

File Path: Y:\GIS\Projects\Prather\_Springs\Maps\OGC\_mtg092908\Chloride\_results.mxd



Surface Water Sampling Location

Creek

Monitoring Wells

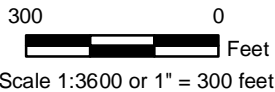
Shallow

Intermediate

Deep

NOTES:  
1. Horizontal Datum: UTM,  
NAD83, Zone 13N, meters  
2. Vertical Datum: NAVD29

**Orange Labels** One or more results exceed 250 mg/L  
**Green Labels** Chloride results less than 250 mg/L



**FIGURE 21** Overview of Chloride Results

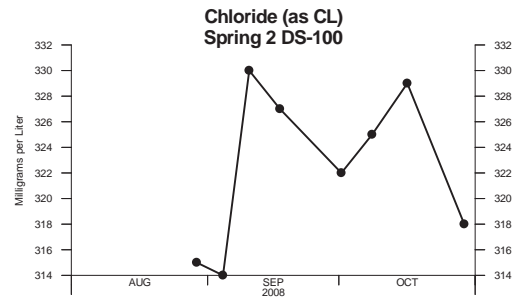
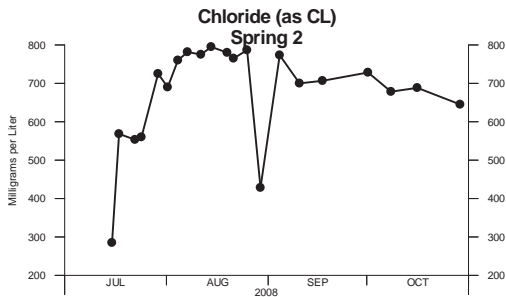
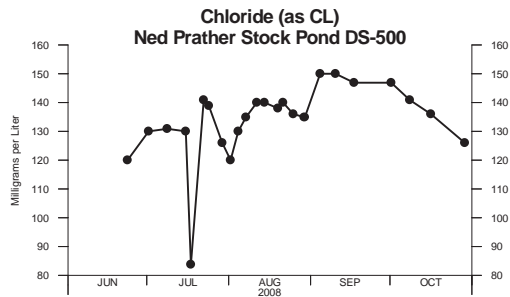
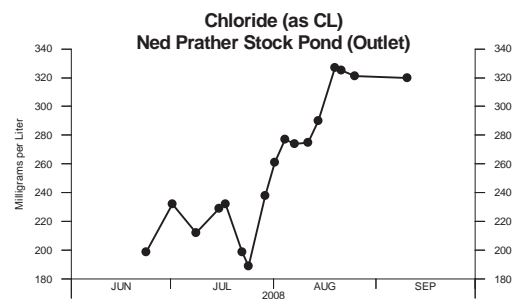
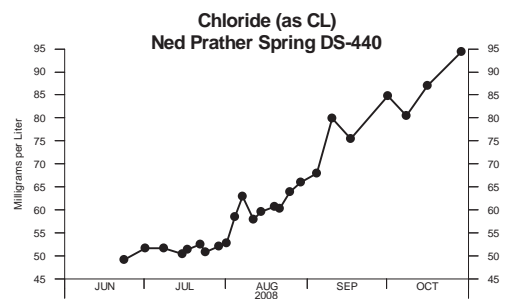
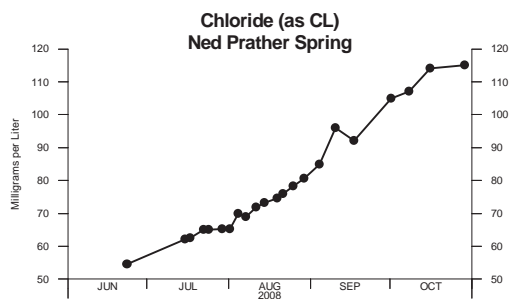
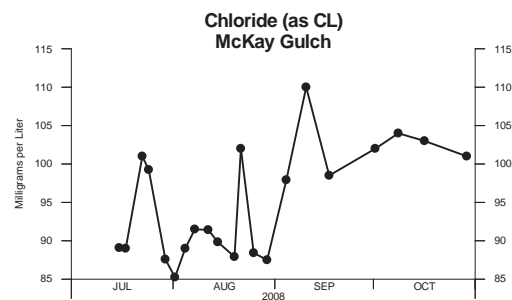
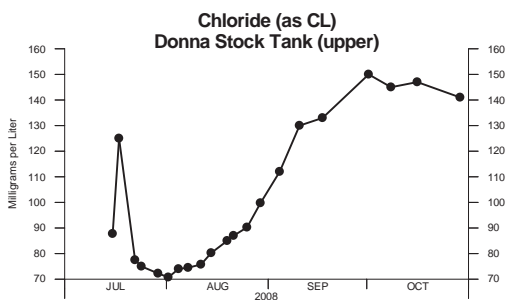
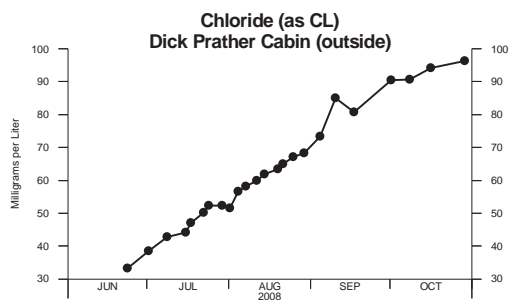
Phase I Prather Spring Site Investigation

File Name  
Chloride\_results.mxd

Rev. Date  
11/21/08

Dr. By  
GCK





#### EXPLANATION

- - Measured Value
- - Undetected (Displayed at RL)

# URS

Project Name: Prather Spring

Job No: 22239335

Date: November 2008

**Figure 22. Time-Series Graphs  
Chloride (as CL)  
Phase I Site Investigation  
Parachute, Colorado**



File Path: Y:\GIS\Projects\Prather\_Springs\Maps\OGC\_mtg092908\HC\_results\_s2.mxd



Surface Water Sampling Location

Creek

Monitoring Wells

Shallow

Intermediate

Deep

**Orange Labels** One or more indicator hydrocarbon analytes exceed the Colorado Basic Groundwater Standard or other standard for the constituent

**Yellow Labels** One or more indicator hydrocarbon analytes were detected, but no results exceeds an associated standard.

**Green Labels** No indicator hydrocarbon analytes were detected

800

Feet

Scale 1:960 or 1" = 80 feet

NOTES:  
1. Horizontal Datum: UTM, NAD83, Zone 13N, meters  
2. Vertical Datum: NAVD29



**FIGURE 23** Spring 2 Area Hydrocarbon Results

Phase I Prather Spring Site Investigation

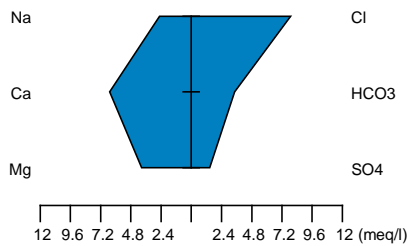
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Rev. Date  
11/21/08

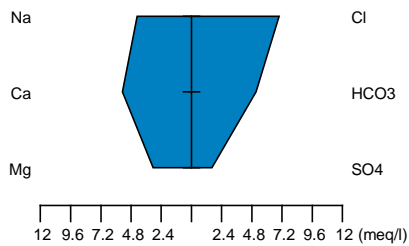
Dr. By  
GCK



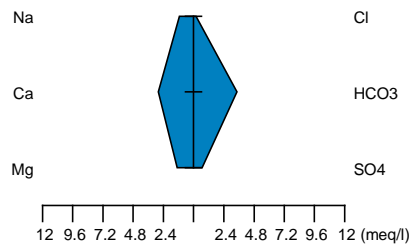
*PS-MW07S, 9/10/2008*



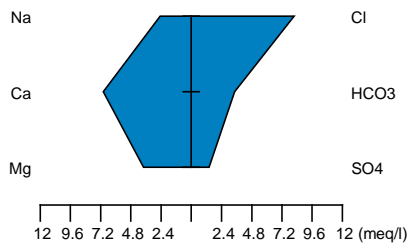
*PS-MW08S, 9/8/2008*



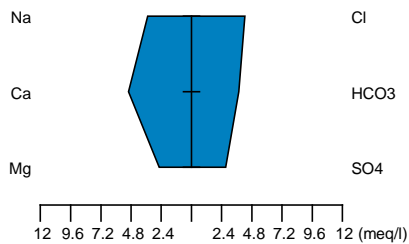
*PS-MW09S, 9/10/2008*



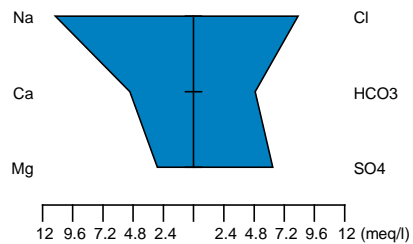
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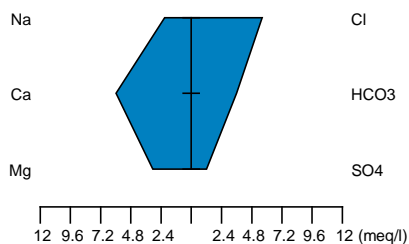
*PS-MW07D, 9/10/2008*



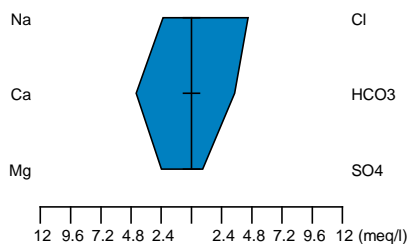
*PS-MW08D, 9/8/2008*



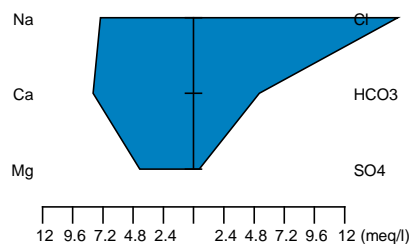
*PS-MW10D, 9/10/2008*



*Spring 2, 6/4/2008*



*Spring 2, 9/4/2008*



DESCRIPTION: **Figure 24.** Stiff Diagram for Shallow and Deep Groundwater Wells - Spring 2

PROJECT: Prather Springs

PROJECT NO: 22239335

CLIENT: Joint Companies

DATE: 11/24/2008



Appendix A - Cordilleran EM-34 Survey Report

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## **EM Survey Results**

An EM 34 survey was used to delineate shallow geologic/hydrogeologic features located in the near surface in the area of the Prather Spring and Spring 2 for the purpose in positioning additional monitoring wells. The Geonics EM34-3 system was used to acquire apparent terrain conductivity of the subsurface in these areas. The EM34-3 consists of two coils with one coil as a transmitter and the other coil as a receiver. The primary magnetic field is generated from the transmitter which induces current into the subsurface. This current generates a secondary magnetic field which is detected along with the primary field by the receiver coil. A total of line length of 1625 meters for 13 transects was surveyed in both areas with a measurement recorded every 10 meters or 30 feet with an effective penetration depth of approximately 25 feet below ground surface (ft-bgs).

The surveys were used to differentiate between saturated colluvium and unsaturated shallow bedrock or siltstone and also to determine if saline conditions exist in the shallow groundwater. The EM survey conductivity data was calibrated using well logs from existing monitoring wells in the areas. The conductivity of the colluvium is influenced by the presence of water and therefore this method was used based a sufficient conductivity contrast between wet colluvium or wet bedrock, which has a higher conductivity (generally greater than 10 mS/m) than the conductivity of dry colluvium or dry siltstone (generally less than 10 mS/m).

A contour map of the observed apparent terrain conductivity values for both areas is shown in Figure 1. The apparent conductivity values found in the Prather Spring area varied from 4 millisiemens per meter (mS/m) to 18 mS/m. The apparent conductivity values in the Spring 2 area varied from 4 mS/m to 150 mS/m. The high conductivity values (greater than 20 mS/m) that were found in the Spring 2 valley were located along the road and are not shown on the map due to the presence of the buried metallic pipe which was unknown at the time of the survey.

In the Prather Spring area, the relationship between the conductivity data and the area geology was based on the well logs from the recently installed monitoring wells and was the basis for the interpretation of the conductivity data. The areas of relatively high conductivity (greater than 10 mS/m) occur where shallow groundwater is encountered (< 15 ft) in the colluvium and were found on the north end of this valley or nearest to the spring (Figure 1). Conductivity values of less than 10 mS/m were found towards the south and away from the spring and up on both sides of the valley (Figure 1). These patterns of conductivity values indicated that towards the north, shallow groundwater would be encountered in colluvium overlying bedrock and towards the south a thin colluvium overlies shallow bedrock void of groundwater in the colluvium. On both sides of this valley, the conductivity values indicate shallow bedrock void of colluvium and greater than 25 ft- bgs to groundwater.

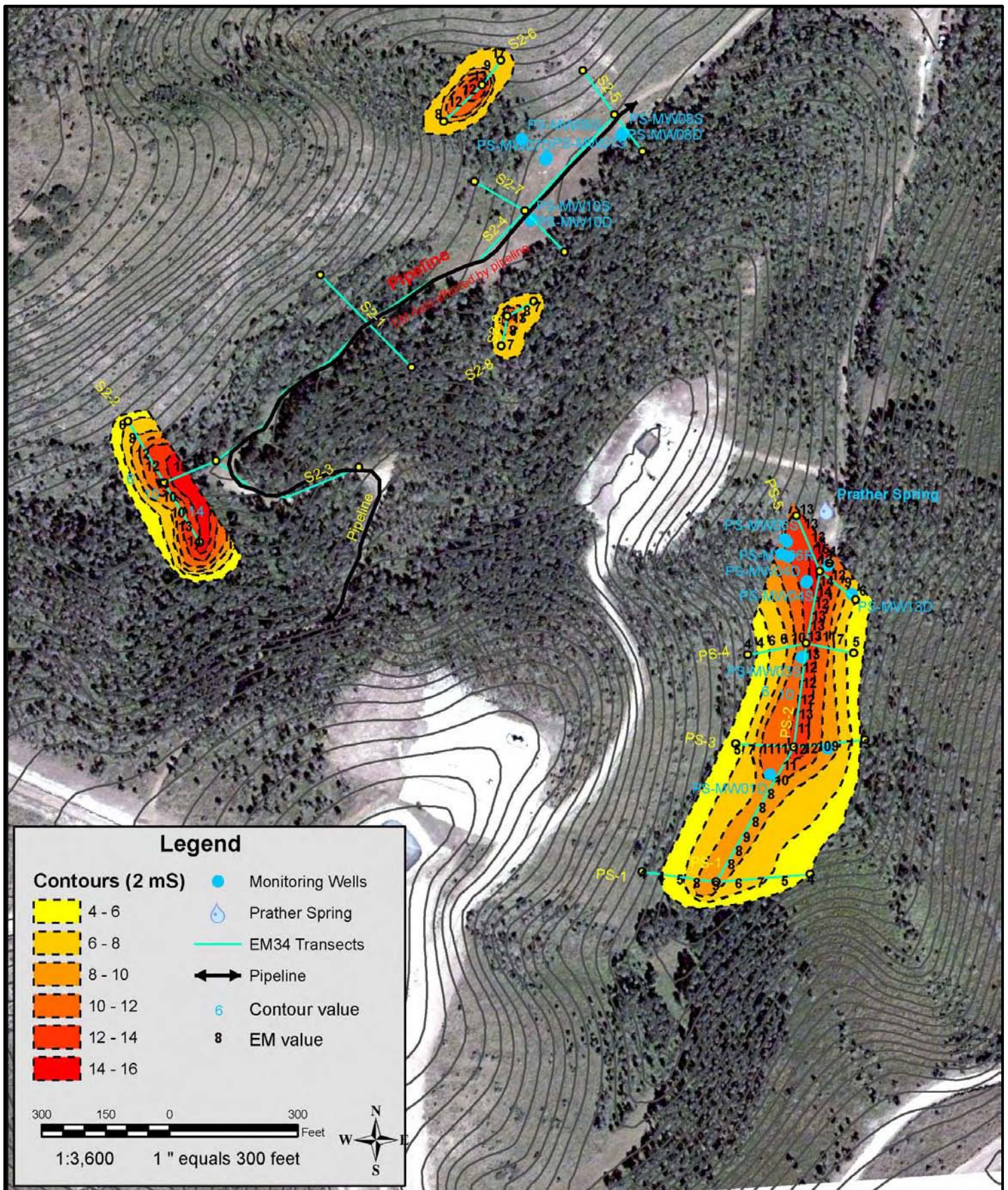
In the Spring 2 area, the interpretation of the conductivity data was based on area monitoring wells logs. The EM survey was conducted prior to learning about the metallic pipeline buried along the existing road and down the center of this valley. Within 30 feet of the metallic pipeline, the EM data was affected by the metallic pipeline resulting in anomalously high conductivity values throughout the entire valley and therefore the data is not usable for the interpretation of subsurface conditions along the



road. However, three of the EM transects (S2-2, S2-6 and S2-8) were not affected by the pipeline (Figure 1). The conductivity values recorded along these transects were similar to the Prather Spring area transects with conductivity values greater than 10 mS/m in the lower areas and conductivity values of less than 10 mS/m were found above the topographically low areas (Figure 1). For these transects, groundwater is encountered in shallow bedrock along with a thin colluvium. On both sides of this valley, the conductivity values indicate shallow bedrock and deeper than 25 ft- bgs to groundwater.

An additional monitoring well installed to shallow groundwater in colluvium in the area of the Prather Spring may be considered in the center of the valley and near the Puckett property line. Additional monitoring wells installed in shallow groundwater may be considered in the area near the S2-2 transect and in the area near the S2-8 transect (Figure 1). Although bedrock was detected by the EM data, it did not differentiate between fractured and unfractured bedrock.

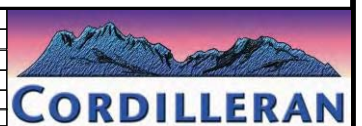




**Fig. 1**

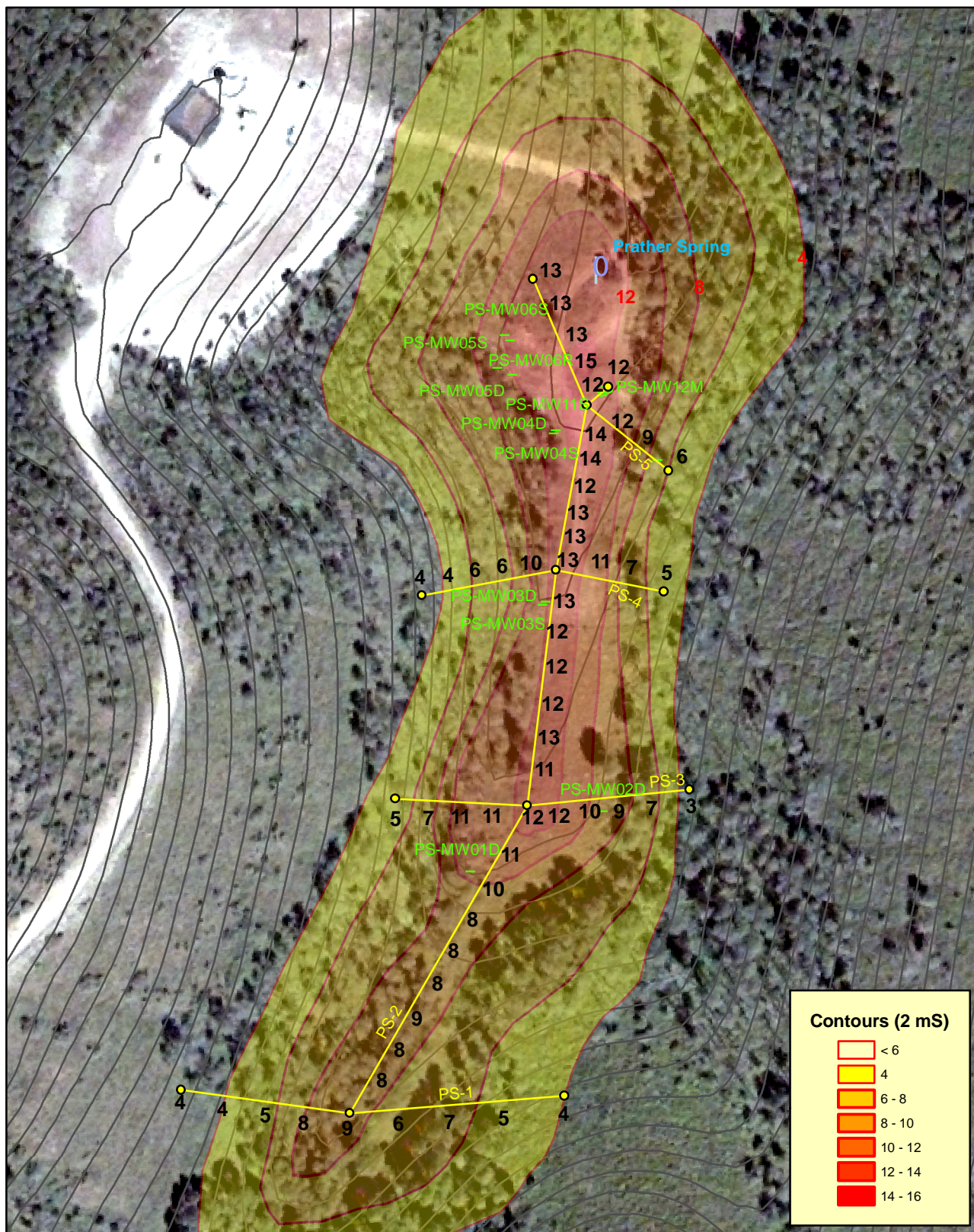
Contoured EM34 Conductivity Data  
for the Prather Springs and  
Spring 2 Areas

Revision Date:	10/30/08
Revision Number:	0
Revised by:	JGM
Approved by:	-
Project Number:	
Scale (approx):	See Map

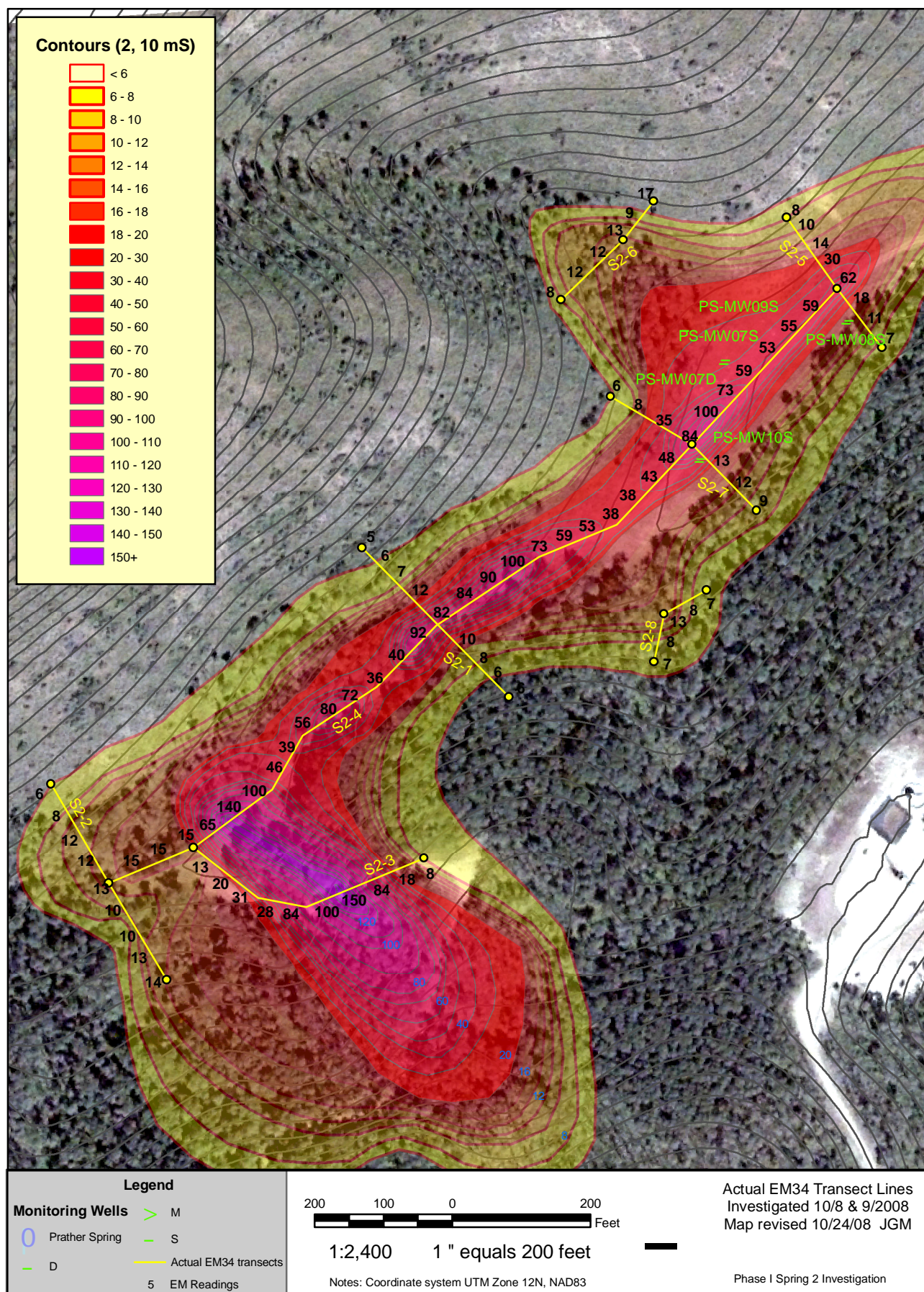


**Figure 1**











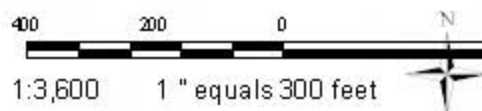


**Legend**

Monitoring Wells    ● S  
 ○ D  
 ⊕ M

— Actual EM34 transect

Notes: Coordinate system: UTM Zone 12N, NAD83



Actual EM34 Transect Lines  
 Investigated 10/8 & 9/2008  
 Map revised 10/15/08 JGM

Phase I Prater Spring Site Investigation