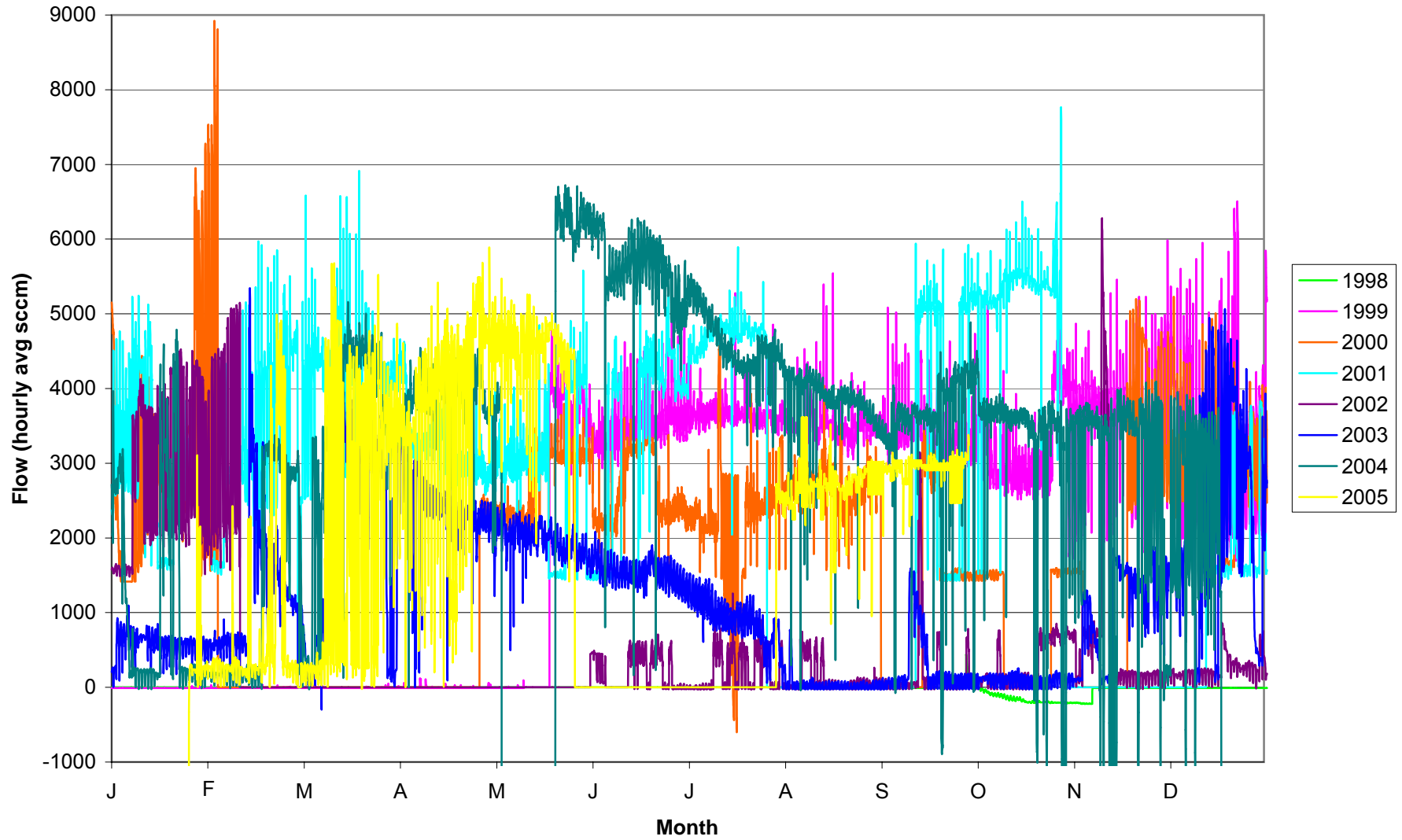
Florida River Gas Flux



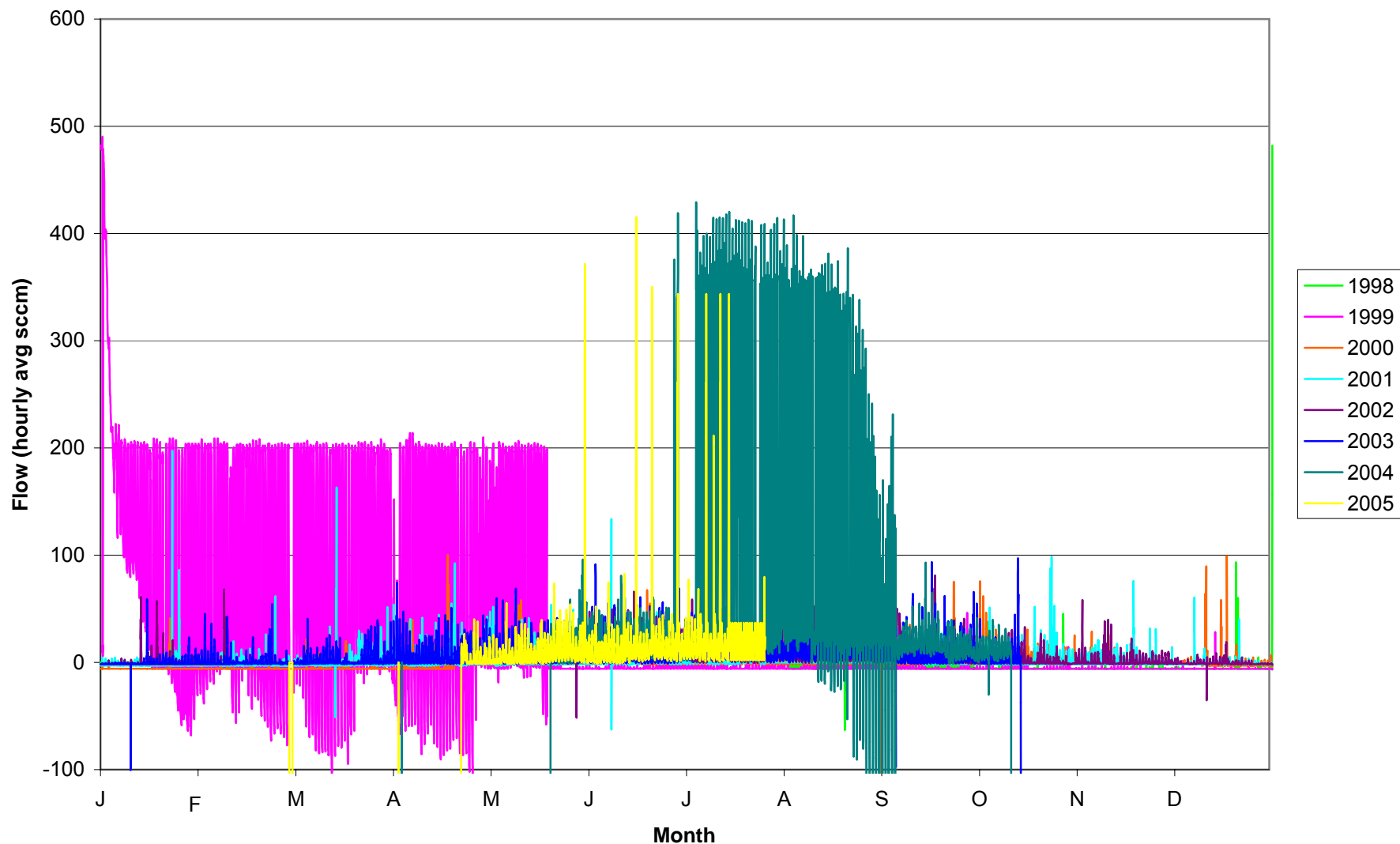
Texas Creek Land Gas Flux



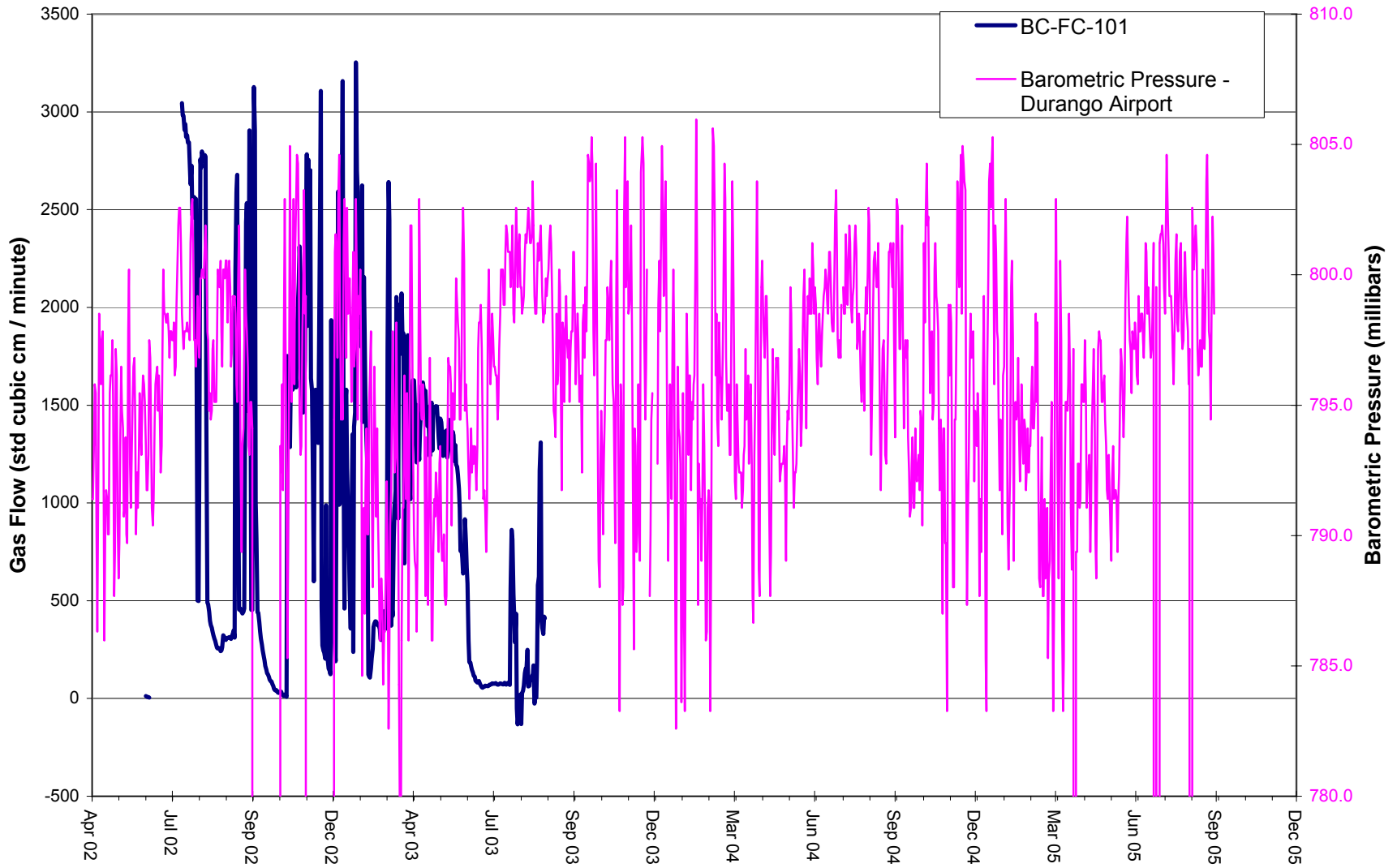
Texas Creek Gas Flux



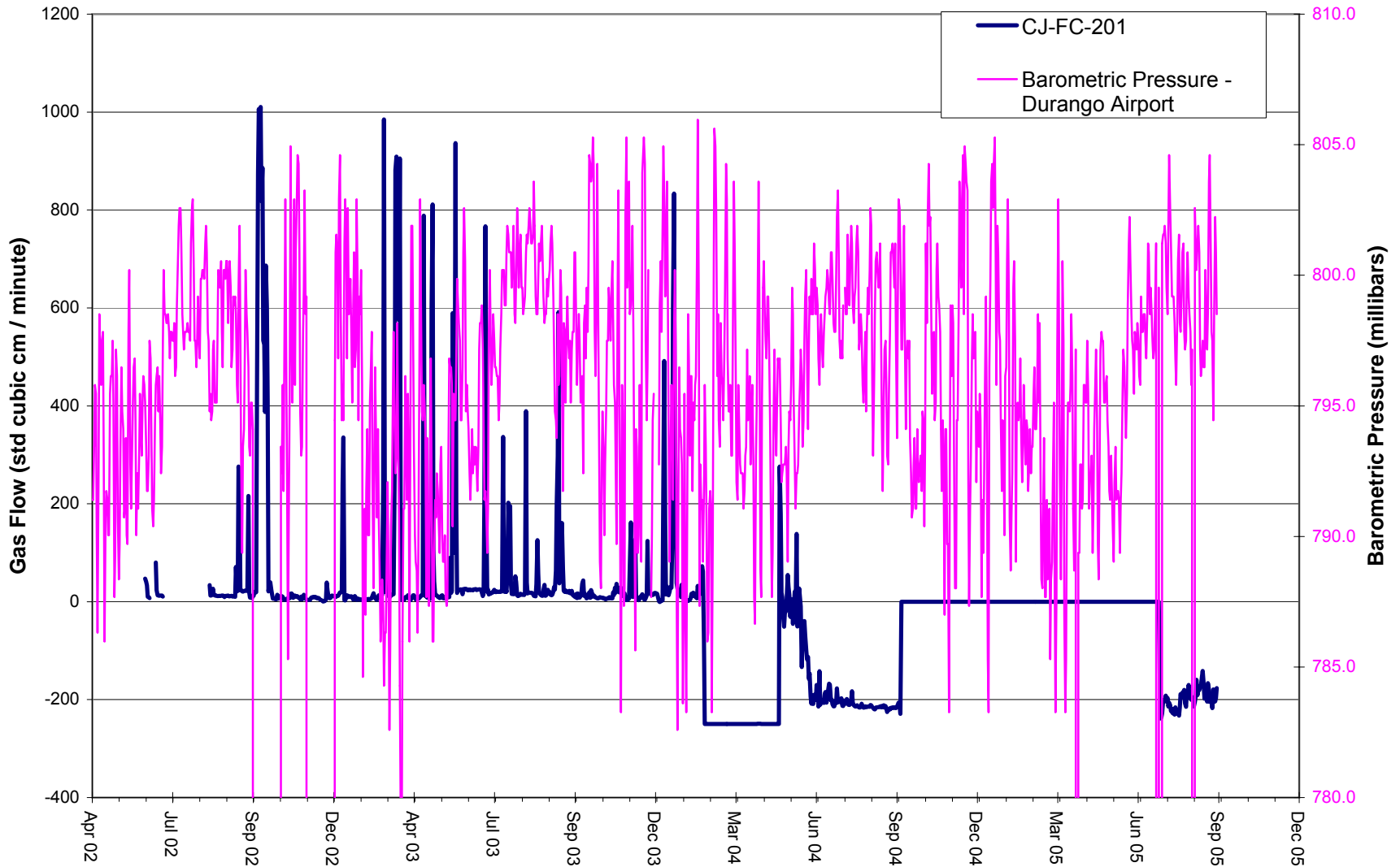
East Pine River Gas Flux



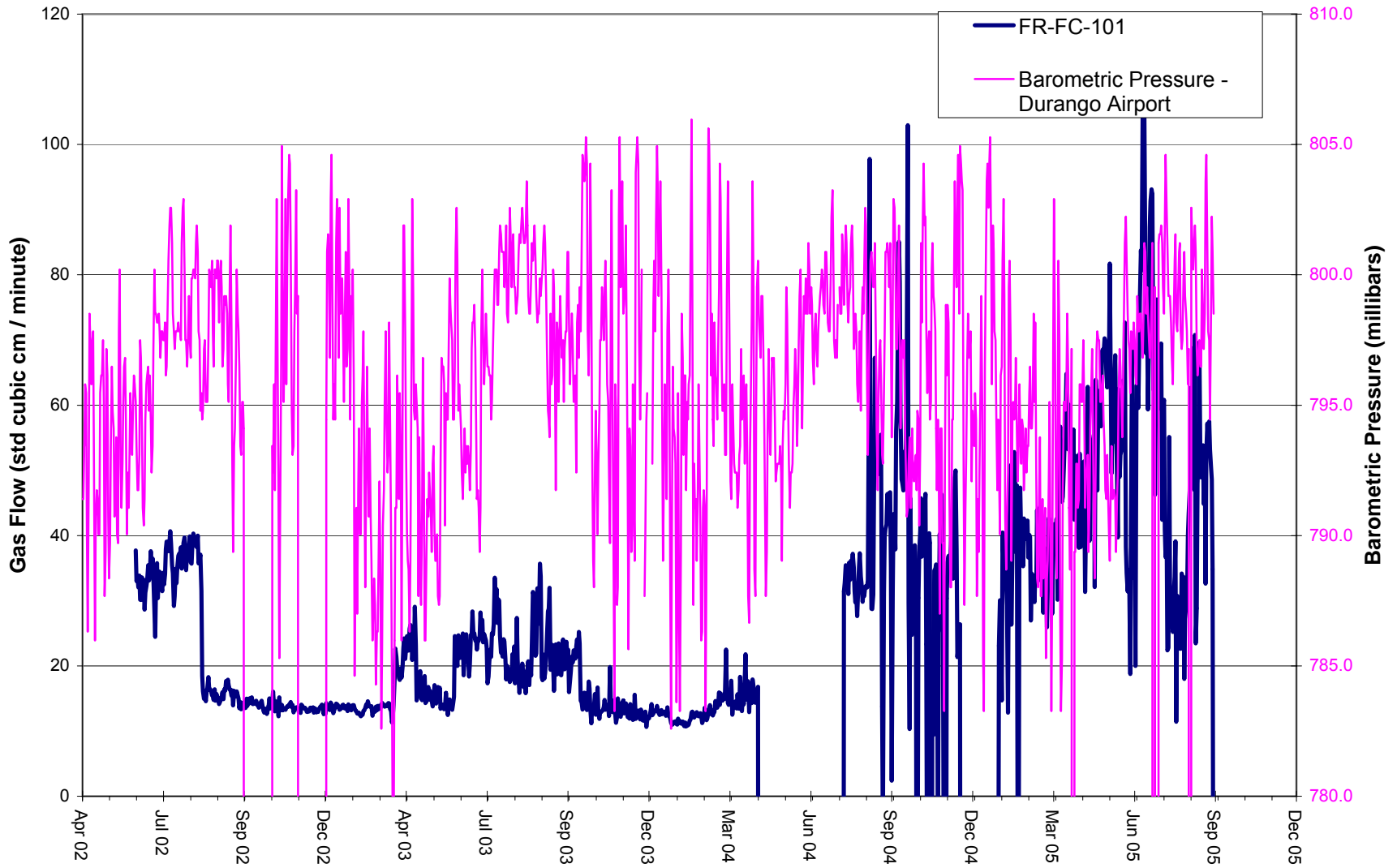
Basin Creek Gas Flux vs Barometric Pressure - 2002-2005



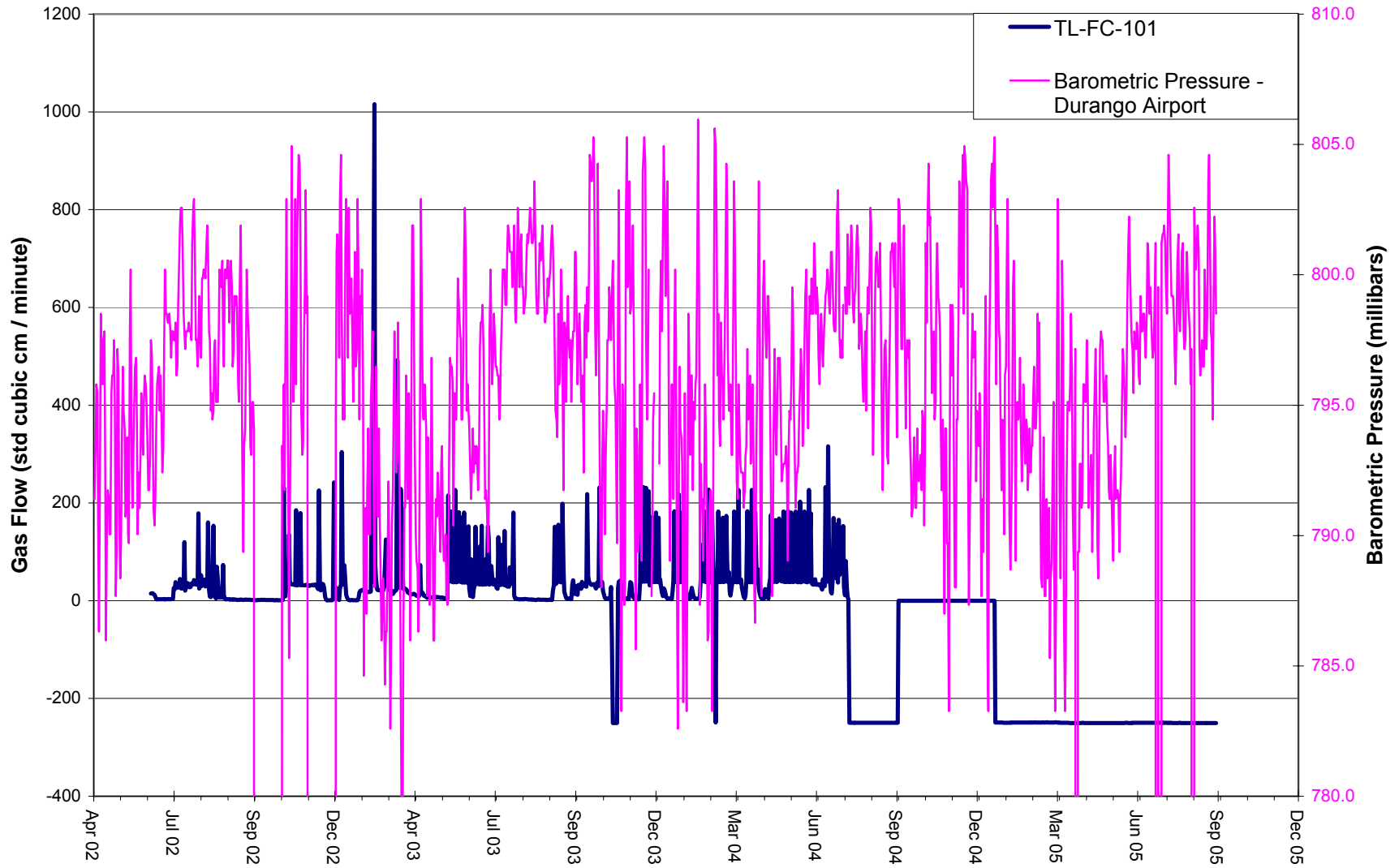
Carbon Junction Gas Flux vs Barometric Pressure - 2002-2005



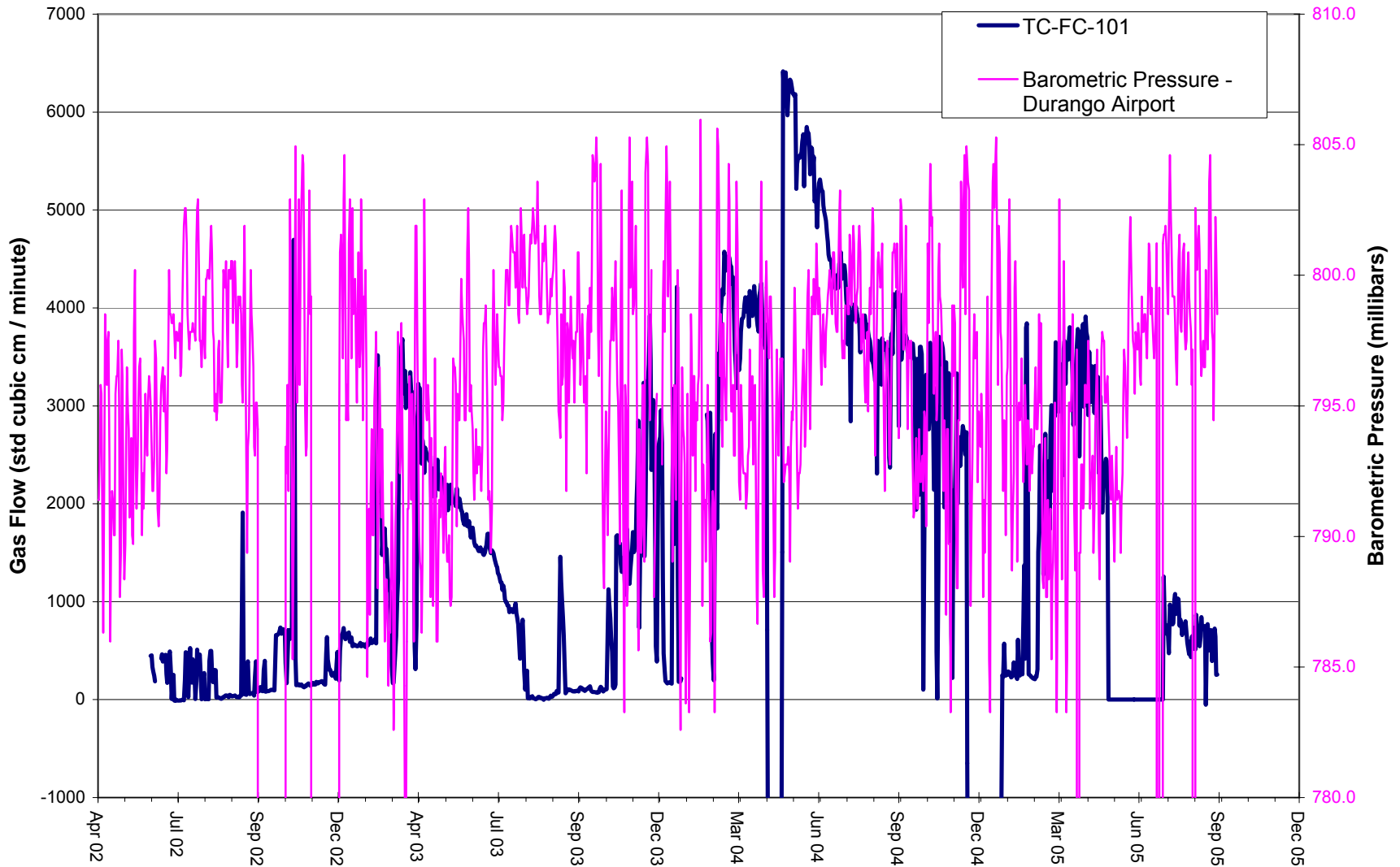
Florida River Gas Flux vs Barometric Pressure - 2002-2005



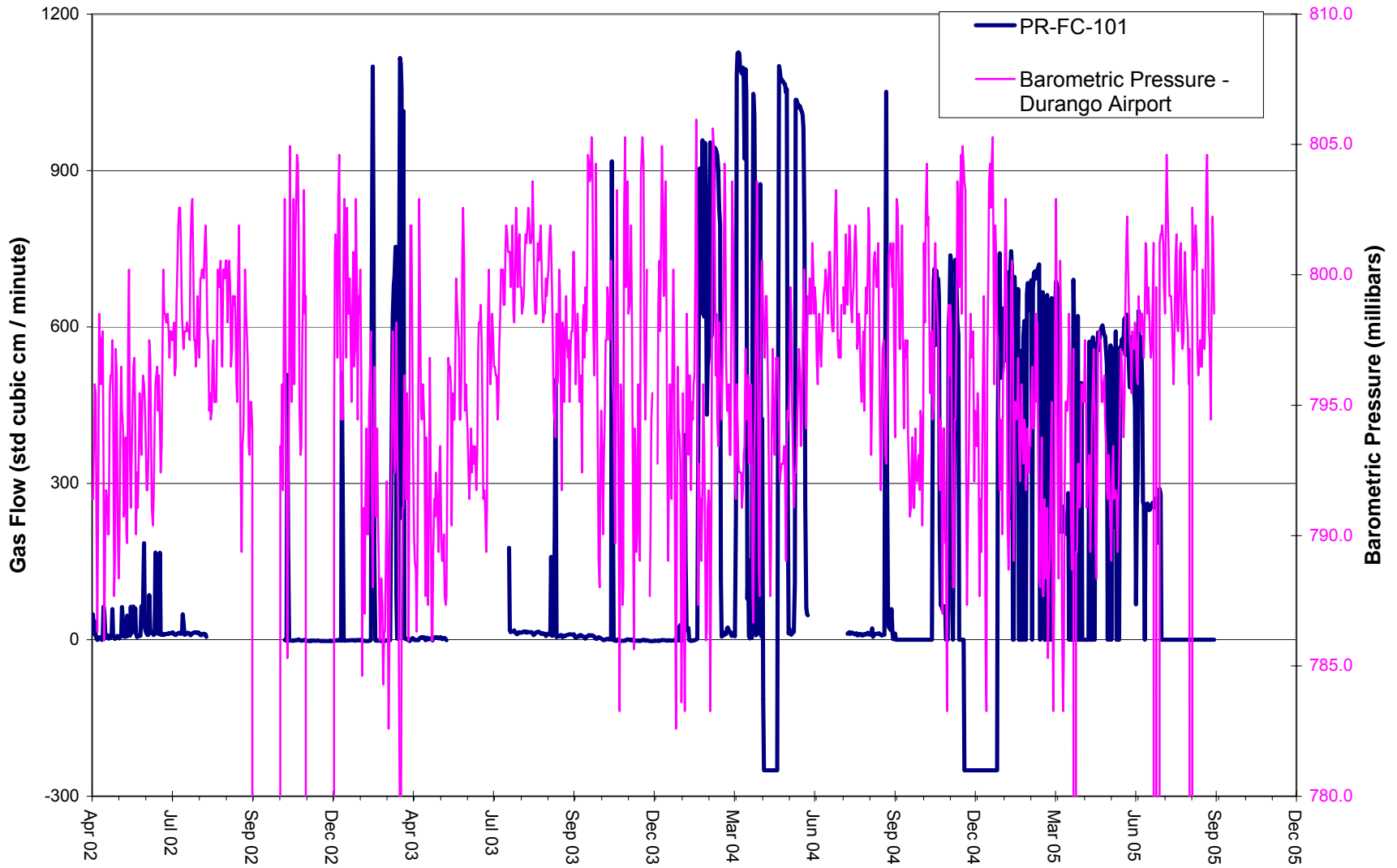
Texas Creek Land Gas Flux vs Barometric Pressure - 2002-2005



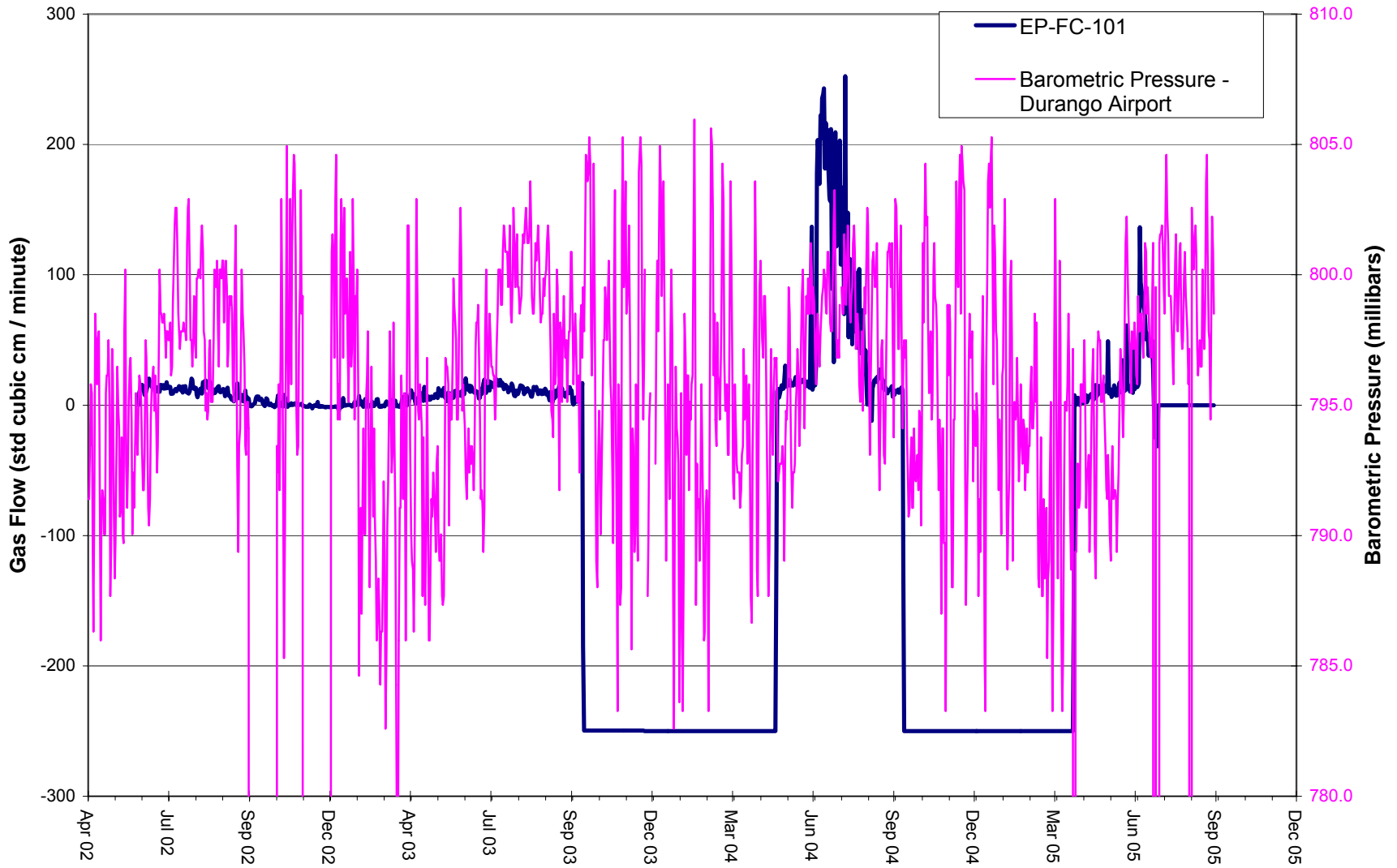
Texas Creek Gas Flux vs Barometric Pressure - 2002-2005



Pine River Gas Flux vs Barometric Pressure - 2002-2005

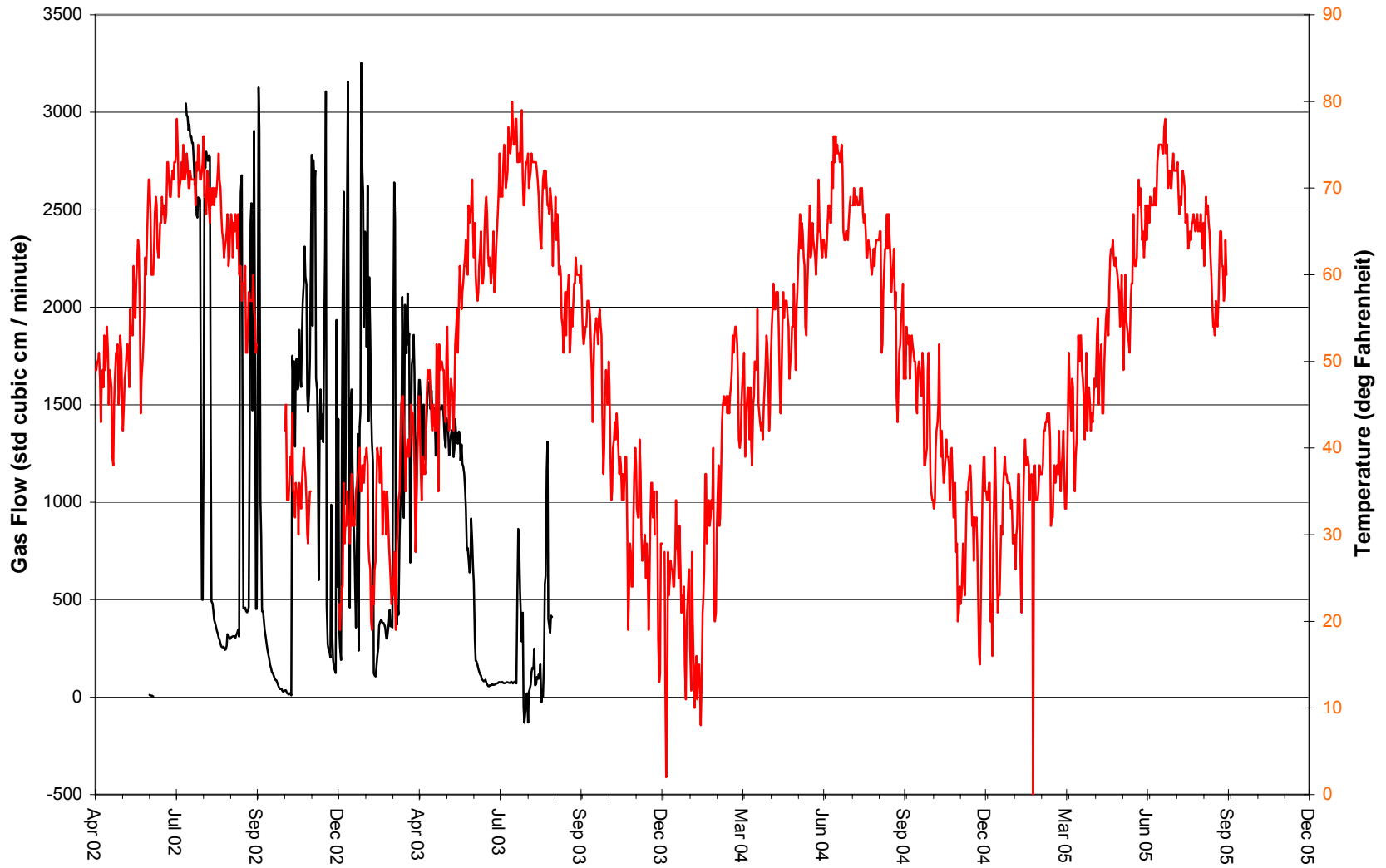


East Pine Gas Flux vs Barometric Pressure - 2002-2005

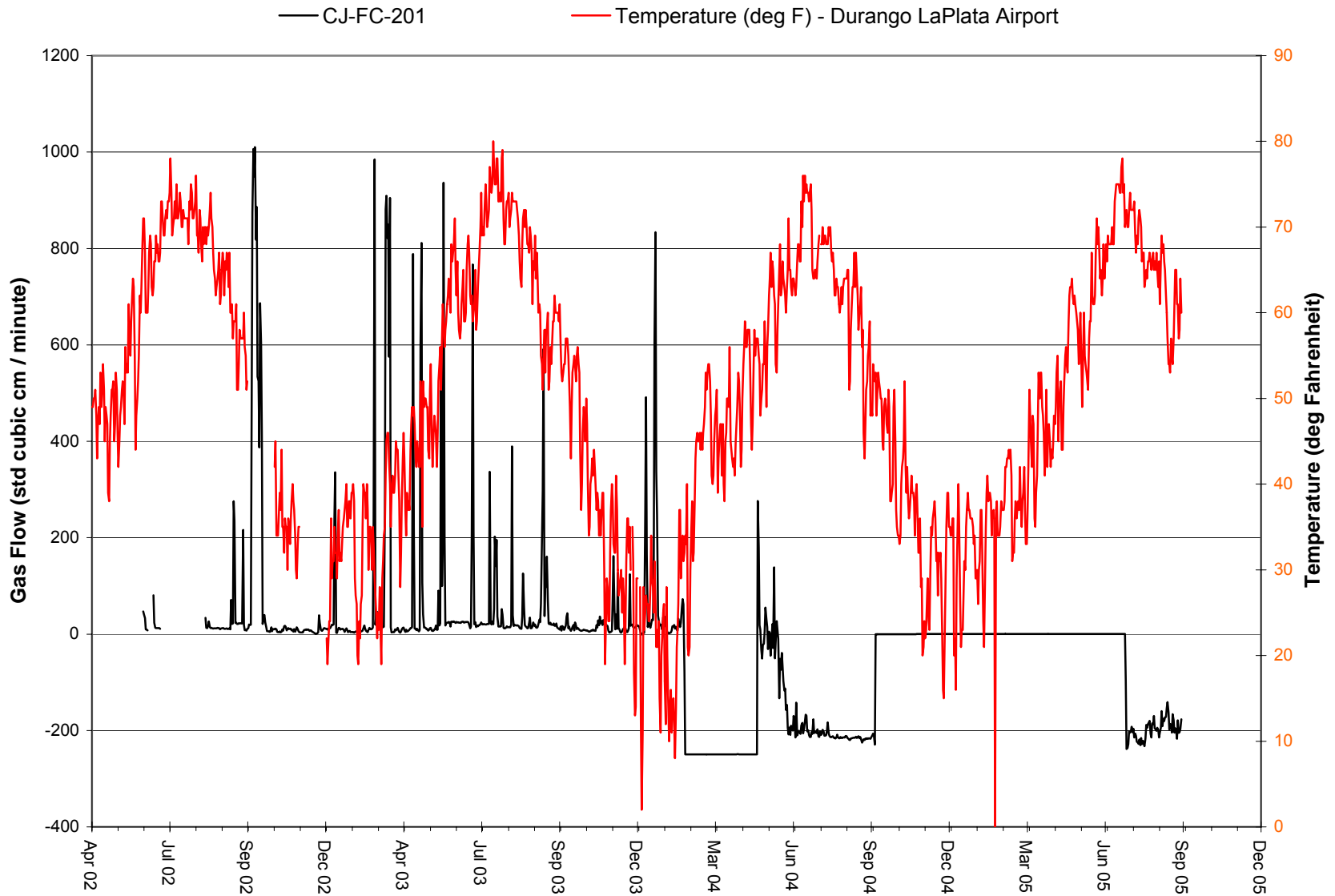


Basin Creek Gas Flux vs Temperature - 2002 - 2005

— BC-FC-101 — Temperature (deg F) - Durango LaPlata Airport

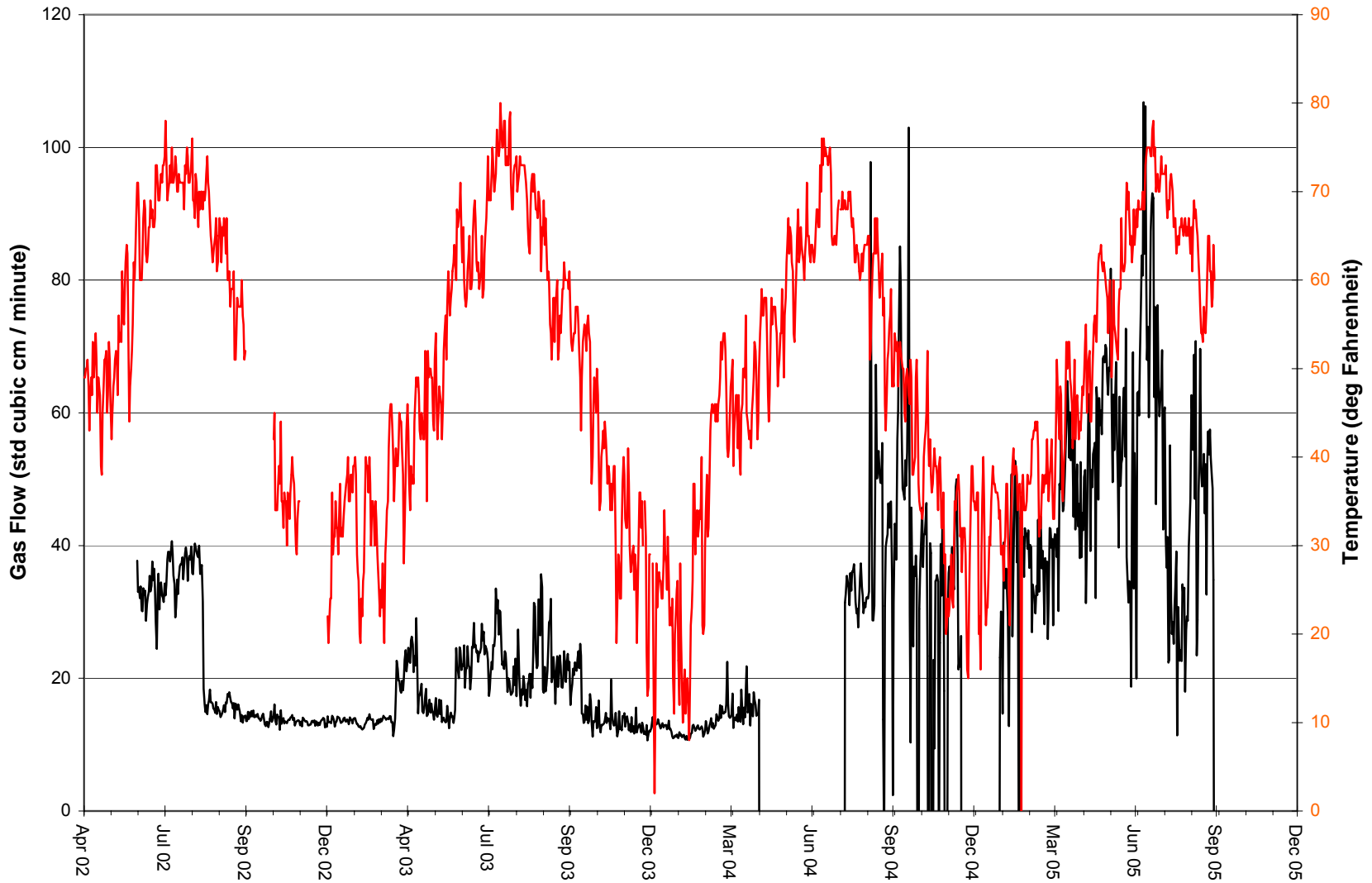


Carbon Junction Gas Flux vs Temperature - 2002 - 2005



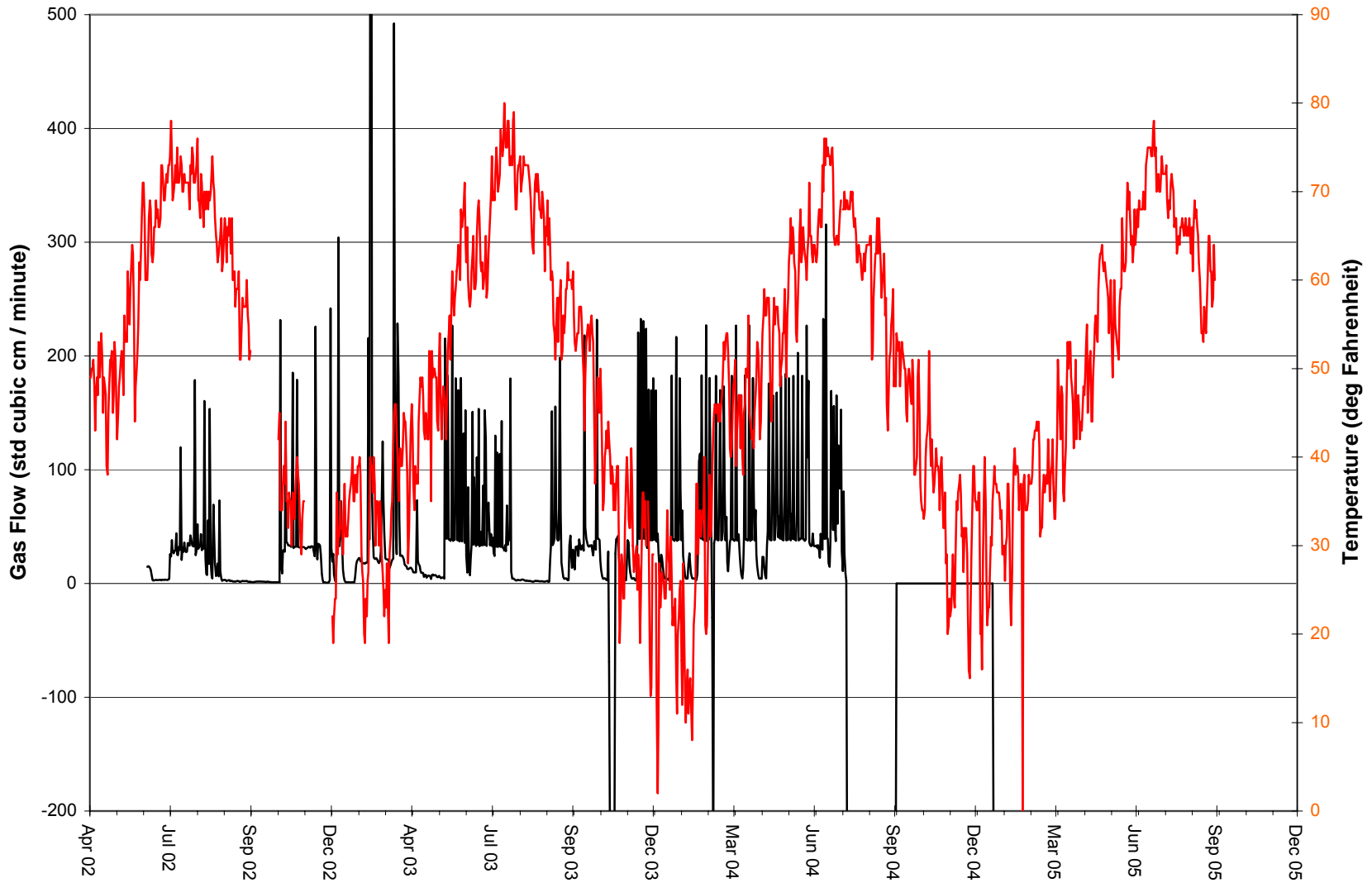
Florida River Gas Flux vs Temperature - 2002 - 2005

— FR-FC-101 — Temperature (deg F) - Durango LaPlata Airport



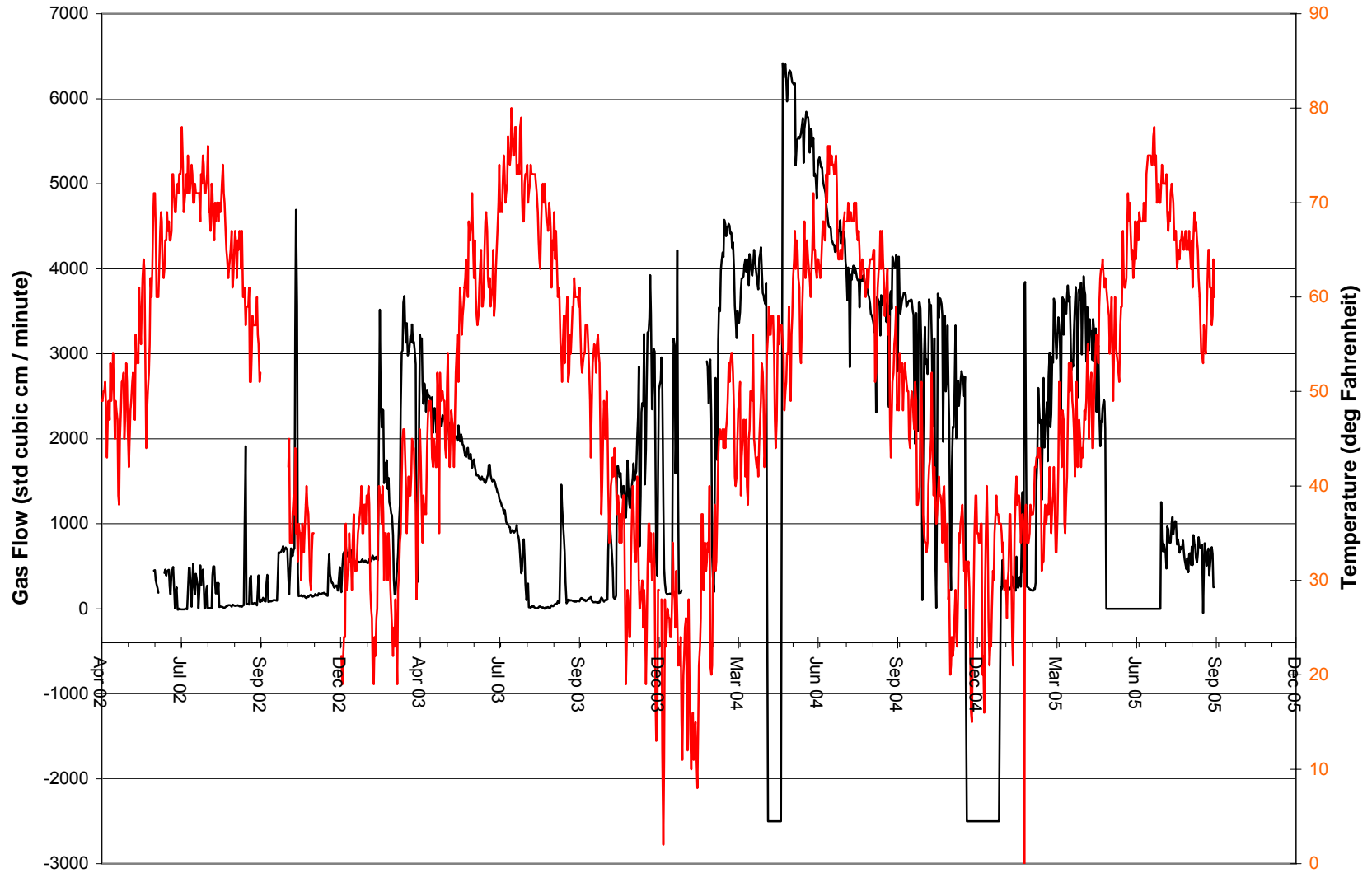
Texas Land Creek Gas Flux vs Temperature - 2002 - 2005

— TL-FC-101 — Temperature (deg F) - Durango LaPlata Airport

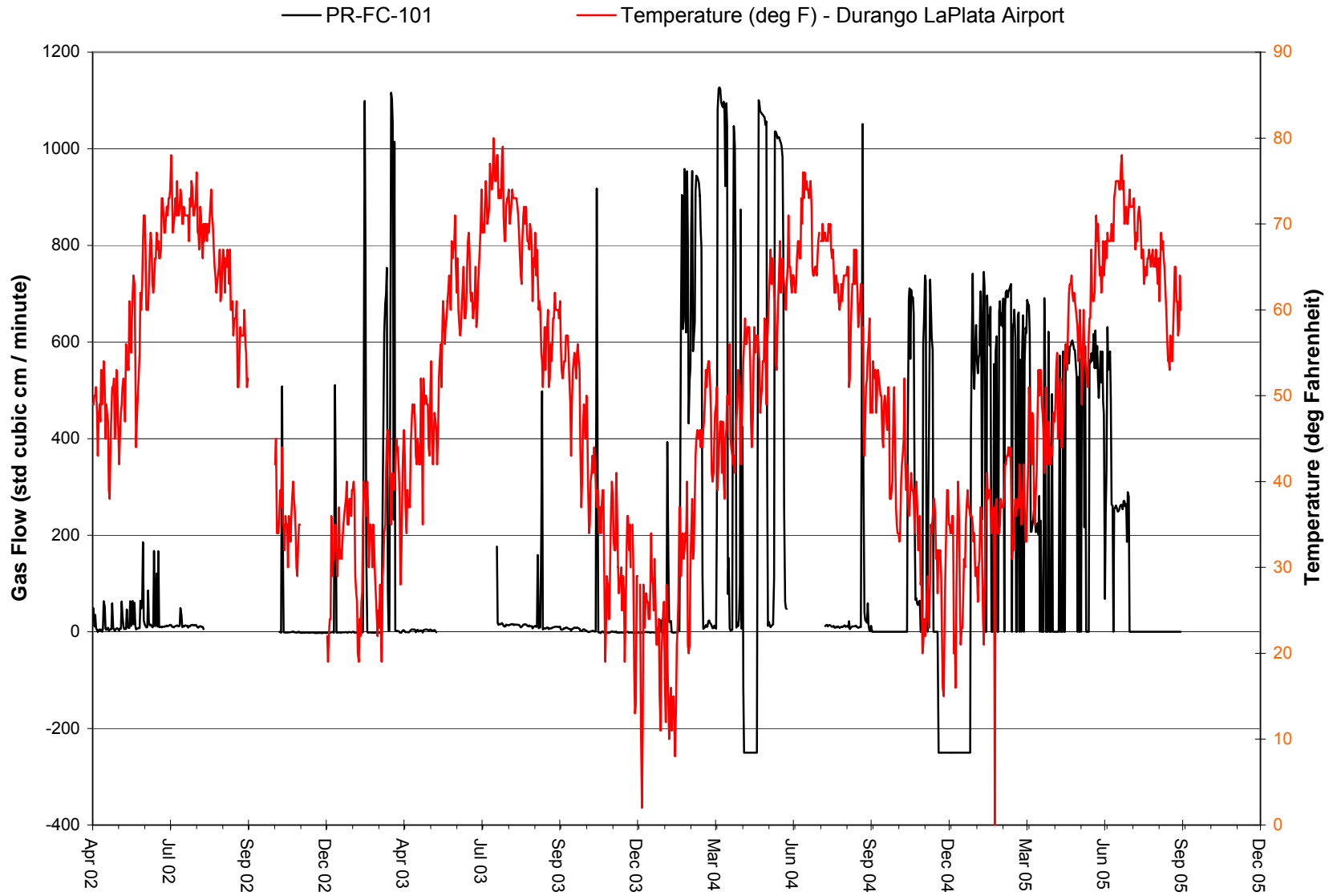


Texas Creek Gas Flux vs Temperature - 2002 - 2005

— TC-FC-101 — Temperature (deg F) - Durango LaPlata Airport



Pine River Gas Flux vs Temperature - 2002 - 2005



East Pine Gas Flux vs Temperature - 2002 - 2005

— EP-FC-101 — Temperature (deg F) - Durango LaPlata Airport

