Tracing Groundwater Flowpaths in the Edwards Aquifer Recharge Zone, Panther Springs Creek Basin, Northern Bexar County, Texas

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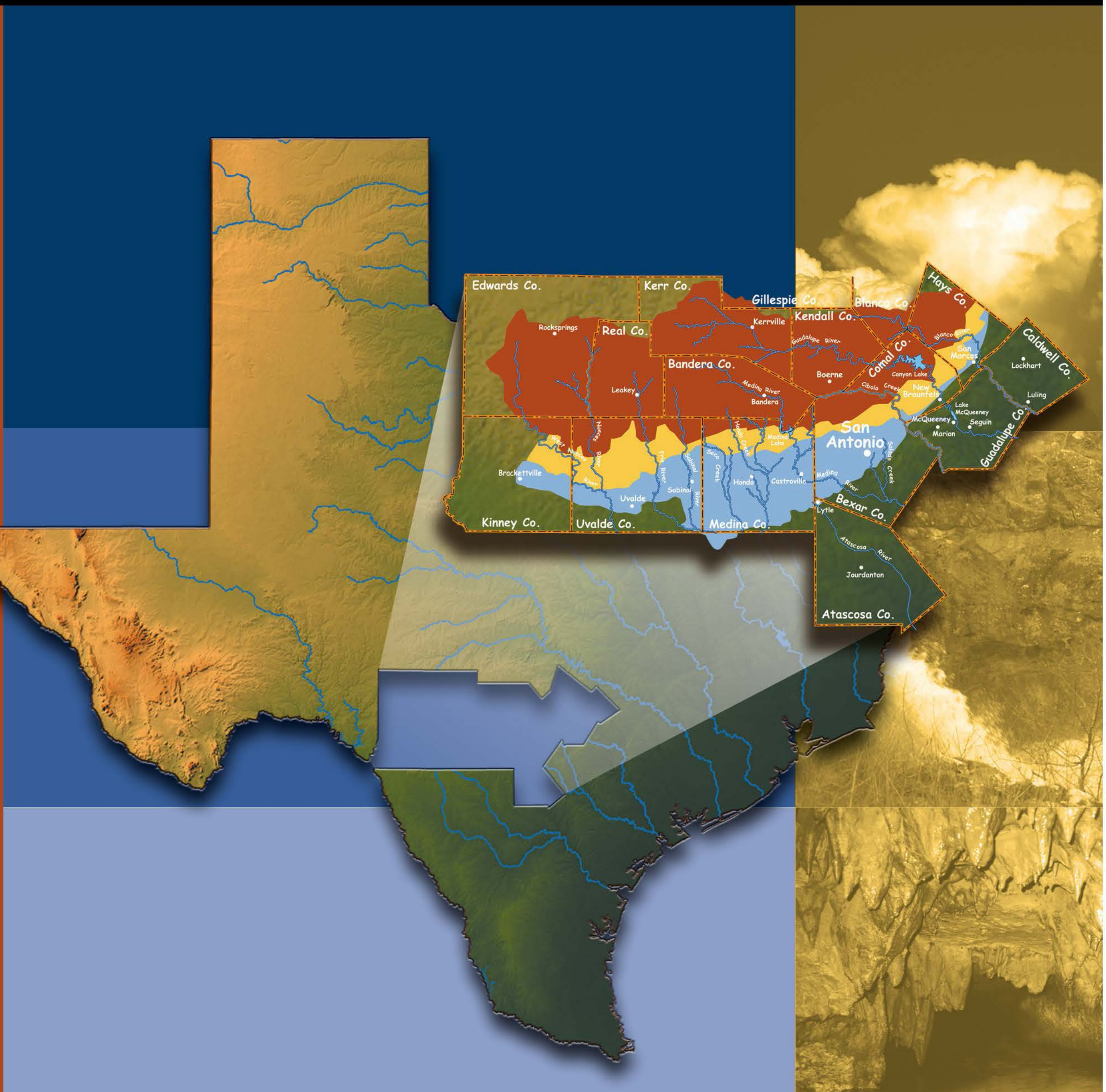

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Tracing Groundwater Flowpaths in the Edwards Aquifer Recharge Zone, Panther Springs Creek Basin, Northern Bexar County, Texas

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EXECUTIVE SUMMARY

This report presents the findings of investigations by the Edwards Aquifer Authority (Authority) of groundwater flowpaths, velocities, and hydrostratigraphy in the Panther Springs Creek groundwater basin, northern Bexar County, Texas.

Purpose

The purpose of this study was to characterize groundwater-flow directions and velocities and to evaluate hydrostratigraphy in the Edwards Aquifer recharge zone in northern Bexar County in south-central Texas.

Scope of the Investigation

In a series of four phases, the Authority injected nontoxic organic dyes into six caves in northern Bexar County within the San Antonio segment of the Balcones Fault Zone Edwards Aquifer to trace groundwater flowpaths and measure groundwater-flow velocities. Each phase built on the findings of the previous phase. The monitoring array consisted of 32 public and private wells, including irrigation wells at the Club at Sonterra, Bexar Metropolitan Water District public water supply wells in the Hollywood Park and Shavano Park areas, and Authority monitor wells. The wells were completed in either the Edwards or the Trinity Aquifer.

Findings of the Investigation

- Results of tracer tests revealed discrete groundwater flowpaths near Panther Springs Creek. Dyes were detected primarily in well 68-28-608 and at lower concentrations in seven other wells. Groundwater velocities to well 68-28-608 ranged from 1,134 to 5,300 meters per day (m/d). Velocities to the seven other wells in which dye was detected ranged from 13 to 2,330 m/d. Velocities were calculated on the basis of straight-line (point-to-point) distances between dye injection and recovery points divided by the time between injection and the first appearance of dye. Because actual groundwater flowpaths are expected to be longer than straight-line distances, actual groundwater velocities are probably greater than calculated groundwater velocities.
- Results demonstrate that groundwater flows freely between injection points in the upper member of the Glen Rose Formation (the hydrostratigraphic unit that comprises the Upper Trinity Aquifer) and detection points in the Edwards Aquifer. Dye was injected into Boneyard Pit and Poor Boy Baculum Cave, which penetrate approximately 40 m of unsaturated Edwards Limestone to the upper member of the Glen Rose Formation. Blanco Road Cave probably extends through the Edwards Limestone to the Glen Rose Formation, although the full vertical extent of Blanco Road Cave could not be entered. Seven of the wells where dye was detected are completed in the Edwards Aquifer, and one is completed in the Trinity Aquifer. Dyes traveling along flowpaths between caves and wells crossed several northeast-southwest-trending faults in which members of the Edwards and Glen Rose formations are juxtaposed. Faults with up to 104 m of vertical displacement did not impede groundwater flow. Consequently, these tracer tests demonstrate excellent communication between groundwater in the Upper Trinity Aquifer and the Edwards Aquifer in the study area.
- One trace was also initiated through a 1-m^2 site thinly covered by soil in an interstream upland area with no observable karst features such as sinkholes, dissolutioned fractures, or caves. Dye was injected in this site followed by 180,000 L of water (at an average rate of 250 L per hour) over a one-month period. Dye was subsequently detected in two wells. This trace demonstrates that vulnerability to contamination is not limited to recognizable karst landforms such as caves and sinkholes.
- The study revealed the three-dimensional groundwater flow system in the Edwards Aquifer in the Panther Springs Creek area. Groundwater flowpaths shift laterally and vertically in response to changing aquifer conditions. Rapid groundwater velocities (>100 m/d) are typical in karst aquifers. Finally, this study demonstrates that large and diverse data sets are required for an adequate characterization of karst aquifers, including tracer tests, hydrophysical surveys, continuous water level measurements, cave mapping, and high-frequency water sampling.

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Abbreviations and acronyms

BEG .... Bureau of Economic Geology, The University of Texas at Austin
d .... day
g .... gram
g/m^3 .... grams per cubic meter
h .... hour
kg .... kilogram
km .... kilometer
L .... liter
LOD .... limit of detection
LOQ .... limit of quantitation
m .... meter
mm .... millimeter
msl .... mean sea level
µg/L .... micro grams per liter
NA .... not available
nm .... nanometer
PCE .... tetrachloroethene
ppb .... parts per billion
ppm .... parts per million
PWS .... public water supply well
QC/QA .... quality control/quality assurance
RPD .... relative percent difference
T .... transmissivity
TDS .... total dissolved solids
USGS .... U.S. Geological Survey

INTRODUCTION

The San Antonio Segment of the Balcones Fault Zone of the Edwards Aquifer (Edwards Aquifer), one of the most permeable and productive aquifers in the United States, provides water to more than 1.7 million people in the south-central Texas region. This highly dissolutioned and faulted karst aquifer is developed in Cretaceous limestones. Groundwater movement in the Edwards Aquifer has been characterized primarily by aquifer tests and geochemical data, potentiometric surface mapping, and computer modeling. Whereas each of these techniques provides useful information, tracer testing has long been recognized by karst hydro-geologists as the most effective tool for quantifying groundwater movement in karst aquifers. Therefore, tracer testing provides empirical data on karst ground-water behavior that can be used to determine groundwater flowpaths, delineate groundwater drainage basins, and measure groundwater velocities, contaminant dilution and dispersion, and aquifer storage properties. Therefore, tracer tests, which provide reproducible data, are far more reliable than other methods used to characterize karst aquifers.

The Edwards Aquifer Authority (Authority) and its contractor, George Veni and Associates, performed a series of tracer tests within the Panther Springs Creek groundwater basin in northern Bexar County/northern San Antonio. These tests involved six injections of nontoxic, organic, fluorescent dyes between October 2004 and September 2006. The purpose of the tracer tests was to determine groundwater flowpaths and measure groundwater velocities within the aquifer and to evaluate the interaction between the Trinity Aquifer (upper Glen Rose Limestone) and Edwards Aquifer.

The Panther Springs Creek surface watershed occupies 64.8 km^2 in northern Bexar County, as shown in Figure 1. Approximately the central 50% of the watershed is located over the Edwards Aquifer recharge zone. The northwestern 25% of the Panther Springs Creek watershed zone originates on the aquifer's contributing zone at Camp Bullis, where the surrounding land surface is largely undeveloped. The watershed drains south from the recharge zone onto the aquifer's transition zone and into a highly developed urban area of northern San Antonio. Ultimately, Panther Springs Creek discharges into Salado Creek, a tributary of the San Antonio River.

The tracer-test monitoring array consisted of 32 public and private wells, including irrigation wells at the Club at Sonterra (golf course), Bexar Metropolitan Water District (BexarMet) public water supply wells in the Hollywood Park area, City of Shavano Park public water supply wells, and Authority monitoring wells. Wells used for monitoring in the study were completed in either the Edwards Aquifer or the Trinity Aquifer. Figure 2 shows locations of wells monitored for this study.

Purpose and Scope

Objectives of these tracer tests were to

- measure groundwater velocity in the Edwards Aquifer Recharge Zone beneath the Panther Springs Creek area,
- investigate the hydrological connection between Edwards and Trinity aquifers, and
- investigate the role of faulting in northern Bexar County on groundwater flowpaths.

Figure 1. Location of Panther Springs Creek Basin and Contiguous Areas in North Central San Antonio

Geologic Setting

In the study area, the Edwards Aquifer is composed of the Lower Cretaceous-age Kainer and Person formations of the Edwards Group and the overlying Georgetown Formation. Three major components of the aquifer system are in the study area: the contributing zone, composed of upper and lower members of the Glen Rose Formation, which stratigraphically underlies the Edwards Aquifer but occurs at higher elevations than the Edwards Aquifer in the recharge zone as a result of faulting; the recharge zone, defined as the hydrologically contiguous outcrop of the Edwards Limestone within the Balcones Fault Zone; and the transition/artesian zone, where the Edwards Limestone

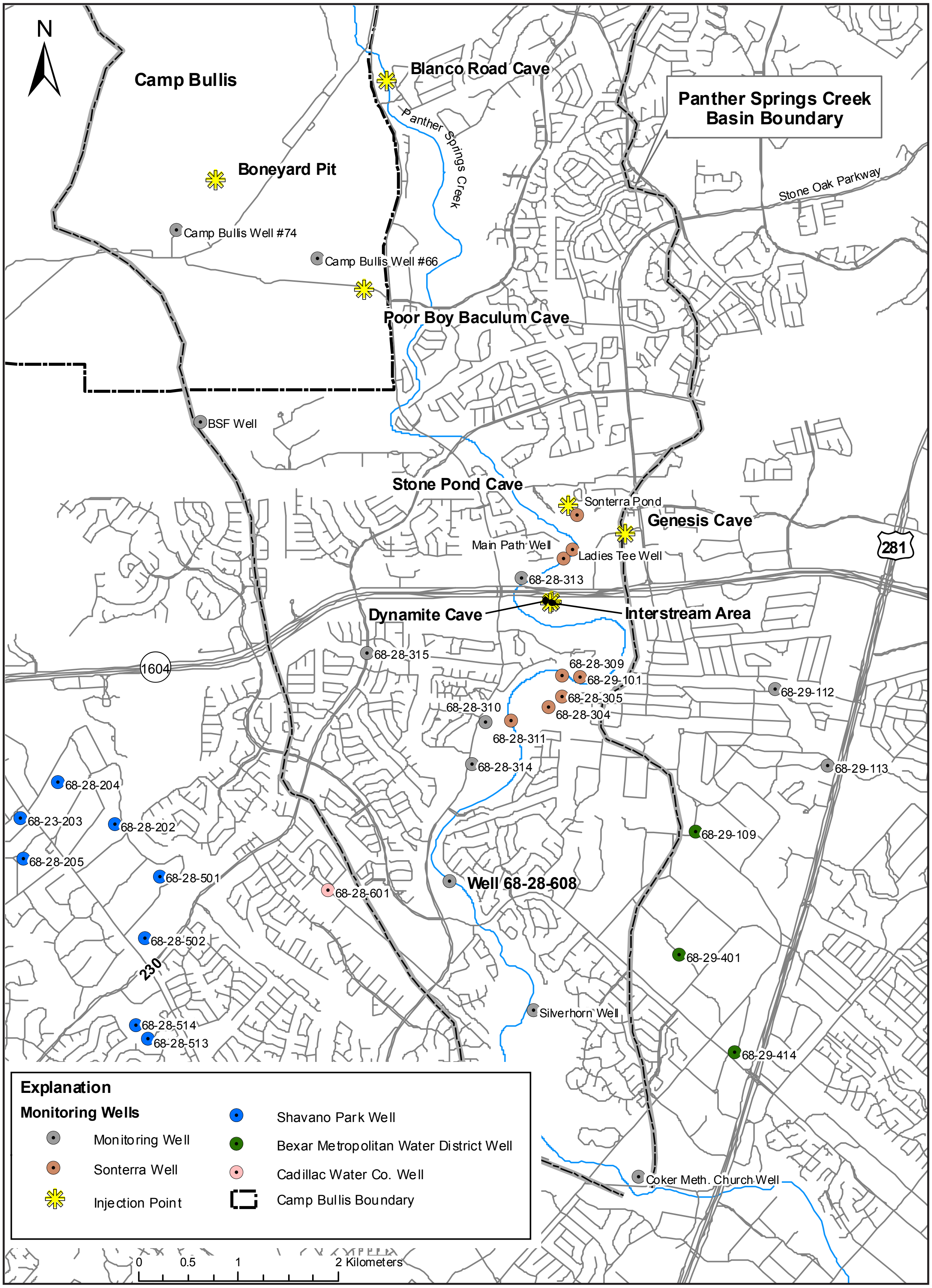


Figure 2. Locations of Injection Points and Monitoring Sites

is overlain by less-permeable units (Del Rio Clay, Buda Limestone, and Eagle Ford Group), although the aquifer is not normally fully saturated. The transition zone is defined as areas with "possible avenues for recharge of surface water to the Edwards Aquifer," according to Texas Administrative Code § 213.3(34). The artesian zone, where the Edwards Limestone is fully saturated, occurs south of the Panther Springs Creek watershed. The study area is within the area shown on Bulverde, Camp Bullis, Castle Hills, and Longhorn U.S. Geological Survey (USGS) 7.5-minute topographic maps.

Both the Edwards Limestone and some units of the upper member of the Glen Rose Formation have well-developed karst features, including caves, sinkholes, and sinking and losing streams. Panther Springs Creek is an ephemeral stream that carries water only after storm events and often loses all flow to the Edwards Aquifer within the recharge zone, which is characterized by thin, rocky soil and highly fractured bedrock. Precipitation and runoff are typically recharged quickly through fractures and karst features until several centimeters of rain has fallen.

The Panther Springs Creek watershed is within the Balcones Fault Zone, which is formed along the homoclinal hinge between the relatively flat lying strata of the Edwards Plateau to the northwest and the more steeply dipping strata in the Gulf of Mexico Basin to the southeast. Locally the fault zone is made up of a series of narrow fault blocks that are typically 900 to 2,300 m wide and generally drop down en echelon to the southeast toward the Gulf of Mexico. Most faults strike between 65° and 80° to the northeast. Most joints of the area parallel major and minor trends of the faults (Wermund et al., 1978). Individual fault displacements may be as much as 104 m, according to geophysical logs in the Panther Springs Creek watershed, but most major fault displacements are about 15 m. Many faults with less than three m of displacement do not appear on geologic maps because the absence of rock outcrops with vertical faces and low density of well data make them difficult to observe.

Within the study area, the Kainer and Person formations were further subdivided by Rose (1972) into seven informal members on the basis of their physical characteristics. In Bexar County, the Edwards Aquifer consists of approximately 147 m of limestone, with lesser quantities of chert, dolomite, and evaporites (Stein and Ozuna, 1995). Most of the members of the Edwards Limestone crop out at the surface near Panther Springs Creek because of faulting. Figure 3 shows the bedrock geology near the tracer tests. Because of erosion, a complete section of the Edwards Limestone is present only in fault blocks south of the recharge zone.

The upper member of the Glen Rose Formation is 137.3 m thick, and the lower member is 97.5 m thick (Clark, 2003) within the study area. Interval A of the upper member is about 37 m thick and highly karstified, and it yields usable amounts of water to wells. Regionally the upper member of the Glen Rose, consisting of poorly permeable, thinly bedded limestone and marl, acts as a lower confining unit for the Edwards Aquifer. However, in parts of the Bexar County area, it contains some highly permeable units, the extents of which are not fully mapped.

Faulting within the study area has juxtaposed the Edwards Limestone against permeable units within the upper and lower members of the Glen Rose Formation. The upper member of the Glen Rose comprises the Upper Trinity Aquifer, and the lower member is part of the Middle Trinity Aquifer. Because displacement of as much as 104 m has occurred along faults within the study area, some faults displace 70% of the Edwards Aquifer as delimited by the Edwards Limestone. Maclay and Small (1984) designated faults that displace 50% or more of the Edwards Limestone as major barriers to groundwater flow. One of the objectives of this study was to test that hypothesis.

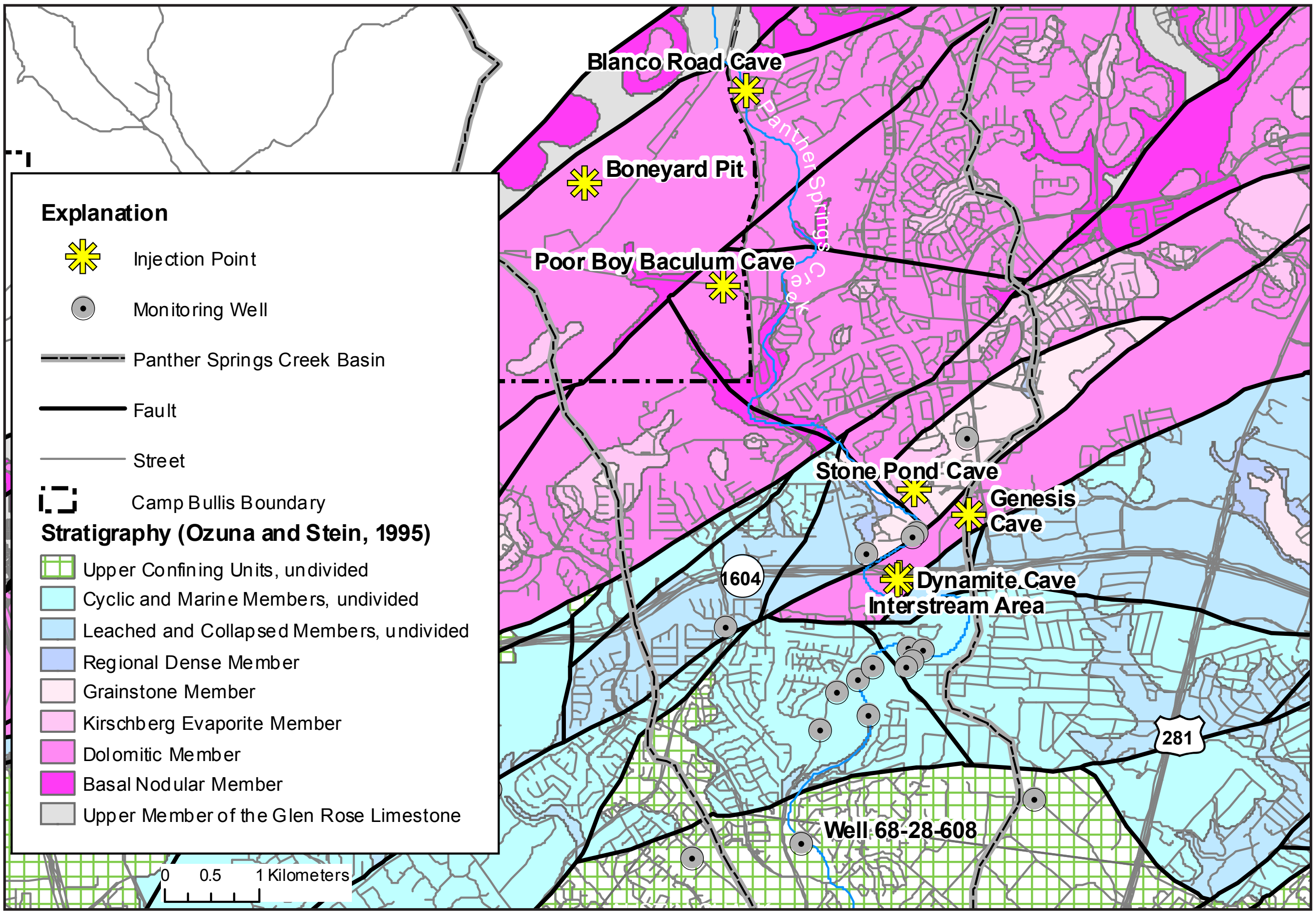


Figure 3. Geologic Map of the Tracer-Test Area

Hydrogeology

Both the Edwards and Trinity aquifers beneath the Panther Springs Creek watershed yield usable quantities of water to wells. For example, the Club at Sonterra extracts water from both aquifers for irrigating its golf courses.

Hydrographs in Figures 4 and 5 show the relationships between groundwater in Edwards and Middle Trinity aquifers in the study area. Each hydrograph shows water level elevations measured between April 2004 and February 2006 and precipitation at the San Antonio Airport. Figure 4 shows water levels in two irrigation wells completed in the Edwards Aquifer: 68-28-304 and 68-29-101. Well 68-28-304 is 116 m deep and cased to 31 m below land surface. Well 68-29-101 is 122 m deep, but casing depth is unknown. Both hydrographs show the influence of irrigation pumping, as well as their response to precipitation events such as September 2004 and May 2005. Rainy conditions in February 2005 are reflected in the hydrograph by a rebound of water levels when nearby irrigation pumping was curtailed. Water level elevations are typically above 198 m above mean sea level (msl).

Figure 5 shows hydrographs of wells in the Middle Trinity Aquifer, which are completed between 365 and 400 m below land surface, with the Edwards Aquifer cased off. The wells are used for irrigation, except for 68-29-100, which was drilled to supply water to a pond, but its yield was inadequate. The well displays a subtle rise in response to precipitation during the spring of 2005. Its water level elevation is generally higher than 200 m because it is upgradient of all other wells at the northeast end of the golf course and unaffected by pumping.

The other wells in Figure 5, 68-28-310, 68-28-309, Ladies Tee, and Main Path, are completed more than 365 m deep, with an open well bore below 107 to 122 m. The

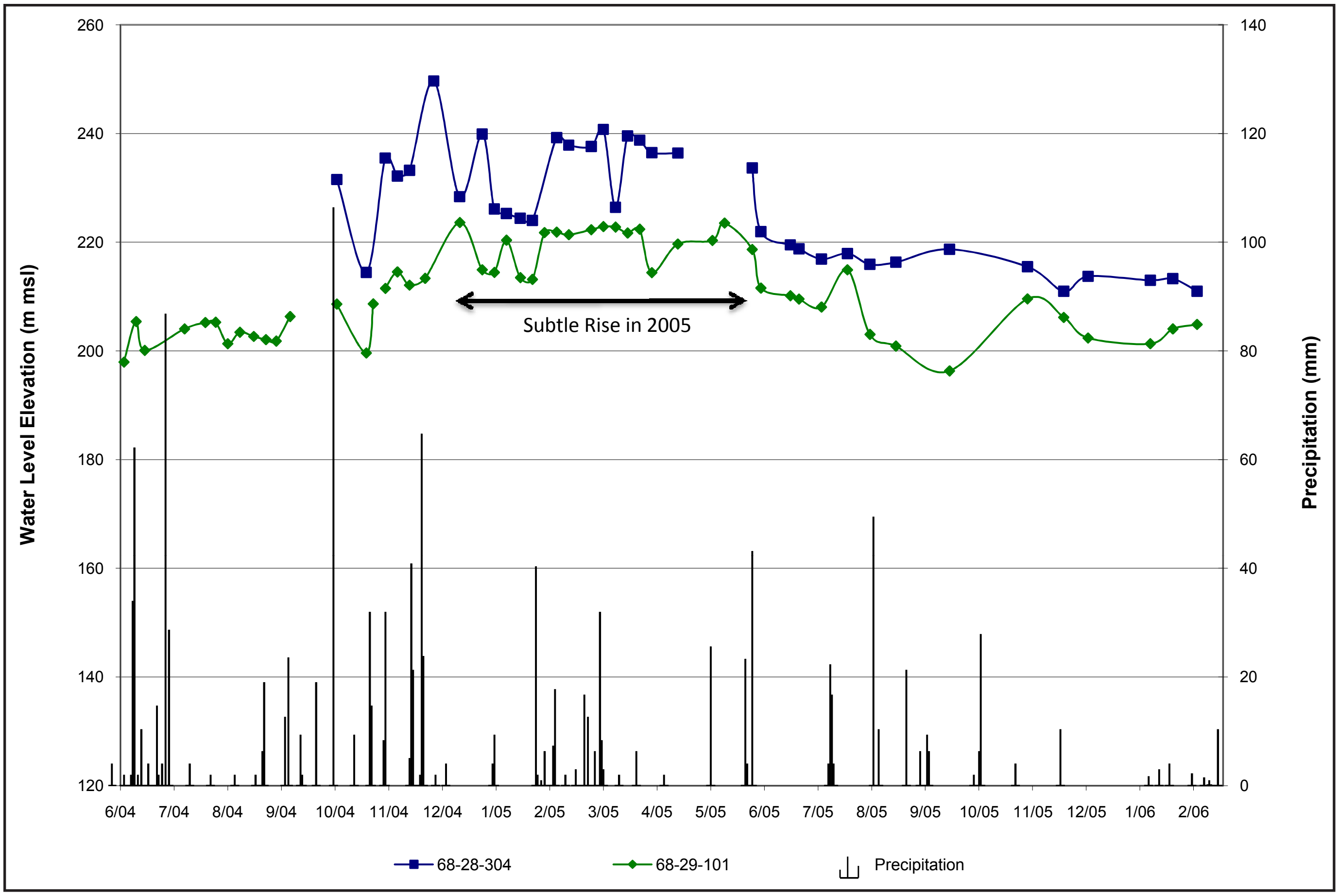


Figure 4. Hydrographs for Edwards Aquifer Wells 68-28-304 and 68-29-101

principal water-yielding zone for these wells is the Cow Creek Limestone, the lowermost unit of the Middle Trinity Aquifer, located near the bottom of the wells, although other units may contribute relatively smaller amounts of water. Water often cascades down the borehole wall in these wells, some of which probably originates from the Glen Rose Formation.

The hydrographs in Figures 4 and 5 indicate that water levels in the Middle Trinity Aquifer are generally lower in elevation than in the Edwards Aquifer, but occasionally the water level in 68-29-101 declines below 68-29-100 and 68-28-309. More subdued fluctuations of water levels in Middle Trinity wells suggest delivery of water along flowpaths longer than those of the Edwards wells and little or no recharge in their immediate area.

Figure 6 is a potentiometric surface map created from water levels measured in wells in July 2005. These data indicate that groundwater flows generally to the southeast in the Panther Springs Creek area, focused along a potentiometric trough beneath the creek. A trough in the potentiometric surface is interpreted to be evidence of a conduit or preferential groundwater

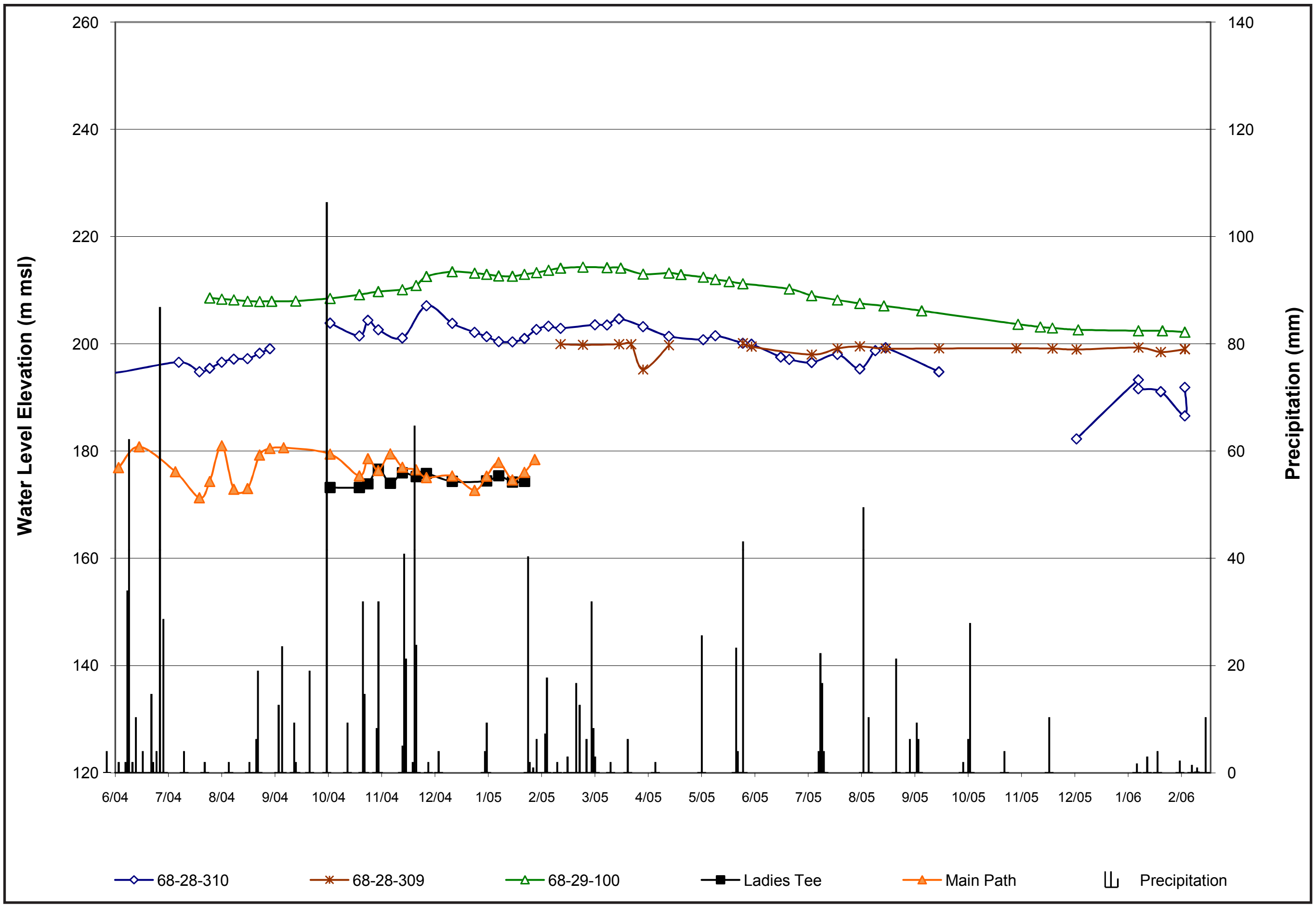


Figure 5. Hydrographs for Middle Trinity Aquifer Wells (Cow Creek Limestone) 68-28-310, 68-28-309, 68-29-100, Ladies Tee, and Main Path

flowpath in the aquifer (Worthington, 2003). Although water levels at least partly reflect pumping from irrigation wells in the area, discharge rates are probably not sufficient to sustain 10 to 20 m of relief on the potentiometric surface. The hydraulic gradient, steepest in contributing and recharge zones, flattens somewhat in the artesian zone. The water-table elevation near northern injection points is estimated at 300 m above msl, according to measurements in nearby Camp Bullis wells (Montgomery Watson Harza, 2005).

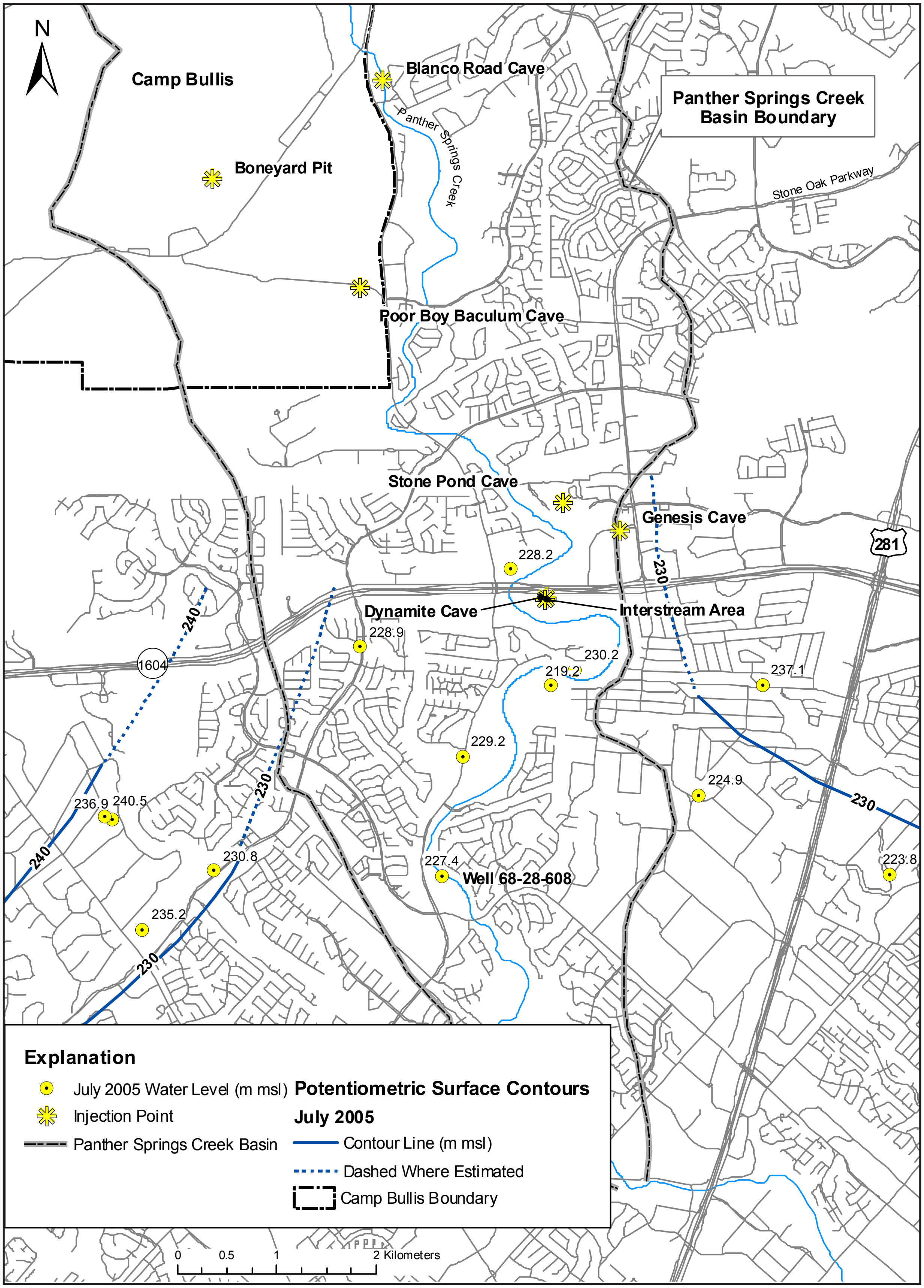


Figure 6. Potentiometric Surface Map of the Edwards Aquifer in the Panther Springs Creek Area—July 2005

METHODOLOGY

Groundwater tracing techniques are recognized as the only direct method of determining apparent or point-to-point groundwater travel times and flow directions in karst aquifers. Tracer testing involves introducing nontoxic, fluorescent, organic dyes into the subsurface via injection points, such as caves, sinkholes, and wells. After injection, charcoal receptors and water samples are collected from wells and springs within the monitored area and analyzed for the presence of dyes. Alexander and Quinlan (1996) discussed the methodology of groundwater tracing using fluorescent dyes in karst terrains.

Testing Phases

For this study, nine tracer tests were performed in four phases, using one or more injection points and tracers, as listed in Table 1. Each phase was designed to build on the previous one, with increasingly longer traces. The purpose of Phase I was to investigate relatively short groundwater flowpaths between injection sites and wells in the monitoring system. Two injection points were used—Dynamite and Stone Pond caves—which are located two to five km from the monitoring wells. In Phase II, injection points at Poor Boy Baculum and Genesis caves were up to eight km from the monitoring wells, and traces tested the hypothesis that faults in the recharge zone are barriers to groundwater flow. In addition, the tracers would be injected into the Trinity Aquifer (upper unit in the Upper Glen Rose Limestone) in the bottom of Poor Boy Baculum Cave to test the hydraulic communication with the Edwards Aquifer. Phase III extended the lengths of potential flowpaths to approximately 10 km by injecting into Boneyard Pit and Blanco Road Cave and also retested the hydraulic communication with the Trinity Aquifer in Poor Boy Baculum Cave. Finally, the purpose of Phase IV was to investigate infiltration of precipitation by placing dye on the ground surface of the recharge zone in an interstream area in the Panther Springs basin.

Table 1. Summary of Injection Points and Dyes

Phase	Injection Site	Date and Time	Dye Mass (g) and Type	Prewet Volume (L)	Flush Volume (L)	Flush Time (h)
I	Stone Pond Cave	10/19/2004 15:15	1,700 Uranine	Pond flowed into cave for several days	102,000 (estimate)	90
	Dynamite Cave	10/19/2004 16:45	2,500 Eosin	480	322,000	88
II	Poor Boy Baculum Cave	12/3/2004 11:50	2,600 Uranine	300	19,000	2.0
	Genesis Cave	12/8/2004 11:15	4,400 Eosin	None	46,000	2.5
III	Poor Boy Baculum Cave	1/14/2005 11:20	2,800 Uranine	None	46,000	2.0
	Boneyard Pit	1/17/2005 11:30	2,000 Phloxine B	1,140	46,000	2.0
	Blanco Road Cave	1/19/2005 13:40	6,440 Eosin	1,700	44,000	2.0
IV	Dynamite Cave	5/25/2006 09:00	3,000 Eosin	None	1,553,000	854.5 (5/25/06–7/1/06)
	Interstream soil	5/25/2006 09:30	3,010 Uranine	None	180,000	1,584.0* (5/25/06–7/24/06)

*Hours shown are less than hours computed between starting and ending dates owing to accidental termination of flush water for a five-d period.

Table 2. Chemical Characteristics of Dyes

Common Name	Color Index Generic Name	Molecular Weight	CAS Number	Excitation Wavelength (nm)
Uranine (sodium fluorescein)	Acid Yellow 73	376.27	518-47-8	493
Eosin (Eosine)	Acid Red 87	691.85	17372-87-1	512
Phloxine B	Acid Red 92	829.63	18472-87-2	541

Dyes

Dyes used in this study were selected because of their nontoxicity, cost effectiveness, and ease of detection. All dyes used by the Authority are fluorescent and used as colorants in medicine, foods, cosmetics, and industrial applications. Table 2 lists the names, molecular weights, and excitation wavelengths of the dyes used in this series of tracer tests. Uranine and Eosin are liquid dyes, and Phloxine B is a powder that was mixed with water before injection. Table 2 also lists the CAS and FDC numbers for the three dyes. The objective of tracer testing is to use a sufficient quantity of dye for detection at monitoring points, but not enough to be visibly apparent in a private or public water supply well. A target peak recovery concentration was, therefore, set at 0.05 g/m^3 (50 µg/L ppb). Volumes were calculated using an equation developed by Worthington and Smart (2003) on the basis of empirical data from 185 tracer tests between sinkholes and springs over distances between 15 m and 31 km and with tracer recovery times varying from two minutes to two months. The following formula from Worthington and Smart (2003) was used:

$$m = 19\,(DQc)^{0.95},$$

where

m = mass of dye injected in grams,

Q = output discharge in m^3/s,

c = peak recovery dye concentration in g/m^3, and

D = distance in meters between injection and recovery points.

Distance (D) used in the calculation is the distance to the closest monitoring wells or water supply wells. The equation was found to work well for Uranine but was slightly less effective for the other, less-fluorescent dyes. Consequently, where Eosin or Phloxine B was used, the target peak dye concentration was generally doubled to 0.10 g/m^3. No wells were visibly colored with dye as a result of the injections. Generally, only dye concentrations above one ppm are visible.

Injection Points

With one exception, caves and sinkholes were selected for injection points because they have been shown to represent direct pathways to groundwater. Because infiltrating water formed the cave or sinkhole, the water most likely dissolved a pathway that carries recharge into the aquifer, although the exact route is not known. In contrast, dyes placed directly in Panther Springs Creek or other surface injection points may travel some unknown distance on the surface or through soil or alluvium before finding a route to the water table. Depending on the properties of the dye and soil, the soil system could retain all or most of the dye and prevent it from reaching the aquifer. Therefore, tracer tests originating in karst features such as caves, sinkholes, or sinking streams (perennial) are expected to be more successful in reaching an aquifer flowpath in a timely manner than those originating from other injection points. Wells were not used as injection points for this study because they may not be as integrated into the regional groundwater-flow system as caves or other dynamic karst features. In addition, measurable concentrations of dye can persist in a well for many months.

The procedure of dye injection consisted of prewetting injection points with water, injecting the dye, and then flushing the dye with additional water to carry it into the aquifer where possible. Prewetting reduces adsorption

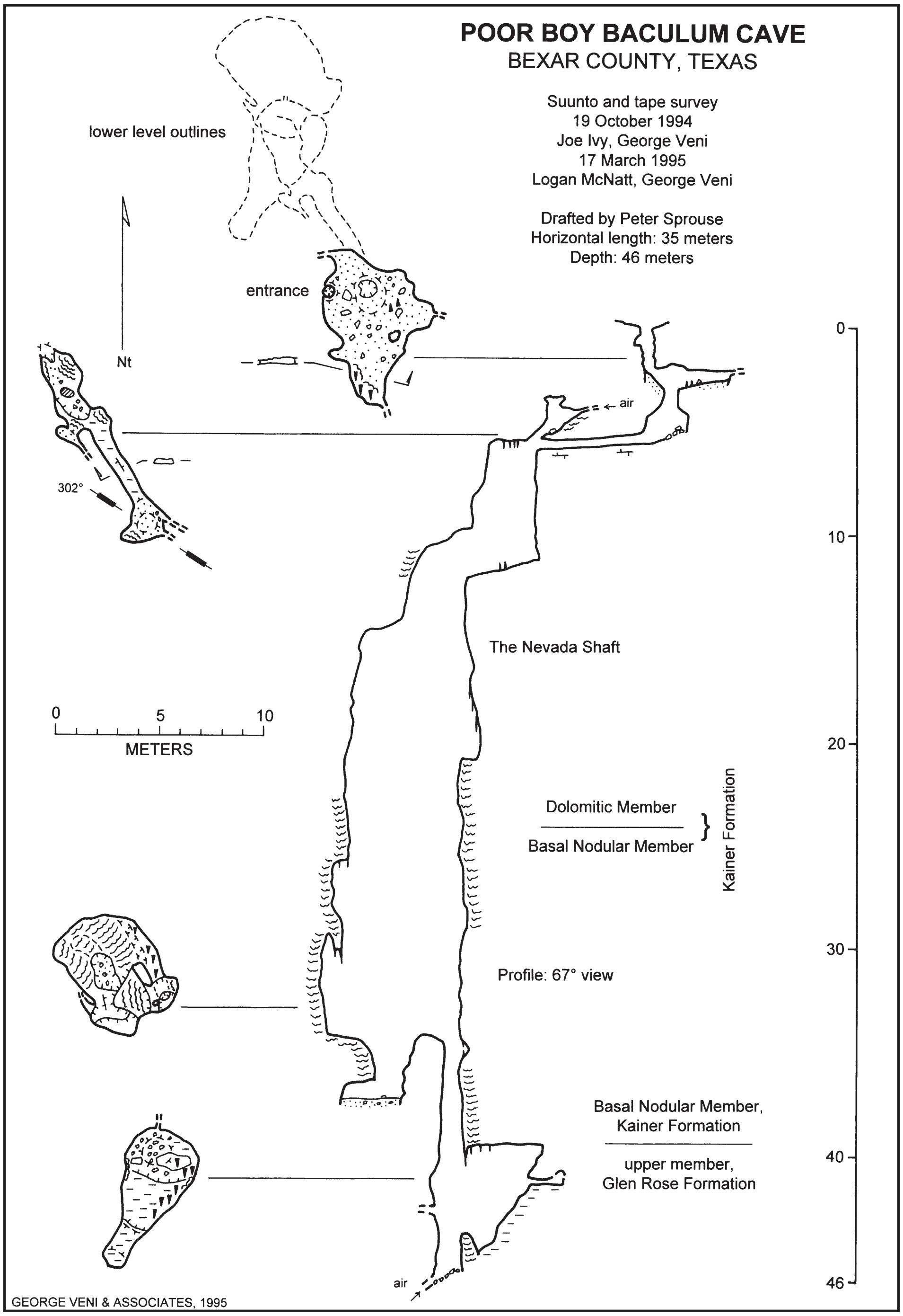


Figure 7. Profile of Poor Boy Baculum Cave (Veni and Associates, 2008)

District or the Club at Sonterra. Following are brief descriptions of injection sites.

Dynamite Cave is located in an eight-m-diameter × two-m-deep sinkhole in the Dolomitic Member of the Kainer Formation. Immediately inside the entrance is a five-m-deep pit, the bottom two m of which is filled with loose household rubbish and leaves. Prior to trash dumping, a room was accessible, probably formed in the Basal Nodular Member of the Kainer, which extended to a depth of 13 m (Veni, 1988). Eosin dye was injected onto the debris in the cave, followed by 322,000 L of water over several days to flush the dye into the aquifer.

Following discovery in 1984, Stone Pond Cave was covered by a liner to create an irrigation pond at the Club at Sonterra golf course. Stormwater overflowing the pond washed soil into the cave, creating a sinkhole at the edge of the liner. Because human access into the cave is currently impossible, no description of the cave is known. Uranine dye was injected into the opening, followed by approximately 102,000 L of pond water. Stormwater also overflowed from the pond into the cave.

Poor Boy Baculum Cave (Figure 7) is a 46-m-deep pit located at Camp Bullis. The first 40 m of the cave is located in the Edwards Limestone, and the remaining six m is within Interval A of the upper member of the Glen Rose Formation. Two injections of Uranine

of the dye on rock and soil as it flows through the vadose zone and epikarst. Dyes were injected into the deepest accessible locations to minimize travel and storage in the vadose zone. Exceptions were Genesis and Poor Boy Baculum caves, where dye could be injected directly into the aquifer. Finally, tens to hundreds of thousands of liters of water were used to flush dyes into the aquifer and push them into active flowpaths. Water used to inject dyes was obtained from Bexar Metropolitan Water

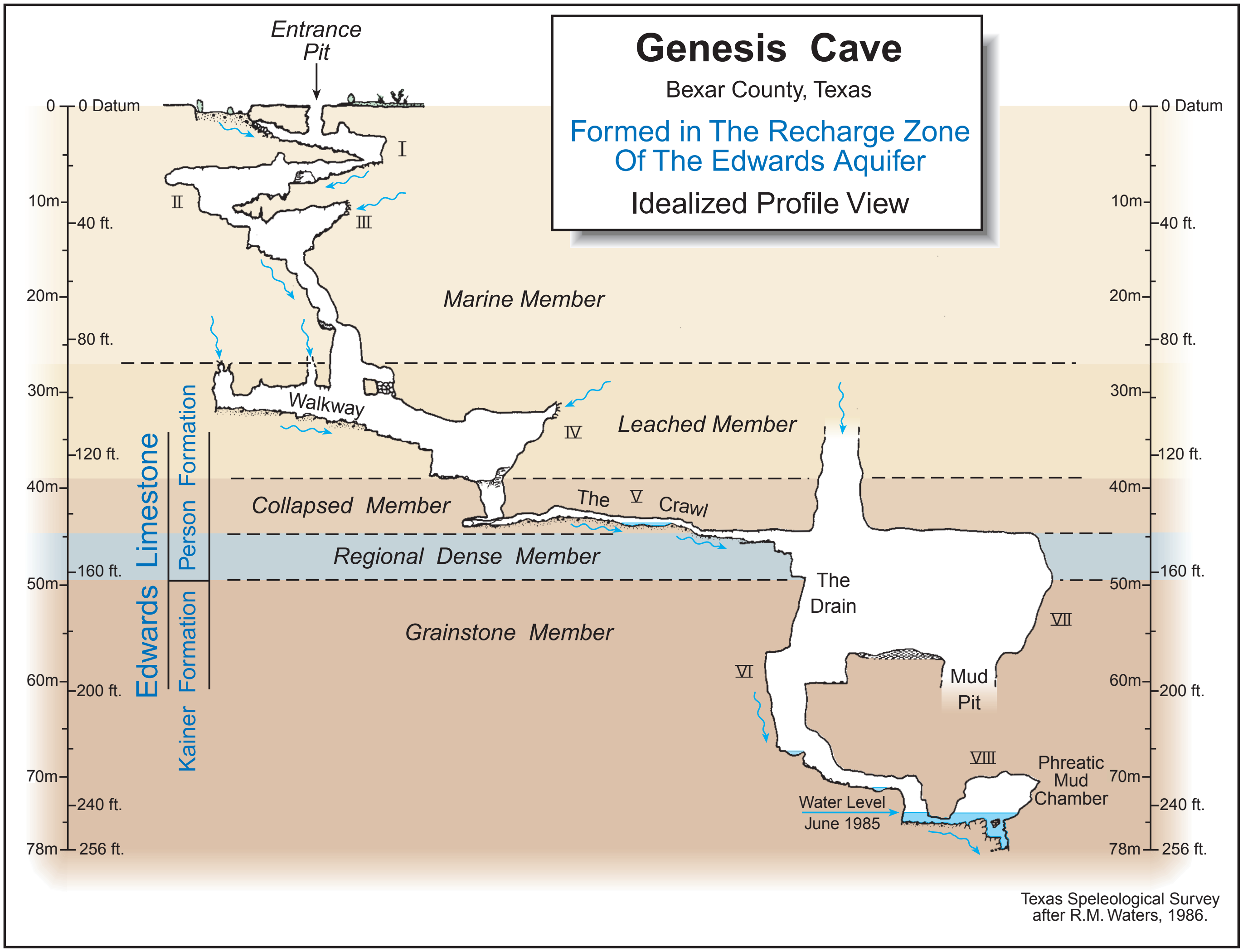


Figure 8. Profile of Genesis Cave (adapted from Veni, 1988)

were performed directly into the aquifer because groundwater had risen and flooded the lower two to four m of the cave. The two injections occurred on December 3, 2004, with 19,000 L of flush water and January 14, 2005, with 46,000 L of flush water.

Genesis Cave (Figure 8) is the deepest cave known in Bexar County, with an explored depth of 78 m and lower levels often intersecting the water table of the Edwards Aquifer (Veni, 1988). Approximately the upper 23 m of the cave is in the Dolomitic Member of the Kainer Formation, with the area below, “The Crawl,” formed in the Basal Nodular Member. Extensive faulting within The Crawl makes its stratigraphic position uncertain. “The Drain,” a 23-m-deep pit at the lower end of The Crawl, probably drops through the Dolomitic and/or the Basal Nodular. The water table was approximately six to eight m below the elevation of The Crawl. Eosin was injected directly into the aquifer, followed by 46,000 L of flush water discharged into the top of the cave.

Boneyard Pit is a 50-m-deep cave located at Camp Bullis. It penetrates the Edwards Limestone and extends six m into Interval A of the upper member of the Glen Rose Formation. The water table rises occasionally to flood the bottom of the cave. Phloxine B was poured into the bottom of the cave, followed by 46,000 L of flush water.

Blanco Road Cave, the most upgradient injection point from the monitoring sites, extends about seven m down through the Dolomitic Member of the Kainer Formation and about two m deeper into the Basal Nodular Member. The explored part of the cave is part of a large collapse into a larger void. The geometry of the collapse and lack of observable solutionally formed passages indicate that the void may have formed in Interval A of the upper member of the Glen Rose Formation. Because the water table in this area occurs in the upper Glen Rose Formation, all recharge that enters through the cave's creekbed entrance, as well as injected dye and flush water, penetrates the Edwards Limestone and enters the Upper Trinity Aquifer. Eosin was injected into the bottom of the cave, followed by 44,000 L of flush water.

The purpose of Phase IV was to test the sensitivity of a karst interstream area in the Panther Springs basin to infiltration and to trace the pathways followed by precipitation. The interstream soil injection site is located about 30 m south of Dynamite Cave. A gentle upland depression about one m in diameter and about five cm in depth shows no indication of being a sinkhole or other distinct karst feature. The surface layer, classified as a Crawford and Bexar stony soil (clay to cherty clay loam [Taylor et al., 1966]), was probed to bedrock at a depth of about 40 cm. This site was selected to test recharge rates and aquifer travel times from a recharge zone location with no obvious karst feature. The slight depression, chosen for its ability to contain water and dye, was deepened to about 15 cm. Water was discharged into the depression from a hose at a steady rate of nearly two L/min for nearly one month without overflowing, making it a point recharge site.

Sample Collection

Thirty-two monitor, irrigation, and municipal water supply wells (Figure 2), completed in Edwards and the Trinity aquifers, were sampled for dye during the tests. Table 3 lists all monitoring wells and types of samples collected and identifies public water supply wells (PWS).

Seven automatic water samplers (autosamplers) were deployed at public water supply wells or irrigation wells, as shown in Figure 2 and described in Table 3. Autosamplers were programmed to collect 24 samples at six- or eight-hour intervals. Water sampling was started before dye injection to collect samples to test for possible background fluorescence. At the end of each automatic cycle, each bottle was decanted into a 13-mm screw-top glass vial and marked with an identification number written in nonfluorescent permanent ink. Vials were placed in a rack and labeled with date, time, and location of the sample set. A grab water sample from the well and duplicate samples were taken for each batch of samples. Samples were stored in a light-proof box to avoid photodecomposition of dye. The vials were handled using standard chain-of-custody protocols as outlined in the Authority's QC/QA *Manual for Tracer Testing* (see Appendix A of this report). Residual water was disposed of away from the sampling location so that it would not be accidentally resampled or cause cross contamination. Empty autosampler bottles were rinsed three times with deionized water. The deionized water and rinsate from one of the autosampler bottles were sampled with each batch of samples and tested to ensure that decontamination procedures were working.

Charcoal receptors (detectors), also known as "bugs," were used to determine whether dye traveled to sites not monitored by autosamplers. They were also used as backup for all automatic sampling sites if an autosampler failed. Charcoal adsorbs dye from the water that passes through the receptor. It yields a time-integrated sample that, barring interference from other organic compounds, is a product of continuous sorption of dye whenever dye is present in water. The charcoal receptors consist of small nylon-screen-mesh packets containing activated coconut charcoal. Where employed, these packets were placed in wells or in the discharge line of a pump. The charcoal receptors were labeled with an engravable aluminum tag containing site identification number, site name, date, time, and initials of those collecting the receptors. The receptors were then submitted for laboratory analysis. Two dye receptors were set at each site and replaced at eight-d intervals, staggered four d apart, to give a four-d resolution to the data. During initial placement of the charcoal packets and during each replacement, a grab sample of water was collected for confirmation when possible, as described in the previous section.

Preparation and Analyses of Samples

Vials from autosamplers and grab samples required no preparation before analysis. Charcoal receptors, however, did require additional preparation prior to analysis. Dye was extracted from the charcoal receptors by eluting the charcoal for one hour in a solution containing 95% of a 70% solution of 2-propanol in water and 5%

Table 3. Summary of Monitoring Wells

Well Name	PWS	State Well Number	Land Surface Elev (m)	Depth (m)	Aquifer	Dye Sampling Method		
						Auto-sampler	Charcoal	Grab
68-28-608 Well	No	68-28-608	260	152	Edwards	X	X	X
BMWD Well 2	Yes	68-29-109	301	140	Edwards		X	X
BMWD Well 6	Yes	68-29-401	268	158	Edwards		X	X
BMWD Well 7	Yes	68-29-414	273	216	Edwards	X	X	X
BSF Well	Yes	NA	344	253	Middle Trinity		X	X
Cadillac Water Co. Well	Yes	68-28-601	288	141	Edwards		X	X
Camp Bullis Well 66	No	NA	322	NA	Trinity		X	X
Camp Bullis Well 74	No	NA	331	NA	Trinity		X	X
Coker Meth. Church	No	NA	217	NA	Edwards			X
Donella Well	No	68-29-112	269	NA	Edwards		X	X
Huebner Well	No	68-28-315	279	85	Edwards		X	X
Mecca Well	No	68-29-113	276	73	Edwards	X	X	X
SARA Blanco Well	No	68-28-314	265	73	Edwards	X	X	X
Shavano Park 1	Yes	68-28-204	321	200	Edwards		X	X
Shavano Park 2	No	68-28-202	292	139	Edwards		X	X
Shavano Park 3	Yes	68-28-501	297	143	Edwards		X	X
Shavano Park 4	Yes	68-28-502	283	154	Edwards		X	X
Shavano Park 5	Yes	68-28-203	293	133	Edwards		X	X
Shavano Park 6	Yes	68-28-205	293	148	Edwards		X	X
Shavano Park 7	Yes	68-28-513	262	155	Edwards	X	X	X
Shavano Park 8	Yes	68-28-514	268	155	Edwards		X	X
Silverhorn Well	No	NA	254	NA	Edwards		X	X
Sonterra Ladies Tee Well	No	NA	320	NA	Middle Trinity		X	X
Sonterra Main Path Well	No	NA	301	NA	Middle Trinity	X	X	X
Sonterra Pond	NA	NA	289	NA	Edwards		X	X
Sonterra Well 5	No	68-29-101	268	122	Edwards	X	X	X
Sonterra Well 6	No	68-28-305	280	102	Edwards		X	X
Sonterra Well 7	No	68-28-304	274	116	Edwards		X	X
Sonterra Well 8	No	68-28-310	265	376	Middle Trinity		X	X
Sonterra Well 9	No	68-28-309	270	373	Middle Trinity	X	X	X
T C Golf Well	No	68-28-311	280	105	Edwards		X	X
Well 313	No	68-28-313	286	91	Edwards			X

sodium hydroxide. The eluent was then decanted into a labeled glass vial and stored in darkness until analyzed.

Laboratory analyses for Uranine, Phloxine B, and Eosin in the vials and eluents from charcoal were performed using a Perkin Elmer LS50B Luminescence Spectrometer. Samples were analyzed using a synchronous scan and right-angle sampling geometry. The scan spanned 401 to 650 nanometers (nm) at 0.5-nm intervals, with a difference between excitation and emission wavelengths (delta lambda) of 15 nm and emission and excitation slits set at six nm. Figure 9 shows a typical spectrograph with an Uranine peak of 492 nm. Note that the LS50B reports the excitation wavelength for the sample, whereas some instruments report emission wavelength. Results of the analysis are recorded in intensity units and converted to concentrations by comparison with known standards. Appendix B contains all of the dye analysis for the project.

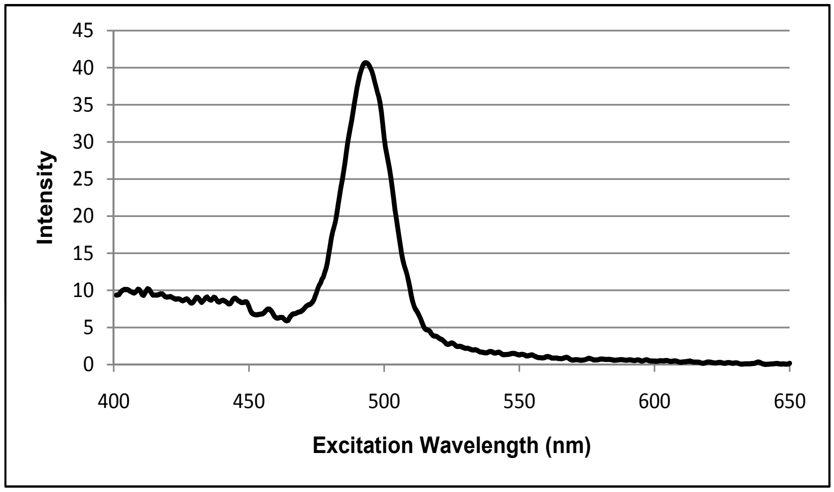


Figure 9. Typical Spectrograph of Uranine Dye

Quality Control

Approximately one in ten samples analyzed was a quality control sample. These included dye standards, duplicate and replicate samples, and rinsate samples. Dye standards were analyzed at the beginning and end of each analytical session, and a partial set was analyzed after every 20 samples. Duplicate and rinsate samples were included into the routine sampling and analysis program.

Dye Standards

Three standards were prepared for each of the three dyes used in the tracer tests. Dye solutions were prepared on the basis of mass and diluted with deionized water filtered through a 0.2-micron filter to produce dye concentrations in the range that was expected in the water samples. Figure 10 shows log-log regression of dye concentration versus amplitude for each dye.

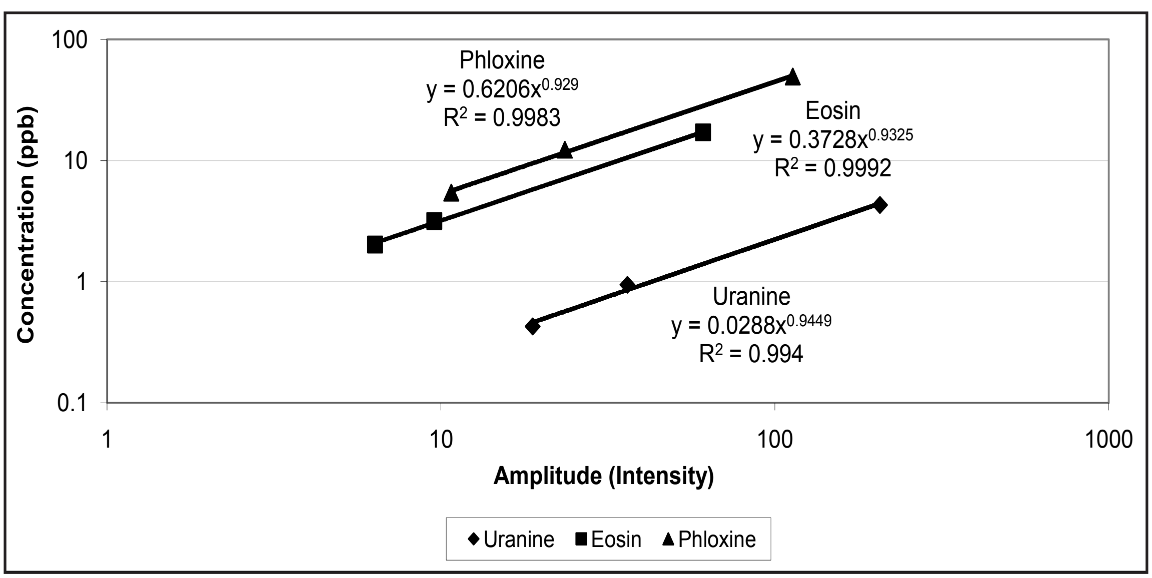


Figure 10. Regression Curves for Dye Standards

Table 4. Summary of Standard Analyses

Standard and Concentration (µg/L)	Count	Mean Excitation Wavelength	Mean Concentration	Concentration Standard Deviation	Minimum Concentration	Maximum Concentration
Eosin 17.117	28	518.0	17.224	0.648	16.459	20.02
Eosin 2.031	42	517.73	2.089	0.136	1.725	2.39
Eosin 3.166	85	517.89	3.059	0.168	2.095	3.59
Phloxine B 5.435	12	539.24	5.629	0.27	5.134	6.01
Phloxine B 12.282	35	539.22	11.651	0.36	10.669	12.45
Phloxine B 49.315	11	539.26	50.185	0.611	49.43	51.16
Uranine 0.428	44	493.65	0.461	0.019	0.42	0.54
Uranine 0.945	86	493.71	0.855	0.037	0.781	1.02
Uranine 4.307	29	493.64	4.431	0.14	4.25	5.02

Table 5. Stability of Standards

Dye	Start Date	End Date	Percent Change
Eosin 17.117	10/25/04 9:11	3/22/05 11:21	0.9%
Eosin 2.031	10/26/04 9:02	4/4/05 12:18	-2.4%
Eosin 3.166	10/25/04 9:09	4/4/05 12:20	-1.5%
Phloxine B 5.435	10/25/04 9:03	3/22/05 11:22	-6.3%
Phloxine B 12.282	10/25/04 9:04	3/22/05 15:33	-5.9%
Phloxine B 49.315	10/25/04 9:05	3/22/05 11:24	-1.7%
Uranine 0.428	10/25/04 9:14	4/4/05 12:21	-7.5%
Uranine 0.945	10/25/04 9:15	4/4/05 12:22	-8.5%
Uranine 4.307	10/25/04 9:16	3/22/05 11:18	-6.5%

Table 4 lists results of standard analyses and includes the mean, standard deviation, maximum, and minimum of the concentration and wavelength for each dye standard. All but one (Eosin 17.117) of the standard analyses fall within the 95% confidence interval around the mean for each dye. Histograms for the four most analyzed standards are shown in Figures 11 through 14, overlain by a normal distribution curve. Height of the bar represents number of standard analyses at concentrations shown on the horizontal axis. Histograms show that curves of dye standards have a smaller standard deviation than predicted by normal distribution.

In general, fluorescence of dye standards remained consistent throughout the testing period, and Figures 15 through 17 show stability of the standards. In these cases, stability is indicated by R^2, correlation coefficient, which expresses the relationship of the x and y values. It would be zero if fluorescence of the standards did not change with time. As shown, R^2 values are slightly higher than zero, and slopes are slightly negative, except for the Eosin 17.117 standard, which is slightly positive. These results indicate that standard concentrations declined by 1.5 to 8.5% during tracer tests, which is acceptable. Table 5 summarizes how standard concentrations varied during the tests.

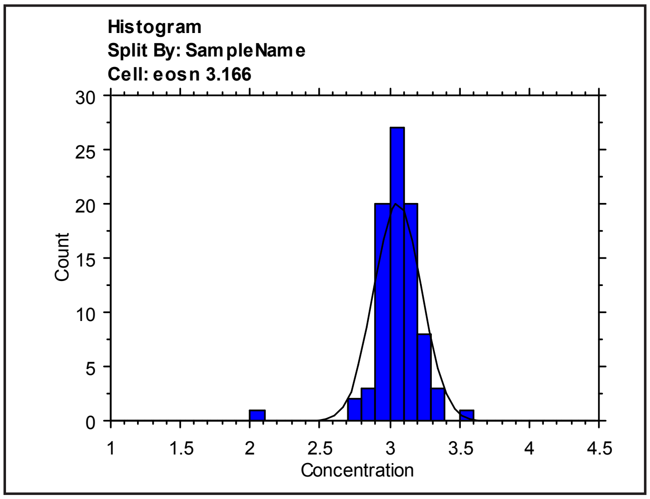


Figure 11. Histogram of Eosin Standard at 3.166 µg/L

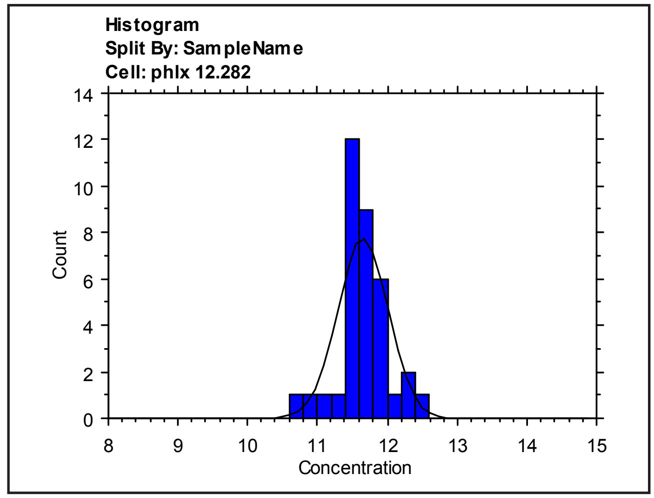


Figure 12. Histogram of Phloxine B Standard at 12.282 µg/L

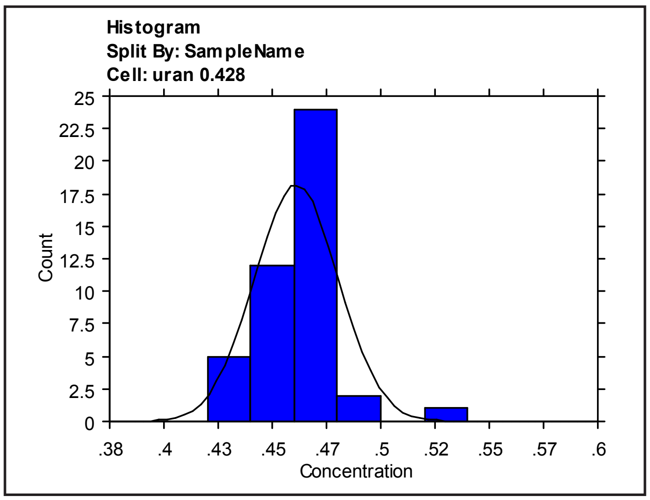


Figure 13. Histogram of Uranine Standard at 0.428 µg/L

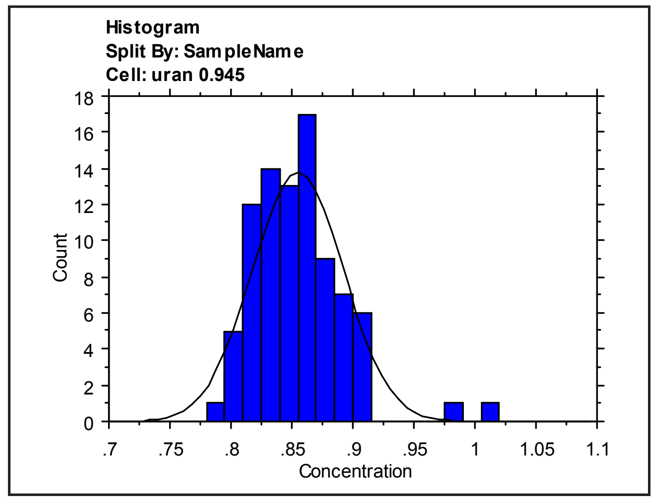


Figure 14. Histogram of Uranine Standard at 0.945 µg/L

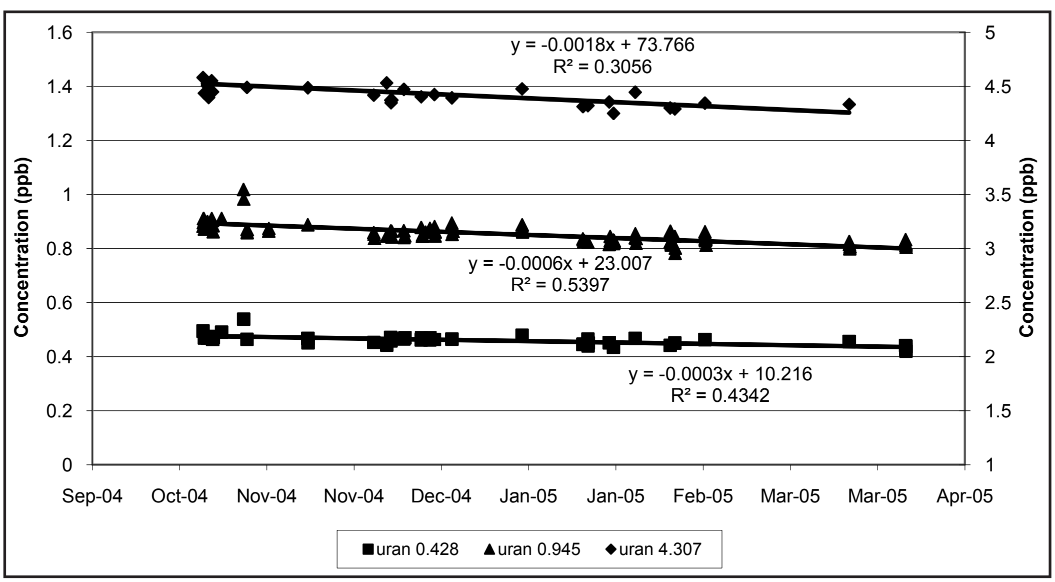


Figure 15. Stability of Uranine Standards

Figure 16. Stability of Eosin Standards

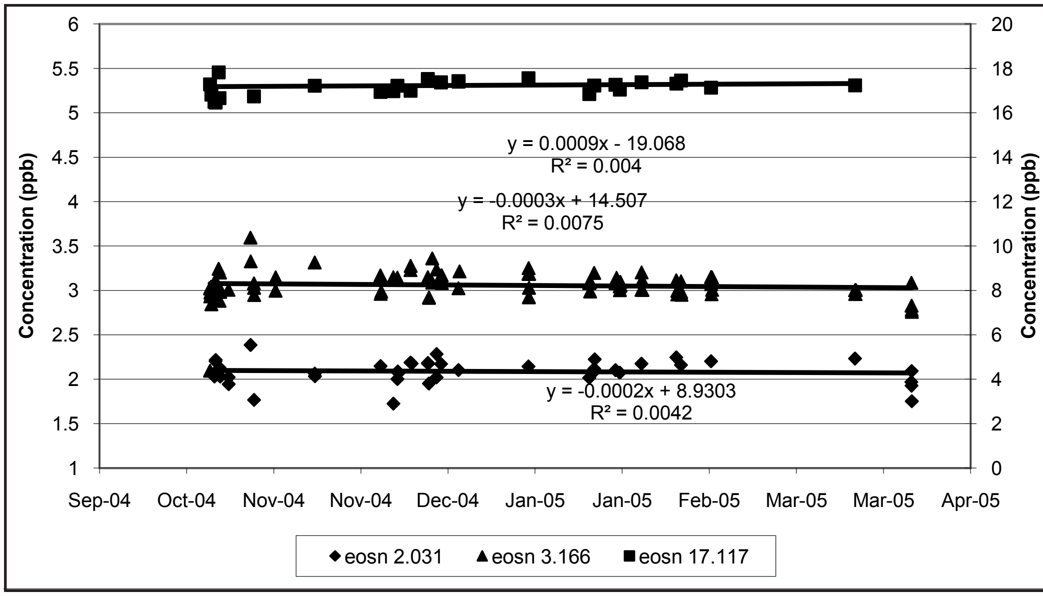
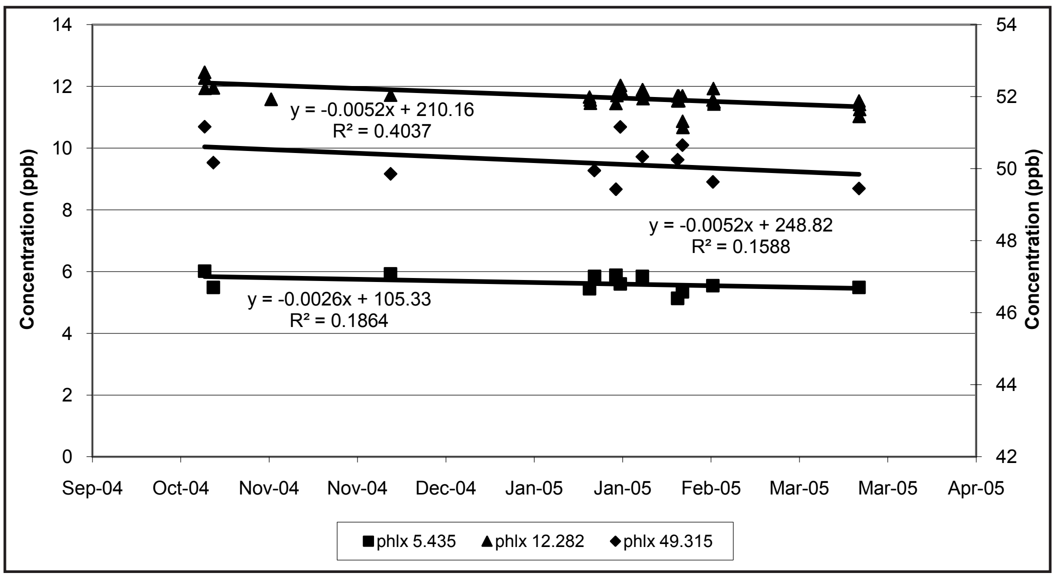


Figure 17. Stability of Phloxine B Standards



Duplicate Samples

Duplicate samples were analyzed to measure precision of the Perkin-Elmer LS-50B Luminescence Spectrometer. The samples were prepared by filling two vials from the same sample container from an autosampler container. Precision is calculated using relative percent difference (RPD), which is the absolute difference between the two intensities of the samples divided by the mean of the two intensities times 100. An RPD of zero indicates that the two concentrations are equal.

Intensity measurements were used instead of concentrations because duplicate samples generally contained no dye. Figures 18 and 19 and Table 6 present statistics for RPDs for water samples and eluent samples from charcoal receptors. Results show much more variability in duplicate samples of eluent than in the water samples. Such results are expected because of the high variability of absorption kinetics in charcoal particles; suspended particles, naturally fluorescent materials, and other impurities in the eluent from the charcoal may disperse excitation or emission light waves in the luminescent spectrometer. RPDs for the water samples are acceptable, with most values (77) having less than 20% variability.

Table 6. Statistical Summary of RPDs

Statistic	Water Samples	Charcoal Receptors (Eluent)
Mean	21.7%	55.5%
Standard Deviation	23.5%	42.2%
Standard Error	2.3%	5.5%
Count (number of samples)	104	59
Minimum	0.2%	2.4%
Maximum	159%	177%

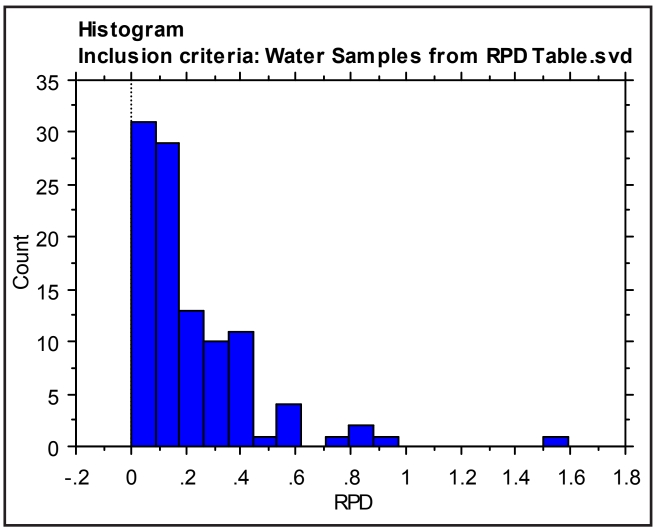


Figure 18. RPD Histogram for Water Samples

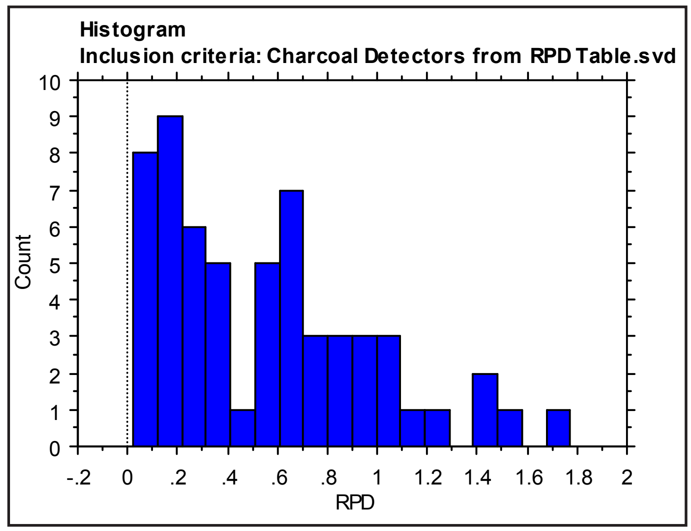


Figure 19. RPD Histogram for Charcoal Receptors

Positive Dye Recovery Interpretation

The LS50B measures fluorescence in intensity units, which is directly proportional to the concentration of dye. However, the maximum intensity of each sample is the sum of any dye present plus background fluorescence. Dye peaks were separated from background fluorescence by fitting the curves to the Pearson VII statistical function using Systat PeakFit® software. The difference between sample and background fluorescence is the net intensity. Net intensity measurements were converted to a concentration, with the calibration curve determined from analyses of standards, as described in the previous sections.

Detection Limits

Detection and quantitation limits for each dye were calculated from background fluorescence of naturally occurring fluorophores and instrument noise, following the method of Alexander (2005). The method defines limits of detection (LOD) and quantitation (LOQ) as three and 10 times the fit standard error of background fluorescence, respectively. Water samples were selected that contained dyes at concentrations just above background fluorescence to calculate LOD and LOQ, and fit standard error was calculated using PeakFit® software. Figure 20 shows original intensities, separated dye peaks, and calculated LODs and LOQs for each dye. Using regression equations in Figure 10 yields the limits of detection and quantitation for each dye in Table 7.

Breakthrough Curves

Breakthrough curves were prepared from laboratory results, from which initial travel time, duration, and peak concentrations were calculated. Breakthrough curves, which are graphs displaying dye concentrations over time, were evaluated to characterize dye response at the wells.

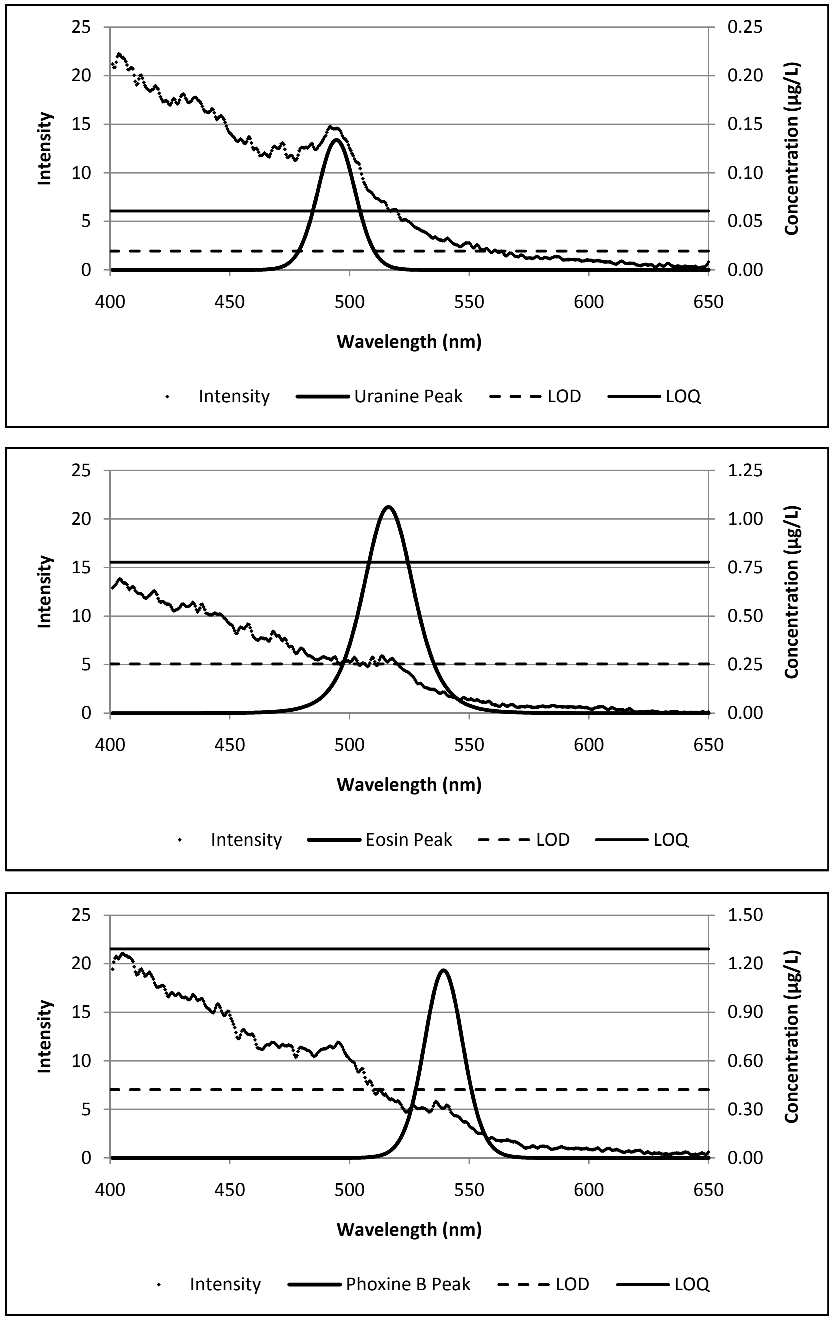


Figure 20. Calculation of LOD and LOQ or Uranine, Eosin, and Phloxine B

Table 7. Limits of Detection and Quantitation for the Dyes

Dye	Sample	Fit Standard Error	Limit of Detection (µg/L)	Limit of Quantitation (µg/L)
Uranine	AY-68-28-608 12/8/2004 11:10 AM	0.22	0.02	0.06
Eosin	AY-68-28-608 2/8/2005 6:30 PM	0.22	0.25	0.78
Phloxine B	AY-68-28-608 1/20/2005 2:46 AM	0.25	0.42	1.29

RESULTS

Results include each of the four phases of the tracer-testing study. The goals of this study were to measure groundwater velocities, establish the degree of hydraulic connectivity between the Edwards and Trinity aquifers, characterize the role of faults, and simulate a point source surficial recharge event in the Edwards Aquifer recharge zone in northern Bexar County.

As a point of reference for aquifer conditions in the Edwards Aquifer, Figure 21 shows water level elevations at well J-17 during the tracer test. J-17 is the Edwards Aquifer index well located in Bexar County that is used to determine when the Authority activates its critical period management plan. It reflects water levels in the artesian zone of the aquifer, which closely correlates to spring discharge at Comal Springs. Water levels increased during Phases I and III and declined during Phases II and IV. J-17 water level fell almost 15 m between Phases I and IV.

Phase I

The purpose of Phase I was to investigate relatively short groundwater flowpaths between injection sites and the monitoring network and to evaluate tracer testing as an investigative tool in the Edwards Aquifer. For the first phase of this study, two injection sites were used—Stone Pond and Dynamite caves. Other potential injection sites occur in the area, but these two sites were selected for their easy access to flush water and especially their central location within the well monitoring network. Whereas potentiometric mapping suggests that dye would flow roughly under the course of Panther

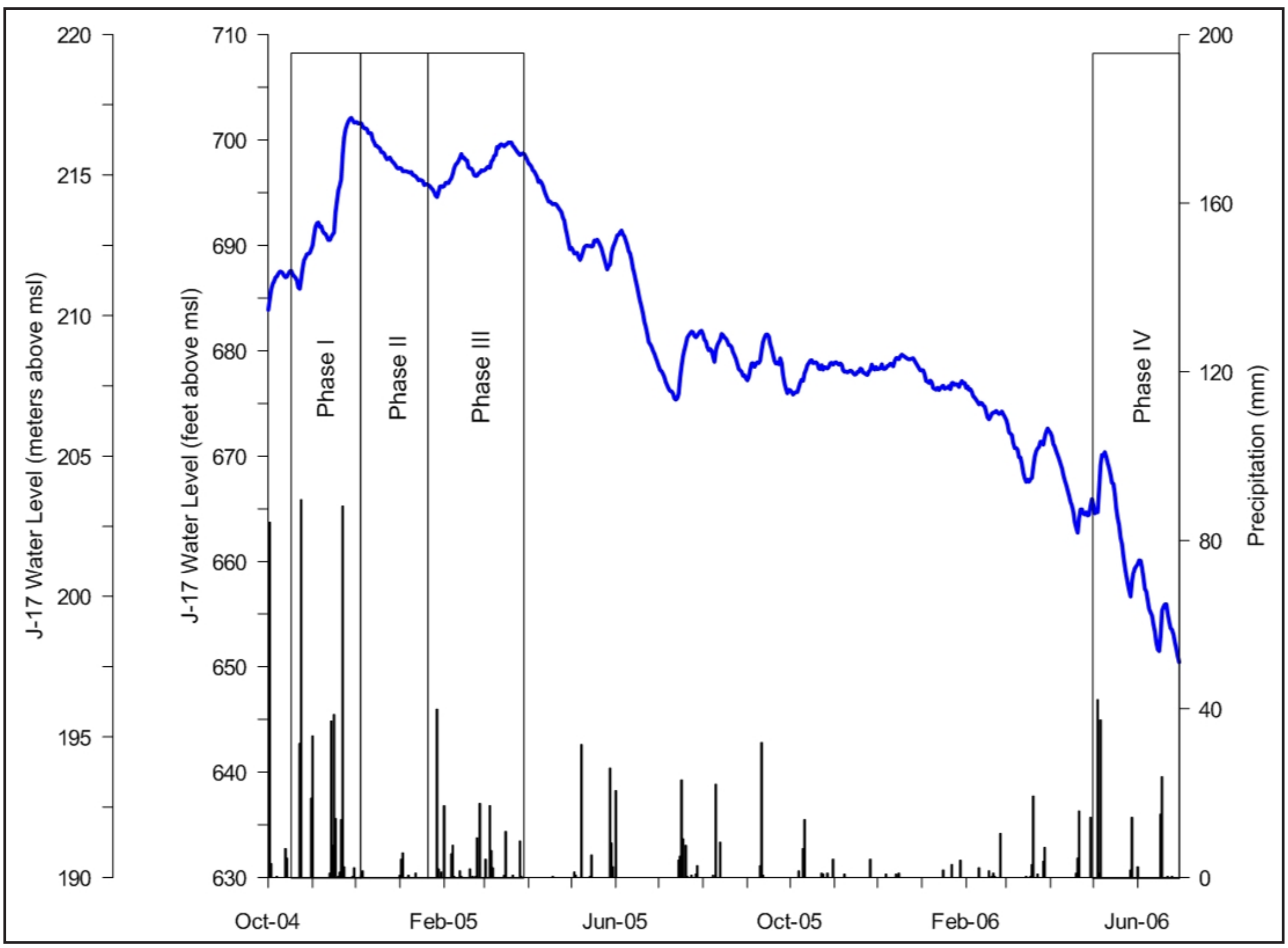


Figure 21. Water Levels in Bexar County Index Well J-17 Showing Variations during the Four Tracing Phases

Table 8. Summary of Phase I Tracer-Test Results

Injection Point	Injection Date	Dye	Dye Recovery Well	Arrival Date	Distance (m)	Travel Time (d)	Apparent Velocity (m/d)
Stone Pond Cave	10/19/04 15:15 J-17 at 209.4 m msl	1,700 g Uranine	68-28-608 (Edwards Ls)	10/22/04 3:24	4,180	2.5	1,670
			68-28-305 (Edwards Ls)	11/29/04	1,920	42	46
Dynamite Cave	10/19/04 16:45 J-17 at 209.4 m msl	2,500 g Eosin	68-28-608 (Edwards Ls)	10/23/04	3,000	2.9	1,030

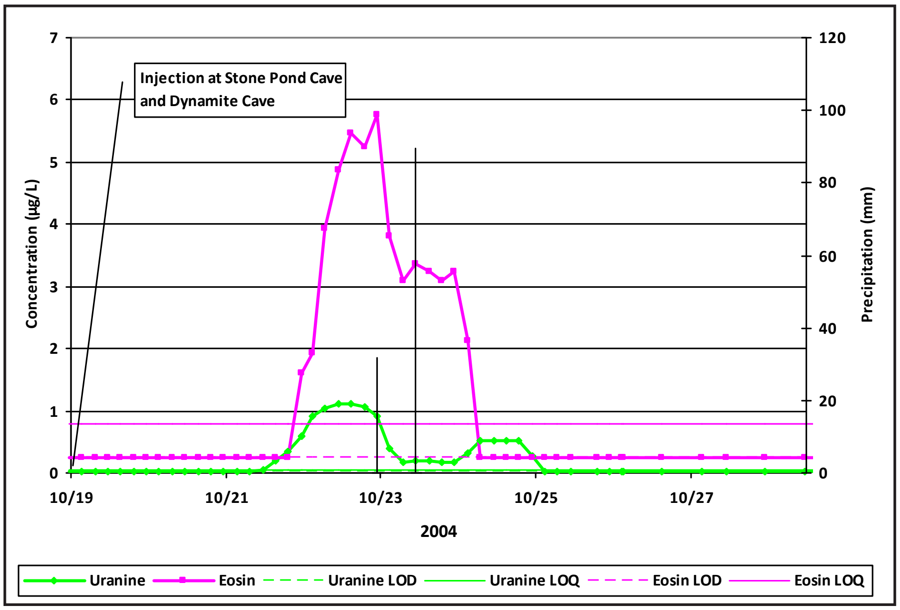


Figure 22. Phase I Breakthrough Curve for 68-28-608 in Water Samples

Springs Creek, significant groundwater conduits can escape resolution of such mapping and divert groundwater in unpredicted directions. Additionally, prevailing thoughts on the influence of faults on groundwater flow (e.g., Maclay and Small, 1984) support the potential for such diversions and, therefore, a conservative start for the tracing program.

As shown in Table 8, on October 19, 2004, at 15:15, 1,700 g of Uranine dye was injected into Stone Pond Cave and flushed by siphoning water from the pond into the cave at an estimated rate of about three L/min. The dye was first detected in well 68-28-608 at 3:34 a.m. on October 22, 2004, 60 hours after injection, as shown in Figure 22. Well 68-28-608, a monitoring well drilled for the Authority by the USGS in the mid-1970s, fully penetrates the Edwards Aquifer. The well is 4,180 m from the injection point, as shown in Figure 23, which means that the dye traveled at an apparent velocity of 1,670 m/d. The rate of dye movement is "apparent velocity" because the actual length of the flowpath is unknown; therefore, groundwater velocity is calculated from the straight-line or point-to-point distance between injection and monitoring points. Duration of travel is measured from time of injection until first arrival of the dye at the monitoring site. Actual velocity is faster than apparent velocity because actual distance is a longer, irregular route.

Uranine was also detected in four charcoal receptors at Sonterra Well 6 (68-28-305), which is completed in the Edwards Aquifer and is used in irrigation at the Club of Sonterra golf course. Although two samples containing Uranine were collected from the well up to six d after Phase II injection of Uranine at Poor Boy Baculum Cave, the source of the Uranine was probably Stone Pond Cave because Uranine was detected in the first two charcoal receptors before Phase II injections. Well 68-28-305 was pumped periodically at about 380 to 760 L/m to irrigate the golf course, and dye required 42 d to reach the well, with an apparent groundwater

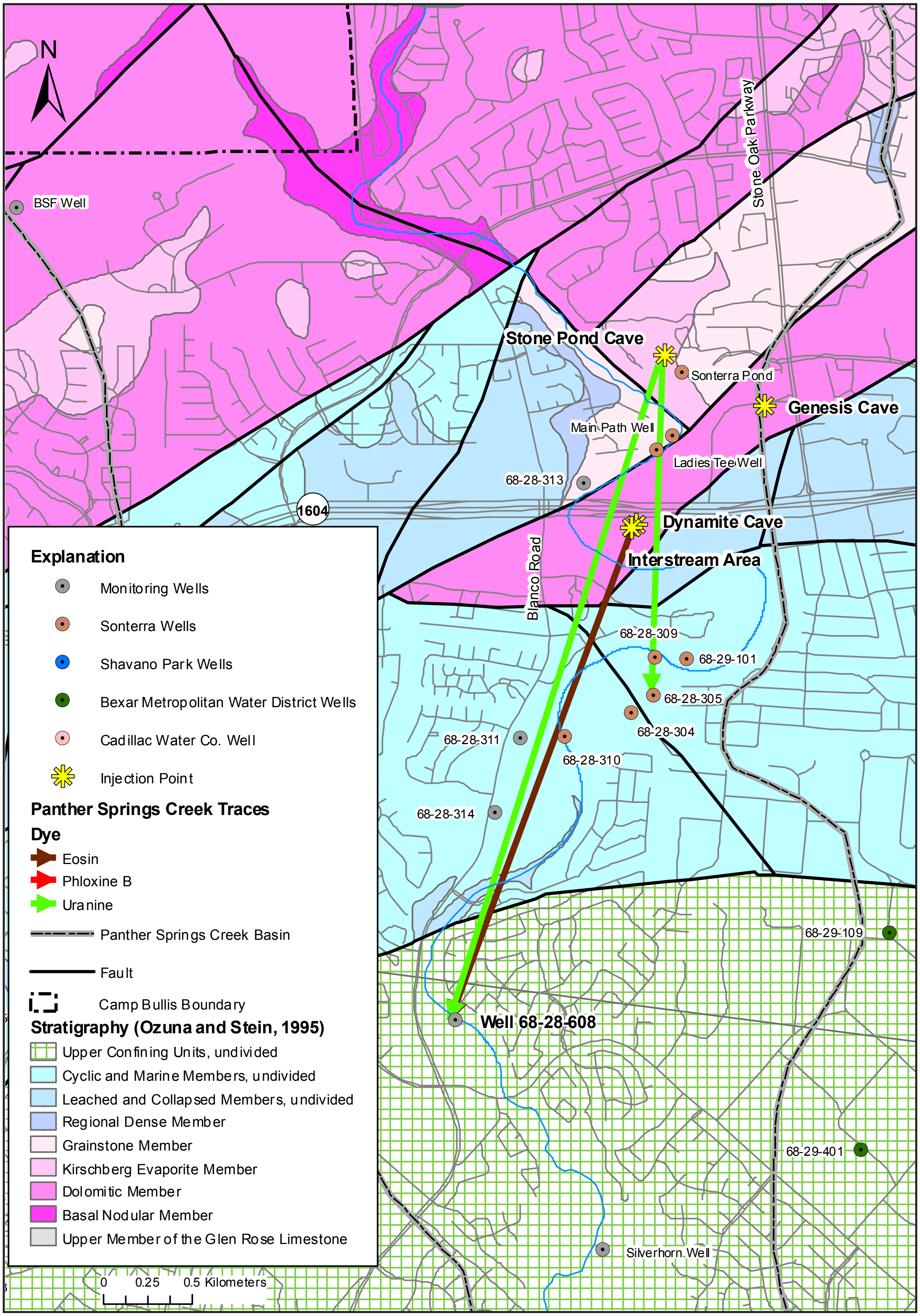


Figure 23. Phase I Tracer-Test Results

velocity of 46 m/d. Well 68-28-305 not being on the main flowpath of the dye may explain why Uranine moved much more slowly to this pumping well than did dye detected in well 68-28-608.

Also on October 19, 2004, but at 16:45, 2,500 g of Eosin dye was injected into Dynamite Cave. Eosin from the cave was first detected in well 68-28-608 on October 23, 2004, 70 h after injection. Dye traveled at an apparent velocity of 1,030 m/d to reach the well 3,290 m from the injection point. The dye was not detected in well 68-28-305.

Figure 22 shows breakthrough curves for both dyes as measured at 68-28-608. Neither dye was intercepted at any Trinity Aquifer well completed below the Edwards Limestone. Breakthrough curves of both dyes have similarities. They each arrived on October 22nd and peaked in concentration on the 23rd. Uranine concentration exceeded its quantitation limit, and although Eosin concentration was below its quantitation limit, it was above the detection limit (see "Detection Limits," p. 19). Despite low concentrations, Eosin detection is reliable because of the large number of analyses and well-defined breakthrough curve. Both dyes also exhibit double peaks, most likely resulting from nearly 90 mm of rainfall that occurred on October 24, 2004. The rainfall probably mobilized additional dye, trapped in pools and in the rock matrix near the injection points. The dyes differ in their concentration and speed of arrival and decline. Eosin from Dynamite Cave was detected at higher concentrations (maximum 5.8 µg/L) than Uranine from Stone Pond Cave (maximum 1.12 µg/L), even though a greater mass of Uranine, which is more fluorescent, was injected than Eosin. This difference may be the result of a combination of factors such as dilution rates and attenuation of dye by soil and rock matrix.

Phase II

The purpose of Phase II was to begin investigating the relationship of groundwater movement between Trinity and Edwards aquifers and the role faults play in controlling groundwater flowpaths in northern Bexar County. The first injection point was Poor Boy Baculum Cave, which is two to three km north (upgradient) of Phase I injection points and is separated from the monitoring network by several faults. The second injection point, Genesis Cave, which is close to Stone Pond Cave, extends vertically to the water table in the Edwards Aquifer. Table 9 summarizes results of the injections.

On December 3, 2004, 2,600 g of Uranine dye was injected into Poor Boy Baculum Cave and detected after 1.2 d at 68-28-608, demonstrating an apparent velocity of 4,980 m/d as shown in Figure 24. This test was also the first empirical demonstration of significant groundwater flow from the Upper Trinity Aquifer into the Edwards Aquifer. Dye was also detected a day later at Sonterra Well 5 (68-29-101), which is completed in the Edwards Aquifer approximately 4,425 m from the cave (Figure 25). Well 68-29-101 is an irrigation well.

Table 9. Summary of Phase II Tracer-Test Results

Injection Point	Injection Date	Dye	Dye Recovery Well	Arrival Date	Distance (m)	Travel Time (d)	Apparent Velocity (m/d)
Poor Boy Baculum Cave	12/3/04 11:50 J-17 at 213.8 m msl	2,600 g Uranine	68-28-608 (Edwards Ls)	12/4/04 16:00	5,980	1.2	4,980
			68-29-101 (Edwards Ls)	12/5/04 9:50	4,425	1.9	2,330
Genesis Cave	12/8/04 11:15 J-17 at 213.7 m msl	4,400 g Eosin	68-28-304 (Edwards Ls)	1/19/05	1,890	37	51
			68-28-305 (Edwards Ls)	1/8/05	1,750	37	47

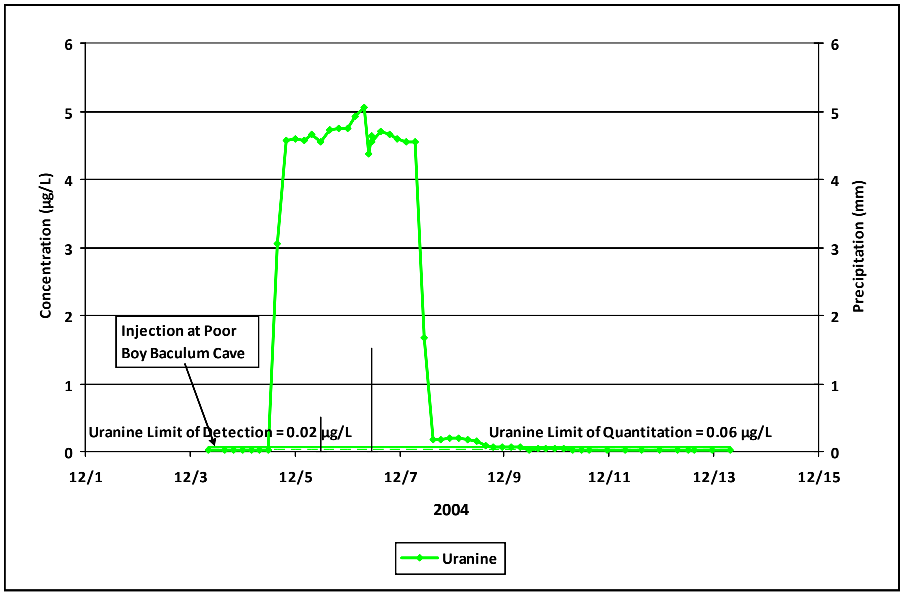


Figure 24. Phase II Breakthrough Curve for 68-28-608 in Water Samples

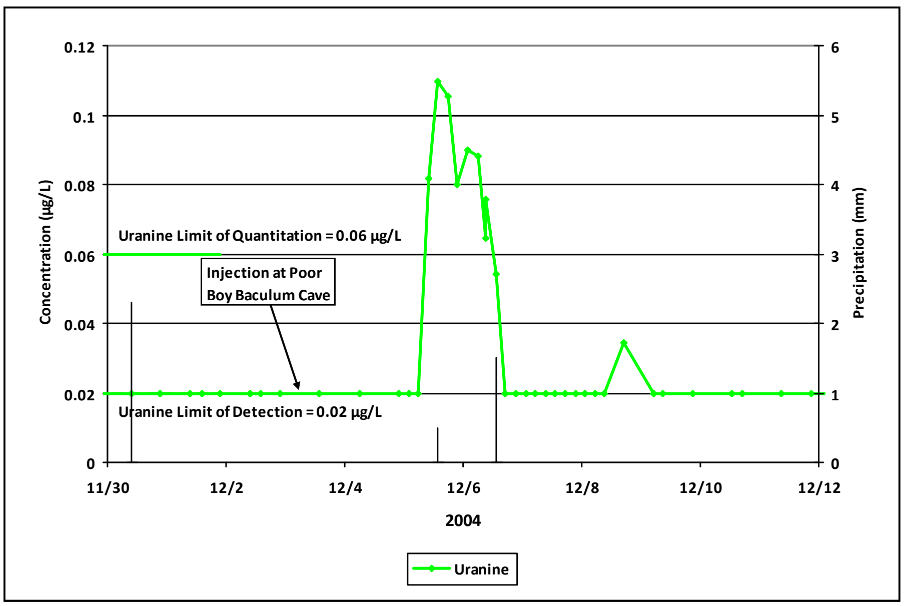


Figure 25. Phase II Breakthrough Curve for 68-29-101 in Water Samples

Uranine was not detected in Trinity Aquifer wells, as shown in Figure 26.

Maximum concentrations for Uranine at 68-28-608 and 68-29-101 were 5.05 µg/L and 0.11 µg/L, respectively. The flat-topped breakthrough curve at 68-28-608 was caused by a malfunction of the autosampler rather than groundwater conditions. Without the malfunction, the breakthrough curve would most likely have been a sharp peak. Breakthrough concentrations for 68-29-101 form a sharp peak, which reflects relatively high groundwater velocities and little dispersion.

On December 3, 2004, 4,400 g of Eosin dye was injected into Genesis Cave and detected in two Edwards Aquifer wells at the Club at Sonterra Golf Course. Breakthrough curves are shown in Figure 27 for Eosin at Sonterra Well 7 (68-28-304) and Sonterra Well 6 (68-28-305). Eosin was detected in water samples at both wells 37 d after injection for apparent velocities of 51 and 47 m/d, respectively, and persisted until approximately January 31, 2005. Eosin concentrations were below quantitation limits but constitute unmistakable detections. In addition, charcoal receptors from both wells yielded high concentrations of Eosin during January 2005.

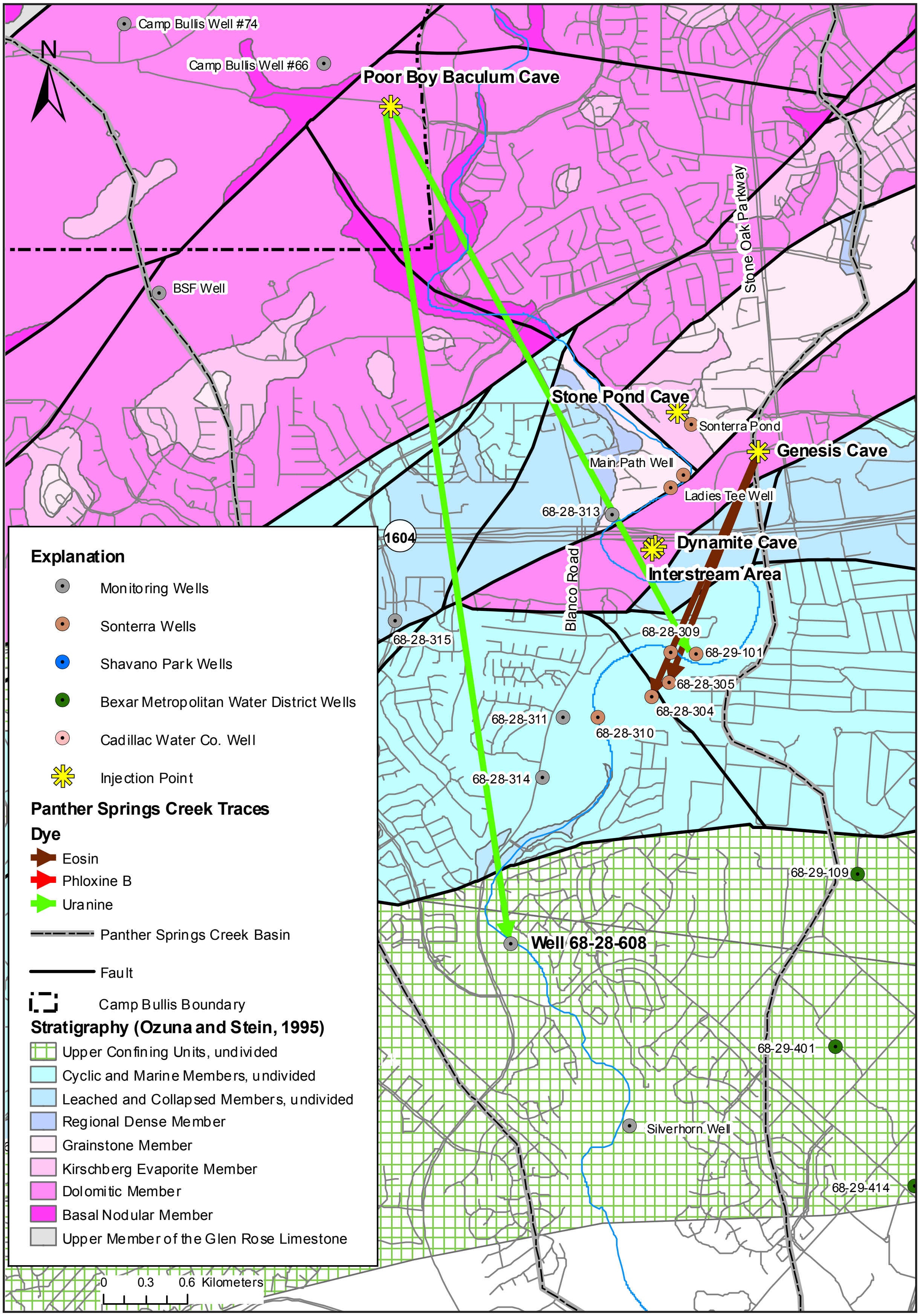


Figure 26. Phase II Tracer-Test Results

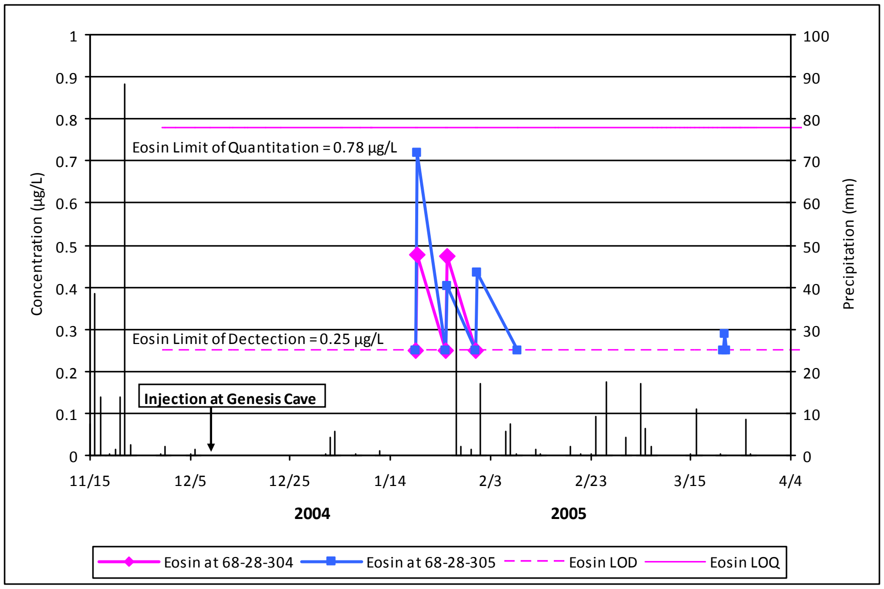


Figure 27. Phase II Breakthrough Curves for 68-28-304 and 68-28-305 in Water Samples

Phase III

The purpose of Phase III was to repeat and confirm the trace from Poor Boy Baculum Cave, to further investigate groundwater flow between Edwards and Upper Trinity aquifers, and to better delineate the Panther Springs Creek groundwater basin. Phase III was designed to further test two important characteristics of the recharge zone in the study area from Phase II: (1) the Upper Trinity and Edwards aquifers are hydraulically connected and (2) Balcones faults are not barriers to groundwater flow. Phase III injection points were Poor Boy Baculum Cave and Boneyard Pit and Blanco Road Cave, which are on the upgradient (north) than Phase II injection points. Entrances to these caves are in the Edwards Limestone, within the Edwards Aquifer recharge zone, but Poor Boy Baculum Cave and Boneyard Pit fully penetrate the Edwards Limestone and terminate in the Upper Glen Rose Limestone at the water table and within the Upper Trinity Aquifer. Results are summarized in Table 10 and Figure 28. Breakthrough curves for recovery of all three dyes at well 68-28-608 are plotted in Figure 29.

On January 14, 2005, 2,800 g of Uranine was injected into Poor Boy Baculum Cave. Dye was detected in four wells: 68-28-608, 68-29-101, 68-28-304, and 68-28-305. It traveled at approximately 3,990 m/d and only required 1.5 d to reach 68-28-608. The dye persisted in 68-28-608 from January 15, 2005, until January 18, 2005, as shown in Figure 29. Uranine traveled at approximately 177 m/d to 68-29-101, requiring 25 d to reach the well, and persisted in 68-29-101 from February 8, 2005, until February 15, as shown in Figure 30. Uranine was detected in two water samples from 68-28-305 on February 8 and 16, 2005, as shown in Figure 31, for an apparent velocity of approximately 178 m/d. It was also detected on a charcoal receptor that was in the well between February 8 and 16, 2005.

The dye required 25 d to reach the well. Dye was detected in six samples from 68-28-304 between February 13 and 15, 2005, as shown in Figure 32, for an apparent velocity of approximately 147 m/d and required 30 d to reach the well. Uranine was injected into Poor Boy Baculum Cave in both Phase II (12/3/04) and Phase III (1/14/05).

At 68-29-101, concentrations between detection and quantitation limits were sufficient for a positive trace, and two analyses were quantifiable to establish the dye at 68-28-305. A number of lines of evidence are used to determine that the Uranine injected for the Phase III injections is the dye that was detected in fieldwork. The dye velocities are consistent with other Phase III tracing velocities, especially the trace from Blanco Road Cave, which has a nearly overlapping apparent flowpath. In addition, complete breakthrough curves were documented for each Uranine trace. Also, 30 d elapsed between Phase II and Phase III injections, and

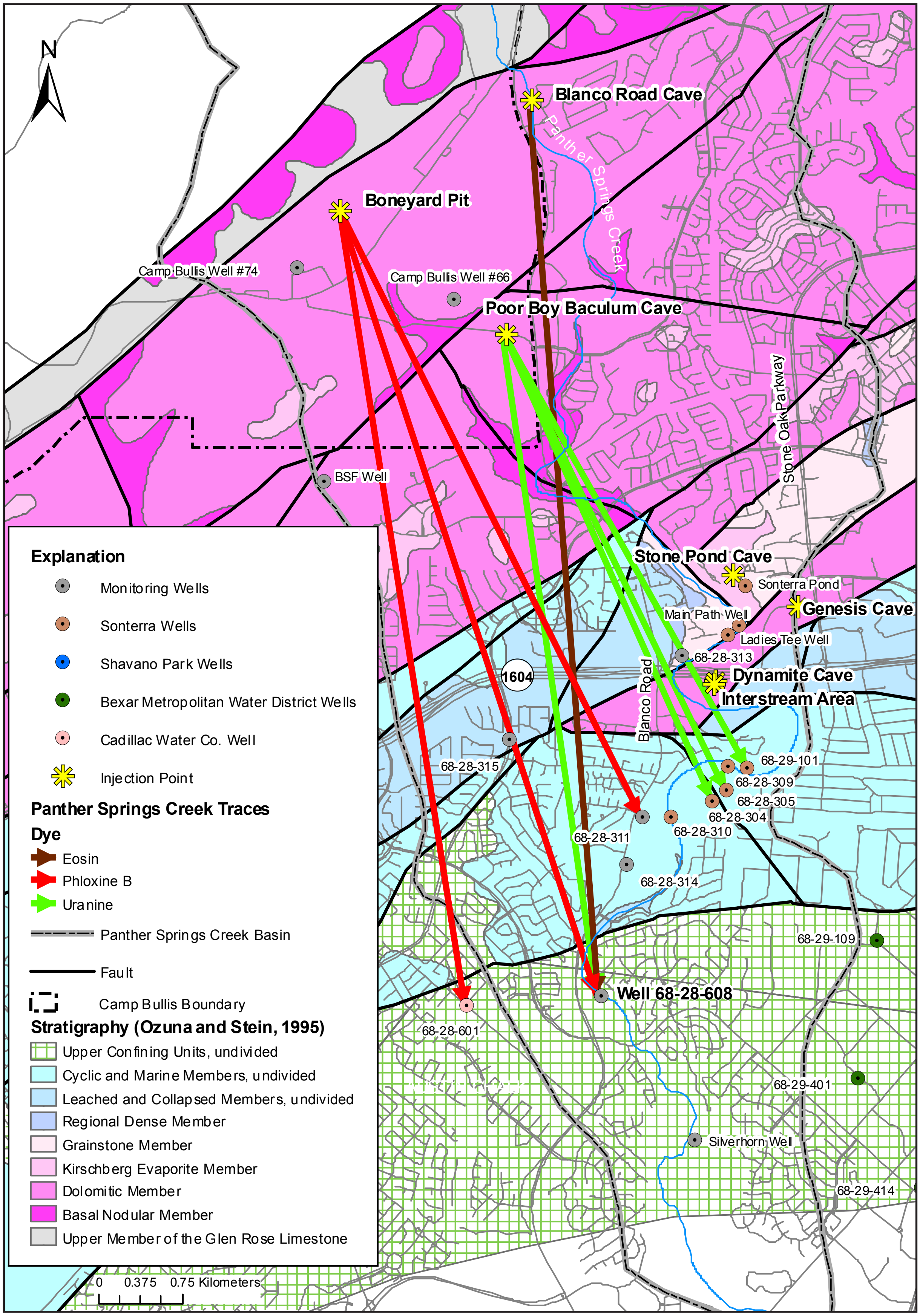


Figure 28. Phase III Tracer-Test Results

Table 10. Summary of Phase III Tracer-Test Results

Injection Point	Injection Date	Dye	Dye Recovery Well	Arrival Date	Distance (m)	Travel Time (d)	Apparent Velocity (m/d)
Poor Boy Baculum Cave	1/14/05 11:20 J-17 at 212.2 m msl	2,800 g Uranine	68-28-608 (Edwards Ls) Monitoring well	1/15/05 22:45	5,980	1.5	3,990
			68-29-101 (Edwards Ls) Irrigation well	2/8/05 17:06	4,425	25	177
			68-28-305 (Edwards Ls) Irrigation well	2/8/05 8:40	4,460	25	178
			68-28-304 (Edwards Ls) Irrigation well	2/13/05 16:40	4,405	30	147
Boneyard Pit	1/17/05 11:30 J-17 at 212.2 m msl	2,000 g Phloxine B	68-28-608 (Edwards Ls) Monitoring well	1/18/05 22:45	7,400	1.5	4,930
			68-28-601 (Edwards Ls) Water supply well	2/11/05	7,200	24	300
			68-28-311 (Edwards Ls) Irrigation well	2/7/05	6,070	20	300
Blanco Road Cave	1/19/05 13:40 J-17 at 212.1 m msl	6,440 g Eosin	68-28-608 (Edwards Ls) Monitoring well	1/23/05 14:46	8,040	4.1	1,960

several samples showed no detectable concentration of dye in the wells between Phase II and Phase III tracer testing.

On January 17, 2005, 2,000 g of Phloxine B was injected into Boneyard Pit and subsequently detected in three wells: 68-28-608, 68-28-311, and 68-28-601. Boneyard Pit provided the second Upper Trinity-to-Edwards groundwater trace, with respective velocities to the wells of 4,930, 300, and 300 m/d. Because dye was detected only in grab samples or charcoal receptors in the latter two wells, no breakthrough curves can be produced for wells 68-28-311 or 68-28-601. Figure 29 shows the breakthrough curve for Phloxine B in well 68-28-608.

On January 19, 2005, 6,440 g of Eosin was injected into Blanco Road Cave. It was detected only in well 68-28-608. This injection produced a presumed third Upper-Trinity-to-Edwards Aquifer trace. The dye was injected into the Basal Nodular Member of the Edwards Limestone and flushed into the aquifer with water. Because the depth to groundwater in the area is estimated at 80 m, dye would need to move vertically downward into the upper unit of the Upper Glen Rose Formation (Trinity Aquifer) and then flow south into the Edwards Limestone, where it was detected in well 68-28-608. The dye traveled from the cave to well 68-28-608 with an apparent velocity of 1,960 m/d. The breakthrough curve for the Eosin injected into Blanco Road Cave is steep and relatively

Figure 29. Phase III Breakthrough Curve for 68-28-608 in Water Samples

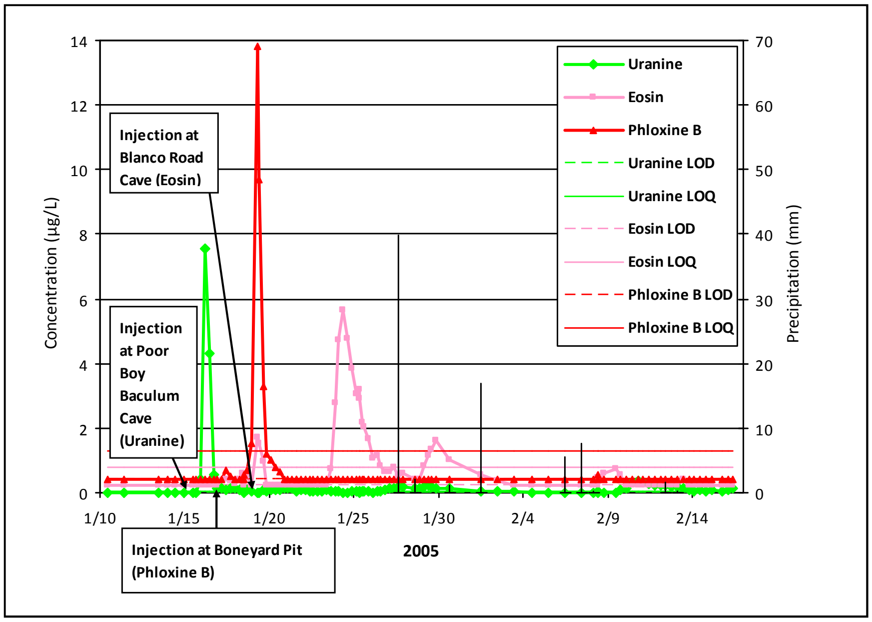
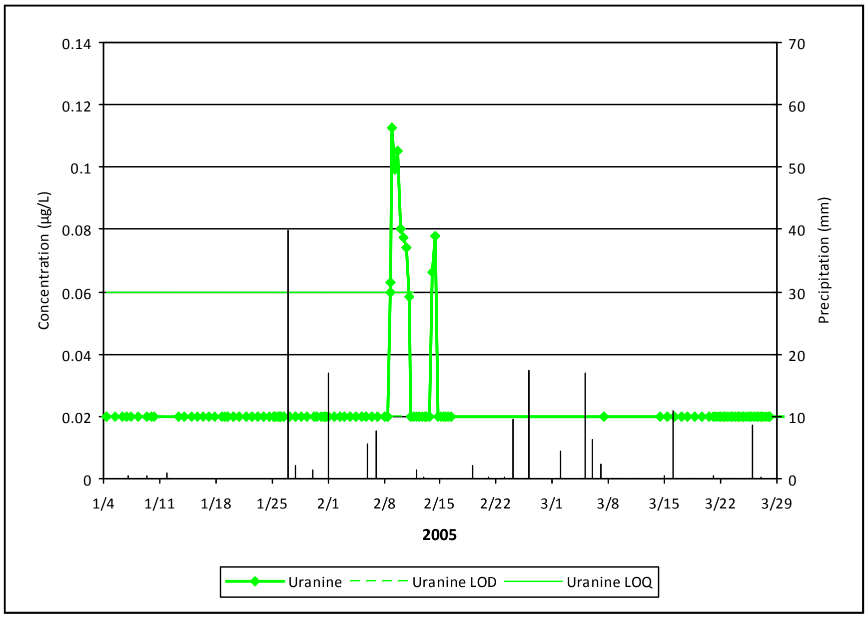


Figure 30. Phase III Breakthrough Curve for Uranine in Water Samples from 68-29-101



broad (see Figure 29). This fact almost certainly reflects a close connection between the cave and a highly permeable flowpath that intersects well 68-28-608. The second and third observed peaks of Eosin in Figure 29 may indicate that some dye was retained in the matrix and/or within the conduits along the flowpath, where it was remobilized during a subsequent rain event. The rainfall hypothesis is supported by the 4.1-d travel time following injection, as compared with a second Eosin peak, which occurred two d after a 40-mm rainfall event on January 27, 2005. It is hypothesized that recharge from the storm, which greatly exceeded the amount of water used to flush the dye into the cave originally, mobilized dye stored along the groundwater flowpath, and dye was subsequently detected in well 68-28-608.

Figure 32 shows the breakthrough curve at 68-28-304 for Uranine injected into Poor Boy Baculum Cave on January 14, 2009 (11:01). Dye traveled for 1.5 d, peaked in 12 to 18 h, and then the concentration steeply declined, indicating a direct and short connection between the cave and a major high-velocity groundwater flowpath.

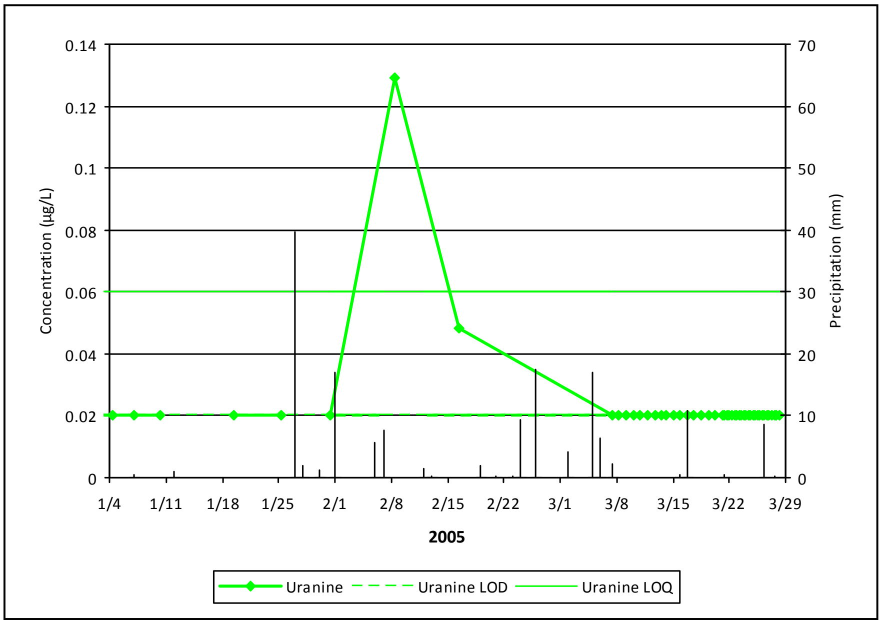


Figure 31. Phase III Breakthrough Curve for Uranine in Water Samples from 68-28-305

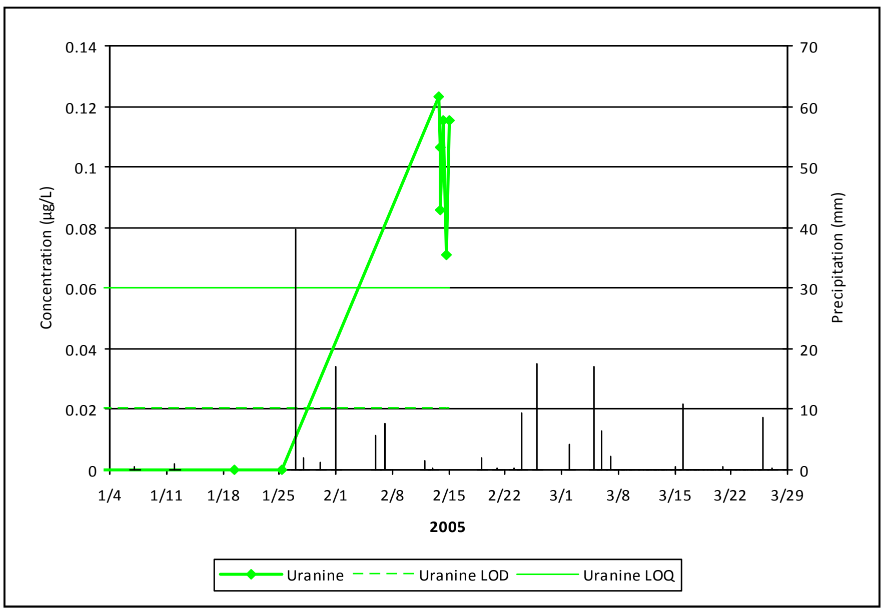


Figure 32. Phase III Breakthrough Curve for Uranine in Water Samples from 68-28-304

Phase IV

The purpose of Phase IV was to simulate precipitation or other liquids entering the soils in an interstream area in the Panther Springs Creek basin. In addition, dye was injected for a second time into Dynamite Cave to compare arrival times between the two tests. On May 25, 2006, liquid Uranine was flushed with water into a shallow swale on the ground surface and allowed to infiltrate into the subsurface. The injection occurred approximately 100 m southwest of Dynamite Cave and south of Loop 1604 in a grassy area behind a store. Eosin was injected on the same day into Dynamite Cave to repeat the Phase I tracer test. Dyes from both injection points were detected at monitoring wells, although tracing results differed from those of Phase I. Wells 68-28-305 and 68-28-309 intercepted Eosin from Dynamite Cave, and 68-28-305 intercepted Uranine from the interstream area. Because both wells are part of the irrigation system at the Club at Sonterra and were in

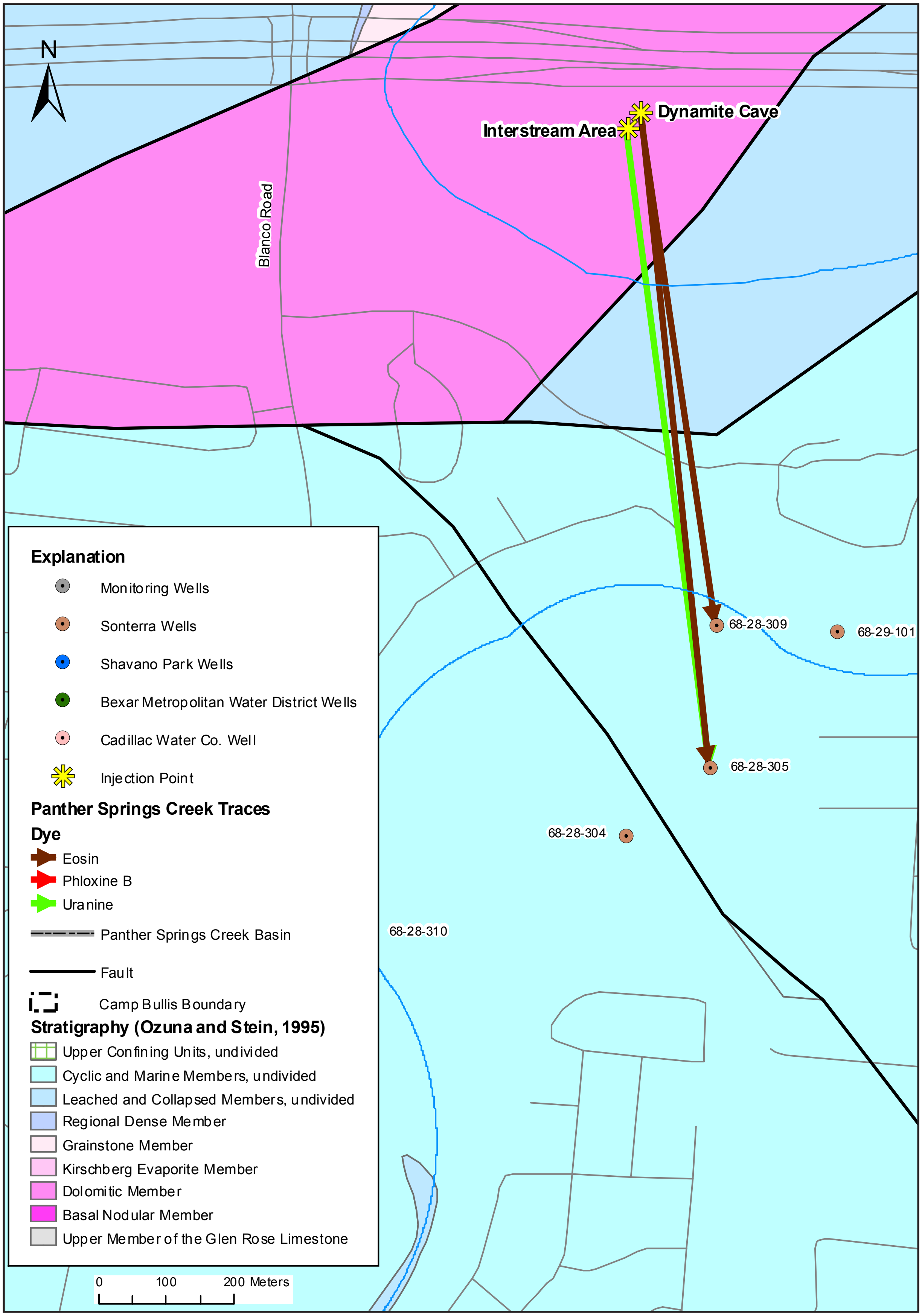


Figure 33. Phase IV Tracer-Test Results

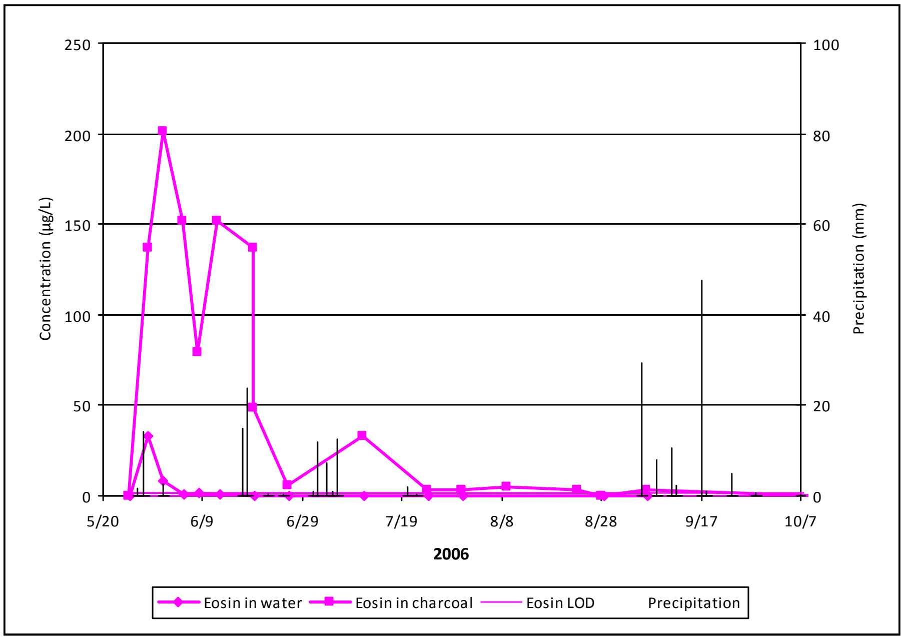


Figure 34. Phase IV Breakthrough Curves for Eosin in Water and Charcoal Samples from 68-28-305

Table 11. Summary of Phase IV Tracer-Test Results.

Injection Point	Injection Date	Dye	Dye Recovery Well	Arrival Date	Distance (m)	Travel Time* (d)	Apparent Velocity* (m/d)
Dynamite Cave	5/25/06 09:00 J-17 at 200.5 m msl	3,000 g Eosin	68-28-305 (Edwards Ls)	5/29–10/11/06	980	4.0	245
			68-28-309 (Trinity Aquifer)	6/19–8/9/06	780	22	35
Interstream Area	5/25/06 09:30 J-17 at 200.5 m msl	3,010 g Uranine	68-28-305 (Edwards Ls)	7/24–31/06	950	60	16

*Exact arrival times for dyes unknown; maximum times/slowest velocities given.

frequent operation during the test, the heavy pumping may have drawn dye to the wells. Unlike Phase I, no dye was detected in 68-28-608. Table 11 summarizes these results. Figure 33 shows the location of dye injection in relation to wells with detectable dye.

Eosin from the Dynamite Cave injection was detected on May 29 in well 68-28-305, which is completed in the Edwards Aquifer. Although Uranine from Stone Pond Cave (Phase I), Eosin from Genesis Cave (Phase II), and Uranine from Poor Boy Baculum Cave (Phase III) also were detected at 68-28-305, preinjection background samples collected for Phase IV indicated that other dyes were no longer present in the well. Figure 34 shows Eosin concentrations in both water and charcoal samples. Dye concentrations are typically higher and more variable in charcoal samples than in water samples. Although undetectable in water, dye persisted until monitoring using charcoal receptors ended in October 2006 in 68-28-305.

All detections at 68-28-305 were characterized by relatively slow groundwater velocities, ranging from 46 m/d in Phase I to 245 m/d in Phase IV, compared with the rapid velocities measured at 68-28-608 in other phases. Well 68-28-305 is an irrigation well and was being pumped at the time of the test.

Eosin was detected at 68-28-309 on June 19, 22 d after injection at Dynamite Cave during Phase IV. Phase IV was the only test in which dye was detected in 68-28-309, which is completed in the Trinity Aquifer at 373 m below ground, with 120 m of casing sealing off the Edwards Aquifer. Because water levels in the Trinity Aquifer are lower than in the Edwards Aquifer, dye transport was apparently influenced by the vertical hydraulic gradient created by pumping to migrate downward into the well.

Well 68-28-305 intercepted Uranine injected at the interstream site on July 24, 60 days after injection. Only charcoal samples collected on July 24 and 31 contained Uranine, indicating that the dye had passed by the well at concentrations too low to detect in water. The order of magnitude decrease in apparent velocity from the Dynamite Cave trace compared with its Phase I trace may be attributed to lower groundwater levels during Phase IV, as indicated in Figure 21. If that is the case, velocities from the interstream location may also be slowed by low groundwater levels, or dye was slowed by moving through soil and epikarst.

Unlike the Phase I tracer test (October 2004), Eosin injected at Dynamite Cave was not detected at 68-28-608. Aquifer conditions apparently changed between Phases I and IV, causing the Eosin to migrate along a different flowpath. During Phase I (October 2004), the elevation of water in 68-28-608 was approximately 220 m msl, whereas it was 205 m msl during Phase IV, a decline of 15 m between Phase I and Phase IV. Similarly, the J-17 water level was 10 to 15 m lower during Phase IV than in Phase I.

Hydrophysical studies of well 68-28-608 (RAS, Inc., 2005), performed after completion of Phase I to III tracer tests, indicate that this well breaches a confining unit between vertically separated high flow zones within the Edwards Limestone. Depending on hydraulic head, water may move either up or down the borehole at a rate of as much as 1,333 L/min. A detailed review of the stratigraphy of well 68-28-608 indicates that the confining unit does not correspond to the contact between the Person and Kainer formations (Regional Dense Member), but rather to a low permeable horizon in the lower part of the Kainer Formation approximately 12 m above the top of the Basal Nodular Member. The direction of vertical groundwater flow in the 68-28-608 well bore may have changed between Phases I and IV, resulting in a change in groundwater-flow conditions and a failure of the well to capture the dye. The change in upward versus downward gradients in well 68-28-608 is well documented in the Authority’s water level measurements during 2007 and 2008 (see "Discussion" p. 35).

DISCUSSION

Evaluation of Groundwater Flowpaths in Panther Springs Creek Watershed

Tracer-test results document that groundwater near Panther Springs Creek has rapid (>1,000 m/d) convergent and divergent flowpaths that trend generally down the potentiometric gradient (south from the recharge zone to the transition zone and toward the artesian zone of the Edwards Aquifer). Dye from Phases I, II, and III converged at or near well 68-28-608, bypassing several high-capacity water supply wells and more slowly intersecting others. Apparently the dye generally follows well-developed preferential flowpaths (conduits) associated with Panther Springs Creek. These flowpaths are seemingly isolated from other flowpaths that carry water to local pumping centers, as indicated by the absence of dye detections at the water supply wells. For example, dye was not drawn to the high-capacity wells in the Hollywood Park area southeast of Genesis Cave, the City of Shavano Park, or Cadillac Water Company water supply wells southwest of the injection points. Only a single sample from irrigation wells completed in the Trinity Aquifer at the Club at Sonterra contained dye (Phase IV).

Divergent flowpaths were indicated by dye detected at seven other wells, in addition to 68-28-608. For example, dye from Boneyard Pit followed at least three different flowpaths, arriving at 68-28-601 and 68-28-311, in addition to 68-28-608. Travel times to wells 68-28-601 and 68-28-311 were slower, and dye concentrations were lower, suggesting that these wells are located on secondary flowpaths and/or were influenced by pumping from the wells. Dye detections between the different phases were inconsistent because of varying conditions, such as groundwater levels and hydraulic gradients. The Phase II trace from Poor Boy Baculum Cave was detected in 68-29-101 and 68-28-608, but in Phase III it was also detected in 68-28-304 and 68-28-305, as well as 68-29-101 and 68-28-608. Phases I through III occurred during relatively high groundwater conditions. The Dynamite Cave traces demonstrated the difference in flowpaths during different groundwater conditions because dye was detected in 68-28-608 when water levels were high during Phase I, but not detected when groundwater levels were lower during Phase IV. This evidence indicates that additional tracer tests are needed to discern the relationship between aquifer levels and flowpaths.

Phase IV results indicate that interstream areas can act as a point source and contribute recharge (and contaminants) to the aquifer rather than just observed karst features and stream channels. For the Phase IV tracer test, 180,000 L of water with dye was injected into the subsurface in an interstream area, and the dye traveled to two nearby wells. The Edwards Aquifer is commonly considered vulnerable to contaminants only in fractured areas and near karst features (Clark, 2000). The dye injection area was classified as "less vulnerable" by Clark (2000). Consequently, results of interstream tracing have shown that the Edwards Aquifer is also vulnerable in interstream areas and where faults, fractures, and solution features are not evident.

Results of Phase IV tracer tests, used in comparison with earlier results, show a range of possibilities regarding groundwater (and contaminant) transport in the aquifer. Groundwater velocities, from the surface to receptor wells, can range from 16 m/d to as high as 4,980 m/d. In one tracer test, 2.8 kg of dye moved 6,290 m in 1.5 d and reached a concentration of more than 5 μg/L in a receptor well. If the tracer test were a contaminant spill of less than one gal of liquid, it would have traveled more than three mi, and the resulting concentration would have exceeded five μg/L, which is a common maximum contaminant limit for many volatile organic compounds such as tetrachloroethene (PCE). In other cases, contaminants can move much more slowly and take more than a month to reach a receptor and persist for many months. The concentrations of detected dye also show that little if any attenuation occurs from natural processes in the recharge zone. In addition, the data indicate that groundwater flowpaths can change according to hydraulic conditions and also be influenced by pumping wells. Sampling protocols for contaminant investigations should also take into account the rate of flow, concentration, and persistence revealed by the tracer-test results.

Evaluation of Stratigraphy and Structure on Groundwater Flowpaths

Figure 35 shows injection points and monitoring wells overlaid on the geologic map of the area. Interpreted groundwater flowpaths from Boneyard Pit and Poor Boy Baculum Cave crossed at least five major faults. Boneyard Pit and Poor Boy Baculum Cave are naturally occurring karst features and readily accept surface water input, as do most karst features in the recharge zone. In addition, the lower levels of both caves intersect the upper member of the Glen Rose Formation and, therefore, dye in the groundwater moved from the Glen Rose Limestone into the Edwards Limestone. Regionally groundwater in the Panther Springs Creek basin moved perpendicularly to the strike of the graben and horst system faulting and into the confined zone of the Edwards Aquifer.

Figure 36 is a schematic structural geologic cross section along the traced groundwater flowpaths. Dye was injected into Poor Boy Baculum Cave and Boneyard Pit, whose entrances are located in the Edwards Limestone, but they terminate in Interval A of the upper member of the Glen Rose Formation. The entrance to Blanco Road Cave is also in the Edwards Limestone, and whereas the cave has not been explored into the Glen Rose, water almost certainly flows vertically down through the collapse feature in the bottom of the cave at the base of the Edwards Limestone into the Glen Rose Formation.

This investigation demonstrated that groundwater in Interval A of the upper member of the Glen Rose Formation (Upper Trinity Aquifer) recharges the Edwards Aquifer in the Panther Springs Creek groundwater basin. Dyes injected into the Trinity Aquifer from Poor Boy Baculum, Boneyard, and Blanco Road caves were subsequently detected in wells in the Edwards Aquifer.

Tracer tests clearly show the connection between the injection point and the recovery points. The flowpaths indicated in Figure 35 are representative of the regional flowpath locations (at the kilometer scale). Whereas it is possible that dye and groundwater could flow around the ends of faults, the flowpath would be many kilometers longer, and groundwater then would have to flow up the potentiometric gradient to appear in the receptor wells. It is much more reasonable to assume that groundwater crosses faults and that faults more likely play an important role in allowing cross-formational flow.

Evaluation of Well 68-28-608

Well 68-28-608 proved highly significant to this tracer study. Without the detections of dyes in this well during Phases I, II, and III at 68-28-608, discovery that major groundwater flowpaths crosscut vertical faults would not have been apparent, and groundwater velocities would have been underestimated by orders of magnitude. The Authority investigated the physical characteristics of the well by performing a variety of downhole geophysical logging. In addition to the Authority's well logging capabilities, the Authority also contracted RAS, Inc.—Integrated Subsurface Evaluation (RAS, Inc., 2005)—to perform a hydrophysical study of the well. RAS logged the well using a three-arm caliper, gamma/induction, and analog video instrument to confirm well construction and borehole conditions. Using deionized water injected at a point near the water surface, RAS measured changes in fluid-electrical conductivity and temperature using a multisensor hydrophysical logging tool to measure groundwater velocity and flow direction. RAS positioned a wireline straddle packer tool at four depths in the borehole to measure head pressures above, below, and within the tested interval. Table 12 lists results.

Given the hydrophysical logging results, well 68-28-608 is interpreted to connect four water-bearing units at different depths in the Edwards Aquifer. The well is located immediately south of the recharge zone, where water-table or artesian conditions may be present, depending on aquifer stage, and the Edwards Limestone is overlain by upper confining units. The four hydrostratigraphic units could be differentiated on the basis of hydraulic heads. The upper three units (depths of 61–67, 114–120, and 123–129 m below ground surface) appear to be hydraulically connected because they have the same hydraulic head when isolated with wireline straddle packers. However, the lowest hydrostratigraphic unit (130–137 m below ground surface) has a significantly different head than do the upper three units when isolated using wireline straddle packers, indicating that it is hydraulically and hydrogeologically isolated from the upper units.

The upper unit is between 61 and 67 m below ground surface in the highly permeable Leached and Collapsed

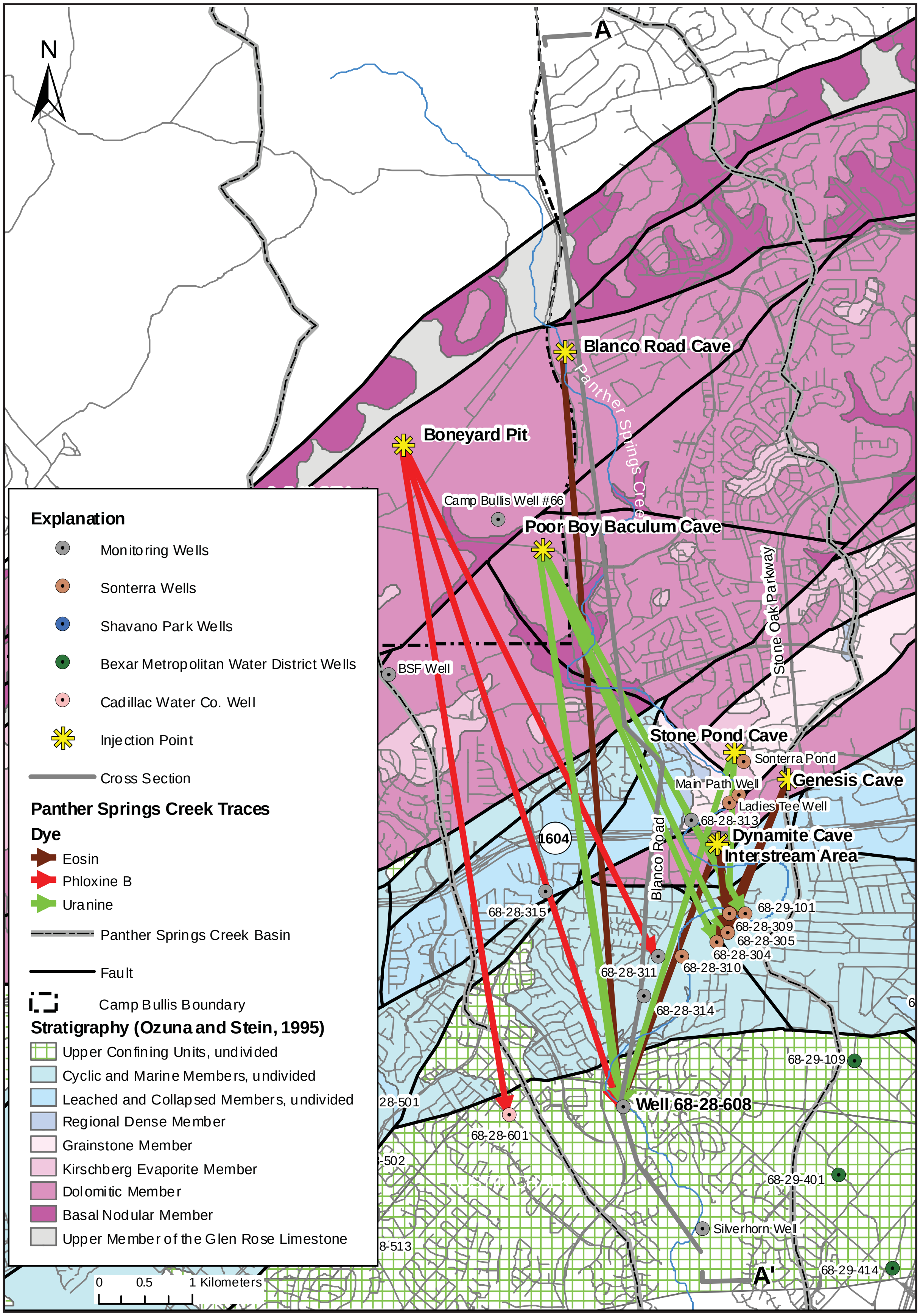


Figure 35. Geologic Map with Tracer-Test Results

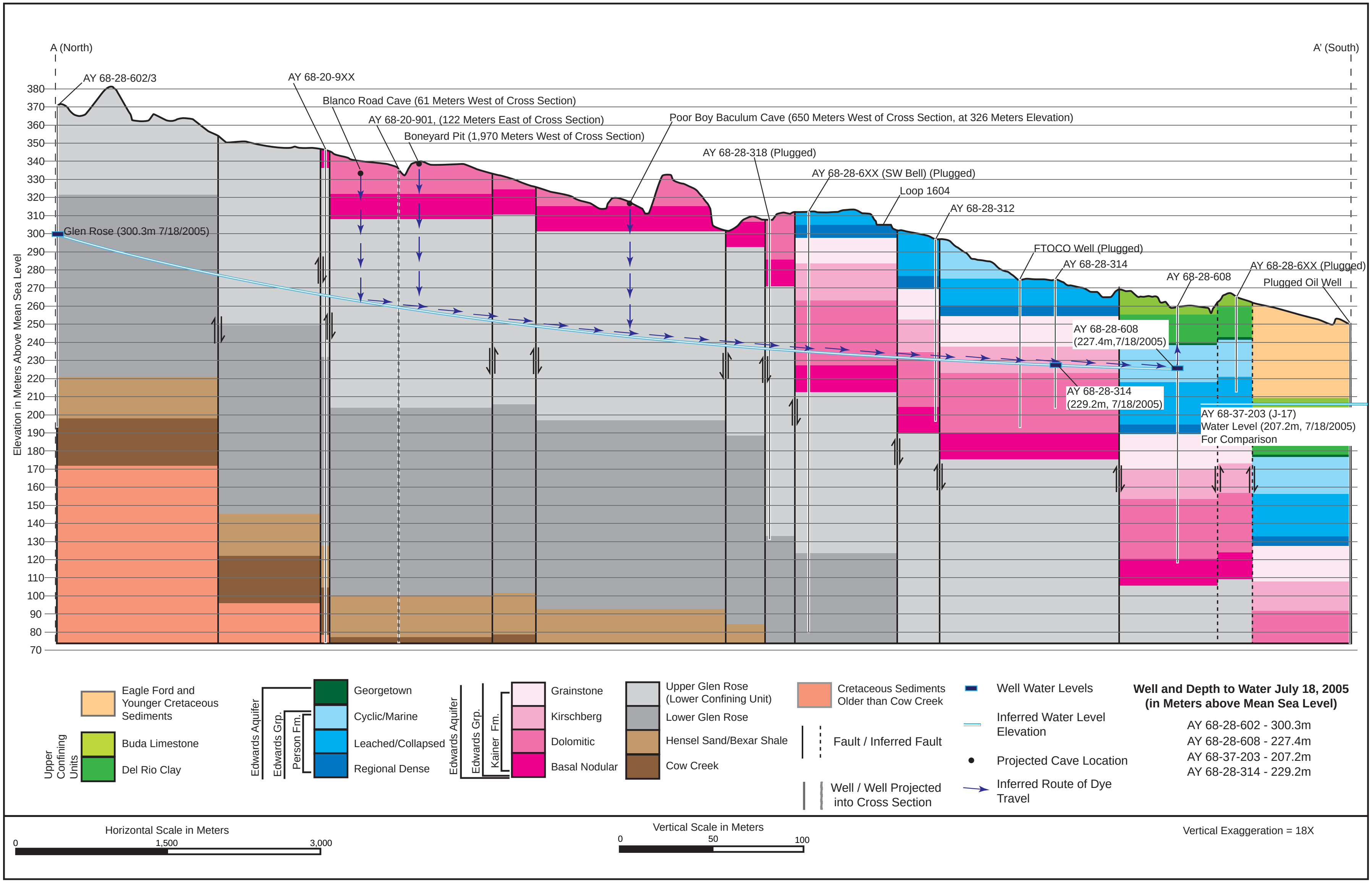


Figure 36. Schematic Cross Section of the Flowpath beneath Panther Springs Creek

Table 12. Summary of Hydrophysical and Packer Tests of Well 68-28-608

Inflow or Test Interval Depth (m below top of casing)	Interval Specific Flow Rate during Ambient Conditions (L/s)	Interval Isolated above Packer (m)	Interval Isolated Below Packer (m)	Change in Pressure above Packer (m) + = Increase - = Decrease	Change in Pressure below Packer (m) + = Increase - = Decrease
Wireline Packer Results					
70.1		53.6–69.8	70.4–146.9	+7.80	- 0.58
86.6		53.6–86.3	86.9–146.9	+ 7.80	- 0.52
107.6		53.6–107.0	107.6–146.9	+ 7.86	- 0.34
122.5		53.6–122.2	122.8–146.9	+ 7.99	< - 0.12
Hydrophysical Results		Member			
61–67	3.8 (inflow)	Leached and collapsed			
114–120	1.4 (inflow)	Dolomitic			
123–129	1.1 (inflow)	Dolomitic			
130 – 137	6.2 (outflow)	Dolomitic/Basal Nodular			

member of the Person Formation in the Edwards Limestone, which is immediately above the poorly soluble, Regional Dense Member. The middle two units, at depths of 114 to 120 m and 123 to 129 m, correspond to the Kirschberg and Dolomitic members, respectively, of the Kainer Formation. The Regional Dense Member has been assumed by many to act as a regional aquitard, hydraulically separating the Person and Kainer formations. However, the hydrophysical data do not indicate that it acts as an aquitard in the area of 68-28-608.

The lower unit is between 130 and 137 m below ground surface within the Dolomitic and Basal Nodular members. During hydrophysical testing, the lower unit was isolated with packers, and the hydraulic head in the upper unit was approximately eight m higher than the lower unit, as listed in Table 12. When the packers were removed and the continuity of the well bore reestablished, the head difference between the upper three units and the lower unit caused a downward flow of water at a rate of approximately 1,300 L/min. All of the high permeability units consist of interconnected, high-density vugular areas.

This observed vertically downward gradient indicates that during the tracer test, dyes intersected well 68-28-608 through the upper unit and exited through the lower unit. This vertical flow scenario is consistent with the dye being transported in the shallowest groundwater zone In the Panther Springs Creek basin.

Recent water levels measured in well 68-28-608, shown in Figure 37, indicate that hydraulic conditions in well 68-28-608 are highly dynamic. Transducers were placed above and below a packer at a depth of 123 m in the well to monitor water levels continuously. Beginning in August 2007, water levels in the lower part of the well were approximately 29 m higher than in the upper part, indicating vertical upward potential movement of groundwater, contrary to conditions during the tracer test. During the subsequent dry period, water levels in the lower part of the well declined, whereas water levels in the upper part remained relatively constant. Finally, hydraulic heads in the lower and upper parts were equal in late December 2007, and water levels in both parts continued to decline. A precipitation event in August 2007 caused water levels in both parts to respond. In March 2008, the lower part registered a

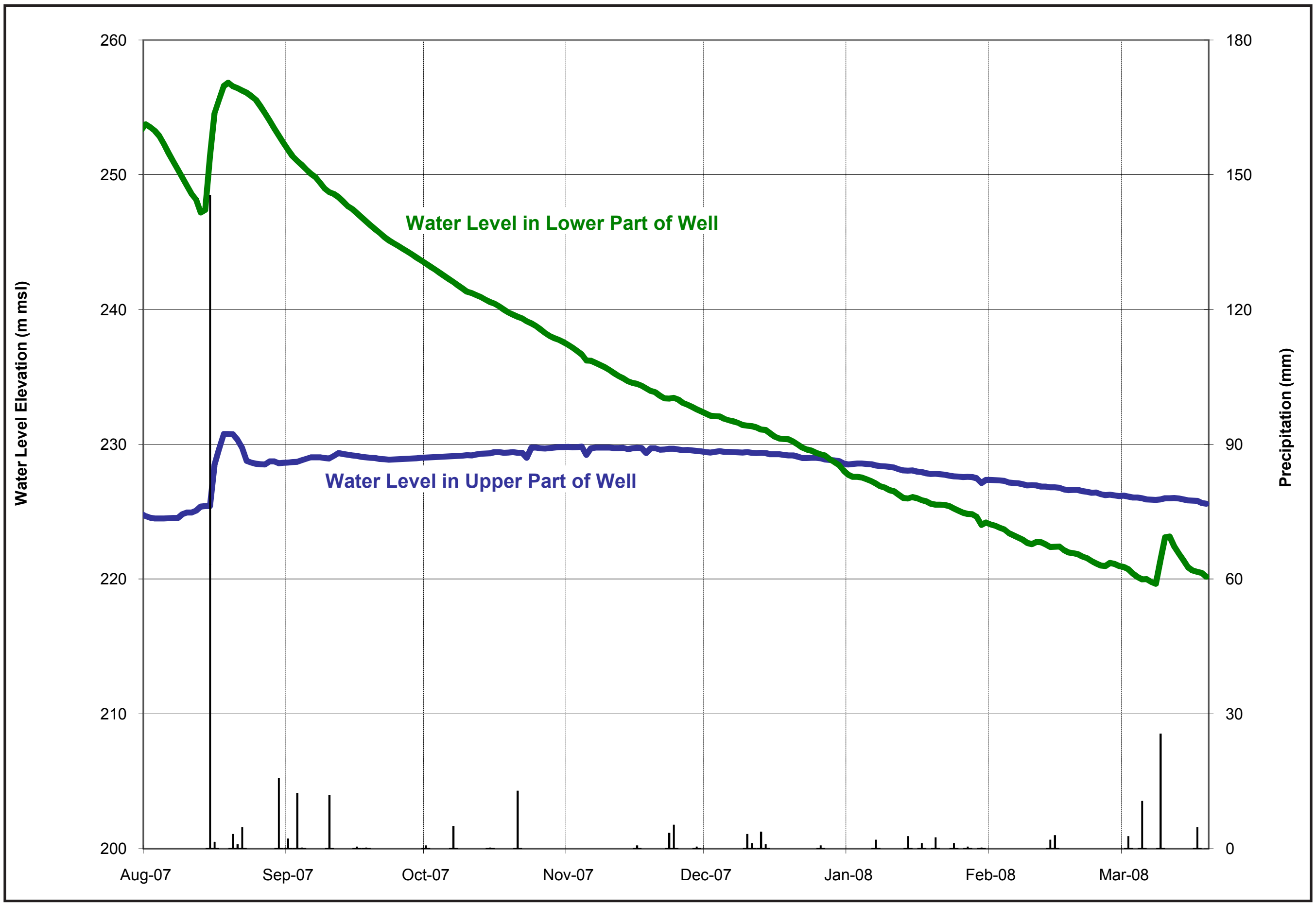


Figure 37. Recent Water Levels in Well 68-28-608

strong response to a precipitation event as compared with a weak response in the upper part. Packer seal was maintained throughout the period, according to packer pressure measurements and the contrasting hydraulic heads above and below the packer.

Given these water-level data, tracer-test results might have been different had they been conducted when hydraulic heads were reversed in the aquifer. Dye in the upper part of the well could have been diluted, or nondetectable, by groundwater inflow if the higher hydraulic head in the lower part of the well had modified the local flow regime.

These data strongly reinforce the concept that flow in this part of the aquifer is nonhomogeneous and anisotropic. The rapid flow, crossing flowpaths, and divergent traces are consistent with regional karst processes being focused on variable lithology and variable structure, creating a highly complex flow system that is evolving and that responds differently under varying natural head and pumping configurations. These results call for continued tracing, especially in areas that are determined to be critical or upgradient of poorly understood or intensely pumped areas.

Genesis Cave Tracing Results

No Eosin dye from Genesis Cave was detected at 68-28-608. Dye detections in wells 68-28-304 and 68-28-305 southwest of Genesis Cave are thought to represent only a small fraction of the dye that was injected at Genesis Cave because those wells are pumped infrequently at a rate of approximately 400 L/min, and, therefore, the wells would have removed only a fraction of a gram of dye a day at that pumping rate. Eosin persisted at 68-28-305 for approximately

12 d. The slow groundwater velocities in comparison with velocities in other tracer tests in this study indicate that the dye was probably pulled into the wells by pumping, although this cave most likely lies within a separate flowpath unrelated to well 68-28-608.

In addition, groundwater mounding downgradient from Genesis Cave due to high recharge conditions may have slowed or diverted groundwater from reaching 68-28-608. Genesis Cave is undoubtedly connected to a more permeable flowpath because of its great depth and the presence of groundwater in the bottom of the cave. No dye was detected in Bexar Metropolitan Water District water supply wells approximately seven km southeast of the cave or in Shavano Park wells approximately 13 km southwest of the cave. Repeating a tracer test at the cave during lower water levels and monitoring additional wells may help to define Genesis Cave's role in the Panther Springs Creek groundwater basin.

CONCEPTUAL MODEL OF GROUNDWATER FLOW IN THE PANTHER SPRINGS CREEK GROUNDWATER BASIN

This section presents the conceptual model of the Panther Springs Creek groundwater basin that is based on tracer testing and compares it with the groundwater model of the area constructed by Lindgren et al. (2004).

Conceptual Model Based on Tracer-Test Results

Results of this tracer study demonstrate the presence of rapid groundwater flowpaths beneath Panther Springs Creek that extend from the recharge zone to at least the transition zone of the Edwards Aquifer. During high groundwater conditions, groundwater velocities were measured at up to 4,980 m/d. Groundwater is recharged by infiltration of runoff into discrete karst features, such as sinkholes and caves in the bed of Panther Springs Creek and in interstream areas. In addition, cross-formational flow also occurs between the Edwards Limestone and Interval A of the upper Glen Rose Formation. Groundwater flows under unconfined or semiconfined conditions from the recharge zone to the transition zone.

Tracer tests demonstrate that there is a rapid and direct hydrologic connection between Interval A of the upper member of the Glen Rose Formation (Upper Trinity Aquifer) and the Edwards Limestone of the Edwards Aquifer in the Panther Springs Creek groundwater basin in northern Bexar County. Faults of the Balcones Fault Zone juxtapose the upper members of the Glen Rose Formation against the Edwards Aquifer. Although several significant faults with as much as 104 m of displacement transect the study area, offsetting the Edwards Limestone by more than 50%, they do not act as a barrier to groundwater flow as previously hypothesized. Interval A of the upper Glen Rose Limestone immediately underlies the Edwards Aquifer and possesses “fracture and cavern porosity,” as reported by Clark (2003), similar to the Edwards Group. Karst processes form flowpaths that are continuous through both the Glen Rose Formation and the Edwards Aquifer and form a single hydrostratigraphic unit in the study area.

Tracer-test results and aquifer conditions in well 68-28-608 reveal a three-dimensional groundwater flow system in the Edwards Aquifer in the Panther Springs Creek area. Groundwater flowpaths shift in response to changing aquifer conditions. The hydrophysical survey of 68-28-608 revealed that flowpaths with different hydraulic heads were vertically separated by a few meters and that groundwater flow may change directions, depending on hydraulic gradients, precipitation, pumping stresses, and other transient stresses. In fact, dyes were successfully detected because aquifer conditions at the time of tracing influence the movement of dyes. Results may have been different if they had been conducted under different hydrologic conditions.

These tests demonstrate the anisotropy that exists in karst aquifers, a fact that is often underrated or misunderstood during characterization of regional groundwater systems. Anisotropic characteristics of karst aquifers include discrete groundwater flowpaths, aquifer characteristics that change with water levels, a large range in groundwater velocities, vertical groundwater flow, and rapid response to precipitation.

Because of anisotropic conditions, a karst groundwater system must be investigated using a variety of techniques that complement the tracer tests. This study benefited from hydrophysical surveys within well 68-28-608, high-frequency water sampling, cave exploration and mapping, continuous water level measurements, precipitation measurements, and detailed geologic mapping.

Comparison of Tracer-Test Results with Computer Model Simulations

The USGS and the Bureau of Economic Geology (BEG), The University of Texas at Austin, constructed a numerical groundwater-flow model of the Edwards Aquifer as part of a 2000–2003 study conducted in cooperation with the U.S. Department of Defense and the Authority (Lindgren et al., 2004). The single-layer, regional model was built using MODFLOW (McDonald and Harbaugh, 1988), covering the area from the groundwater divide in Kinney County on the west to Barton Springs on the east and calibrated using monthly recharge, pumpage, and water level data from 1947 through 2000. The model incorporates high transmissivity zones (high T zones) represented by one-cell-wide (1,320 ft) zones with large hydraulic-conductivity values (as much as 300,000 ft/d), whereas the rest of the model had lower hydraulic conductivities to represent the aquifer matrix. Locations of modeled high T zones were guided by known locations of major troughs in the potentiometric surface of the aquifer, channels of sinking streams, zones of lower groundwater having lower total dissolved solids (TDS) that indicate less residence time, and faults or grabens in the Balcones Fault Zone. The combination of high T zones and faults simulates converging groundwater flow downgradient from the recharge zone to the artesian zone to discharge points at Comal, San Marcos, or other springs. The physical basis for high T zones is dissolution that occurs as a result of the interaction of slightly acidic water with carbonate rocks. Dissolution is occurring within the recharge zone of the area, as well as at depth in the artesian zone. Simulated high T zones carry most of the groundwater flow because of their higher hydraulic conductivities compared with those of the matrix cells. Flow is also influenced by barrier faults that impede or redirect flow. According to Lindgren et al. (2004), "…the effectiveness of a fault as a barrier to flow perpendicular to the fault is proportional to the fault displacement." The model contains faults to simulate the Balcones Fault Zone, and the hydraulic conductance of each fault is proportional to its displacement.

Tracer tests in the Panther Springs Creek groundwater basin provide an opportunity to compare computer model simulation with actual groundwater conditions. After the model was calibrated, MODPATH (Pollock, 1994) was used to simulate groundwater flowpaths by placing particles within each of the cells of the injection points and running the model. MODPATH produces flowpaths and velocities for each particle as it follows the hydraulic gradient generated for a particular time under transient conditions by the model.

Tracer-test results and model simulation for the Panther Springs Creek area are shown in Figure 38. Whereas groundwater flowpaths carried tracers southward, the model predicted that they would travel southeastward toward a simulated high T zone in eastern Bexar County that carries water to Comal and San Marcos springs. Simulated groundwater flow is influenced primarily by the hydraulic gradient toward the high T zone because the modeled recharge zone is largely homogeneous in the Panther Springs Creek basin, an oversimplification based on known hydrogeology at the time of model preparation.

Few faults were inserted into the model near Panther Springs Creek because Lindgren et al. (2004) concluded that faults in the recharge zone would have little influence on groundwater flow. In fact, principal faults in the model separating the recharge zone from the artesian zone did not influence groundwater-flow directions because, as Figure 38 shows, the tracer-test flowpath crosses the modeled recharge zone boundary faulting. Actual groundwater velocities varied from model predictions. The length of the line between modeled flowpath arrows represents one year of travel, a distance ranging from one to two km. Because dyes traveled as far as several kilometers a day, MODPATH and MODFLOW severely underestimated groundwater velocity. Modeled velocities near faults are less than they are near injection points because hydraulic conductivities are lower. In addition, the faults are not continuous, which also allows groundwater to cross faulted areas. Lindgren et al. (2004) were cognizant of the limitations of the model and also recommended against using the model to simulate travel times of contaminants in groundwater.

There are several reasons that model simulation differs from tracer tests, but the main reason is anisotropy of the Edwards Aquifer compared with isotropy of the model. This investigation revealed horizontal and vertical anisotropy of the aquifer, which the model cannot readily simulate. The model is limited to varying hydraulic conductivity and saturated thickness of the single layer to create anisotropic conditions. A single-layer MODFLOW model of the aquifer was built because existing subsurface data were insufficient to simulate the anisotropic properties of additional layers. Although more layers could be added, data-acquisition

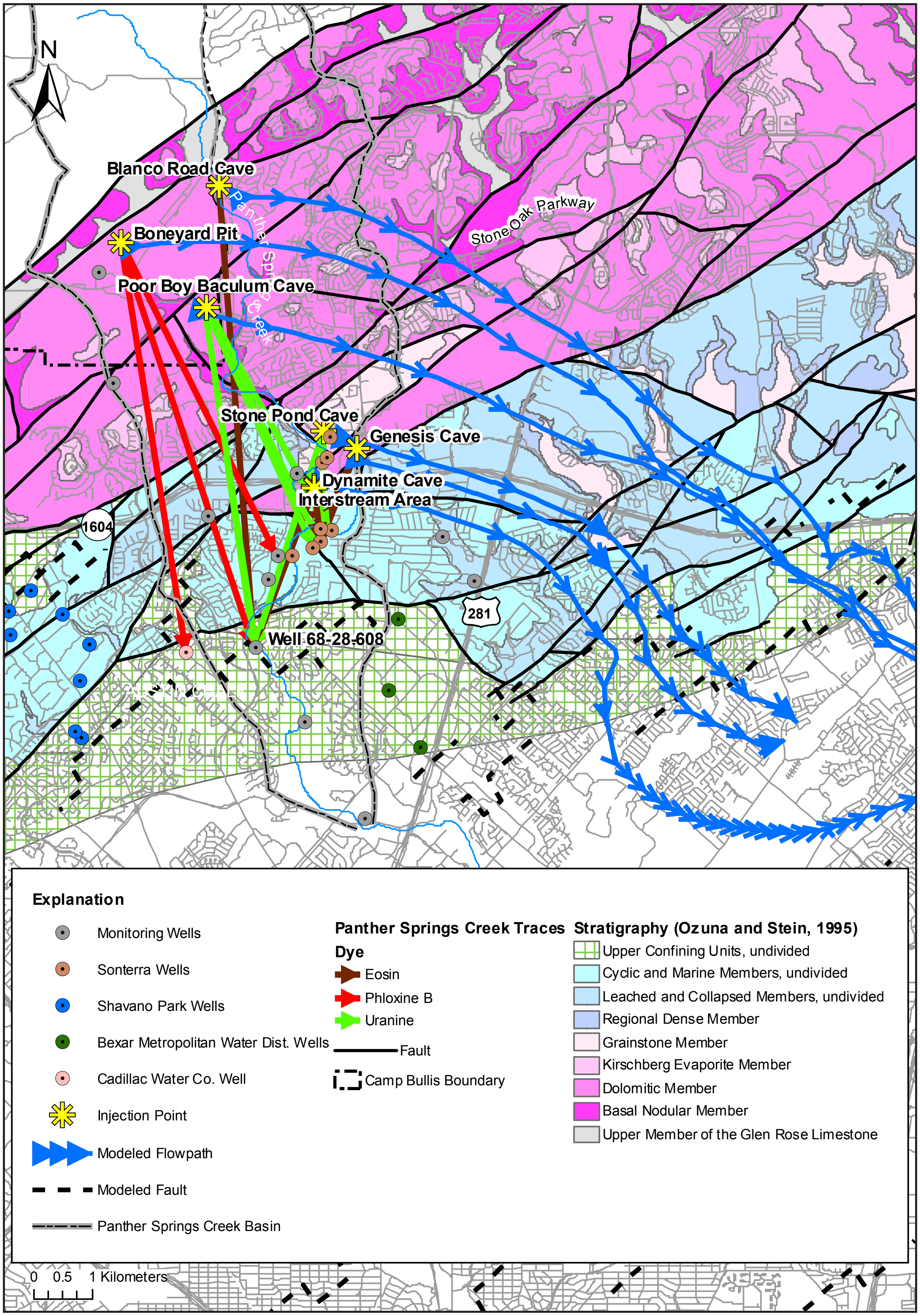


Figure 38. Tracer-Test Results Compared with Model Simulation

costs of characterizing each layer would be extremely high. Consequently, while groundwater models are being designed and built, there are tradeoffs among (1) sufficiency of subsurface data, (2) costs of obtaining new data, and (3) objectives of the model.

Despite the disagreement between tracer-test results and simulated conditions, constructing and critiquing a conceptual model are the appropriate functions of the numerical groundwater model. Both model and tracer tests provide insight into behavior of the aquifer. The numerical model was constructed with the best available subsurface data, and now it may be improved using results of tracer tests. This process of modeling and testing may be repeated many times, the model becoming more representative of the aquifer with each iteration.

Groundwater models in karst systems, even if calibrated and verified with water level data, should not be used for particle tracking/contaminant transport studies unless they have first been calibrated with tracer-testing data.

CONCLUSIONS

- Tracer tests showed that preferential groundwater flowpaths are associated with the Panther Springs Creek basin in the Edwards Aquifer recharge zone in northern Bexar County.
- Solution features associated with flowpaths are connected to the ground surface.
- These high-transmissivity flowpaths crossed several northeast-southwest-trending faults in which members of the Edwards and Glen Rose formations are juxtaposed by as much as 104 m of vertical displacement.
- Apparent groundwater velocities measured by tracer tests ranged from 16 to 4,980 m/d in the Panther Springs Creek groundwater basin.
- The aquifer system has three-dimensional anisotropy and is highly heterogeneous, with multiple flowpaths and vertical gradients that vary with groundwater levels.
- Surface water entering the Edwards Limestone in the recharge zone may pass through the Edwards Limestone and enter Interval A of the upper Glen Rose Formation in the Panther Springs Creek basin.
- Groundwater from Interval A of the upper Glen Rose Formation of the Upper Trinity Aquifer recharges the Edwards Aquifer in the Panther Springs Creek basin.
- Water wells in the Edwards Aquifer are vulnerable to potential contaminants that infiltrate the recharge zone from stormwater runoff or contaminant spills, even in the absence of obvious karst features or fractures, as shown by the interstream area trace.
- Karst aquifer studies have large data requirements for characterizing the groundwater-flow system, including tracer tests, hydrophysical surveys, continuous water level measurements, cave mapping, and high-frequency water sampling.
- Groundwater models in karst systems, even if calibrated and verified with water level data, should not be used for particle tracking/contaminant transport studies unless calibrated with tracer-testing data.

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REFERENCES

Alexander, E.C., Jr., and Quinlan, J.F., 1996, Introduction to practical techniques for tracing groundwater in carbonates and other fractured rocks. In: Schindel, G.M., Quinlan, J.F., Davies, G.J., and Ray, J.A., Guidelines for wellhead and springhead protection area delineation in carbonate rocks: U.S. EPA Region IV Groundwater Protection Branch, 195 p.

Alexander, S.C., 2005, Spectral deconvolution and quantification of natural organic material and fluorescent tracer dyes. In: Sinkholes and the engineering and environmental impacts of karst: Proceedings of the 10th Multidisciplinary Conference, September 24–28, San Antonio: ASCE Geotechnical Special Publication No. 144, p. 441–448.

Clark, A.K., 2000, Vulnerability of ground water to contamination, Edwards Aquifer Recharge Zone, Bexar County, Texas, 1998: U.S. Geological Survey Water-Resources Investigations Report 00-4149, 9 p.

Clark, A.K., 2003, Geological framework and hydrogeologic features of the Glen Rose Limestone, Camp Bullis Training Site, Bexar County, Texas: U.S. Geological Survey Water-Resources Investigations Report 03-4081, 9 p. + 1 pl.

George Veni and Associates, 2008, Hydrogeological, biological, archeological, and paleontological karst investigations, Camp Bullis, Texas, 1993-2007. Report for Natural and Cultural Resources, Environmental Division, Fort Sam Houston, Texas, by George Veni and Associates, Carlsbad, New Mexico, 2621 p.

Lindgren, R.J., Dutton, A.R., Hovorka, S.D., Worthington, S.R.H., and Painter, S., 2004, Conceptualization and simulation of the Edwards aquifer, San Antonio region, Texas: U.S. Geological Survey Scientific Investigations Report 2004–5277, 143 p.

Maclay, R.W., and Small, T.A., 1984, Carbonate geology and hydrology of the Edwards aquifer in the San Antonio area, Texas: U.S. Geological Survey Open-File Report 83-537, 72 p.

McDonald, M.G., and Harbaugh, A.W., 1988, A modular three dimensional finite-difference ground-water flow model: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 6, Chapter A1, variously paginated.

Montgomery Watson Harza, 2005, Final sixth interim data evaluation report for Site 8, Camp Bullis Training Site, Texas, prepared for the U.S. Army Corps of Engineers—Tulsa District, June.

Pollock, D.W., 1994, User's guide for MODPATH/MODPATH-PLOT, Version 3: a particle tracking post-processing package for MODFLOW, the U.S. Geological Survey finite-difference ground-water flow model: U.S. Geological Survey Open-File Report 94-464, 234 p.

RAS, Inc., 2005, Geophysical, hydrophysical logging, wireline straddle packer testing and scanning colloidal borescope flowmeter pilot study, Well 608 and Bracken Well: Edwards Aquifer Authority, San Antonio, Texas, 112 p.

Rose, P.R., 1972, Edwards Group, surface and subsurface, central Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 74, 198 p.

Stein, W.G., and Ozuna, G.B., 1995, Geologic framework and hydrogeologic characteristics of the Edwards Aquifer recharge zone, Bexar County, Texas: U.S. Geological Survey Water-Resources Investigations Report 95-4030, 8 p., 1 sheet.

Taylor, F.B., R.B. Hailey, and D.L. Richmond, 1966 (reprinted 1991), Soil survey of Bexar County, Texas, Series 1962, No. 12: Soil Conservation Service, U.S. Department of Agriculture, 126 p. + 99 pls.

Veni, George, 1988, The caves of Bexar County, Second Edition: Austin, Texas Memorial Museum, Speleological Monographs, 2, 300 p.

Wermund, E.G., Cepeda, J.C., and Luttrell, P.E., 1978, Regional distribution of fractures in the southern Edwards Plateau and their relationship to tectonics and caves: The University of Texas at Austin, Bureau of Economic Geology, Geologic Circular 78-2, 13 p.

Worthington, S.R.H., 2003. Conduits and turbulent flow in the Edwards Aquifer: Worthington Groundwater, report prepared for Edwards Aquifer Authority, 42 p.

Worthington, S.R.H., and Smart, C.C., 2003, Empirical determination of tracer mass for sink to springs tests in karst. In: Beck, B.F., ed., Sinkholes and the engineering and environmental impacts of karst: Proceedings of the Ninth Multidisciplinary Conference, Huntsville, Alabama: American Society of Civil Engineers, Geotechnical Special Publication No. 122, p. 287–295.

APPENDIX A. EDWARDS AQUIFER AUTHORITY QC/QA MANUAL FOR TRACER TESTING

The following *Quality Control/Quality Assurance (QC/QA) Manual for Tracer Testing* was prepared to define field and laboratory operations and methods for the performance of tracer testing of groundwater in karst terranes using fluorescent dyes. Operations and procedures contained in this manual define a high standard of data collection. However, depending on the needs of the user, they may determine that some QC/QA methods are unnecessary, given an evaluation of the application of results.

A 1.0 SAMPLING PROCEDURES

The initial field investigation for tracer-test studies will be conducted by an Edwards Aquifer Authority hydrogeologist or contractor experienced in identification of karst features. Work will be supervised by the Authority's Chief Technical Officer or project manager. The hydrogeologist will evaluate potential monitoring and injection locations and will also place background dye receptors (detectors) and oversee other personnel in the collection and replacement of dye receptors.

A 1.1 PROCEDURES FOR SAMPLING GROUND-WATER AND SURFACE WATER FOR DYE

Water samples may be collected for direct analysis of dye or in support of data from passive dye receptors. Water samples from springs and surface streams will be collected by submerging a laboratory-supplied container directly into the water. The clean sample bottle will be rinsed with sample water before being used to collect a sample for analysis. When a sample is collected from a spring or stream, the container will we placed upstream of the sampler and oriented upstream during sample collection.

Samples from groundwater monitoring wells will be collected with precleaned dedicated PVC or Teflon® bailers or dedicated submersible pump. Prior to sampling, the water level in the well will be determined using an electronic water level meter and fiberglass or steel tape and recorded in a field book. Date, time, location, tracing project name, and other relevant field data will be recorded in the field book. Groundwater will not be purged from the well before the sample is collected.

Table A 1-1 lists sample containers, preservatives, holding times, and conditions for groundwater and eluent samples. Only new sample containers will be used for sample collection. For each shipment of containers received, blanks will be taken from the lot and analyzed for presence of dye. Results will be reviewed before any containers from the lot are used.

All sample containers will be stored in an area isolated from the extraction laboratory. Trip blanks for dye will also be prepared in this area.

A 1.2 PROCEDURES FOR USE OF ACTIVATED CARBON RECEPTORS

Dye receptors (detectors) consisting of granular-activated coconut carbon (charcoal) will be used to adsorb dye present in surface water or groundwater. Approximately 20 g of charcoal will be placed into a nylon-screen-mesh packet and placed in springs, cave streams, surface streams, and monitoring wells. Charcoal is used to adsorb Uranine, Rhodamine WT, Sulforhodamine B, Phloxine B, and Eosin.

Dye receptors will be suspended in a surface stream, spring, or cave stream using a wire, string, pins, and/or weight. Detectors will be placed so that they are exposed to any flow that may be present. A rock, brick, or concrete weight (gumdrop) will be used to help maximize the volume of water flowing through the packet and secured with dark-colored nylon string to a nearby tree, tree root, rock, or pin. The dark-colored string is used to blend with the surroundings and help to minimize tampering.

Placement of dye receptors in monitor wells will also utilize the nylon-screen packet but will be weighted using

TABLE A 1-1 REQUIRED CONTAINERS, SAMPLE STORAGE TECHNIQUES, AND RECOMMENDED HOLDING TIMES FOR DYES IN WATER

Parameter	Sample Container	Sample Storage/ Preservation	Recommended Maximum Holding Times
Uranine (Sodium Fluorescein) (Acid Yellow 73)	13-mm glass culture tube with Teflon®-lined screw-top lid or 50-mL plastic culture tube with Teflon®-lined screw-top lid	Store in dark at 4º C	Six months
Rhodamine WT (Acid Red 388)	13-mm glass culture tube with Teflon®-lined screw-top lid or 50-mL plastic culture tube with Teflon®-lined screw-top lid	Store in dark at 4º C	Six months
Sulforhodamine B (Acid Red 52)	13-mm glass culture tube with Teflon®-lined screw-top lid or 50-mL plastic culture tube with Teflon®-lined screw top lid	Store in dark at 4º C	Six months
Eosin (Acid Red 87)	13-mm glass culture tube with Teflon®-lined screw-top lid or 50-mL plastic culture tube with Teflon®-lined screw-top lid	Store in dark at 4º C	Six months
Phloxine B (Acid Red 92)	13-mm glass culture tube with Teflon®-lined screw-top lid or 50-mL plastic culture tube with Teflon®-lined screw-top lid	Store in dark at 4º C	Six months
Optical Brightener Solophenyl (Direct Yellow 96) Blankophor (F.B.A. 28) Tinopal CBSX (F.B.A. 35)	13-mm glass culture tube with Teflon®-lined screw-top lid or 50-mL plastic culture tube with Teflon®-lined screw-top lid	Store in dark at 4º C	Six months

new glass marbles to force the dye receptors below the surface water.

For sampling of water wells, a PVC pipe will be fitted with a hose for attaching to a faucet. The PVC pipe will be constructed such that it will allow placement of a nylon-screen packet within the pipe that will channel flow through the packet.

A 2.0 SAMPLE CUSTODY

A 2.1 FIELD COLLECTION AND SHIPMENT

When samples are transferred/shipped from the field, they will be accompanied by chain-of-custody records. The records will include signatures of relinquisher and receiver, date and time of exchange, and any pertinent remarks. Attached at the end of this QC/QA document will be a sample chain-of-custody form.

During sample collection, the following procedures will be observed:

- To maintain validity of the sample, on-site procedures will be reviewed prior to arrival in the field and confirmed for accuracy.
- Sample handling will be minimized to reduce the chance of error, confusion, or damage.
- Sample bags will be marked in the field in waterproof ink to prevent misidentification due to label illegibility.
- The shipping container will be either padlocked or provided with a tamperproof seal.

Samples will be shipped in one of the following ways so that safeguards in chain of custody can be observed:

- Registered mail, so that a return receipt is requested and available for documentation;
- Common carrier, so that a bill of lading can serve this purpose; or
- Air freight collect, for complete documentation.

Samples collected in the field under supervision of the Authority's staff for field analysis will contain a sample identification form that does not require a chain-of-custody form. All samples determined to be hazardous, according to the U.S. Department of Transportation (U.S. DOT) (49 CFR Section 172.1 or 49 CFR 173.3), will be shipped in strict accordance with U.S. DOT regulations.

A 2.2 DOCUMENT AND SAMPLE CONTROL

A field logbook will be maintained by the sampler as a permanent record of all activities relating to collection of a sample. Information included in the logbook will include a list of those responsible for a sample, date collected, description of location and sample number, and the testing objective. The logbook will also include data on weather at the time of sampling and location and other related field conditions. If the field book is lost or damaged, the loss or damage will promptly be reported to the Chief Technical Officer or Project Manager. This procedure will also be used for field-data and in-house records. Table A 2-1 presents a list of specific information that will be recorded at the time a sample is collected.

A sample logbook will also be maintained by the sample custodian as a permanent record of all activities relating to receipt and disposition of samples. Information included in the logbook are initials of sampler, sample number and location, date collected, date received, project, and testing parameters.

Identification of samples will be serialized in an alpha-numeric system consistent with the procedures of the study. If a sample is contaminated, it is to be disposed of properly and noted in the logbook. Similarly, if a sample is lost, it is to be documented and the Chief Technical Officer or Project Manager promptly notified. Tags or labels affixed to the sample will include all information listed above and the sample number.

TABLE A 2-1 SAMPLE INFORMATION

IN SITU SAMPLES, if collected (e.g., temperature, conductivity)	
DATA in LOGBOOK	Project name or code
	Identification number
	Location name
	Date
	Time
	Sampler(s) initials
	Field observations— weather, problems, etc.
	Remarks
	Value of parameters measured
TRANSPORTED SAMPLES	
DATA on TAGS or LABELS	All above information
	Split sample/duplicate
	Sample/blank

A 2.3 PACKAGING

Sample packaging for shipment is done such that under normal handling, there is no release or damage of dye receptors, effectiveness of the packing is not reduced, and there is no internal mixing of substances. Procedures that are followed to achieve these objectives are:

- Volume of the sample will be limited to the quantity needed for analysis.
- Plastic containers will be used whenever possible. The plastic container will be protected from puncture. If glass containers are used, the glass will be well cushioned.
- Screw lids will be used whenever possible.
- Charcoal receptors will be placed in plastic bags, with the bags sealed to contain a minimum volume of air.

A 2.4 SAMPLE RECEIPT

Upon receipt, the sample custodian will follow these procedures:

- If samples have been damaged during shipment, remaining samples will be carefully examined to determine whether they were affected. Any affected samples will also be considered damaged. It will be noted on the chain-of-custody record/field logbook that specific samples were damaged and that samples will be removed from the analytical schedule.
- Samples received will be compared against those listed on the chain-of-custody form.
- The chain-of-custody form will be signed and dated and attached to the waybill.
- Samples will be entered in the sample logbook, which will contain the following information:
    - Project identification
    - Sample numbers
    - Sample location name
    - Type of sample
    - Date and time sampled
    - Date and time received
- Samples will be placed in proper storage.
- The appropriate Project Manager will be notified of sample arrival.
- Completed chain-of-custody records will be placed in the project file.
- If samples arrive either without a chain-of-custody record or an incorrect chain-of-custody record, the following procedure will be undertaken by the sample custodian:
    - If the chain-of-custody form is incorrect or incomplete, a memorandum to the Project Manager and field personnel will be prepared stating the inaccuracy and necessary correction. The memorandum must be signed and dated by the person originating the chain-of-custody form. The memorandum serves as an amendment to the chain-of-custody form. If the information on the chain-of-custody form cannot be corrected by the Project Manager or the field personnel, affected samples will be removed from the analytical schedule.
    - If the chain-of-custody record is not shipped with the samples, field personnel will be contacted and a memorandum prepared that lists persons involved in collection, shipment, receipt, and times, dates, and events of such. Each person involved must sign and date this memorandum. The completed memorandum will be maintained in lieu of the chain-of-custody record.

A 2.5 SAMPLE STORAGE

Water samples will be stored in a secure area in the dark at 4º C unless signed out for analysis by analytical personnel.

A 2.6 CUSTODY DURING TESTING PROGRAM

When chain-of-custody samples are being analyzed or processed, they will be signed out by the appropriate analyst. The individual performing the tests becomes responsible for the samples at that point. Samples will be maintained within sight or in the secure possession of the individual performing the test. When the work is completed, samples will be returned and logged in to secure them in the proper storage location. During processing, the sample may be split into several fractions, depending on the analysis required. The chain-of-custody record remains intact, however, for all sample fractions with the corresponding sample number.

After the analytical results have been reported, chain-of-custody samples remain secured in storage. Restricted access to these samples is maintained.

A 3.0 CALIBRATION PROCEDURES

A 3.1 LABORATORY INSTRUMENTS

The following procedures will be followed for calibration of laboratory instruments:

A 3.1.1 Luminescence Spectrometer (Perkin Elmer LS-50B)

The luminescence spectrometer is standardized for the parameter of interest by analysis of calibration standards prepared by diluting a stock solution of known concentration. Three working standards are prepared from the stock solution. The concentration of calibration standards is chosen to cover the working range of the instrument. Subsequently, all measurements are made within this range. After working standards are prepared, instrument response is calibrated to provide a direct readout. The calibration curve is completed by plotting instrument response versus concentration (in µg/L) of the parameter being analyzed. Verification of the calibration curve is accomplished by analyzing a midpoint standard. For the luminescence spectrometer, accuracy checks must conform to within 20%.

Once the initial calibration curve has been created, check standards are analyzed every twentieth sample to confirm the initial calibration curve. A typical analysis sequence is as follows:

- Working standards are prepared by dilution of a stock standard solution of the parameter of interest.
- A calibration curve is established within the working range of the instrument by analysis of three calibration standards.
- Samples are analyzed for the parameter of interest.
- During sample analysis, a calibration check standard is analyzed every twentieth sample to monitor instrument stability. If analysis indicates that instrument calibration is not within 20%, the calibration curve is recalculated, and analysis is repeated.
- Following completion of the sample analysis, the calibration check standard is reanalyzed to confirm the initial calibration curve.

If calibration is confirmed (within 20%), analysis is complete. However, if calibration is not confirmed, the analyst should recalculate the calibration curve and repeat the analysis.

A 4.0 QUALITY CONTROL SAMPLES

A 4.1 TRIP BLANKS

A trip blank for water samples will consist of dye-free distilled water that is placed in a sample bottle before fieldwork. Trip-blank water will have been tested and shown to be negative for the presence of fluorescent dyes. The purpose of the trip blank is to test for inadvertent presence of contamination by dye. A trip blank will accompany field personnel during all dye-detector collection activities. A trip blank will not be used for activated carbon (charcoal) receptors.

All water samples will be collected in plastic or glass containers. A prepared trip blank will utilize the same type of container as is used for sampling of media.

A 4.2 FIELD BLANKS

A field blank for water will be obtained by pouring dye-free distilled water into a sample bottle in the field at the first site sampled. One field blank will be collected for each sampling event. The field blank will be used to test for the presence of airborne dye particles as tracer injection artifacts.

A 4.3 CONTROL BLANKS

A control blank for activated charcoal will consist of an activated-charcoal receptor that has been placed in a spring or well located in an area out of the influence of the tracer test. The control blank will have been placed during the previous sampling round and will be collected at the start of the current sampling round. Doing so assures that the control blank will be handled and treated like other charcoal receptors. This protocol better replicates field conditions, thus achieving one of the purposes of using blanks and enhancing the QC/QA program. The term *control blank* is used because, strictly speaking, it is neither a trip blank nor a field blank. A control blank will be utilized during the entire tracer test and will be collected during each dye-detector collection event.

A 4.4 FIELD REPLICATES

A field replicate is a second water or charcoal sample collected from a location that is monitored as part of a tracer-testing program. The field replicate must be placed, collected, and analyzed in the exact same manner as was the original sample from the site. Replicate samples should be collected from one site in 20 that will be analyzed, as for the tracer test. A field replicate will be labeled in accordance with field sampling protocols and may include the word *replicate* or other unique label recorded in the field book.

A 4.5 METHOD BLANK

Distilled water is analyzed to show that the dye signal indicated is not a property of water itself. It will be analyzed once for every 20 samples.

Figure A-1: Chain-of-Custody Form

Edwards Aquifer Authority Tracer Test: Charcoal Detectors

Site:	
Crew:	
Collection Date (MM/DD/YY):	
Start Time/Date:	**End Time/Date:**
Datum Type Options (for below) Top of Well or Staff Gauge	

Location	Grab Sample	In Date (MM/DD/YY)	Out Time/Date (MM/DD/YY)	Water Level	Datum Type	Other Comments
Blank						Blank detector

*Chain-of-Custody information should have signature and date

Relinquished by:	**Received by:**
Relinquished by:	**Received by:**
Relinquished by:	**Received by:**
Relinquished by:	**Received by:**
Relinquished by:	**Received by:**

APPENDIX B. RESULTS OF DYE ANALYSES

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1619	AY-68-28-112	1/15/2005 to 1/20/2005	Charcoal	None	None
2059	AY-68-28-112	1/15/2005 to 2/1/2005	Charcoal	None	None
2091	AY-68-28-112	1/20/2005 to 2/1/2005	Charcoal	None	None
491	AY-68-28-608	10/20/2004 11:24:00 PM	Water	None	None
493	AY-68-28-608	10/20/2004 3:24:00 PM	Water	None	None
492	AY-68-28-608	10/20/2004 7:24:00 PM	Water	None	None
487	AY-68-28-608	10/21/2004 11:24:00 AM	Water	None	None
195	AY-68-28-608	10/21/2004 11:24:00 PM	Water	Uranine	0.056
490	AY-68-28-608	10/21/2004 3:24:00 AM	Water	None	None
488	AY-68-28-608	10/21/2004 3:24:00 PM	Water	None	None
489	AY-68-28-608	10/21/2004 7:24:00 AM	Water	None	None
298	AY-68-28-608	10/21/2004 7:24:00 PM	Water	None	None
540	AY-68-28-608	10/18/2004 to 10/22/2004	Charcoal	None	None
536	AY-68-28-608	10/18/2004 to 10/22/2004	Charcoal	Uranine	1.3
569	AY-68-28-608	10/18/2004 to 10/22/2004	Charcoal	Uranine	2.7
569	AY-68-28-608	10/18/2004 to 10/22/2004	Charcoal	Eosin	7.6
536	AY-68-28-608	10/18/2004 to 10/22/2004	Charcoal	Eosin	3.8
334	AY-68-28-608	10/22/2004 10:56:00 PM	Water	Uranine	1.1
334	AY-68-28-608	10/22/2004 10:56:00 PM	Water	Eosin	4.9
198	AY-68-28-608	10/22/2004 11:24:00 AM	Water	Uranine	0.60
359	AY-68-28-608	10/22/2004 11:24:00 AM	Water	Uranine	0.60
359	AY-68-28-608	10/22/2004 11:24:00 AM	Water	Eosin	1.6
198	AY-68-28-608	10/22/2004 11:24:00 AM	Water	Eosin	0.70J*
332	AY-68-28-608	10/22/2004 2:56:00 PM	Water	Uranine	0.90
332	AY-68-28-608	10/22/2004 2:56:00 PM	Water	Eosin	1.9
196	AY-68-28-608	10/22/2004 3:24:00 AM	Water	Uranine	0.20
333	AY-68-28-608	10/22/2004 6:56:00 PM	Water	Uranine	1.0
333	AY-68-28-608	10/22/2004 6:56:00 PM	Water	Eosin	3.9
360	AY-68-28-608	10/22/2004 7:24:00 AM	Water	Uranine	0.36
197	AY-68-28-608	10/22/2004 7:24:00 AM	Water	Uranine	0.35
337	AY-68-28-608	10/23/2004 10:56:00 AM	Water	Uranine	0.91
337	AY-68-28-608	10/23/2004 10:56:00 AM	Water	Eosin	5.8
340	AY-68-28-608	10/23/2004 10:56:00 PM	Water	Uranine	0.19
340	AY-68-28-608	10/23/2004 10:56:00 PM	Water	Eosin	3.4
335	AY-68-28-608	10/23/2004 2:56:00 AM	Water	Uranine	1.1
335	AY-68-28-608	10/23/2004 2:56:00 AM	Water	Eosin	5.5
338	AY-68-28-608	10/23/2004 2:56:00 PM	Water	Uranine	0.40
338	AY-68-28-608	10/23/2004 2:56:00 PM	Water	Eosin	3.8

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
336	AY-68-28-608	10/23/2004 6:56:00 AM	Water	Uranine	1.1
336	AY-68-28-608	10/23/2004 6:56:00 AM	Water	Eosin	5.2
339	AY-68-28-608	10/23/2004 6:56:00 PM	Water	Uranine	0.19
339	AY-68-28-608	10/23/2004 6:56:00 PM	Water	Eosin	3.1
343	AY-68-28-608	10/24/2004 10:56:00 AM	Water	Uranine	0.16
358	AY-68-28-608	10/24/2004 10:56:00 AM	Water	Uranine	0.18
343	AY-68-28-608	10/24/2004 10:56:00 AM	Water	Eosin	2.9
358	AY-68-28-608	10/24/2004 10:56:00 AM	Water	Eosin	3.2
346	AY-68-28-608	10/24/2004 10:56:00 PM	Water	Uranine	0.52
346	AY-68-28-608	10/24/2004 10:56:00 PM	Water	Eosin	0.70J*
341	AY-68-28-608	10/24/2004 2:56:00 AM	Water	Uranine	0.19
341	AY-68-28-608	10/24/2004 2:56:00 AM	Water	Eosin	3.2
344	AY-68-28-608	10/24/2004 2:56:00 PM	Water	Uranine	0.33
344	AY-68-28-608	10/24/2004 2:56:00 PM	Water	Eosin	2.1
342	AY-68-28-608	10/24/2004 6:56:00 AM	Water	Uranine	0.18
342	AY-68-28-608	10/24/2004 6:56:00 AM	Water	Eosin	3.1
345	AY-68-28-608	10/24/2004 6:56:00 PM	Water	Uranine	0.52
345	AY-68-28-608	10/24/2004 6:56:00 PM	Water	Eosin	1.0
349	AY-68-28-608	10/25/2004 10:56:00 AM	Water	Uranine	0.26
349	AY-68-28-608	10/25/2004 10:56:00 AM	Water	Eosin	0.40J*
352	AY-68-28-608	10/25/2004 10:56:00 PM	Water	None	None
347	AY-68-28-608	10/25/2004 2:56:00 AM	Water	Uranine	0.53
347	AY-68-28-608	10/25/2004 2:56:00 AM	Water	Eosin	0.60J*
350	AY-68-28-608	10/25/2004 2:56:00 PM	Water	None	None
348	AY-68-28-608	10/25/2004 6:56:00 AM	Water	Uranine	0.53
348	AY-68-28-608	10/25/2004 6:56:00 AM	Water	Eosin	0.60J*
351	AY-68-28-608	10/25/2004 6:56:00 PM	Water	None	None
576	AY-68-28-608	10/22/2004 to 10/26/2004	Charcoal	Uranine	0.74
576	AY-68-28-608	10/22/2004 to 10/26/2004	Charcoal	Eosin	4.1
357	AY-68-28-608	10/26/2004 10:56:00 AM	Water	None	None
364	AY-68-28-608	10/26/2004 2:40:00 PM	Water	None	None
651	AY-68-28-608	10/26/2004 3:20:00 PM	Water	None	None
356	AY-68-28-608	10/26/2004 6:56:00 AM	Water	None	None
652	AY-68-28-608	10/27/2004 3:20:00 AM	Water	None	None
653	AY-68-28-608	10/27/2004 3:20:00 PM	Water	None	None
655	AY-68-28-608	10/28/2004 11:20:00 AM	Water	None	None
656	AY-68-28-608	10/28/2004 11:20:00 PM	Water	None	None
1156	AY-68-28-608	10/26/2004 to 10/29/2004	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
657	AY-68-28-608	10/29/2004 11:20:00 AM	Water	None	None
658	AY-68-28-608	10/29/2004 3:20:00 PM	Water	None	None
726	AY-68-28-608	10/29/2004 3:27:00 PM	Water	None	None
727	AY-68-28-608	10/30/2004 3:27:00 AM	Water	None	None
728	AY-68-28-608	10/30/2004 7:27:00 PM	Water	None	None
729	AY-68-28-608	10/31/2004 11:27:00 AM	Water	None	None
730	AY-68-28-608	11/1/2004 3:27:00 AM	Water	None	None
732	AY-68-28-608	11/1/2004 3:27:00 PM	Water	None	None
734	AY-68-28-608	11/2/2004 11:27:00 AM	Water	None	None
733	AY-68-28-608	11/2/2004 11:27:00 AM	Water	None	None
624	AY-68-28-608	11/3/2004	Water	None	None
623	AY-68-28-608	11/3/2004	Water	None	None
735	AY-68-28-608	11/3/2004 1:50:00 PM	Water	None	None
746	AY-68-28-608	11/3/2004 3:03:00 PM	Water	None	None
747	AY-68-28-608	11/3/2004 9:03:00 PM	Water	None	None
748	AY-68-28-608	11/4/2004 3:03:00 AM	Water	None	None
769	AY-68-28-608	11/4/2004 3:03:00 PM	Water	None	None
749	AY-68-28-608	11/4/2004 9:03:00 AM	Water	None	None
768	AY-68-28-608	11/4/2004 9:03:00 PM	Water	None	None
770	AY-68-28-608	11/5/2004 3:03:00 AM	Water	None	None
767	AY-68-28-608	11/5/2004 3:03:00 AM	Water	None	None
765	AY-68-28-608	11/5/2004 3:03:00 PM	Water	None	None
766	AY-68-28-608	11/5/2004 9:03:00 AM	Water	None	None
764	AY-68-28-608	11/5/2004 9:03:00 PM	Water	None	None
763	AY-68-28-608	11/6/2004 3:03:00 AM	Water	None	None
761	AY-68-28-608	11/6/2004 3:03:00 PM	Water	None	None
762	AY-68-28-608	11/6/2004 9:03:00 AM	Water	None	None
760	AY-68-28-608	11/6/2004 9:03:00 PM	Water	None	None
759	AY-68-28-608	11/7/2004 3:03:00 AM	Water	None	None
757	AY-68-28-608	11/7/2004 3:03:00 PM	Water	None	None
758	AY-68-28-608	11/7/2004 9:03:00 AM	Water	None	None
756	AY-68-28-608	11/7/2004 9:03:00 PM	Water	None	None
755	AY-68-28-608	11/8/2004 3:03:00 AM	Water	None	None
753	AY-68-28-608	11/8/2004 3:03:00 PM	Water	None	None
754	AY-68-28-608	11/8/2004 9:03:00 AM	Water	None	None
752	AY-68-28-608	11/8/2004 9:03:00 PM	Water	None	None
1212	AY-68-28-608	11/2/2004 to 11/9/2004	Charcoal	None	None
771	AY-68-28-608	11/9/2004 10:00:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
751	AY-68-28-608	11/9/2004 3:03:00 AM	Water	None	None
750	AY-68-28-608	11/9/2004 9:03:00 AM	Water	None	None
774	AY-68-28-608	11/9/2004 9:03:00 AM	Water	None	None
781	AY-68-28-608	11/29/2004 3:00:00 PM	Water	None	None
1586	AY-68-28-608	10/29/2004 to 11/30/2004	Charcoal	None	None
782	AY-68-28-608	11/30/2004 3:00:00 AM	Water	None	None
783	AY-68-28-608	11/30/2004 7:00:00 PM	Water	None	None
784	AY-68-28-608	12/1/2004 11:00:00 AM	Water	None	None
787	AY-68-28-608	12/1/2004 7:00:00 PM	Water	None	None
785	AY-68-28-608	12/1/2004 7:00:00 PM	Water	None	None
1188	AY-68-28-608	11/29/2004 to 12/2/2004	Charcoal	None	None
393	AY-68-28-608	12/2/2004	Water	None	None
786	AY-68-28-608	12/2/2004 11:00:00 AM	Water	None	None
396	AY-68-28-608	12/2/2004 12:00:00 PM	Water	None	None
397	AY-68-28-608	12/3/2004 4:00:00 PM	Water	None	None
401	AY-68-28-608	12/3/2004 8:00:00 AM	Water	None	None
398	AY-68-28-608	12/3/2004 8:00:00 PM	Water	None	None
405	AY-68-28-608	12/4/2004	Water	None	None
402	AY-68-28-608	12/4/2004 12:00:00 PM	Water	None	None
406	AY-68-28-608	12/4/2004 4:00:00 AM	Water	None	None
403	AY-68-28-608	12/4/2004 4:00:00 PM	Water	Uranine	3.1
424	AY-68-28-608	12/4/2004 8:00:00 AM	Water	None	None
404	AY-68-28-608	12/4/2004 8:00:00 PM	Water	Uranine	4.6
425	AY-68-28-608	12/5/2004	Water	Uranine	4.6
417	AY-68-28-608	12/5/2004 12:00:00 PM	Water	Uranine	4.5
412	AY-68-28-608	12/5/2004 4:00:00 AM	Water	Uranine	4.6
423	AY-68-28-608	12/5/2004 4:00:00 PM	Water	Uranine	4.7
418	AY-68-28-608	12/5/2004 4:00:00 PM	Water	Uranine	4.7
413	AY-68-28-608	12/5/2004 8:00:00 AM	Water	Uranine	4.7
419	AY-68-28-608	12/5/2004 8:00:00 PM	Water	Uranine	4.8
1204	AY-68-28-608	12/2/2004 to 12/6/2004	Charcoal	Uranine	4.4
420	AY-68-28-608	12/6/2004	Water	Uranine	4.8
853	AY-68-28-608	12/6/2004 10:00:00 AM	Water	Uranine	4.4
884	AY-68-28-608	12/6/2004 11:10:00 AM	Water	Uranine	4.5
866	AY-68-28-608	12/6/2004 11:10:00 AM	Water	Uranine	4.6
869	AY-68-28-608	12/6/2004 11:10:00 PM	Water	Uranine	4.6
867	AY-68-28-608	12/6/2004 3:10:00 PM	Water	Uranine	4.7
421	AY-68-28-608	12/6/2004 4:00:00 AM	Water	Uranine	4.9

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
868	AY-68-28-608	12/6/2004 7:10:00 PM	Water	Uranine	4.7
422	AY-68-28-608	12/6/2004 8:00:00 AM	Water	Uranine	5.0
872	AY-68-28-608	12/7/2004 11:10:00 AM	Water	Uranine	1.7
875	AY-68-28-608	12/7/2004 11:10:00 PM	Water	Uranine	0.19
870	AY-68-28-608	12/7/2004 3:10:00 AM	Water	Uranine	4.6
873	AY-68-28-608	12/7/2004 3:10:00 PM	Water	Uranine	0.17
873	AY-68-28-608	12/7/2004 3:10:00 PM	Water	Uranine	0.18
871	AY-68-28-608	12/7/2004 7:10:00 AM	Water	Uranine	4.5
874	AY-68-28-608	12/7/2004 7:10:00 PM	Water	Uranine	0.19
878	AY-68-28-608	12/8/2004 11:10:00 AM	Water	Uranine	0.15
881	AY-68-28-608	12/8/2004 11:10:00 PM	Water	Uranine	0.062
876	AY-68-28-608	12/8/2004 3:10:00 AM	Water	Uranine	0.19
879	AY-68-28-608	12/8/2004 3:10:00 PM	Water	Uranine	0.093
877	AY-68-28-608	12/8/2004 7:10:00 AM	Water	Uranine	0.17
880	AY-68-28-608	12/8/2004 7:10:00 PM	Water	Uranine	0.069
1221	AY-68-28-608	12/6/2004 to 12/9/2004	Charcoal	Uranine	8.0
940	AY-68-28-608	12/9/2004 11:10:00 AM	Water	Uranine	0.052J*
882	AY-68-28-608	12/9/2004 3:10:00 AM	Water	Uranine	0.062
883	AY-68-28-608	12/9/2004 7:10:00 AM	Water	Uranine	0.071
942	AY-68-28-608	12/9/2004 7:10:00 PM	Water	Uranine	0.042J*
946	AY-68-28-608	12/10/2004 11:10:00 AM	Water	None	None
948	AY-68-28-608	12/10/2004 11:10:00 PM	Water	None	None
947	AY-68-28-608	12/10/2004 3:10:00 PM	Water	None	None
951	AY-68-28-608	12/11/2004 11:10:00 PM	Water	None	None
950	AY-68-28-608	12/11/2004 3:10:00 PM	Water	None	None
949	AY-68-28-608	12/11/2004 7:10:00 AM	Water	None	None
954	AY-68-28-608	12/12/2004 11:10:00 PM	Water	None	None
1142	AY-68-28-608	12/12/2004 12:00:00 PM	Water	None	None
953	AY-68-28-608	12/12/2004 3:10:00 PM	Water	None	None
952	AY-68-28-608	12/12/2004 7:10:00 AM	Water	None	None
1066	AY-68-28-608	12/13/2004 11:55:00 AM	Water	None	None
1067	AY-68-28-608	12/13/2004 11:55:00 PM	Water	None	None
956	AY-68-28-608	12/13/2004 7:10:00 AM	Water	None	None
955	AY-68-28-608	12/13/2004 7:10:00 AM	Water	None	None
1235	AY-68-28-608	12/9/2004 to 12/13/2004	Charcoal	None	None
1068	AY-68-28-608	12/14/2004 11:55:00 AM	Water	None	None
1069	AY-68-28-608	12/14/2004 11:55:00 PM	Water	None	None
1070	AY-68-28-608	12/15/2004 11:55:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1071	AY-68-28-608	12/15/2004 11:55:00 PM	Water	None	None
1073	AY-68-28-608	12/15/2004 11:55:00 PM	Water	None	None
1099	AY-68-28-608	12/13/2004 to 12/16/2004	Charcoal	None	None
1285	AY-68-28-608	12/16/2004 12:00:00 PM	Water	None	None
1293	AY-68-28-608	12/16/2004 4:00:00 PM	Water	None	None
1286	AY-68-28-608	12/16/2004 4:00:00 PM	Water	None	None
1072	AY-68-28-608	12/16/2004 7:55:00 AM	Water	None	None
1287	AY-68-28-608	12/17/2004 12:00:00 PM	Water	None	None
1288	AY-68-28-608	12/17/2004 4:00:00 PM	Water	None	None
1289	AY-68-28-608	12/18/2004 12:00:00 PM	Water	None	None
1290	AY-68-28-608	12/18/2004 4:00:00 PM	Water	None	None
1291	AY-68-28-608	12/19/2004 12:00:00 PM	Water	None	None
1292	AY-68-28-608	12/19/2004 4:00:00 PM	Water	None	None
1311	AY-68-28-608	12/16/2004 to 12/20/2004	Charcoal	None	None
1328	AY-68-28-608	12/20/2004 11:40:00 AM	Water	None	None
1329	AY-68-28-608	12/20/2004 11:40:00 PM	Water	None	None
1402	AY-68-28-608	12/21/2004 4:00:00 PM	Water	None	None
1330	AY-68-28-608	12/21/2004 4:01:00 PM	Water	None	None
1331	AY-68-28-608	12/22/2004 4:01:00 PM	Water	None	None
2023	AY-68-28-608	12/20/2004 to 12/23/2004	Charcoal	None	None
1403	AY-68-28-608	12/23/2004 9:15:00 AM	Water	None	None
1436	AY-68-28-608	12/23/2004 9:27:00 AM	Water	None	None
1449	AY-68-28-608	12/23/2004 9:27:00 PM	Water	None	None
1437	AY-68-28-608	12/23/2004 9:27:00 PM	Water	None	None
1438	AY-68-28-608	12/24/2004 9:27:00 PM	Water	None	None
1439	AY-68-28-608	12/25/2004 9:27:00 PM	Water	None	None
1440	AY-68-28-608	12/26/2004 9:27:00 PM	Water	None	None
1441	AY-68-28-608	12/27/2004 9:27:00 AM	Water	None	None
1442	AY-68-28-608	12/28/2004 9:27:00 PM	Water	None	None
1443	AY-68-28-608	12/29/2004 9:27:00 PM	Water	None	None
1444	AY-68-28-608	12/30/2004 9:27:00 PM	Water	None	None
1445	AY-68-28-608	12/31/2004 9:27:00 PM	Water	None	None
1446	AY-68-28-608	1/1/2005 9:27:00 PM	Water	None	None
1447	AY-68-28-608	1/2/2005 9:27:00 PM	Water	None	None
1448	AY-68-28-608	1/3/2005 9:27:00 PM	Water	None	None
1418	AY-68-28-608	1/4/2005 10:45:00 AM	Water	None	None
1572	AY-68-28-608	1/4/2005 10:54:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2104	AY-68-28-608	12/28/2004 to 1/4/2005	Charcoal	None	None
1573	AY-68-28-608	1/5/2005 10:54:00 AM	Water	None	None
1574	AY-68-28-608	1/6/2005 10:54:00 AM	Water	None	None
1575	AY-68-28-608	1/7/2005 10:54:00 AM	Water	None	None
1578	AY-68-28-608	1/7/2005 10:54:00 AM	Water	None	None
1576	AY-68-28-608	1/8/2005 10:54:00 AM	Water	None	None
1577	AY-68-28-608	1/9/2005 10:54:00 AM	Water	None	None
1644	AY-68-28-608	1/10/2005 10:49:00 AM	Water	None	None
1945	AY-68-28-608	1/4/2005 to 1/10/2005	Charcoal	None	None
2017	AY-68-28-608	1/4/2005 to 1/10/2005	Charcoal	None	None
1645	AY-68-28-608	1/11/2005 10:49:00 AM	Water	None	None
1646	AY-68-28-608	1/13/2005 10:45:00 AM	Water	None	None
1518	AY-68-28-608	1/13/2005 10:45:00 AM	Water	None	None
1354	AY-68-28-608	1/13/2005 10:45:00 PM	Water	None	None
1355	AY-68-28-608	1/14/2005 10:45:00 AM	Water	None	None
1356	AY-68-28-608	1/14/2005 10:45:00 PM	Water	None	None
1357	AY-68-28-608	1/15/2005 10:45:00 AM	Water	None	None
1358	AY-68-28-608	1/15/2005 10:45:00 PM	Water	Uranine	0.43
1359	AY-68-28-608	1/15/2005 4:45:00 PM	Water	None	None
1361	AY-68-28-608	1/16/2005 10:45:00 AM	Water	Uranine	4.3
1363	AY-68-28-608	1/16/2005 10:45:00 PM	Water	Uranine	0.15
1360	AY-68-28-608	1/16/2005 4:45:00 AM	Water	Uranine	7.5
1378	AY-68-28-608	1/16/2005 4:45:00 PM	Water	Uranine	0.56
1362	AY-68-28-608	1/16/2005 4:45:00 PM	Water	Uranine	0.56
1367	AY-68-28-608	1/17/2005 10:45:00 PM	Water	Uranine	0.12
1364	AY-68-28-608	1/17/2005 4:45:00 AM	Water	Uranine	0.12
1614	AY-68-28-608	1/10/2005 to 1/18/2005	Charcoal	Uranine	5.7
1374	AY-68-28-608	1/18/2005 10:45:00 PM	Water	Phloxine B	1.5
1772	AY-68-28-608	1/18/2005 12:00:00 PM	Water	None	None
1568	AY-68-28-608	1/18/2005 12:30:00 PM	Water	Uranine	0.13
1568	AY-68-28-608	1/18/2005 12:30:00 PM	Water	Uranine	0.15
1368	AY-68-28-608	1/18/2005 4:45:00 AM	Water	Uranine	0.10
1373	AY-68-28-608	1/18/2005 4:45:00 PM	Water	Uranine	0.13
1696	AY-68-28-608	1/18/2005 to 1/19/2005	Charcoal	None	None
1558	AY-68-28-608	1/19/2005 2:30:00 PM	Water	None	None
1669	AY-68-28-608	1/19/2005 2:46:00 PM	Water	Uranine	0.074
1692	AY-68-28-608	1/19/2005 2:46:00 PM	Water	Phloxine B	3.0
1669	AY-68-28-608	1/19/2005 2:46:00 PM	Water	Phloxine B	3.3

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1379	AY-68-28-608	1/19/2005 8:15:00 AM	Water	Phloxine B	14.0
1668	AY-68-28-608	1/19/2005 8:46:00 AM	Water	Uranine	0.15
1668	AY-68-28-608	1/19/2005 8:46:00 AM	Water	Phloxine B	9.7
1670	AY-68-28-608	1/19/2005 8:46:00 PM	Water	Uranine	0.069
1670	AY-68-28-608	1/19/2005 8:46:00 PM	Water	Phloxine B	1.2J*
1671	AY-68-28-608	1/20/2005 2:46:00 AM	Water	Uranine	0.088
1671	AY-68-28-608	1/20/2005 2:46:00 AM	Water	Phloxine B	1.0J*
1673	AY-68-28-608	1/20/2005 2:46:00 PM	Water	Uranine	0.12
1673	AY-68-28-608	1/20/2005 2:46:00 PM	Water	Phloxine B	0.67J*
1672	AY-68-28-608	1/20/2005 8:46:00 AM	Water	Uranine	0.10
1672	AY-68-28-608	1/20/2005 8:46:00 AM	Water	Phloxine B	0.79J*
1674	AY-68-28-608	1/20/2005 8:46:00 PM	Water	Uranine	0.15
1674	AY-68-28-608	1/20/2005 8:46:00 PM	Water	Phloxine B	<0.42
1733	AY-68-28-608	1/21/2005 2:45:00 PM	Water	Uranine	0.10
1675	AY-68-28-608	1/21/2005 2:46:00 AM	Water	Uranine	0.15
1677	AY-68-28-608	1/21/2005 2:46:00 PM	Water	Uranine	0.064
1676	AY-68-28-608	1/21/2005 8:46:00 AM	Water	Uranine	0.12
1775	AY-68-28-608	1/21/2005 8:46:00 AM	Water	Uranine	0.12
1678	AY-68-28-608	1/21/2005 8:46:00 PM	Water	Uranine	0.075
1679	AY-68-28-608	1/22/2005 2:46:00 AM	Water	Uranine	0.093
1681	AY-68-28-608	1/22/2005 2:46:00 PM	Water	Uranine	0.056
1680	AY-68-28-608	1/22/2005 8:46:00 AM	Water	Uranine	0.050J*
1682	AY-68-28-608	1/22/2005 8:46:00 PM	Water	Uranine	0.063
1683	AY-68-28-608	1/23/2005 2:46:00 AM	Water	Uranine	0.050J*
1685	AY-68-28-608	1/23/2005 2:46:00 PM	Water	Uranine	0.038J*
1685	AY-68-28-608	1/23/2005 2:46:00 PM	Water	Eosin	0.25J*
1684	AY-68-28-608	1/23/2005 8:46:00 AM	Water	Uranine	0.093
1686	AY-68-28-608	1/23/2005 8:46:00 PM	Water	Eosin	2.8
1687	AY-68-28-608	1/24/2005 2:46:00 AM	Water	Eosin	4.7
1689	AY-68-28-608	1/24/2005 2:46:00 PM	Water	Eosin	4.8
1688	AY-68-28-608	1/24/2005 8:46:00 AM	Water	Eosin	5.7
1690	AY-68-28-608	1/24/2005 8:46:00 PM	Water	Eosin	3.8
1694	AY-68-28-608	1/19/2005 to 1/25/2005	Charcoal	Eosin	2.8
1694	AY-68-28-608	1/19/2005 to 1/25/2005	Charcoal	Phloxine B	13.0
1776	AY-68-28-608	1/25/2005 11:00:00 AM	Water	Eosin	2.2
1914	AY-68-28-608	1/25/2005 2:31:00 PM	Water	Eosin	1.9
1897	AY-68-28-608	1/25/2005 2:31:00 PM	Water	Eosin	2.0
1691	AY-68-28-608	1/25/2005 2:46:00 AM	Water	Uranine	0.037J*

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1691	AY-68-28-608	1/25/2005 2:46:00 AM	Water	Eosin	3.1
1735	AY-68-28-608	1/25/2005 8:15:00 AM	Water	Uranine	0.040J*
1735	AY-68-28-608	1/25/2005 8:15:00 AM	Water	Eosin	3.2
1896	AY-68-28-608	1/25/2005 8:31:00 AM	Water	Eosin	2.9
1898	AY-68-28-608	1/25/2005 8:31:00 PM	Water	Eosin	1.7
1899	AY-68-28-608	1/26/2005 2:31:00 AM	Water	Eosin	1.1
1901	AY-68-28-608	1/26/2005 2:31:00 PM	Water	Uranine	0.034J*
1901	AY-68-28-608	1/26/2005 2:31:00 PM	Water	Eosin	0.85
1900	AY-68-28-608	1/26/2005 8:31:00 AM	Water	Eosin	1.2
1902	AY-68-28-608	1/26/2005 8:31:00 PM	Water	Uranine	0.084
1902	AY-68-28-608	1/26/2005 8:31:00 PM	Water	Eosin	0.64J*
1903	AY-68-28-608	1/27/2005 2:31:00 AM	Water	Uranine	0.14
1903	AY-68-28-608	1/27/2005 2:31:00 AM	Water	Eosin	0.64J*
1905	AY-68-28-608	1/27/2005 2:31:00 PM	Water	Uranine	0.19
1905	AY-68-28-608	1/27/2005 2:31:00 PM	Water	Eosin	0.51J*
1904	AY-68-28-608	1/27/2005 8:31:00 AM	Water	Uranine	0.16
1906	AY-68-28-608	1/27/2005 8:31:00 PM	Water	Uranine	0.19
1906	AY-68-28-608	1/27/2005 8:31:00 PM	Water	Eosin	0.61J*
1907	AY-68-28-608	1/28/2005 2:31:00 PM	Water	Uranine	0.14
1907	AY-68-28-608	1/28/2005 2:31:00 PM	Water	Eosin	0.41J*
1908	AY-68-28-608	1/28/2005 8:31:00 PM	Water	Uranine	0.16
1908	AY-68-28-608	1/28/2005 8:31:00 PM	Water	Eosin	0.43J*
1909	AY-68-28-608	1/29/2005 2:31:00 AM	Water	Uranine	0.19
1909	AY-68-28-608	1/29/2005 2:31:00 AM	Water	Eosin	0.84
1911	AY-68-28-608	1/29/2005 2:31:00 PM	Water	Uranine	0.19
1911	AY-68-28-608	1/29/2005 2:31:00 PM	Water	Eosin	1.4
1910	AY-68-28-608	1/29/2005 8:31:00 AM	Water	Uranine	0.21
1910	AY-68-28-608	1/29/2005 8:31:00 AM	Water	Eosin	1.2
1912	AY-68-28-608	1/29/2005 8:31:00 PM	Water	Uranine	0.13
1912	AY-68-28-608	1/29/2005 8:31:00 PM	Water	Eosin	1.6
1913	AY-68-28-608	1/30/2005 2:31:00 PM	Water	Uranine	0.15
1913	AY-68-28-608	1/30/2005 2:31:00 PM	Water	Eosin	1.0
1920	AY-68-28-608	1/25/2005 to 1/31/2005	Charcoal	None	None
2015	AY-68-28-608	1/25/2005 to 1/31/2005	Charcoal	None	None
1992	AY-68-28-608	2/4/2005 11:25:00 AM	Water	None	None
1993	AY-68-28-608	2/5/2005 11:25:00 AM	Water	None	None
1994	AY-68-28-608	2/6/2005 11:25:00 AM	Water	None	None
1995	AY-68-28-608	2/7/2005 11:25:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2061	AY-68-28-608	1/31/2005 to 2/8/2005	Charcoal	None	None
2196	AY-68-28-608	2/8/2005 10:30:00 AM	Water	None	None
2171	AY-68-28-608	2/8/2005 10:30:00 AM	Water	None	None
1996	AY-68-28-608	2/8/2005 3:25:00 AM	Water	None	None
2173	AY-68-28-608	2/8/2005 6:30:00 PM	Water	Eosin	0.62J*
2172	AY-68-28-608	2/9/2005 10:30:00 AM	Water	Eosin	0.72J*
2174	AY-68-28-608	2/9/2005 6:30:00 PM	Water	Uranine	0.091
2174	AY-68-28-608	2/9/2005 6:30:00 PM	Water	Eosin	0.56J*
2176	AY-68-28-608	2/10/2005 10:30:00 AM	Water	Uranine	0.35
2175	AY-68-28-608	2/10/2005 2:30:00 AM	Water	Uranine	0.14
2180	AY-68-28-608	2/10/2005 6:30:00 PM	Water	Uranine	0.35
2182	AY-68-28-608	2/11/2005 10:30:00 AM	Water	Uranine	0.28
2181	AY-68-28-608	2/11/2005 2:30:00 AM	Water	Uranine	0.32
2183	AY-68-28-608	2/11/2005 6:30:00 PM	Water	Uranine	0.23
2185	AY-68-28-608	2/12/2005 10:30:00 AM	Water	Uranine	0.22
2184	AY-68-28-608	2/12/2005 2:30:00 AM	Water	Uranine	0.23
2186	AY-68-28-608	2/12/2005 6:30:00 PM	Water	Uranine	0.16
2188	AY-68-28-608	2/13/2005 10:30:00 AM	Water	Uranine	0.13
2187	AY-68-28-608	2/13/2005 2:30:00 AM	Water	Uranine	0.17
2189	AY-68-28-608	2/13/2005 6:30:00 PM	Water	Uranine	0.091
2191	AY-68-28-608	2/14/2005 10:30:00 AM	Water	Uranine	0.071
2190	AY-68-28-608	2/14/2005 2:30:00 AM	Water	Uranine	0.052J*
2192	AY-68-28-608	2/14/2005 6:30:00 PM	Water	Uranine	0.038J*
2193	AY-68-28-608	2/15/2005 2:30:00 AM	Water	Uranine	0.074
2194	AY-68-28-608	2/15/2005 6:30:00 PM	Water	Uranine	0.051J*
2195	AY-68-28-608	2/16/2005 2:30:00 AM	Water	Uranine	0.083
2209	AY-68-28-608	2/16/2005 8:40:00 AM	Water	Uranine	0.15
2402	AY-68-28-608	3/1/2005 10:58:00 AM	Water	None	None
2394	AY-68-28-608	3/7/2005 2:40:00 PM	Water	None	None
2395	AY-68-28-608	3/8/2005 2:40:00 PM	Water	None	None
2396	AY-68-28-608	3/9/2005 2:40:00 PM	Water	None	None
2397	AY-68-28-608	3/10/2005 2:40:00 PM	Water	None	None
2398	AY-68-28-608	3/11/2005 2:40:00 PM	Water	None	None
2399	AY-68-28-608	3/12/2005 2:40:00 PM	Water	None	None
2400	AY-68-28-608	3/13/2005 2:40:00 PM	Water	None	None
2401	AY-68-28-608	3/14/2005 2:40:00 AM	Water	None	None
2315	AY-68-28-608	3/21/2005 10:40:00 PM	Water	None	None
2314	AY-68-28-608	3/21/2005 2:40:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2316	AY-68-28-608	3/23/2005 10:40:00 PM	Water	None	None
2318	AY-68-28-608	3/24/2005 2:40:00 PM	Water	None	None
2317	AY-68-28-608	3/24/2005 6:40:00 AM	Water	None	None
3009	AY-68-28-608	10/26/2005 to 11/6/2005	Charcoal	None	None
2560	AY-68-28-608	5/22/2006 11:56:00 AM	Water	None	None
2561	AY-68-28-608	5/22/2006 11:56:00 PM	Water	None	None
2562	AY-68-28-608	5/23/2006 11:56:00 AM	Water	None	None
2557	AY-68-28-608	5/23/2006 11:56:00 AM	Water	None	None
2566	AY-68-28-608	5/23/2006 11:56:00 PM	Water	None	None
2563	AY-68-28-608	5/23/2006 11:56:00 PM	Water	None	None
2564	AY-68-28-608	5/24/2006 11:56:00 AM	Water	None	None
2565	AY-68-28-608	5/24/2006 11:56:00 PM	Water	None	None
2592	AY-68-28-608	5/22/2006 to 5/25/2006	Charcoal	None	None
2567	AY-68-28-608	5/25/2006 10:23:00 AM	Water	None	None
2568	AY-68-28-608	5/25/2006 10:23:00 PM	Water	None	None
2569	AY-68-28-608	5/26/2006 10:23:00 AM	Water	None	None
2570	AY-68-28-608	5/26/2006 10:23:00 PM	Water	None	None
2571	AY-68-28-608	5/27/2006 10:23:00 AM	Water	None	None
2575	AY-68-28-608	5/27/2006 10:23:00 PM	Water	None	None
2572	AY-68-28-608	5/27/2006 10:23:00 PM	Water	None	None
2573	AY-68-28-608	5/28/2006 10:23:00 AM	Water	None	None
2574	AY-68-28-608	5/28/2006 10:23:00 PM	Water	None	None
2600	AY-68-28-608	5/25/2006 to 5/29/2006	Charcoal	None	None
2577	AY-68-28-608	5/29/2006 5:24:00 PM	Water	None	None
2576	AY-68-28-608	5/29/2006 9:24:00 AM	Water	None	None
2578	AY-68-28-608	5/30/2006 1:24:00 AM	Water	None	None
2580	AY-68-28-608	5/30/2006 5:24:00 PM	Water	None	None
2586	AY-68-28-608	5/30/2006 9:24:00 AM	Water	None	None
2579	AY-68-28-608	5/30/2006 9:24:00 AM	Water	None	None
2581	AY-68-28-608	5/31/2006 1:24:00 AM	Water	None	None
2583	AY-68-28-608	5/31/2006 5:24:00 PM	Water	None	None
2582	AY-68-28-608	5/31/2006 9:24:00 AM	Water	None	None
2603	AY-68-28-608	5/29/2006 to 6/1/2006	Charcoal	None	None
2692	AY-68-28-608	6/1/2006 1:20:00 PM	Water	None	None
2584	AY-68-28-608	6/1/2006 1:24:00 AM	Water	None	None
2585	AY-68-28-608	6/1/2006 5:24:00 AM	Water	None	None
2613	AY-68-28-608	6/1/2006 9:15:00 AM	Water	None	None
2633	AY-68-28-608	6/2/2006 1:20:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2693	AY-68-28-608	6/3/2006 1:20:00 PM	Water	None	None
2634	AY-68-28-608	6/4/2006 9:20:00 AM	Water	None	None
2679	AY-68-28-608	6/1/2006 to 6/5/2006	Charcoal	None	None
2694	AY-68-28-608	6/5/2006 1:11:00 PM	Water	None	None
2635	AY-68-28-608	6/6/2006 9:11:00 AM	Water	None	None
2695	AY-68-28-608	6/7/2006 1:11:00 PM	Water	None	None
2684	AY-68-28-608	6/5/2006 to 6/8/2006	Charcoal	None	None
2661	AY-68-28-608	6/8/2006 1:02:00 PM	Water	None	None
2660	AY-68-28-608	6/8/2006 1:02:00 PM	Water	None	None
2631	AY-68-28-608	6/8/2006 1:11:00 AM	Water	None	None
2632	AY-68-28-608	6/8/2006 5:11:00 AM	Water	None	None
2651	AY-68-28-608	6/8/2006 9:02:00 AM	Water	None	None
2652	AY-68-28-608	6/8/2006 9:02:00 PM	Water	None	None
2653	AY-68-28-608	6/9/2006 9:02:00 AM	Water	None	None
2654	AY-68-28-608	6/9/2006 9:02:00 PM	Water	None	None
2655	AY-68-28-608	6/10/2006 9:02:00 AM	Water	None	None
2656	AY-68-28-608	6/10/2006 9:02:00 PM	Water	None	None
2657	AY-68-28-608	6/11/2006 9:02:00 AM	Water	None	None
2658	AY-68-28-608	6/11/2006 9:02:00 PM	Water	None	None
2659	AY-68-28-608	6/12/2006 5:02:00 AM	Water	None	None
2714	AY-68-28-608	6/12/2006 9:07:00 AM	Water	None	None
2715	AY-68-28-608	6/12/2006 9:07:00 PM	Water	None	None
2690	AY-68-28-608	6/8/2006 to 6/12/2006	Charcoal	None	None
2716	AY-68-28-608	6/13/2006 9:07:00 AM	Water	None	None
2721	AY-68-28-608	6/13/2006 9:07:00 AM	Water	None	None
2717	AY-68-28-608	6/13/2006 9:07:00 PM	Water	None	None
2718	AY-68-28-608	6/14/2006 9:07:00 AM	Water	None	None
2719	AY-68-28-608	6/14/2006 9:07:00 PM	Water	None	None
2736	AY-68-28-608	6/12/2006 to 6/15/2006	Charcoal	None	None
2722	AY-68-28-608	6/15/2006 2:52:00 PM	Water	None	None
2720	AY-68-28-608	6/15/2006 9:07:00 AM	Water	None	None
2723	AY-68-28-608	6/16/2006 2:52:00 AM	Water	None	None
2731	AY-68-28-608	6/16/2006 2:52:00 AM	Water	None	None
2724	AY-68-28-608	6/16/2006 2:52:00 PM	Water	None	None
2725	AY-68-28-608	6/17/2006 2:52:00 AM	Water	None	None
2726	AY-68-28-608	6/17/2006 2:52:00 PM	Water	None	None
2727	AY-68-28-608	6/18/2006 2:52:00 AM	Water	None	None
2728	AY-68-28-608	6/18/2006 2:52:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2738	AY-68-28-608	6/15/2006 to 6/19/2006	Charcoal	None	None
2729	AY-68-28-608	6/19/2006 2:52:00 AM	Water	None	None
2730	AY-68-28-608	6/19/2006 6:52:00 AM	Water	None	None
2762	AY-68-28-608	6/19/2006 8:43:00 AM	Water	None	None
2763	AY-68-28-608	6/19/2006 8:43:00 PM	Water	None	None
2764	AY-68-28-608	6/20/2006 8:43:00 AM	Water	None	None
2765	AY-68-28-608	6/20/2006 8:43:00 PM	Water	None	None
2766	AY-68-28-608	6/21/2006 12:43:00 AM	Water	None	None
2770	AY-68-28-608	6/21/2006 12:43:00 AM	Water	None	None
2767	AY-68-28-608	6/21/2006 8:43:00 AM	Water	None	None
2768	AY-68-28-608	6/21/2006 8:43:00 PM	Water	None	None
2805	AY-68-28-608	6/19/2006 to 6/22/2006	Charcoal	None	None
2769	AY-68-28-608	6/22/2006 12:43:00 PM	Water	None	None
2771	AY-68-28-608	6/22/2006 6:57:00 PM	Water	None	None
2772	AY-68-28-608	6/23/2006 12:57:00 AM	Water	None	None
2777	AY-68-28-608	6/23/2006 12:57:00 AM	Water	None	None
2773	AY-68-28-608	6/23/2006 6:57:00 PM	Water	None	None
2774	AY-68-28-608	6/24/2006 6:57:00 PM	Water	None	None
2775	AY-68-28-608	6/25/2006 6:57:00 PM	Water	None	None
2783	AY-68-28-608	6/22/2006 to 6/26/2006	Charcoal	None	None
2814	AY-68-28-608	6/26/2006 12:11:00 PM	Water	None	None
2776	AY-68-28-608	6/26/2006 6:57:00 AM	Water	None	None
2815	AY-68-28-608	6/27/2006 12:11:00 AM	Water	None	None
2816	AY-68-28-608	6/28/2006 12:11:00 AM	Water	None	None
2820	AY-68-28-608	6/29/2006 12:11:00 AM	Water	None	None
2817	AY-68-28-608	6/29/2006 12:11:00 AM	Water	None	None
2818	AY-68-28-608	6/30/2006 12:11:00 AM	Water	None	None
2806	AY-68-28-608	6/26/2006 to 7/1/2006	Charcoal	None	None
2819	AY-68-28-608	7/1/2006 12:11:00 AM	Water	None	None
2821	AY-68-28-608	7/1/2006 5:25:00 PM	Water	None	None
2826	AY-68-28-608	7/1/2006 5:25:00 PM	Water	None	None
2822	AY-68-28-608	7/2/2006 5:25:00 PM	Water	None	None
2823	AY-68-28-608	7/3/2006 5:25:00 PM	Water	None	None
2824	AY-68-28-608	7/4/2006 5:25:00 PM	Water	None	None
2807	AY-68-28-608	7/1/2006 to 7/5/2006	Charcoal	None	None
2825	AY-68-28-608	7/5/2006 11:25:00 AM	Water	None	None
2834	AY-68-28-608	7/5/2006 3:27:00 PM	Water	None	None
2827	AY-68-28-608	7/5/2006 3:27:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2828	AY-68-28-608	7/6/2006 3:27:00 PM	Water	None	None
2829	AY-68-28-608	7/7/2006 3:27:00 PM	Water	None	None
2830	AY-68-28-608	7/8/2006 3:27:00 PM	Water	None	None
2831	AY-68-28-608	7/9/2006 3:27:00 PM	Water	None	None
2832	AY-68-28-608	7/10/2006 3:27:00 PM	Water	None	None
2833	AY-68-28-608	7/11/2006 3:27:00 AM	Water	None	None
2843	AY-68-28-608	7/11/2006 9:42:00 AM	Water	None	None
2808	AY-68-28-608	7/5/2006 to 7/11/2006	Charcoal	None	None
2844	AY-68-28-608	7/12/2006 9:42:00 AM	Water	None	None
2850	AY-68-28-608	7/12/2006 9:42:00 PM	Water	None	None
2845	AY-68-28-608	7/12/2006 9:42:00 PM	Water	None	None
2846	AY-68-28-608	7/13/2006 9:42:00 AM	Water	None	None
2847	AY-68-28-608	7/14/2006 9:42:00 AM	Water	None	None
2848	AY-68-28-608	7/15/2006 9:42:00 AM	Water	None	None
2849	AY-68-28-608	7/16/2006 9:42:00 AM	Water	None	None
2861	AY-68-28-608	7/10/2006 to 7/17/2006	Charcoal	None	None
2851	AY-68-28-608	7/17/2006 9:11:00 AM	Water	None	None
2852	AY-68-28-608	7/18/2006 9:11:00 AM	Water	None	None
2853	AY-68-28-608	7/19/2006 9:11:00 AM	Water	None	None
2859	AY-68-28-608	7/20/2006 3:11:00 PM	Water	None	None
2855	AY-68-28-608	7/20/2006 3:11:00 PM	Water	None	None
2854	AY-68-28-608	7/20/2006 9:11:00 AM	Water	None	None
2856	AY-68-28-608	7/21/2006 9:11:00 AM	Water	None	None
2857	AY-68-28-608	7/22/2006 9:11:00 AM	Water	None	None
2858	AY-68-28-608	7/23/2006 3:11:00 AM	Water	None	None
2860	AY-68-28-608	7/17/2006 to 7/24/2006	Charcoal	None	None
2878	AY-68-28-608	7/24/2006 9:22:00 AM	Water	None	None
2885	AY-68-28-608	7/24/2006 9:22:00 AM	Water	None	None
2879	AY-68-28-608	7/25/2006 9:22:00 AM	Water	None	None
2880	AY-68-28-608	7/26/2006 9:22:00 AM	Water	None	None
2881	AY-68-28-608	7/27/2006 9:22:00 AM	Water	None	None
2882	AY-68-28-608	7/28/2006 9:22:00 AM	Water	None	None
2883	AY-68-28-608	7/29/2006 9:22:00 AM	Water	None	None
2884	AY-68-28-608	7/30/2006 3:22:00 AM	Water	None	None
2904	AY-68-28-608	7/24/2006 to 7/31/2006	Charcoal	None	None
2895	AY-68-28-608	7/31/2006 10:24:00 AM	Water	None	None
2886	AY-68-28-608	7/31/2006 10:24:00 AM	Water	None	None
2887	AY-68-28-608	8/1/2006 10:24:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2888	AY-68-28-608	8/2/2006 10:24:00 AM	Water	None	None
2889	AY-68-28-608	8/3/2006 10:24:00 AM	Water	None	None
2890	AY-68-28-608	8/4/2006 10:24:00 AM	Water	None	None
2891	AY-68-28-608	8/5/2006 10:24:00 AM	Water	None	None
2892	AY-68-28-608	8/6/2006 10:24:00 AM	Water	None	None
2893	AY-68-28-608	8/7/2006 10:24:00 AM	Water	None	None
2894	AY-68-28-608	8/8/2006 2:24:00 AM	Water	None	None
2874	AY-68-28-608	7/31/2006 to 8/9/2006	Charcoal	None	None
2913	AY-68-28-608	8/9/2006 10:48:00 AM	Water	None	None
2933	AY-68-28-608	8/9/2006 10:48:00 AM	Water	None	None
2927	AY-68-28-608	8/10/2006 10:48:00 AM	Water	None	None
2928	AY-68-28-608	8/11/2006 10:48:00 AM	Water	None	None
2929	AY-68-28-608	8/12/2006 10:48:00 AM	Water	None	None
2930	AY-68-28-608	8/13/2006 10:48:00 AM	Water	None	None
2931	AY-68-28-608	8/14/2006 10:48:00 AM	Water	None	None
2932	AY-68-28-608	8/15/2006 10:48:00 AM	Water	None	None
2934	AY-68-28-608	8/16/2006 10:12:00 AM	Water	None	None
2944	AY-68-28-608	8/9/2005 to 8/16/2006	Charcoal	None	None
2935	AY-68-28-608	8/17/2006 10:12:00 AM	Water	None	None
2943	AY-68-28-608	8/17/2006 2:12:00 AM	Water	None	None
2942	AY-68-28-608	8/17/2006 2:12:00 AM	Water	None	None
2936	AY-68-28-608	8/18/2006 10:12:00 AM	Water	None	None
2937	AY-68-28-608	8/19/2006 10:12:00 AM	Water	None	None
2938	AY-68-28-608	8/20/2006 10:12:00 AM	Water	None	None
2939	AY-68-28-608	8/21/2006 10:12:00 AM	Water	None	None
2940	AY-68-28-608	8/22/2006 10:12:00 AM	Water	None	None
2951	AY-68-28-608	8/16/2005 to 8/23/2006	Charcoal	None	None
2941	AY-68-28-608	8/23/2006 10:12:00 AM	Water	None	None
2952	AY-68-28-608	8/23/2006 11:00:00 AM	Water	None	None
2953	AY-68-28-608	8/24/2006 11:00:00 AM	Water	None	None
2960	AY-68-28-608	8/24/2006 7:00:00 PM	Water	None	None
2954	AY-68-28-608	8/24/2006 7:00:00 PM	Water	None	None
2955	AY-68-28-608	8/25/2006 7:00:00 PM	Water	None	None
2956	AY-68-28-608	8/26/2006 7:00:00 PM	Water	None	None
2957	AY-68-28-608	8/27/2006 7:00:00 PM	Water	None	None
2958	AY-68-28-608	8/28/2006 7:00:00 PM	Water	None	None
2959	AY-68-28-608	8/29/2006 7:00:00 PM	Water	None	None
2989	AY-68-28-608	10/2/2006 11:16:00 AM	Water	None	None

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2988	AY-68-28-608	10/2/2006 11:16:00 PM	Water	None	None
2978	AY-68-28-608	10/2/2006 11:16:00 PM	Water	None	None
2979	AY-68-28-608	10/3/2006 11:16:00 AM	Water	None	None
2980	AY-68-28-608	10/4/2006 11:16:00 AM	Water	None	None
2981	AY-68-28-608	10/5/2006 11:16:00 AM	Water	None	None
2982	AY-68-28-608	10/6/2006 11:16:00 AM	Water	None	None
2983	AY-68-28-608	10/7/2006 11:16:00 AM	Water	None	None
2984	AY-68-28-608	10/8/2006 11:16:00 AM	Water	None	None
2985	AY-68-28-608	10/9/2006 11:16:00 AM	Water	None	None
2986	AY-68-28-608	10/10/2006 11:16:00 AM	Water	None	None
2987	AY-68-28-608	10/11/2006 11:16:00 AM	Water	None	None
2996	AY-68-28-608	10/2/2006 to 10/11/2006	Charcoal	None	None
3002	AY-68-28-608	10/18/2006 12:30:00 PM	Water	None	None
3003	AY-68-28-608	10/19/2006 12:30:00 PM	Water	None	None
3004	AY-68-28-608	10/20/2006 12:30:00 PM	Water	None	None
3005	AY-68-28-608	10/21/2006 12:30:00 AM	Water	None	None
3007	AY-68-28-608	10/18/2006 to 10/26/2006	Charcoal	None	None
3006	AY-68-28-608	10/26/2006 5:15:00 PM	Water	None	None
815	AY-68-29-113	11/30/2004 3:20:00 PM	Water	None	None
788	AY-68-29-113	11/30/2004 3:37:00 PM	Water	None	None
789	AY-68-29-113	12/1/2004 11:37:00 AM	Water	None	None
790	AY-68-29-113	12/1/2004 11:37:00 PM	Water	None	None
426	AY-68-29-113	12/2/2004 1:00:00 PM	Water	None	None
791	AY-68-29-113	12/2/2004 11:37:00 AM	Water	None	None
793	AY-68-29-113	12/2/2004 7:37:00 AM	Water	None	None
792	AY-68-29-113	12/2/2004 7:37:00 AM	Water	None	None
433	AY-68-29-113	12/3/2004 1:00:00 AM	Water	None	None
427	AY-68-29-113	12/3/2004 1:00:00 AM	Water	None	None
428	AY-68-29-113	12/3/2004 5:00:00 PM	Water	None	None
429	AY-68-29-113	12/4/2004 9:00:00 AM	Water	None	None
430	AY-68-29-113	12/5/2004 1:00:00 AM	Water	None	None
431	AY-68-29-113	12/5/2004 5:00:00 PM	Water	None	None
1206	AY-68-29-113	12/2/2004 to 12/6/2004	Charcoal	None	None
919	AY-68-29-113	12/6/2004 12:00:00 PM	Water	None	None
920	AY-68-29-113	12/6/2004 4:00:00 PM	Water	None	None
926	AY-68-29-113	12/6/2004 4:00:00 PM	Water	None	None
432	AY-68-29-113	12/6/2004 9:00:00 AM	Water	None	None
921	AY-68-29-113	12/7/2004 4:00:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
922	AY-68-29-113	12/7/2004 4:00:00 PM	Water	None	None
923	AY-68-29-113	12/8/2004 4:00:00 AM	Water	None	None
924	AY-68-29-113	12/8/2004 8:00:00 PM	Water	None	None
1219	AY-68-29-113	12/6/2004 to 12/9/2004	Charcoal	None	None
1031	AY-68-29-113	12/9/2004 12:17:00 PM	Water	None	None
925	AY-68-29-113	12/9/2004 8:00:00 AM	Water	None	None
927	AY-68-29-113	12/10/2004 1:00:00 PM	Water	None	None
1032	AY-68-29-113	12/10/2004 12:17:00 AM	Water	None	None
1033	AY-68-29-113	12/10/2004 12:17:00 PM	Water	None	None
1034	AY-68-29-113	12/11/2004 12:17:00 AM	Water	None	None
1035	AY-68-29-113	12/11/2004 12:17:00 PM	Water	None	None
1036	AY-68-29-113	12/11/2004 4:17:00 PM	Water	None	None
1040	AY-68-29-113	12/11/2004 4:17:00 PM	Water	None	None
1144	AY-68-29-113	12/12/2004 12:00:00 PM	Water	None	None
1038	AY-68-29-113	12/12/2004 12:17:00 PM	Water	None	None
1037	AY-68-29-113	12/12/2004 4:17:00 AM	Water	None	None
1039	AY-68-29-113	12/12/2004 8:17:00 PM	Water	None	None
983	AY-68-29-113	12/12/2004 8:50:00 AM	Water	None	None
1128	AY-68-29-113	12/12/2004 8:50:00 AM	Water	None	None
1058	AY-68-29-113	12/13/2004 1:00:00 PM	Water	None	None
1059	AY-68-29-113	12/13/2004 5:00:00 PM	Water	None	None
1234	AY-68-29-113	12/9/2004 to 12/13/2004	Charcoal	None	None
1060	AY-68-29-113	12/14/2004 1:00:00 PM	Water	None	None
1061	AY-68-29-113	12/14/2004 5:00:00 PM	Water	None	None
1062	AY-68-29-113	12/15/2004 3:00:00 PM	Water	None	None
1063	AY-68-29-113	12/15/2004 5:00:00 PM	Water	None	None
1065	AY-68-29-113	12/15/2004 5:00:00 PM	Water	None	None
1064	AY-68-29-113	12/15/2004 9:00:00 PM	Water	None	None
1100	AY-68-29-113	12/13/2004 to 12/16/2004	Charcoal	None	None
1256	AY-68-29-113	12/16/2004 1:00:00 PM	Water	None	None
1109	AY-68-29-113	12/16/2004 11:45:00 AM	Water	None	None
1257	AY-68-29-113	12/16/2004 5:00:00 PM	Water	None	None
1258	AY-68-29-113	12/17/2004 1:00:00 AM	Water	None	None
1261	AY-68-29-113	12/17/2004 11:10:00 AM	Water	None	None
1388	AY-68-29-113	12/20/2004 11:10:00 AM	Water	None	None
1384	AY-68-29-113	12/20/2004 11:10:00 AM	Water	None	None
1262	AY-68-29-113	12/20/2004 11:20:00 AM	Water	None	None
1385	AY-68-29-113	12/20/2004 3:10:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1789	AY-68-29-113	12/16/2004 to 12/21/2004	Charcoal	None	None
1386	AY-68-29-113	12/21/2004 4:10:00 AM	Water	None	None
1387	AY-68-29-113	12/21/2004 5:35:00 PM	Water	None	None
2021	AY-68-29-113	12/20/2004 to 12/23/2004	Charcoal	None	None
2073	AY-68-29-113	12/21/2004 to 12/23/2004	Charcoal	None	None
1472	AY-68-29-113	12/23/2004 10:10:00 AM	Water	None	None
1464	AY-68-29-113	12/23/2004 10:10:00 AM	Water	None	None
1465	AY-68-29-113	12/24/2004 10:10:00 AM	Water	None	None
1466	AY-68-29-113	12/29/2004 10:10:00 AM	Water	None	None
1467	AY-68-29-113	12/30/2004 10:10:00 AM	Water	None	None
1468	AY-68-29-113	12/31/2004 10:10:00 AM	Water	None	None
1469	AY-68-29-113	1/1/2005 10:10:00 AM	Water	None	None
1470	AY-68-29-113	1/2/2005 10:10:00 AM	Water	None	None
1471	AY-68-29-113	1/3/2005 10:10:00 PM	Water	None	None
1415	AY-68-29-113	1/4/2005 11:30:00 AM	Water	None	None
1829	AY-68-29-113	1/4/2005 11:46:00 AM	Water	None	None
2072	AY-68-29-113	12/23/2004 to 1/4/2005	Charcoal	None	None
1830	AY-68-29-113	1/5/2005 11:46:00 AM	Water	None	None
1831	AY-68-29-113	1/6/2005 11:46:00 AM	Water	None	None
1832	AY-68-29-113	1/7/2005 11:46:00 AM	Water	None	None
1833	AY-68-29-113	1/8/2005 11:46:00 AM	Water	None	None
1834	AY-68-29-113	1/9/2005 11:46:00 AM	Water	None	None
1835	AY-68-29-113	1/9/2005 11:46:00 AM	Water	None	None
2019	AY-68-29-113	1/4/2005 to 1/10/2005	Charcoal	None	None
1944	AY-68-29-113	1/4/2005 to 1/10/2005	Charcoal	None	None
1506	AY-68-29-113	1/13/2005 11:28:00 AM	Water	None	None
1507	AY-68-29-113	1/13/2005 11:28:00 PM	Water	None	None
1517	AY-68-29-113	1/14/2005 11:28:00 AM	Water	None	None
1516	AY-68-29-113	1/14/2005 11:28:00 AM	Water	None	None
1510	AY-68-29-113	1/14/2005 11:28:00 PM	Water	None	None
1508	AY-68-29-113	1/14/2005 5:28:00 PM	Water	None	None
1509	AY-68-29-113	1/15/2005 11:28:00 AM	Water	None	None
1511	AY-68-29-113	1/15/2005 11:28:00 PM	Water	None	None
1512	AY-68-29-113	1/16/2005 5:28:00 PM	Water	None	None
1513	AY-68-29-113	1/17/2005 11:28:00 AM	Water	None	None
1514	AY-68-29-113	1/18/2005 11:28:00 AM	Water	None	None
1515	AY-68-29-113	1/18/2005 11:28:00 PM	Water	None	None
1716	AY-68-29-113	1/13/2005 to 1/19/2005	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1567	AY-68-29-113	1/19/2005 9:10:00 AM	Water	None	None
1748	AY-68-29-113	1/19/2005 9:35:00 AM	Water	None	None
1749	AY-68-29-113	1/19/2005 9:35:00 PM	Water	None	None
1760	AY-68-29-113	1/20/2005 3:35:00 PM	Water	None	None
1752	AY-68-29-113	1/20/2005 3:35:00 PM	Water	None	None
1750	AY-68-29-113	1/20/2005 9:35:00 AM	Water	None	None
1751	AY-68-29-113	1/20/2005 9:35:00 PM	Water	None	None
1753	AY-68-29-113	1/21/2005 9:35:00 AM	Water	None	None
1754	AY-68-29-113	1/22/2005 3:35:00 AM	Water	None	None
1755	AY-68-29-113	1/22/2005 9:35:00 PM	Water	None	None
1756	AY-68-29-113	1/23/2005 3:35:00 PM	Water	None	None
1757	AY-68-29-113	1/24/2005 9:35:00 AM	Water	None	None
1701	AY-68-29-113	1/19/2005 to 1/25/2005	Charcoal	None	None
1758	AY-68-29-113	1/25/2005 3:35:00 AM	Water	None	None
1734	AY-68-29-113	1/25/2005 9:03:00 AM	Water	None	None
1895	AY-68-29-113	1/25/2005 9:12:00 AM	Water	None	None
1886	AY-68-29-113	1/25/2005 9:12:00 AM	Water	None	None
1887	AY-68-29-113	1/26/2005 3:12:00 AM	Water	None	None
1890	AY-68-29-113	1/26/2005 9:12:00 PM	Water	None	None
1888	AY-68-29-113	1/27/2005 3:12:00 PM	Water	None	None
1889	AY-68-29-113	1/28/2005 9:12:00 AM	Water	None	None
1891	AY-68-29-113	1/29/2005 3:12:00 AM	Water	None	None
1892	AY-68-29-113	1/29/2005 9:12:00 PM	Water	None	None
1893	AY-68-29-113	1/30/2005 3:12:00 PM	Water	None	None
2013	AY-68-29-113	1/29/2005 to 1/31/2005	Charcoal	None	None
1946	AY-68-29-113	1/29/2005 to 1/31/2005	Charcoal	None	None
1894	AY-68-29-113	1/31/2005 3:12:00 AM	Water	None	None
2097	AY-68-29-113	1/24/2005 to 2/1/2005	Charcoal	None	None
270	Bexar Met Well	10/19/2004 3:15:00 PM	Water	None	None
271	Bexar Met Well	10/19/2004 6:05:00 PM	Water	None	None
274	Bexar Met Well	10/21/2004 11:30:00 AM	Water	None	None
273	Bexar Met Well	10/21/2004 11:35:00 AM	Water	None	None
272	Bexar Met Well	10/21/2004 5:45:00 PM	Water	None	None
275	Bexar Met Well	10/22/2004 2:50:00 PM	Water	None	None
268	Bexar Met Well	10/22/2004 4:45:00 PM	Water	None	None
269	Bexar Met Well	10/22/2004 9:15:00 AM	Water	None	None
276	Bexar Met Well	10/23/2004 11:30:00 AM	Water	None	None
279	Bexar Met Well	10/23/2004 11:40:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
277	Bexar Met Well	10/23/2004 4:45:00 PM	Water	None	None
278	Bexar Met Well	10/23/2004 4:50:00 PM	Water	None	None
280	Bexar Met Well	10/24/2004 9:30:00 AM	Water	None	None
281	Bexar Met Well	10/24/2004 9:45:00 AM	Water	None	None
282	Bexar Met Well	10/25/2004 9:35:00 AM	Water	None	None
362	Bexar Met Well	10/26/2004 6:00:00 PM	Water	None	None
677	Bexar Met Well	10/27/2004 11:20:00 AM	Water	None	None
678	Bexar Met Well	10/28/2004 11:45:00 AM	Water	None	None
679	Bexar Met Well	10/29/2004 9:00:00 AM	Water	None	None
964	Bexar Met Well	12/14/2004 11:30:00 AM	Water	None	None
1120	Bexar Met Well	12/15/2004 2:00:00 PM	Water	None	None
1121	Bexar Met Well	12/16/2004 2:30:00 PM	Water	None	None
1260	Bexar Met Well	12/17/2004 12:30:00 PM	Water	None	None
1259	Bexar Met Well	12/20/2004 11:00:00 AM	Water	None	None
1407	Bexar Met Well	12/21/2004 12:00:00 PM	Water	None	None
1629	Bexar Met Well	1/20/2005 11:57:00 AM	Water	None	None
295	BexarMet Well 7	10/21/2004 10:30:00 AM	Water	None	None
287	BexarMet Well 7	10/22/2004 10:50:00 AM	Water	None	None
289	BexarMet Well 7	10/23/2004 10:30:00 AM	Water	None	None
288	BexarMet Well 7	10/24/2004 8:45:00 AM	Water	None	None
265	BexarMet Well 7	10/25/2004 11:05:00 AM	Water	None	None
570	BexarMet Well 7	10/22/2004 to 10/26/2004	Charcoal	None	None
581	BexarMet Well 7	10/26/2004 10:32:00 AM	Water	None	None
696	BexarMet Well 7	10/27/2004 10:13:00 AM	Water	None	None
697	BexarMet Well 7	10/28/2004 10:26:00 AM	Water	None	None
1157	BexarMet Well 7	10/21/2004 to 10/29/2004	Charcoal	None	None
698	BexarMet Well 7	10/29/2004 10:10:00 AM	Water	None	None
699	BexarMet Well 7	10/30/2004 10:00:00 AM	Water	None	None
721	BexarMet Well 7	10/31/2004 9:52:00 AM	Water	None	None
722	BexarMet Well 7	11/1/2004 10:18:00 AM	Water	None	None
723	BexarMet Well 7	11/2/2004 10:19:00 AM	Water	None	None
724	BexarMet Well 7	11/3/2004 1:10:00 PM	Water	None	None
725	BexarMet Well 7	11/4/2004 10:15:00 AM	Water	None	None
1588	BexarMet Well 7	10/26/2004 to 11/30/2004	Charcoal	None	None
1166	BexarMet Well 7	10/29/2004 to 11/30/2004	Charcoal	None	None
814	BexarMet Well 7	11/30/2004 1:15:00 PM	Water	None	None
823	BexarMet Well 7	12/1/2004 10:00:00 AM	Water	None	None
834	BexarMet Well 7	12/2/2004 10:15:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
835	BexarMet Well 7	12/2/2004 10:15:00 PM	Water	None	None
822	BexarMet Well 7	12/2/2004 10:22:00 AM	Water	None	None
836	BexarMet Well 7	12/3/2004 2:15:00 PM	Water	None	None
841	BexarMet Well 7	12/3/2004 2:15:00 PM	Water	None	None
838	BexarMet Well 7	12/4/2004 10:15:00 PM	Water	None	None
837	BexarMet Well 7	12/4/2004 6:15:00 AM	Water	None	None
839	BexarMet Well 7	12/5/2004 2:15:00 PM	Water	None	None
1205	BexarMet Well 7	12/2/2004 to 12/6/2004	Charcoal	None	None
857	BexarMet Well 7	12/6/2004 11:20:00 AM	Water	None	None
912	BexarMet Well 7	12/6/2004 11:50:00 AM	Water	None	None
913	BexarMet Well 7	12/6/2004 11:50:00 PM	Water	None	None
840	BexarMet Well 7	12/6/2004 6:15:00 AM	Water	None	None
914	BexarMet Well 7	12/7/2004 11:50:00 AM	Water	None	None
915	BexarMet Well 7	12/7/2004 11:50:00 PM	Water	None	None
916	BexarMet Well 7	12/8/2004 11:50:00 AM	Water	None	None
917	BexarMet Well 7	12/8/2004 11:50:00 PM	Water	None	None
1222	BexarMet Well 7	12/6/2004 to 12/9/2004	Charcoal	None	None
1022	BexarMet Well 7	12/9/2004 10:00:00 AM	Water	None	None
918	BexarMet Well 7	12/9/2004 3:50:00 AM	Water	None	None
1030	BexarMet Well 7	12/9/2004 9:45:00 AM	Water	None	None
1021	BexarMet Well 7	12/9/2004 9:45:00 AM	Water	None	None
929	BexarMet Well 7	12/10/2004 9:10:00 AM	Water	None	None
1023	BexarMet Well 7	12/10/2004 9:45:00 AM	Water	None	None
1024	BexarMet Well 7	12/10/2004 9:45:00 PM	Water	None	None
1025	BexarMet Well 7	12/11/2004 9:45:00 AM	Water	None	None
1026	BexarMet Well 7	12/11/2004 9:45:00 PM	Water	None	None
1027	BexarMet Well 7	12/12/2004 1:45:00 PM	Water	None	None
1028	BexarMet Well 7	12/12/2004 9:45:00 PM	Water	None	None
1029	BexarMet Well 7	12/13/2004 5:45:00 AM	Water	None	None
1093	BexarMet Well 7	12/13/2004 9:49:00 AM	Water	None	None
1114	BexarMet Well 7	12/13/2004 9:49:00 PM	Water	None	None
1231	BexarMet Well 7	12/9/2004 to 12/13/2004	Charcoal	None	None
965	BexarMet Well 7	12/14/2004 9:00:00 AM	Water	None	None
1115	BexarMet Well 7	12/14/2004 9:49:00 AM	Water	None	None
1116	BexarMet Well 7	12/14/2004 9:49:00 PM	Water	None	None
1119	BexarMet Well 7	12/14/2004 9:49:00 PM	Water	None	None
967	BexarMet Well 7	12/15/2004 9:33:00 AM	Water	None	None
1117	BexarMet Well 7	12/15/2004 9:49:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1118	BexarMet Well 7	12/15/2004 9:49:00 PM	Water	None	None
1098	BexarMet Well 7	12/13/2004 to 12/16/2004	Charcoal	None	None
1263	BexarMet Well 7	12/16/2004 9:40:00 AM	Water	None	None
1272	BexarMet Well 7	12/16/2004 9:40:00 AM	Water	None	None
1264	BexarMet Well 7	12/16/2004 9:40:00 PM	Water	None	None
1265	BexarMet Well 7	12/17/2004 9:40:00 AM	Water	None	None
1266	BexarMet Well 7	12/17/2004 9:40:00 PM	Water	None	None
1267	BexarMet Well 7	12/18/2004 9:40:00 AM	Water	None	None
1268	BexarMet Well 7	12/18/2004 9:40:00 PM	Water	None	None
1269	BexarMet Well 7	12/19/2004 9:40:00 AM	Water	None	None
1270	BexarMet Well 7	12/19/2004 9:40:00 PM	Water	None	None
1317	BexarMet Well 7	12/16/2004 to 12/20/2004	Charcoal	None	None
1271	BexarMet Well 7	12/20/2004 5:40:00 AM	Water	None	None
1389	BexarMet Well 7	12/20/2004 9:40:00 AM	Water	None	None
1390	BexarMet Well 7	12/20/2004 9:40:00 PM	Water	None	None
1396	BexarMet Well 7	12/20/2004 9:40:00 PM	Water	None	None
1391	BexarMet Well 7	12/21/2004 9:40:00 AM	Water	None	None
1392	BexarMet Well 7	12/21/2004 9:40:00 PM	Water	None	None
1393	BexarMet Well 7	12/22/2004 9:40:00 AM	Water	None	None
1394	BexarMet Well 7	12/22/2004 9:40:00 PM	Water	None	None
2074	BexarMet Well 7	12/20/2004 to 12/23/2004	Charcoal	None	None
1450	BexarMet Well 7	12/23/2004 10:15:00 AM	Water	None	None
1395	BexarMet Well 7	12/23/2004 9:40:00 AM	Water	None	None
1451	BexarMet Well 7	12/24/2004 10:15:00 AM	Water	None	None
1452	BexarMet Well 7	12/25/2004 10:15:00 AM	Water	None	None
1453	BexarMet Well 7	12/26/2004 10:15:00 AM	Water	None	None
1454	BexarMet Well 7	12/27/2004 10:15:00 AM	Water	None	None
1455	BexarMet Well 7	12/28/2004 10:15:00 AM	Water	None	None
1458	BexarMet Well 7	12/29/2004 10:15:00 AM	Water	None	None
1459	BexarMet Well 7	12/30/2004 10:15:00 AM	Water	None	None
1460	BexarMet Well 7	12/31/2004 10:15:00 AM	Water	None	None
1461	BexarMet Well 7	1/1/2005 10:15:00 AM	Water	None	None
1462	BexarMet Well 7	1/2/2005 10:15:00 AM	Water	None	None
1463	BexarMet Well 7	1/3/2005 10:15:00 AM	Water	None	None
1421	BexarMet Well 7	1/4/2005 9:45:00 AM	Water	None	None
1648	BexarMet Well 7	1/4/2005 9:45:00 AM	Water	None	None
2067	BexarMet Well 7	12/23/2004 to 1/4/2005	Charcoal	None	None
1649	BexarMet Well 7	1/5/2005 9:45:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1650	BexarMet Well 7	1/6/2005 9:45:00 AM	Water	None	None
1651	BexarMet Well 7	1/7/2005 9:45:00 AM	Water	None	None
1652	BexarMet Well 7	1/9/2005 9:45:00 AM	Water	None	None
1653	BexarMet Well 7	1/10/2005 9:45:00 AM	Water	None	None
1654	BexarMet Well 7	1/11/2005 9:45:00 AM	Water	None	None
1655	BexarMet Well 7	1/12/2005 9:45:00 AM	Water	None	None
1634	BexarMet Well 7	1/13/2005 10:00:00 AM	Water	None	None
1521	BexarMet Well 7	1/13/2005 11:24:00 AM	Water	None	None
1522	BexarMet Well 7	1/13/2005 11:24:00 PM	Water	None	None
1615	BexarMet Well 7	1/4/2005 to 1/13/2005	Charcoal	None	None
1523	BexarMet Well 7	1/14/2005 11:24:00 AM	Water	None	None
1524	BexarMet Well 7	1/14/2005 11:24:00 PM	Water	None	None
1525	BexarMet Well 7	1/15/2005 11:24:00 AM	Water	None	None
1526	BexarMet Well 7	1/15/2005 11:24:00 PM	Water	None	None
1527	BexarMet Well 7	1/16/2005 11:24:00 AM	Water	None	None
1528	BexarMet Well 7	1/16/2005 11:24:00 PM	Water	None	None
1529	BexarMet Well 7	1/17/2005 11:24:00 AM	Water	None	None
1531	BexarMet Well 7	1/17/2005 11:24:00 PM	Water	None	None
1530	BexarMet Well 7	1/17/2005 5:24:00 AM	Water	None	None
1534	BexarMet Well 7	1/17/2005 5:24:00 AM	Water	None	None
1532	BexarMet Well 7	1/18/2005 11:24:00 AM	Water	None	None
1713	BexarMet Well 7	1/13/2005 to 1/19/2005	Charcoal	None	None
1566	BexarMet Well 7	1/19/2005	Water	None	None
1533	BexarMet Well 7	1/19/2005 5:24:00 AM	Water	None	None
2197	BexarMet Well 7	1/19/2005 9:40:00 AM	Water	None	None
2198	BexarMet Well 7	1/20/2005 9:40:00 AM	Water	None	None
2204	BexarMet Well 7	1/20/2005 9:40:00 AM	Water	None	None
2199	BexarMet Well 7	1/21/2005 9:40:00 AM	Water	None	None
2200	BexarMet Well 7	1/22/2005 9:40:00 AM	Water	None	None
2201	BexarMet Well 7	1/23/2005 9:40:00 AM	Water	None	None
2202	BexarMet Well 7	1/24/2005 9:40:00 AM	Water	None	None
2203	BexarMet Well 7	1/25/2005 3:40:00 AM	Water	None	None
2223	BexarMet Well 7	1/19/2005 to 2/11/2005	Charcoal	None	None
2216	BexarMet Well 7	2/11/2005 11:15:00 AM	Water	None	None
2339	BexarMet Well 7	2/18/2005 to 3/21/2005	Charcoal	None	None
2436	BexarMet Well 7	3/21/2005 9:00:00 AM	Water	None	None
284	Blackhawk Trail	10/21/2004 9:50:00 AM	Water	None	None
546	Blackhawk Trail	10/18/2004 to 10/22/2004	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
285	Blackhawk Trail	10/23/2004 10:15:00 AM	Water	None	None
286	Blackhawk Trail	10/24/2004 8:35:00 AM	Water	None	None
266	Blackhawk Trail	10/25/2004 10:50:00 AM	Water	None	None
572	Blackhawk Trail	10/22/2004 to 10/26/2004	Charcoal	None	None
583	Blackhawk Trail	10/26/2004 10:20:00 AM	Water	None	None
688	Blackhawk Trail	10/27/2004 10:01:00 AM	Water	None	None
689	Blackhawk Trail	10/28/2004 10:20:00 AM	Water	None	None
1154	Blackhawk Trail	10/22/2004 to 10/29/2004	Charcoal	None	None
690	Blackhawk Trail	10/29/2004 9:50:00 AM	Water	None	None
691	Blackhawk Trail	10/30/2004 9:55:00 AM	Water	None	None
717	Blackhawk Trail	10/31/2004 9:45:00 AM	Water	None	None
718	Blackhawk Trail	11/1/2004 10:10:00 AM	Water	None	None
831	Blackhawk Trail	10/26/2004 to 11/2/2004	Charcoal	None	None
719	Blackhawk Trail	11/2/2004 10:07:00 AM	Water	None	None
720	Blackhawk Trail	11/4/2004 10:08:00 AM	Water	None	None
826	Blackhawk Trail	11/2/2004 to 11/29/2004	Charcoal	None	None
1584	Blackhawk Trail	10/26/2004 to 11/30/2004	Charcoal	None	None
1185	Blackhawk Trail	10/29/2004 to 11/30/2004	Charcoal	None	None
1187	Blackhawk Trail	11/2/2004 to 11/30/2004	Charcoal	None	None
832	Blackhawk Trail	11/29/2004 to 11/30/2004	Charcoal	None	None
825	Blackhawk Trail	12/1/2004 1:00:00 PM	Water	None	None
824	Blackhawk Trail	12/1/2004 10:40:00 AM	Water	None	None
1189	Blackhawk Trail	11/30/2004 to 12/2/2004	Charcoal	None	None
820	Blackhawk Trail	12/2/2004 10:30:00 AM	Water	None	None
1201	Blackhawk Trail	11/30/2004 to 12/6/2004	Charcoal	None	None
1202	Blackhawk Trail	12/2/2004 to 12/6/2004	Charcoal	None	None
1126	Blackhawk Trail	12/6/2004 to 12/9/2004	Charcoal	None	None
1239	Blackhawk Trail	12/6/2004 to 12/9/2004	Charcoal	None	None
937	Blackhawk Trail	12/9/2004 10:12:00 AM	Water	None	None
928	Blackhawk Trail	12/10/2004 9:30:00 AM	Water	None	None
985	Blackhawk Trail	12/11/2004 9:05:00 AM	Water	None	None
1130	Blackhawk Trail	12/11/2004 9:05:00 AM	Water	None	None
1129	Blackhawk Trail	12/12/2004 9:00:00 AM	Water	None	None
984	Blackhawk Trail	12/12/2004 9:00:00 AM	Water	None	None
988	Blackhawk Trail	12/13/2004 10:00:00 AM	Water	None	None
1133	Blackhawk Trail	12/13/2004 10:00:00 AM	Water	None	None
1232	Blackhawk Trail	12/9/2004 to 12/13/2004	Charcoal	None	None
961	Blackhawk Trail	12/14/2004 9:15:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
962	Blackhawk Trail	12/15/2004 9:46:00 AM	Water	None	None
1104	Blackhawk Trail	12/9/2004 to 12/16/2004	Charcoal	None	None
1320	Blackhawk Trail	12/13/2004 to 12/20/2004	Charcoal	None	None
1404	Blackhawk Trail	12/21/2004 10:26:00 AM	Water	None	None
2075	Blackhawk Trail	12/20/2004 to 12/23/2004	Charcoal	None	None
1405	Blackhawk Trail	12/23/2004 10:21:00 AM	Water	None	None
1416	Blackhawk Trail	1/4/2005 9:52:00 AM	Water	None	None
1785	Blackhawk Trail	12/16/2004 to 1/4/2005	Charcoal	None	None
1622	Blackhawk Trail	1/10/2005 to 1/13/2005	Charcoal	None	None
1632	Blackhawk Trail	1/13/2005 10:35:00 AM	Water	None	None
1612	Blackhawk Trail	1/4/2005 to 1/13/2005	Charcoal	None	None
1610	Blackhawk Trail	12/23/2004 to 1/13/2005	Charcoal	None	None
1613	Blackhawk Trail	1/13/2005 to 1/19/2005	Charcoal	None	None
1559	Blackhawk Trail	1/19/2005 9:48:00 AM	Water	None	None
1781	Blackhawk Trail	1/21/2005 2:00:00 PM	Water	None	None
1704	Blackhawk Trail	1/13/2005 to 1/25/2005	Charcoal	None	None
1782	Blackhawk Trail	1/25/2005 9:03:00 AM	Water	None	None
1932	Blackhawk Trail	1/19/2005 to 1/31/2005	Charcoal	None	None
2016	Blackhawk Trail	1/19/2005 to 1/31/2005	Charcoal	None	None
1937	Blackhawk Trail	1/31/2005 9:15:00 AM	Water	None	None
2056	Blackhawk Trail	1/25/2005 to 2/7/2005	Charcoal	None	None
2034	Blackhawk Trail	2/7/2005 10:25:00 AM	Water	None	None
2218	Blackhawk Trail	1/31/2005 to 2/11/2005	Charcoal	None	None
2213	Blackhawk Trail	2/11/2005 10:22:00 AM	Water	None	None
2342	Blackhawk Trail	2/11/2005 to 3/21/2005	Charcoal	None	None
2435	Blackhawk Trail	3/21/2005 9:30:00 AM	Water	None	None
2345	Blackhawk Trail	3/7/2005 to 3/21/2005	Charcoal	None	None
827	BSF Well	11/29/2004 to 12/2/2004	Charcoal	None	None
1190	BSF Well	11/30/2004 to 12/6/2004	Charcoal	None	None
1184	BSF Well	12/6/2004 8:20:00 AM	Water	None	None
1125	BSF Well	12/4/2004 to 12/8/2004	Charcoal	None	None
1238	BSF Well	12/4/2004 to 12/8/2004	Charcoal	None	None
932	BSF Well	12/8/2004 11:23:00 AM	Water	None	None
930	BSF Well	12/10/2004 12:32:00 PM	Water	None	None
992	BSF Well	12/13/2004 8:37:00 AM	Water	None	None
1137	BSF Well	12/13/2004 8:37:00 AM	Water	None	None
1233	BSF Well	12/9/2004 to 12/13/2004	Charcoal	None	None
1105	BSF Well	12/13/2004 to 12/16/2004	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1110	BSF Well	12/16/2004 12:00:00 PM	Water	None	None
1315	BSF Well	12/8/2004 to 12/20/2004	Charcoal	None	None
1419	BSF Well	1/4/2005 12:05:00 PM	Water	None	None
1787	BSF Well	12/20/2004 to 1/4/2005	Charcoal	None	None
1635	BSF Well	1/10/2005 3:44:00 PM	Water	None	None
1617	BSF Well	1/4/2005 to 1/10/2005	Charcoal	None	None
1636	BSF Well	1/13/2005 1:30:00 PM	Water	None	None
1621	BSF Well	1/13/2005 to 1/15/2005	Charcoal	None	None
1637	BSF Well	1/15/2005 2:10:00 PM	Water	None	None
1639	BSF Well	1/17/2005 5:13:00 PM	Water	None	None
1570	BSF Well	1/17/2005 5:13:00 PM	Water	None	None
1705	BSF Well	1/15/2005 to 1/19/2005	Charcoal	None	None
1620	BSF Well	1/15/2005 to 1/19/2005	Charcoal	None	None
1519	BSF Well	1/19/2005 11:22:00 AM	Water	None	None
1520	BSF Well	1/19/2005 11:22:00 AM	Water	None	None
1640	BSF Well	1/19/2005 4:48:00 PM	Water	None	None
1638	BSF Well	1/20/2005 10:14:00 AM	Water	None	None
1731	BSF Well	1/21/2005 1:30:00 PM	Water	None	None
1707	BSF Well	1/19/2005 to 1/24/2005	Charcoal	None	None
1801	BSF Well	1/24/2005 4:45:00 PM	Water	None	None
2006	BSF Well	1/27/2005 10:11:00 AM	Water	None	None
1998	BSF Well	1/28/2005 10:10:00 AM	Water	None	None
1999	BSF Well	1/29/2005 10:00:00 AM	Water	None	None
2107	BSF Well	1/30/2005 10:00:00 AM	Water	None	None
2000	BSF Well	1/30/2005 10:07:00 AM	Water	None	None
2092	BSF Well	1/20/2005 to 1/31/2005	Charcoal	None	None
1949	BSF Well	1/24/2005 to 1/31/2005	Charcoal	None	None
2014	BSF Well	1/24/2005 to 1/31/2005	Charcoal	None	None
2040	BSF Well	1/31/2005 1:50:00 PM	Water	None	None
1940	BSF Well	1/31/2005 1:50:00 PM	Water	None	None
2001	BSF Well	1/31/2005 10:07:00 AM	Water	None	None
2002	BSF Well	2/1/2005 10:01:00 AM	Water	None	None
2003	BSF Well	2/4/2005 10:02:00 AM	Water	None	None
2004	BSF Well	2/6/2005 10:05:00 AM	Water	None	None
2005	BSF Well	2/7/2005 10:00:00 AM	Water	None	None
2403	BSF Well	3/2/2005 10:59:00 AM	Water	None	None
2404	BSF Well	3/3/2005 11:03:00 AM	Water	None	None
2405	BSF Well	3/4/2005 11:01:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2406	BSF Well	3/5/2005 10:05:00 AM	Water	None	None
2407	BSF Well	3/6/2005 9:38:00 AM	Water	None	None
2412	BSF Well	3/7/2005 11:02:00 AM	Water	None	None
2413	BSF Well	3/8/2005 11:10:00 AM	Water	None	None
2414	BSF Well	3/9/2005 11:08:00 AM	Water	None	None
2415	BSF Well	3/10/2005 11:04:00 AM	Water	None	None
2416	BSF Well	3/11/2005 11:46:00 AM	Water	None	None
2417	BSF Well	3/12/2005 10:08:00 AM	Water	None	None
2418	BSF Well	3/13/2005 11:05:00 AM	Water	None	None
2419	BSF Well	3/14/2005 10:52:00 AM	Water	None	None
2420	BSF Well	3/15/2005 2:20:00 PM	Water	None	None
2421	BSF Well	3/16/2005 11:39:00 AM	Water	None	None
2422	BSF Well	3/17/2005 11:14:00 AM	Water	None	None
2423	BSF Well	3/18/2005 1:22:00 PM	Water	None	None
2424	BSF Well	3/19/2005 2:27:00 PM	Water	None	None
2425	BSF Well	3/20/2005 11:12:00 AM	Water	None	None
2312	BSF Well	3/21/2005 9:37:00 AM	Water	None	None
2313	BSF Well	3/22/2005 11:54:00 AM	Water	None	None
2311	BSF Well	3/23/2005 12:03:00 PM	Water	None	None
539	Cadillac Water Co.	10/18/2004 to 10/22/2004	Charcoal	None	None
571	Cadillac Water Co.	10/22/2004 to 10/26/2004	Charcoal	None	None
692	Cadillac Water Co.	10/27/2004 10:30:00 AM	Water	None	None
695	Cadillac Water Co.	10/28/2004 10:50:00 AM	Water	None	None
1155	Cadillac Water Co.	10/20/2004 to 10/29/2004	Charcoal	None	None
693	Cadillac Water Co.	10/29/2004 10:40:00 AM	Water	None	None
694	Cadillac Water Co.	10/30/2004 10:22:00 AM	Water	None	None
709	Cadillac Water Co.	10/31/2004 10:13:00 AM	Water	None	None
706	Cadillac Water Co.	11/1/2004 10:35:00 AM	Water	None	None
1582	Cadillac Water Co.	10/26/2004 to 11/2/2004	Charcoal	None	None
705	Cadillac Water Co.	11/2/2004 10:45:00 AM	Water	None	None
708	Cadillac Water Co.	11/3/2004 1:17:00 PM	Water	None	None
707	Cadillac Water Co.	11/4/2004 10:37:00 AM	Water	None	None
1213	Cadillac Water Co.	11/2/2004 to 11/9/2004	Charcoal	None	None
1208	Cadillac Water Co.	11/2/2004 to 11/9/2004	Charcoal	None	None
1161	Cadillac Water Co.	11/9/2004 to 11/29/2004	Charcoal	None	None
1159	Cadillac Water Co.	11/29/2004 to 12/2/2004	Charcoal	None	None
1163	Cadillac Water Co.	11/29/2004 to 12/2/2004	Charcoal	None	None
821	Cadillac Water Co.	12/2/2004 11:20:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (μg/L)
1203	Cadillac Water Co.	12/2/2004 to 12/6/2004	Charcoal	None	None
856	Cadillac Water Co.	12/6/2004 9:00:00 AM	Water	None	None
1225	Cadillac Water Co.	12/6/2004 to 12/9/2004	Charcoal	None	None
987	Cadillac Water Co.	12/13/2004 10:45:00 AM	Water	None	None
1132	Cadillac Water Co.	12/13/2004 10:45:00 AM	Water	None	None
1041	Cadillac Water Co.	12/9/2004 to 12/13/2004	Charcoal	None	None
1312	Cadillac Water Co.	12/9/2004 to 12/17/2004	Charcoal	None	None
1309	Cadillac Water Co.	12/13/2004 to 12/20/2004	Charcoal	None	None
1784	Cadillac Water Co.	12/20/2004 to 12/23/2004	Charcoal	None	None
1793	Cadillac Water Co.	12/17/2004 to 1/4/2005	Charcoal	None	None
1633	Cadillac Water Co.	1/13/2005 9:45:00 AM	Water	None	None
1643	Cadillac Water Co.	1/4/2005 to 1/13/2005	Charcoal	None	None
1611	Cadillac Water Co.	12/23/2004 to 1/13/2005	Charcoal	None	None
1783	Cadillac Water Co.	1/13/2005 to 1/18/2005	Charcoal	None	None
1774	Cadillac Water Co.	1/18/2005 2:12:00 PM	Water	None	None
1771	Cadillac Water Co.	1/23/2005 10:59:00 AM	Water	None	None
1710	Cadillac Water Co.	1/13/2005 to 1/25/2005	Charcoal	None	None
1773	Cadillac Water Co.	1/25/2005 9:40:00 AM	Water	None	None
2011	Cadillac Water Co.	1/18/2005 to 1/31/2005	Charcoal	None	None
1933	Cadillac Water Co.	1/18/2005 to 1/31/2005	Charcoal	None	None
1934	Cadillac Water Co.	1/31/2005 8:48:00 AM	Water	None	None
2063	Cadillac Water Co.	1/25/2005 to 2/7/2005	Charcoal	None	None
2033	Cadillac Water Co.	2/7/2005 10:02:00 AM	Water	None	None
2220	Cadillac Water Co.	1/31/2005 to 2/11/2005	Charcoal	Phloxine B	4.1
2215	Cadillac Water Co.	2/11/2005 11:00:00 AM	Water	None	None
2340	Cadillac Water Co.	2/18/2005 to 3/21/2005	Charcoal	Phloxine B	2.0
2433	Cadillac Water Co.	3/21/2005 10:00:00 AM	Water	None	None
2343	Cadillac Water Co.	3/7/2005 to 3/21/2005	Charcoal	None	None
1237	Camp Bullis Well 66	12/2/2004 to 12/8/2004	Charcoal	None	None
1124	Camp Bullis Well 66	12/2/2004 to 12/8/2004	Charcoal	None	None
933	Camp Bullis Well 66	12/8/2004 10:33:00 AM	Water	None	None
1408	Camp Bullis Well 66	12/21/2004 1:20:00 PM	Water	None	None
1569	Camp Bullis Well 66	1/14/2005 3:05:00 PM	Water	None	None
1624	Camp Bullis Well 66	1/14/2005 to 1/17/2005	Charcoal	None	None
1625	Camp Bullis Well 66	1/14/2005 to 1/17/2005	Charcoal	None	None
1641	Camp Bullis Well 66	1/17/2005 2:55:00 PM	Water	None	None
1788	Camp Bullis Well 66	1/17/2005 to 1/20/2005	Charcoal	None	None
1709	Camp Bullis Well 66	1/20/2005 to 1/25/2005	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1800	Camp Bullis Well 66	1/25/2005 1:30:00 PM	Water	None	None
2057	Camp Bullis Well 66	1/25/2005 to 2/7/2005	Charcoal	None	None
2037	Camp Bullis Well 66	2/7/2005 2:05:00 PM	Water	None	None
1647	Camp Bullis Well 74	1/14/2005 2:35:00 PM	Water	None	None
1571	Camp Bullis Well 74	1/14/2005 2:35:00 PM	Water	None	None
1623	Camp Bullis Well 74	1/14/2005 to 1/17/2005	Charcoal	None	None
1706	Camp Bullis Well 74	1/17/2005 to 1/25/2005	Charcoal	None	None
2064	Camp Bullis Well 74	1/17/2005 to 2/7/2005	Charcoal	None	None
2098	Camp Bullis Well 74	1/25/2005 to 2/7/2005	Charcoal	None	None
389	Coker Methodist	10/29/2004 1:00:00 PM	Water	None	None
388	Coker Methodist	10/29/2004 1:00:00 PM	Water	None	None
1730	Coker Methodist	1/21/2005 2:22:00 PM	Water	None	None
535	Huebner at Fawn Bluff Well	10/20/2004 to 10/23/2004	Charcoal	None	None
577	Huebner at Fawn Bluff Well	10/23/2004 to 10/26/2004	Charcoal	None	None
1224	Huebner at Fawn Bluff Well	10/26/2004 to 12/7/2004	Charcoal	None	None
2020	Huebner at Fawn Bluff Well	12/15/2004 to 12/23/2004	Charcoal	None	None
1607	Huebner at Fawn Bluff Well	12/23/2004 to 1/13/2005	Charcoal	None	None
1790	Huebner at Fawn Bluff Well	1/13/2005 to 1/18/2005	Charcoal	None	None
1714	Huebner at Fawn Bluff Well	1/18/2005 to 1/24/2005	Charcoal	None	None
1695	Ladies Tee	1/15/2005 to 1/20/2005	Charcoal	None	None
1618	Ladies Tee	1/15/2005 to 1/20/2005	Charcoal	None	None
2066	Ladies Tee	1/25/2005 to 2/1/2005	Charcoal	None	None
2094	Ladies Tee	1/25/2005 to 2/1/2005	Charcoal	None	None
1107	Main Path Well	9/30/2004 10:00:00 AM	Water	None	None
842	Main Path Well	12/3/2004 10:00:00 AM	Water	None	None
851	Main Path Well	12/3/2004 10:00:00 PM	Water	None	None
845	Main Path Well	12/3/2004 10:00:00 PM	Water	None	None
846	Main Path Well	12/4/2004 2:00:00 PM	Water	None	None
847	Main Path Well	12/5/2004 2:00:00 AM	Water	None	None
848	Main Path Well	12/5/2004 2:00:00 PM	Water	None	None
1191	Main Path Well	12/3/2004 to 12/6/2004	Charcoal	None	None
850	Main Path Well	12/6/2004 10:00:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
849	Main Path Well	12/6/2004 2:00:00 AM	Water	None	None
1223	Main Path Well	12/6/2004 to 12/9/2004	Charcoal	None	None
971	Main Path Well	12/9/2004 11:18:00 PM	Water	None	None
970	Main Path Well	12/9/2004 3:18:00 PM	Water	None	None
979	Main Path Well	12/9/2004 3:18:00 PM	Water	None	None
934	Main Path Well	12/9/2004 3:20:00 PM	Water	None	None
972	Main Path Well	12/10/2004 7:18:00 AM	Water	None	None
973	Main Path Well	12/10/2004 7:18:00 PM	Water	None	None
974	Main Path Well	12/11/2004 7:18:00 AM	Water	None	None
976	Main Path Well	12/11/2004 7:18:00 AM	Water	None	None
975	Main Path Well	12/11/2004 7:18:00 PM	Water	None	None
977	Main Path Well	12/12/2004 7:18:00 PM	Water	None	None
1085	Main Path Well	12/13/2004 10:53:00 AM	Water	None	None
1086	Main Path Well	12/13/2004 10:53:00 PM	Water	None	None
1092	Main Path Well	12/13/2004 2:53:00 PM	Water	None	None
978	Main Path Well	12/13/2004 7:18:00 AM	Water	None	None
1094	Main Path Well	12/13/2004 to 12/13/2004	Charcoal	None	None
1229	Main Path Well	12/9/2004 to 12/13/2004	Charcoal	None	None
1087	Main Path Well	12/14/2004 10:53:00 AM	Water	None	None
1088	Main Path Well	12/14/2004 10:53:00 PM	Water	None	None
1089	Main Path Well	12/15/2004 10:53:00 AM	Water	None	None
1090	Main Path Well	12/15/2004 10:53:00 PM	Water	None	None
1275	Main Path Well	12/16/2004 10:14:00 AM	Water	None	None
1276	Main Path Well	12/16/2004 10:14:00 PM	Water	None	None
1091	Main Path Well	12/16/2004 6:53:00 AM	Water	None	None
1277	Main Path Well	12/17/2004 10:14:00 AM	Water	None	None
1284	Main Path Well	12/17/2004 10:14:00 PM	Water	None	None
1278	Main Path Well	12/17/2004 10:14:00 PM	Water	None	None
1279	Main Path Well	12/18/2004 10:14:00 AM	Water	None	None
1280	Main Path Well	12/18/2004 10:14:00 PM	Water	None	None
1281	Main Path Well	12/19/2004 10:14:00 AM	Water	None	None
1282	Main Path Well	12/19/2004 10:14:00 PM	Water	None	None
1283	Main Path Well	12/20/2004 6:14:00 AM	Water	None	None
1339	Main Path Well	12/20/2004 9:50:00 AM	Water	None	None
1340	Main Path Well	12/20/2004 9:50:00 PM	Water	None	None
1346	Main Path Well	12/21/2004 9:50:00 AM	Water	None	None
1341	Main Path Well	12/21/2004 9:50:00 AM	Water	None	None
1342	Main Path Well	12/21/2004 9:50:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1343	Main Path Well	12/22/2004 9:50:00 AM	Water	None	None
1344	Main Path Well	12/22/2004 9:50:00 PM	Water	None	None
2007	Main Path Well	12/20/2004 to 12/23/2004	Charcoal	None	None
1473	Main Path Well	12/23/2004 1:04:00 PM	Water	None	None
1345	Main Path Well	12/23/2004 9:50:00 AM	Water	None	None
1474	Main Path Well	12/24/2004 1:04:00 PM	Water	None	None
1486	Main Path Well	12/24/2004 1:04:00 PM	Water	None	None
1475	Main Path Well	12/25/2004 1:04:00 PM	Water	None	None
1476	Main Path Well	12/26/2004 1:04:00 PM	Water	None	None
1477	Main Path Well	12/27/2004 1:04:00 PM	Water	None	None
1478	Main Path Well	12/28/2004 1:04:00 PM	Water	None	None
1479	Main Path Well	12/29/2004 1:04:00 PM	Water	None	None
1480	Main Path Well	12/30/2004 1:04:00 PM	Water	None	None
1481	Main Path Well	12/31/2004 1:04:00 PM	Water	None	None
1482	Main Path Well	1/1/2005 1:04:00 PM	Water	None	None
1483	Main Path Well	1/2/2005 1:04:00 PM	Water	None	None
1484	Main Path Well	1/3/2005 1:04:00 PM	Water	None	None
1485	Main Path Well	1/4/2005 1:04:00 AM	Water	None	None
1417	Main Path Well	1/4/2005 10:05:00 AM	Water	None	None
1821	Main Path Well	1/4/2005 10:17:00 AM	Water	None	None
2106	Main Path Well	12/23/2004 to 1/4/2005	Charcoal	None	None
1822	Main Path Well	1/5/2005 10:17:00 AM	Water	None	None
1823	Main Path Well	1/6/2005 10:17:00 AM	Water	None	None
1824	Main Path Well	1/6/2005 10:17:00 PM	Water	None	None
1828	Main Path Well	1/6/2005 10:17:00 PM	Water	None	None
1825	Main Path Well	1/7/2005 10:17:00 PM	Water	None	None
1826	Main Path Well	1/8/2005 10:17:00 PM	Water	None	None
1827	Main Path Well	1/9/2005 10:17:00 PM	Water	None	None
2100	Main Path Well	1/4/2005 to 1/10/2005	Charcoal	None	None
1919	Main Path Well	1/4/2005 to 1/10/2005	Charcoal	None	None
555	SARA Blanco Well	10/19/2004 12:07:00 PM	Water	None	None
556	SARA Blanco Well	10/20/2004 12:07:00 AM	Water	None	None
557	SARA Blanco Well	10/20/2004 12:07:00 PM	Water	None	None
558	SARA Blanco Well	10/21/2004 12:07:00 AM	Water	None	None
559	SARA Blanco Well	10/21/2004 12:07:00 PM	Water	None	None
561	SARA Blanco Well	10/21/2004 4:07:00 AM	Water	None	None
562	SARA Blanco Well	10/21/2004 4:07:00 AM	Water	None	None
545	SARA Blanco Well	10/18/2004 to 10/22/2004	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
560	SARA Blanco Well	10/22/2004 12:07:00 AM	Water	None	None
368	SARA Blanco Well	10/22/2004 4:00:00 PM	Water	None	None
579	SARA Blanco Well	10/22/2004 4:00:00 PM	Water	None	None
296	SARA Blanco Well	10/22/2004 4:07:00 AM	Water	None	None
369	SARA Blanco Well	10/23/2004	Water	None	None
371	SARA Blanco Well	10/23/2004 4:00:00 PM	Water	None	None
370	SARA Blanco Well	10/23/2004 8:00:00 AM	Water	None	None
373	SARA Blanco Well	10/24/2004 12:00:00 PM	Water	None	None
372	SARA Blanco Well	10/24/2004 4:00:00 AM	Water	None	None
374	SARA Blanco Well	10/24/2004 8:00:00 PM	Water	None	None
376	SARA Blanco Well	10/25/2004 12:00:00 PM	Water	None	None
375	SARA Blanco Well	10/25/2004 4:00:00 AM	Water	None	None
377	SARA Blanco Well	10/25/2004 8:00:00 PM	Water	None	None
578	SARA Blanco Well	10/26/2004 12:00:00 PM	Water	None	None
328	SARA Blanco Well	10/26/2004 3:15:00 PM	Water	None	None
365	SARA Blanco Well	10/26/2004 3:15:00 PM	Water	None	None
378	SARA Blanco Well	10/26/2004 4:00:00 AM	Water	None	None
659	SARA Blanco Well	10/26/2004 4:01:00 PM	Water	None	None
660	SARA Blanco Well	10/27/2004 12:01:00 AM	Water	None	None
661	SARA Blanco Well	10/27/2004 12:01:00 PM	Water	None	None
662	SARA Blanco Well	10/28/2004 12:01:00 AM	Water	None	None
663	SARA Blanco Well	10/28/2004 12:01:00 PM	Water	None	None
1148	SARA Blanco Well	10/26/2004 to 10/29/2004	Charcoal	None	None
664	SARA Blanco Well	10/29/2004 12:01:00 AM	Water	None	None
665	SARA Blanco Well	10/29/2004 12:01:00 PM	Water	None	None
2219	Shavano Park 1	1/24/2005 to 2/10/2005	Charcoal	None	None
1308	Shavano Park 6828202	12/13/2004 to 12/20/2004	Charcoal	None	None
1307	Shavano Park 6828202	12/16/2004 to 12/20/2004	Charcoal	None	None
1616	Shavano Park 6828202	1/4/2005 to 1/13/2005	Charcoal	None	None
1786	Shavano Park 6828202	1/13/2005 to 1/18/2005	Charcoal	None	None
1693	Shavano Park 6828202	1/18/2005 to 1/24/2005	Charcoal	None	None
2224	Shavano Park 6828202	1/24/2005 to 2/10/2005	Charcoal	None	None
1851	Shavano Park 7	1/25/2005 10:52:00 AM	Water	None	None
1799	Shavano Park 7	1/25/2005 10:57:00 AM	Water	None	None
1853	Shavano Park 7	1/26/2005 10:52:00 PM	Water	None	None
1852	Shavano Park 7	1/26/2005 4:52:00 AM	Water	None	None
1860	Shavano Park 7	1/26/2005 4:52:00 AM	Water	None	None
1854	Shavano Park 7	1/27/2005 4:52:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1855	Shavano Park 7	1/28/2005 10:52:00 AM	Water	None	None
1857	Shavano Park 7	1/29/2005 10:52:00 PM	Water	None	None
1856	Shavano Park 7	1/29/2005 4:52:00 AM	Water	None	None
1858	Shavano Park 7	1/30/2005 4:52:00 PM	Water	None	None
1948	Shavano Park 7	1/24/2005 to 1/31/2005	Charcoal	None	None
2009	Shavano Park 7	1/25/2005 to 1/31/2005	Charcoal	None	None
1942	Shavano Park 7	1/31/2005 10:34:00 AM	Water	None	None
1859	Shavano Park 7	1/31/2005 4:52:00 AM	Water	None	None
2083	Shavano Park 7	1/31/2005 to 2/7/2005	Charcoal	None	None
2038	Shavano Park 7	2/7/2005 3:01:00 PM	Water	None	None
2221	Shavano Park 7	2/7/2005 to 2/10/2005	Charcoal	None	None
2222	Shavano Park 7	2/7/2005 to 2/10/2005	Charcoal	None	None
1947	Shavano Park 8	1/24/2005 to 1/31/2005	Charcoal	None	None
2012	Shavano Park 8	1/24/2005 to 1/31/2005	Charcoal	None	None
1936	Shavano Park 8	1/31/2005 11:36:00 AM	Water	None	None
2096	Shavano Park 8	1/31/2005 to 2/8/2005	Charcoal	None	None
2065	Shavano Park 8	1/31/2005 to 2/8/2005	Charcoal	None	None
1642	Silverhorn Well	1/21/2005 11:15:00 AM	Water	None	None
1708	Silverhorn Well	1/21/2005 to 1/25/2005	Charcoal	None	None
1797	Silverhorn Well	1/25/2005 11:38:00 AM	Water	None	None
544	Sonterra GC Pond	10/15/2004 to 10/18/2004	Charcoal	None	None
534	Sonterra GC Pond	10/18/2004 to 10/22/2004	Charcoal	None	None
573	Sonterra GC Pond	10/22/2004 to 10/26/2004	Charcoal	None	None
680	Sonterra GC Pond	10/29/2004 10:40:00 AM	Water	None	None
1196	Sonterra GC Pond	11/29/2004 to 12/6/2004	Charcoal	None	None
1217	Sonterra GC Pond	11/29/2004 to 12/9/2004	Charcoal	None	None
1216	Sonterra GC Pond	11/29/2004 to 12/9/2004	Charcoal	None	None
1236	Sonterra GC Pond	12/9/2004 to 12/13/2004	Charcoal	None	None
1106	Sonterra GC Pond	12/13/2004 to 12/16/2004	Charcoal	None	None
1321	Sonterra GC Pond	12/16/2004 to 12/20/2004	Charcoal	None	None
1406	Sonterra GC Pond	12/23/2004 12:45:00 PM	Water	None	None
2103	Sonterra GC Pond	12/23/2004 to 1/4/2005	Charcoal	None	None
1929	Sonterra GC Pond	1/4/2005 to 1/10/2005	Charcoal	None	None
2089	Sonterra GC Pond	1/4/2005 to 1/10/2005	Charcoal	None	None
511	Sonterra Well 5	10/18/2004 11:50:00 AM	Water	None	None
514	Sonterra Well 5	10/18/2004 11:50:00 PM	Water	None	None
512	Sonterra Well 5	10/18/2004 3:50:00 PM	Water	None	None
513	Sonterra Well 5	10/18/2004 7:50:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
517	Sonterra Well 5	10/19/2004 11:50:00 AM	Water	None	None
519	Sonterra Well 5	10/19/2004 11:50:00 PM	Water	None	None
515	Sonterra Well 5	10/19/2004 3:50:00 AM	Water	None	None
518	Sonterra Well 5	10/19/2004 3:50:00 PM	Water	None	None
516	Sonterra Well 5	10/19/2004 7:50:00 AM	Water	None	None
522	Sonterra Well 5	10/20/2004 11:50:00 AM	Water	None	None
525	Sonterra Well 5	10/20/2004 11:50:00 PM	Water	None	None
520	Sonterra Well 5	10/20/2004 3:50:00 AM	Water	None	None
523	Sonterra Well 5	10/20/2004 3:50:00 PM	Water	None	None
554	Sonterra Well 5	10/20/2004 3:50:00 PM	Water	None	None
521	Sonterra Well 5	10/20/2004 7:50:00 AM	Water	None	None
524	Sonterra Well 5	10/20/2004 7:50:00 PM	Water	None	None
549	Sonterra Well 5	10/21/2004 11:50:00 AM	Water	None	None
552	Sonterra Well 5	10/21/2004 11:50:00 PM	Water	None	None
526	Sonterra Well 5	10/21/2004 3:50:00 AM	Water	None	None
550	Sonterra Well 5	10/21/2004 3:50:00 PM	Water	None	None
548	Sonterra Well 5	10/21/2004 7:50:00 AM	Water	None	None
551	Sonterra Well 5	10/21/2004 7:50:00 PM	Water	None	None
538	Sonterra Well 5	10/18/2004 to 10/22/2004	Charcoal	None	None
553	Sonterra Well 5	10/22/2004 3:50:00 AM	Water	None	None
587	Sonterra Well 5	10/22/2004 5:47:00 PM	Water	None	None
299	Sonterra Well 5	10/22/2004 7:50:00 AM	Water	None	None
586	Sonterra Well 5	10/22/2004 9:47:00 AM	Water	None	None
588	Sonterra Well 5	10/23/2004 1:47:00 AM	Water	None	None
590	Sonterra Well 5	10/23/2004 5:47:00 PM	Water	None	None
589	Sonterra Well 5	10/23/2004 9:47:00 AM	Water	None	None
591	Sonterra Well 5	10/24/2004 1:47:00 AM	Water	None	None
599	Sonterra Well 5	10/24/2004 1:47:00 PM	Water	None	None
593	Sonterra Well 5	10/24/2004 1:47:00 PM	Water	None	None
592	Sonterra Well 5	10/24/2004 9:47:00 AM	Water	None	None
594	Sonterra Well 5	10/24/2004 9:47:00 PM	Water	None	None
596	Sonterra Well 5	10/25/2004 1:47:00 PM	Water	None	None
595	Sonterra Well 5	10/25/2004 5:47:00 AM	Water	None	None
597	Sonterra Well 5	10/25/2004 9:47:00 PM	Water	None	None
666	Sonterra Well 5	10/26/2004 10:25:00 AM	Water	None	None
598	Sonterra Well 5	10/26/2004 5:47:00 AM	Water	None	None
667	Sonterra Well 5	10/26/2004 6:25:00 PM	Water	None	None
361	Sonterra Well 5	10/26/2004 9:45:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
330	Sonterra Well 5	10/26/2004 9:45:00 AM	Water	None	None
668	Sonterra Well 5	10/27/2004 6:25:00 AM	Water	None	None
673	Sonterra Well 5	10/27/2004 6:25:00 AM	Water	None	None
669	Sonterra Well 5	10/27/2004 6:25:00 PM	Water	None	None
670	Sonterra Well 5	10/28/2004 6:25:00 AM	Water	None	None
671	Sonterra Well 5	10/28/2004 6:25:00 PM	Water	None	None
1145	Sonterra Well 5	10/26/2004 to 10/29/2004	Charcoal	None	None
672	Sonterra Well 5	10/29/2004 6:25:00 AM	Water	None	None
829	Sonterra Well 5	10/29/2004 to 11/29/2004	Charcoal	None	None
802	Sonterra Well 5	11/29/2004 9:27:00 AM	Water	None	None
803	Sonterra Well 5	11/29/2004 9:27:00 PM	Water	None	None
804	Sonterra Well 5	11/30/2004 9:27:00 AM	Water	None	None
809	Sonterra Well 5	11/30/2004 9:27:00 PM	Water	None	None
805	Sonterra Well 5	11/30/2004 9:27:00 PM	Water	None	None
816	Sonterra Well 5	12/1/2004 2:18:00 PM	Water	None	None
806	Sonterra Well 5	12/1/2004 9:27:00 AM	Water	None	None
807	Sonterra Well 5	12/1/2004 9:27:00 PM	Water	None	None
462	Sonterra Well 5	12/2/2004 1:50:00 PM	Water	None	None
443	Sonterra Well 5	12/2/2004 1:50:00 PM	Water	None	None
808	Sonterra Well 5	12/2/2004 9:27:00 AM	Water	None	None
442	Sonterra Well 5	12/2/2004 9:50:00 AM	Water	None	None
444	Sonterra Well 5	12/2/2004 9:50:00 PM	Water	None	None
445	Sonterra Well 5	12/3/2004 1:50:00 PM	Water	None	None
446	Sonterra Well 5	12/4/2004 5:50:00 AM	Water	None	None
447	Sonterra Well 5	12/4/2004 9:50:00 PM	Water	None	None
457	Sonterra Well 5	12/5/2004 1:50:00 AM	Water	None	None
454	Sonterra Well 5	12/5/2004 1:50:00 PM	Water	Uranine	0.11
456	Sonterra Well 5	12/5/2004 5:50:00 AM	Water	None	None
458	Sonterra Well 5	12/5/2004 5:50:00 PM	Water	Uranine	0.11
455	Sonterra Well 5	12/5/2004 9:50:00 AM	Water	Uranine	0.082
459	Sonterra Well 5	12/5/2004 9:50:00 PM	Water	Uranine	0.080
1192	Sonterra Well 5	12/2/2004 to 12/6/2004	Charcoal	None	None
886	Sonterra Well 5	12/6/2004 1:16:00 PM	Water	Uranine	0.054J*
460	Sonterra Well 5	12/6/2004 1:50:00 AM	Water	Uranine	0.090
887	Sonterra Well 5	12/6/2004 5:16:00 PM	Water	None	None
902	Sonterra Well 5	12/6/2004 5:16:00 PM	Water	None	None
461	Sonterra Well 5	12/6/2004 5:50:00 AM	Water	Uranine	0.088
852	Sonterra Well 5	12/6/2004 9:05:00 AM	Water	Uranine	0.064

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (μg/L)
885	Sonterra Well 5	12/6/2004 9:16:00 AM	Water	Uranine	0.076
888	Sonterra Well 5	12/6/2004 9:16:00 PM	Water	None	None
889	Sonterra Well 5	12/7/2004 1:16:00 AM	Water	None	None
892	Sonterra Well 5	12/7/2004 1:16:00 PM	Water	None	None
890	Sonterra Well 5	12/7/2004 5:16:00 AM	Water	None	None
893	Sonterra Well 5	12/7/2004 5:16:00 PM	Water	None	None
891	Sonterra Well 5	12/7/2004 9:16:00 AM	Water	None	None
894	Sonterra Well 5	12/7/2004 9:16:00 PM	Water	None	None
895	Sonterra Well 5	12/8/2004 1:16:00 AM	Water	None	None
896	Sonterra Well 5	12/8/2004 5:16:00 AM	Water	None	None
899	Sonterra Well 5	12/8/2004 9:16:00 AM	Water	None	None
1220	Sonterra Well 5	12/6/2004 to 12/9/2004	Charcoal	None	None
901	Sonterra Well 5	12/9/2004 5:16:00 AM	Water	None	None
1001	Sonterra Well 5	12/9/2004 9:00:00 AM	Water	None	None
1002	Sonterra Well 5	12/9/2004 9:00:00 PM	Water	None	None
1003	Sonterra Well 5	12/10/2004 1:00:00 PM	Water	None	None
1004	Sonterra Well 5	12/10/2004 5:00:00 PM	Water	None	None
1005	Sonterra Well 5	12/11/2004 9:00:00 AM	Water	None	None
1006	Sonterra Well 5	12/11/2004 9:00:00 PM	Water	None	None
1010	Sonterra Well 5	12/12/2004 5:00:00 AM	Water	None	None
1007	Sonterra Well 5	12/12/2004 5:00:00 AM	Water	None	None
1008	Sonterra Well 5	12/12/2004 5:00:00 PM	Water	None	None
1009	Sonterra Well 5	12/13/2004 5:00:00 AM	Water	None	None
1076	Sonterra Well 5	12/13/2004 9:43:00 AM	Water	None	None
1077	Sonterra Well 5	12/13/2004 9:43:00 PM	Water	None	None
1230	Sonterra Well 5	12/9/2004 to 12/13/2004	Charcoal	None	None
1078	Sonterra Well 5	12/14/2004 1:43:00 AM	Water	None	None
1084	Sonterra Well 5	12/14/2004 1:43:00 AM	Water	None	None
1079	Sonterra Well 5	12/14/2004 1:43:00 PM	Water	None	None
1080	Sonterra Well 5	12/15/2004 1:43:00 AM	Water	None	None
1081	Sonterra Well 5	12/15/2004 1:43:00 PM	Water	None	None
1096	Sonterra Well 5	12/9/2004 to 12/15/2004	Charcoal	None	None
1095	Sonterra Well 5	12/13/2004 to 12/16/2004	Charcoal	None	None
1082	Sonterra Well 5	12/16/2004 1:43:00 AM	Water	None	None
1083	Sonterra Well 5	12/16/2004 5:43:00 AM	Water	None	None
1294	Sonterra Well 5	12/16/2004 9:24:00 AM	Water	None	None
1295	Sonterra Well 5	12/16/2004 9:24:00 PM	Water	None	None
1296	Sonterra Well 5	12/17/2004 9:24:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1297	Sonterra Well 5	12/17/2004 9:24:00 PM	Water	None	None
1298	Sonterra Well 5	12/18/2004 9:24:00 AM	Water	None	None
1299	Sonterra Well 5	12/18/2004 9:24:00 PM	Water	None	None
1300	Sonterra Well 5	12/19/2004 9:24:00 AM	Water	None	None
1301	Sonterra Well 5	12/19/2004 9:24:00 PM	Water	None	None
1306	Sonterra Well 5	12/16/2004 to 12/20/2004	Charcoal	None	None
1316	Sonterra Well 5	12/16/2004 to 12/20/2004	Charcoal	None	None
1302	Sonterra Well 5	12/20/2004 5:24:00 AM	Water	None	None
1332	Sonterra Well 5	12/20/2004 9:17:00 AM	Water	None	None
1333	Sonterra Well 5	12/20/2004 9:17:00 PM	Water	None	None
1334	Sonterra Well 5	12/21/2004 9:17:00 AM	Water	None	None
1338	Sonterra Well 5	12/21/2004 9:17:00 PM	Water	None	None
1335	Sonterra Well 5	12/21/2004 9:17:00 PM	Water	None	None
1336	Sonterra Well 5	12/22/2004 9:17:00 AM	Water	None	None
1337	Sonterra Well 5	12/22/2004 9:17:00 PM	Water	None	None
2077	Sonterra Well 5	12/20/2004 to 12/23/2004	Charcoal	None	None
1398	Sonterra Well 5	12/23/2004 11:20:00 AM	Water	None	None
1409	Sonterra Well 5	12/23/2004 11:35:00 AM	Water	None	None
1487	Sonterra Well 5	12/23/2004 12:04:00 PM	Water	None	None
1488	Sonterra Well 5	12/24/2004 12:04:00 PM	Water	None	None
1496	Sonterra Well 5	12/25/2004 12:04:00 AM	Water	None	None
1497	Sonterra Well 5	12/25/2004 12:04:00 AM	Water	None	None
1489	Sonterra Well 5	12/25/2004 12:04:00 PM	Water	None	None
1490	Sonterra Well 5	12/26/2004 12:04:00 PM	Water	None	None
1491	Sonterra Well 5	12/27/2004 12:04:00 PM	Water	None	None
1397	Sonterra Well 5	12/28/2004 1:50:00 PM	Water	None	None
1492	Sonterra Well 5	12/28/2004 12:04:00 PM	Water	None	None
1493	Sonterra Well 5	12/29/2004 12:04:00 PM	Water	None	None
1494	Sonterra Well 5	12/30/2004 12:04:00 PM	Water	None	None
1495	Sonterra Well 5	12/31/2004 12:04:00 PM	Water	None	None
1412	Sonterra Well 5	1/4/2005 8:40:00 AM	Water	None	None
1802	Sonterra Well 5	1/4/2005 9:06:00 AM	Water	None	None
2102	Sonterra Well 5	12/23/2004 to 1/4/2005	Charcoal	None	None
1803	Sonterra Well 5	1/5/2005 9:06:00 AM	Water	None	None
1804	Sonterra Well 5	1/6/2005 9:06:00 AM	Water	None	None
1805	Sonterra Well 5	1/6/2005 9:06:00 PM	Water	None	None
1810	Sonterra Well 5	1/6/2005 9:06:00 PM	Water	None	None
1806	Sonterra Well 5	1/7/2005 9:06:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1807	Sonterra Well 5	1/8/2005 9:06:00 AM	Water	None	None
1808	Sonterra Well 5	1/9/2005 9:06:00 AM	Water	None	None
1809	Sonterra Well 5	1/9/2005 9:06:00 PM	Water	None	None
1837	Sonterra Well 5	1/10/2005 9:07:00 AM	Water	None	None
2090	Sonterra Well 5	1/4/2005 to 1/10/2005	Charcoal	None	None
1922	Sonterra Well 5	1/4/2005 to 1/10/2005	Charcoal	None	None
1544	Sonterra Well 5	1/13/2005 9:53:00 AM	Water	None	None
1535	Sonterra Well 5	1/13/2005 9:53:00 AM	Water	None	None
1536	Sonterra Well 5	1/14/2005 3:53:00 AM	Water	None	None
1537	Sonterra Well 5	1/14/2005 9:53:00 PM	Water	None	None
1538	Sonterra Well 5	1/15/2005 3:53:00 PM	Water	None	None
1539	Sonterra Well 5	1/16/2005 9:53:00 AM	Water	None	None
1540	Sonterra Well 5	1/17/2005 3:53:00 AM	Water	None	None
1541	Sonterra Well 5	1/17/2005 9:53:00 PM	Water	None	None
1542	Sonterra Well 5	1/18/2005 3:53:00 PM	Water	None	None
1604	Sonterra Well 5	1/10/2005 to 1/19/2005	Charcoal	None	None
1562	Sonterra Well 5	1/19/2005 11:45:00 AM	Water	None	None
1717	Sonterra Well 5	1/19/2005 11:52:00 AM	Water	None	None
1543	Sonterra Well 5	1/19/2005 3:53:00 AM	Water	None	None
1719	Sonterra Well 5	1/20/2005 11:52:00 PM	Water	None	None
1729	Sonterra Well 5	1/20/2005 5:52:00 AM	Water	None	None
1718	Sonterra Well 5	1/20/2005 5:52:00 AM	Water	None	None
1720	Sonterra Well 5	1/21/2005 5:52:00 PM	Water	None	None
1721	Sonterra Well 5	1/22/2005 11:52:00 AM	Water	None	None
1726	Sonterra Well 5	1/23/2005 11:52:00 PM	Water	None	None
1725	Sonterra Well 5	1/23/2005 5:52:00 AM	Water	None	None
1727	Sonterra Well 5	1/24/2005 5:52:00 PM	Water	None	None
1777	Sonterra Well 5	1/25/2005 10:20:00 AM	Water	None	None
1871	Sonterra Well 5	1/25/2005 10:32:00 AM	Water	None	None
1885	Sonterra Well 5	1/25/2005 4:32:00 PM	Water	None	None
1728	Sonterra Well 5	1/25/2005 5:52:00 AM	Water	None	None
1873	Sonterra Well 5	1/26/2005 10:32:00 AM	Water	None	None
1876	Sonterra Well 5	1/27/2005 10:32:00 PM	Water	None	None
1875	Sonterra Well 5	1/27/2005 4:32:00 AM	Water	None	None
1880	Sonterra Well 5	1/28/2005 4:32:00 PM	Water	None	None
1881	Sonterra Well 5	1/29/2005 10:32:00 AM	Water	None	None
1882	Sonterra Well 5	1/30/2005 4:32:00 AM	Water	None	None
1883	Sonterra Well 5	1/30/2005 4:32:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2010	Sonterra Well 5	1/25/2005 to 1/31/2005	Charcoal	None	None
1921	Sonterra Well 5	1/25/2005 to 1/31/2005	Charcoal	None	None
1938	Sonterra Well 5	1/31/2005 10:40:00 AM	Water	None	None
1962	Sonterra Well 5	1/31/2005 10:45:00 AM	Water	None	None
1884	Sonterra Well 5	1/31/2005 4:32:00 AM	Water	None	None
1975	Sonterra Well 5	1/31/2005 6:45:00 PM	Water	None	None
1974	Sonterra Well 5	1/31/2005 6:45:00 PM	Water	None	None
1963	Sonterra Well 5	2/1/2005 2:45:00 AM	Water	None	None
1964	Sonterra Well 5	2/1/2005 6:45:00 PM	Water	None	None
1965	Sonterra Well 5	2/2/2005 10:45:00 AM	Water	None	None
1966	Sonterra Well 5	2/3/2005 2:45:00 AM	Water	None	None
1967	Sonterra Well 5	2/3/2005 6:45:00 PM	Water	None	None
1968	Sonterra Well 5	2/4/2005 10:45:00 AM	Water	None	None
1969	Sonterra Well 5	2/5/2005 2:45:00 AM	Water	None	None
1970	Sonterra Well 5	2/5/2005 6:45:00 PM	Water	None	None
1971	Sonterra Well 5	2/6/2005 10:45:00 AM	Water	None	None
1972	Sonterra Well 5	2/7/2005 2:45:00 AM	Water	None	None
2076	Sonterra Well 5	1/31/2004 to 2/8/2005	Charcoal	None	None
1973	Sonterra Well 5	2/8/2005 2:45:00 AM	Water	None	None
2146	Sonterra Well 5	2/8/2005 5:06:00 PM	Water	Uranine	0.063
2124	Sonterra Well 5	2/8/2005 5:06:00 PM	Water	Uranine	0.060
2032	Sonterra Well 5	2/8/2005 8:50:00 AM	Water	None	None
2123	Sonterra Well 5	2/8/2005 9:06:00 AM	Water	None	None
2125	Sonterra Well 5	2/9/2005 1:06:00 AM	Water	Uranine	0.11
2127	Sonterra Well 5	2/9/2005 5:06:00 PM	Water	Uranine	0.11
2126	Sonterra Well 5	2/9/2005 9:06:00 AM	Water	Uranine	0.10
2128	Sonterra Well 5	2/10/2005 1:06:00 AM	Water	Uranine	0.080
2130	Sonterra Well 5	2/10/2005 5:06:00 PM	Water	Uranine	0.074
2129	Sonterra Well 5	2/10/2005 9:06:00 AM	Water	Uranine	0.077
2131	Sonterra Well 5	2/11/2005 1:06:00 AM	Water	Uranine	0.058
2133	Sonterra Well 5	2/11/2005 5:06:00 PM	Water	None	None
2132	Sonterra Well 5	2/11/2005 9:06:00 AM	Water	None	None
2134	Sonterra Well 5	2/12/2005 1:06:00 AM	Water	None	None
2140	Sonterra Well 5	2/12/2005 5:06:00 PM	Water	None	None
2135	Sonterra Well 5	2/12/2005 9:06:00 AM	Water	None	None
2139	Sonterra Well 5	2/13/2005 1:06:00 AM	Water	None	None
2122	Sonterra Well 5	2/13/2005 9:06:00 AM	Water	None	None
2137	Sonterra Well 5	2/14/2005 1:06:00 AM	Water	Uranine	0.066

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2141	Sonterra Well 5	2/14/2005 5:06:00 PM	Water	None	None
2136	Sonterra Well 5	2/14/2005 9:06:00 AM	Water	Uranine	0.078
2142	Sonterra Well 5	2/15/2005 1:06:00 AM	Water	None	None
2144	Sonterra Well 5	2/15/2005 5:06:00 PM	Water	None	None
2143	Sonterra Well 5	2/15/2005 9:06:00 AM	Water	None	None
2145	Sonterra Well 5	2/16/2005 1:06:00 AM	Water	None	None
2208	Sonterra Well 5	2/16/2005 10:10:00 AM	Water	None	None
2426	Sonterra Well 5	3/7/2005 10:32:00 AM	Water	None	None
2356	Sonterra Well 5	3/14/2005 10:21:00 AM	Water	None	None
2357	Sonterra Well 5	3/15/2005 7:21:00 AM	Water	None	None
2358	Sonterra Well 5	3/16/2005 4:21:00 AM	Water	None	None
2359	Sonterra Well 5	3/17/2005 1:21:00 AM	Water	None	None
2360	Sonterra Well 5	3/17/2005 10:21:00 PM	Water	None	None
2361	Sonterra Well 5	3/18/2005 7:21:00 PM	Water	None	None
2362	Sonterra Well 5	3/19/2005 4:21:00 PM	Water	None	None
2363	Sonterra Well 5	3/20/2005 1:21:00 PM	Water	None	None
2319	Sonterra Well 5	3/21/2005 10:38:00 AM	Water	None	None
2364	Sonterra Well 5	3/21/2005 3:21:00 AM	Water	None	None
2320	Sonterra Well 5	3/21/2005 5:38:00 PM	Water	None	None
2321	Sonterra Well 5	3/22/2005 12:38:00 AM	Water	None	None
2323	Sonterra Well 5	3/22/2005 2:38:00 PM	Water	None	None
2322	Sonterra Well 5	3/22/2005 7:38:00 AM	Water	None	None
2324	Sonterra Well 5	3/22/2005 9:38:00 PM	Water	None	None
2326	Sonterra Well 5	3/23/2005 11:38:00 AM	Water	None	None
2325	Sonterra Well 5	3/23/2005 4:38:00 AM	Water	None	None
2327	Sonterra Well 5	3/23/2005 6:38:00 PM	Water	None	None
2328	Sonterra Well 5	3/24/2005 1:38:00 AM	Water	None	None
2236	Sonterra Well 5	3/24/2005 10:38:00 PM	Water	None	None
2231	Sonterra Well 5	3/24/2005 3:38:00 PM	Water	None	None
2230	Sonterra Well 5	3/24/2005 8:38:00 AM	Water	None	None
2238	Sonterra Well 5	3/25/2005 12:38:00 PM	Water	None	None
2237	Sonterra Well 5	3/25/2005 5:38:00 AM	Water	None	None
2239	Sonterra Well 5	3/25/2005 7:38:00 PM	Water	None	None
2243	Sonterra Well 5	3/26/2005 11:38:00 PM	Water	None	None
2240	Sonterra Well 5	3/26/2005 2:38:00 AM	Water	None	None
2242	Sonterra Well 5	3/26/2005 4:38:00 PM	Water	None	None
2241	Sonterra Well 5	3/26/2005 9:38:00 AM	Water	None	None
2245	Sonterra Well 5	3/27/2005 1:38:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2244	Sonterra Well 5	3/27/2005 6:38:00 AM	Water	None	None
2246	Sonterra Well 5	3/27/2005 8:38:00 PM	Water	None	None
2247	Sonterra Well 5	3/28/2005 3:38:00 AM	Water	None	None
3010	Sonterra Well 5	10/23/2005 to 11/6/2005	Charcoal	None	None
2595	Sonterra Well 5	5/22/2006 to 5/25/2006	Charcoal	None	None
2610	Sonterra Well 5	5/25/2006 1:45:00 PM	Water	None	None
2601	Sonterra Well 5	5/25/2006 to 5/29/2006	Charcoal	None	None
2611	Sonterra Well 5	5/29/2006 8:00:00 AM	Water	None	None
2602	Sonterra Well 5	5/29/2006 to 6/1/2006	Charcoal	None	None
2612	Sonterra Well 5	6/1/2006 8:00:00 AM	Water	None	None
2680	Sonterra Well 5	5/29/2006 to 6/5/2006	Charcoal	None	None
2665	Sonterra Well 5	6/5/2006 8:00:00 AM	Water	None	None
2686	Sonterra Well 5	6/5/2006 to 6/8/2006	Charcoal	None	None
2666	Sonterra Well 5	6/8/2006 7:50:00 AM	Water	None	None
2667	Sonterra Well 5	6/12/2006 7:50:00 AM	Water	None	None
2687	Sonterra Well 5	6/5/2006 to 6/12/2006	Charcoal	None	None
2741	Sonterra Well 5	6/12/2006 to 6/19/2006	Charcoal	None	None
2735	Sonterra Well 5	6/19/2006 7:45:00 AM	Water	None	None
2742	Sonterra Well 5	6/8/2006 to 6/19/2006	Charcoal	None	None
2782	Sonterra Well 5	6/19/2006 to 6/26/2006	Charcoal	None	None
2780	Sonterra Well 5	6/26/2006 8:00:00 AM	Water	None	None
2811	Sonterra Well 5	6/26/2006 to 7/11/2006	Charcoal	None	None
2835	Sonterra Well 5	7/11/2006 11:00:00 AM	Water	None	None
2863	Sonterra Well 5	7/11/2006 to 7/24/2006	Charcoal	None	None
2902	Sonterra Well 5	7/24/2006 to 7/31/2006	Charcoal	None	None
2906	Sonterra Well 5	7/31/2006 9:10:00 AM	Water	None	None
2876	Sonterra Well 5	7/31/2006 to 8/9/2006	Charcoal	None	None
2945	Sonterra Well 5	8/9/2005 to 8/16/2006	Charcoal	None	None
2950	Sonterra Well 5	8/16/2005 to 8/23/2006	Charcoal	None	None
2966	Sonterra Well 5	8/23/2005 to 8/28/2006	Charcoal	None	None
2969	Sonterra Well 5	8/28/2005 to 9/6/2006	Charcoal	None	None
2997	Sonterra Well 5	10/11/2006 10:30:00 AM	Water	None	None
2994	Sonterra Well 5	10/2/2006 to 10/11/2006	Charcoal	None	None
3000	Sonterra Well 5	10/18/2006 to 10/23/2006	Charcoal	None	None
2999	Sonterra Well 5	10/23/2006 10:45:00 AM	Water	None	None
283	Sonterra Well 6	10/21/2004 4:37:00 PM	Water	None	None
575	Sonterra Well 6	10/22/2004 to 10/26/2004	Charcoal	None	None
366	Sonterra Well 6	10/26/2004 9:15:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
675	Sonterra Well 6	10/27/2004 12:26:00 PM	Water	None	None
1146	Sonterra Well 6	10/21/2004 to 10/29/2004	Charcoal	None	None
674	Sonterra Well 6	10/29/2004 10:15:00 AM	Water	None	None
828	Sonterra Well 6	10/29/2004 to 11/29/2004	Charcoal	Uranine	0.13
1169	Sonterra Well 6	10/26/2004 to 11/30/2004	Charcoal	None	None
1168	Sonterra Well 6	10/29/2004 to 11/30/2004	Charcoal	None	None
1186	Sonterra Well 6	11/29/2004 to 12/2/2004	Charcoal	Uranine	0.26
1193	Sonterra Well 6	11/29/2004 to 12/6/2004	Charcoal	Uranine	0.16
1218	Sonterra Well 6	12/2/2004 to 12/9/2004	Charcoal	Uranine	0.60
1209	Sonterra Well 6	12/6/2004 to 12/9/2004	Charcoal	Uranine	0.22
1209	Sonterra Well 6	12/6/2004 to 12/9/2004	Charcoal	Uranine	0.12
989	Sonterra Well 6	12/13/2004 8:50:00 AM	Water	None	None
1134	Sonterra Well 6	12/13/2004 8:50:00 AM	Water	None	None
1226	Sonterra Well 6	12/9/2004 to 12/13/2004	Charcoal	None	None
1102	Sonterra Well 6	12/13/2004 to 12/16/2004	Charcoal	None	None
1111	Sonterra Well 6	12/16/2004 8:40:00 AM	Water	None	None
1314	Sonterra Well 6	12/16/2004 to 12/20/2004	Charcoal	None	None
2099	Sonterra Well 6	12/20/2004 to 12/23/2004	Charcoal	None	None
2071	Sonterra Well 6	12/20/2004 to 12/23/2004	Charcoal	None	None
1411	Sonterra Well 6	1/4/2005 8:25:00 AM	Water	None	None
2018	Sonterra Well 6	12/23/2004 to 1/4/2005	Charcoal	None	None
1836	Sonterra Well 6	1/10/2005 9:00:00 AM	Water	None	None
1924	Sonterra Well 6	1/4/2005 to 1/10/2005	Charcoal	None	None
2085	Sonterra Well 6	1/4/2005 to 1/10/2005	Charcoal	None	None
1605	Sonterra Well 6	1/10/2005 to 1/19/2005	Charcoal	Uranine	0.083
1605	Sonterra Well 6	1/10/2005 to 1/19/2005	Charcoal	Eosin	6.1
1563	Sonterra Well 6	1/19/2005 11:50:00 AM	Water	Eosin	0.72J*
1563	Sonterra Well 6	1/19/2005 11:50:00 AM	Water	Eosin	0.62J*
1697	Sonterra Well 6	1/19/2005 to 1/25/2005	Charcoal	Eosin	59.0
1923	Sonterra Well 6	1/24/2005 to 1/31/2005	Charcoal	Eosin	1.6
2086	Sonterra Well 6	1/25/2005 to 1/31/2005	Charcoal	None	None
2060	Sonterra Well 6	1/31/2005 to 2/8/2005	Charcoal	Uranine	0.29
2060	Sonterra Well 6	1/31/2005 to 2/8/2005	Charcoal	Eosin	22.0
2031	Sonterra Well 6	2/8/2005 8:40:00 AM	Water	Uranine	0.13
2167	Sonterra Well 6	2/8/2005 to 2/16/2005	Charcoal	Uranine	1.9
2167	Sonterra Well 6	2/8/2005 to 2/16/2005	Charcoal	Eosin	3.5
2365	Sonterra Well 6	3/7/2005 10:51:00 AM	Water	None	None
2366	Sonterra Well 6	3/8/2005 7:51:00 AM	Water	None	None

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2367	Sonterra Well 6	3/9/2005 4:51:00 AM	Water	None	None
2368	Sonterra Well 6	3/10/2005 1:51:00 AM	Water	None	None
2369	Sonterra Well 6	3/10/2005 10:51:00 PM	Water	None	None
2370	Sonterra Well 6	3/11/2005 8:51:00 PM	Water	None	None
2371	Sonterra Well 6	3/12/2005 5:51:00 PM	Water	None	None
2372	Sonterra Well 6	3/13/2005 2:51:00 PM	Water	None	None
2373	Sonterra Well 6	3/14/2005 4:51:00 AM	Water	None	None
2374	Sonterra Well 6	3/15/2005 12:40:00 AM	Water	None	None
2378	Sonterra Well 6	3/15/2005 9:40:00 PM	Water	None	None
2379	Sonterra Well 6	3/16/2005 6:40:00 PM	Water	None	None
2380	Sonterra Well 6	3/17/2005 3:40:00 PM	Water	None	None
2381	Sonterra Well 6	3/18/2005 1:40:00 PM	Water	None	None
2382	Sonterra Well 6	3/19/2005 10:40:00 AM	Water	None	None
2383	Sonterra Well 6	3/20/2005 7:40:00 AM	Water	None	None
2248	Sonterra Well 6	3/21/2005 10:55:00 AM	Water	None	None
2384	Sonterra Well 6	3/21/2005 4:40:00 AM	Water	None	None
2250	Sonterra Well 6	3/22/2005 12:55:00 AM	Water	None	None
2252	Sonterra Well 6	3/22/2005 2:55:00 PM	Water	None	None
2251	Sonterra Well 6	3/22/2005 7:55:00 AM	Water	None	None
2253	Sonterra Well 6	3/22/2005 9:55:00 PM	Water	None	None
2255	Sonterra Well 6	3/23/2005 11:55:00 AM	Water	None	None
2254	Sonterra Well 6	3/23/2005 4:55:00 AM	Water	None	None
2262	Sonterra Well 6	3/23/2005 6:55:00 PM	Water	None	None
2263	Sonterra Well 6	3/24/2005 1:55:00 AM	Water	None	None
2266	Sonterra Well 6	3/24/2005 10:55:00 PM	Water	None	None
2265	Sonterra Well 6	3/24/2005 3:55:00 PM	Water	None	None
2264	Sonterra Well 6	3/24/2005 8:55:00 AM	Water	None	None
2268	Sonterra Well 6	3/25/2005 12:55:00 PM	Water	None	None
2267	Sonterra Well 6	3/25/2005 5:55:00 AM	Water	None	None
2269	Sonterra Well 6	3/25/2005 7:55:00 PM	Water	None	None
2273	Sonterra Well 6	3/26/2005 11:55:00 PM	Water	None	None
2270	Sonterra Well 6	3/26/2005 2:55:00 AM	Water	None	None
2272	Sonterra Well 6	3/26/2005 4:55:00 PM	Water	None	None
2271	Sonterra Well 6	3/26/2005 9:55:00 AM	Water	None	None
2275	Sonterra Well 6	3/27/2005 1:55:00 PM	Water	None	None
2274	Sonterra Well 6	3/27/2005 6:55:00 AM	Water	None	None
2276	Sonterra Well 6	3/27/2005 8:55:00 PM	Water	None	None
2277	Sonterra Well 6	3/28/2005 3:55:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2594	Sonterra Well 6	5/22/2006 to 5/25/2006	Charcoal	None	None
2607	Sonterra Well 6	5/25/2006 12:45:00 PM	Water	None	None
2596	Sonterra Well 6	5/25/2006 to 5/29/2006	Charcoal	Eosin	1590
2608	Sonterra Well 6	5/29/2006	Water	Eosin	391
2606	Sonterra Well 6	5/29/2006 to 6/1/2006	Charcoal	Eosin	2320
2609	Sonterra Well 6	6/1/2006	Water	Eosin	97.0
2681	Sonterra Well 6	5/29/2006 to 6/5/2006	Charcoal	Eosin	1760
2662	Sonterra Well 6	6/5/2006 8:10:00 AM	Water	Eosin	11.0
2682	Sonterra Well 6	6/5/2006 to 6/8/2006	Charcoal	Eosin	920
2663	Sonterra Well 6	6/8/2006 8:00:00 AM	Water	Eosin	22.0
2691	Sonterra Well 6	6/1/2006 to 6/12/2006	Charcoal	Eosin	1760
2664	Sonterra Well 6	6/12/2006 8:00:00 AM	Water	Eosin	10.0
2737	Sonterra Well 6	6/12/2006 to 6/19/2006	Charcoal	Eosin	571
2734	Sonterra Well 6	6/19/2006 7:50:00 AM	Water	None	None
2743	Sonterra Well 6	6/8/2006 to 6/19/2006	Charcoal	Eosin	1590
2784	Sonterra Well 6	6/19/2006 to 6/26/2006	Charcoal	Eosin	67.0
2779	Sonterra Well 6	6/26/2006 8:10:00 AM	Water	Eosin	1.2
2812	Sonterra Well 6	6/26/2006 to 7/11/2006	Charcoal	Eosin	391
2836	Sonterra Well 6	7/11/2006 11:15:00 AM	Water	None	None
2864	Sonterra Well 6	7/11/2006 to 7/24/2006	Charcoal	Uranine	3.4
2864	Sonterra Well 6	7/11/2006 to 7/24/2006	Charcoal	Eosin	119
2867	Sonterra Well 6	7/24/2006 8:07:00 AM	Water	None	None
2900	Sonterra Well 6	7/24/2006 to 7/31/2006	Charcoal	Eosin	84.0
2905	Sonterra Well 6	7/31/2006 9:25:00 AM	Water	None	None
2873	Sonterra Well 6	7/31/2006 to 8/9/2006	Charcoal	Eosin	55.0
2948	Sonterra Well 6	8/16/2005 to 8/23/2006	Charcoal	Eosin	36.0
2965	Sonterra Well 6	8/23/2006 to 8/28/2006	Charcoal	Eosin	2.2
2971	Sonterra Well 6	8/28/2006 10:05:00 AM	Water	None	None
2968	Sonterra Well 6	8/28/2005 to 9/6/2006	Charcoal	Eosin	36.0
2973	Sonterra Well 6	9/6/2006 9:15:00 AM	Water	None	None
2995	Sonterra Well 6	10/2/2006 to 10/11/2006	Charcoal	Eosin	3.0
542	Sonterra Well 7	10/15/2004 to 10/18/2004	Charcoal	None	None
479	Sonterra Well 7	10/18/2004 12:15:00 PM	Water	None	None
494	Sonterra Well 7	10/18/2004 4:15:00 PM	Water	None	None
495	Sonterra Well 7	10/18/2004 8:15:00 PM	Water	None	None
480	Sonterra Well 7	10/19/2004 12:15:00 AM	Water	None	None
498	Sonterra Well 7	10/19/2004 12:15:00 PM	Water	None	None
510	Sonterra Well 7	10/19/2004 12:15:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
496	Sonterra Well 7	10/19/2004 4:15:00 AM	Water	None	None
481	Sonterra Well 7	10/19/2004 4:15:00 PM	Water	None	None
497	Sonterra Well 7	10/19/2004 8:15:00 AM	Water	None	None
499	Sonterra Well 7	10/19/2004 8:15:00 PM	Water	None	None
500	Sonterra Well 7	10/20/2004 12:15:00 AM	Water	None	None
502	Sonterra Well 7	10/20/2004 12:15:00 PM	Water	None	None
501	Sonterra Well 7	10/20/2004 4:15:00 AM	Water	None	None
483	Sonterra Well 7	10/20/2004 4:15:00 PM	Water	None	None
482	Sonterra Well 7	10/20/2004 8:15:00 AM	Water	None	None
503	Sonterra Well 7	10/20/2004 8:15:00 PM	Water	None	None
504	Sonterra Well 7	10/21/2004 12:15:00 AM	Water	None	None
506	Sonterra Well 7	10/21/2004 12:15:00 PM	Water	None	None
484	Sonterra Well 7	10/21/2004 4:15:00 AM	Water	None	None
485	Sonterra Well 7	10/21/2004 4:15:00 PM	Water	None	None
505	Sonterra Well 7	10/21/2004 8:15:00 AM	Water	None	None
507	Sonterra Well 7	10/21/2004 8:15:00 PM	Water	None	None
533	Sonterra Well 7	10/18/2004 to 10/22/2004	Charcoal	None	None
508	Sonterra Well 7	10/22/2004 12:15:00 AM	Water	None	None
486	Sonterra Well 7	10/22/2004 4:15:00 AM	Water	None	None
297	Sonterra Well 7	10/22/2004 4:15:00 AM	Water	None	None
509	Sonterra Well 7	10/22/2004 8:15:00 AM	Water	None	None
600	Sonterra Well 7	10/22/2004 9:24:00 AM	Water	None	None
601	Sonterra Well 7	10/22/2004 9:24:00 PM	Water	None	None
602	Sonterra Well 7	10/23/2004 5:24:00 AM	Water	None	None
603	Sonterra Well 7	10/24/2004 5:24:00 PM	Water	None	None
580	Sonterra Well 7	10/26/2004 11:02:00 AM	Water	None	None
331	Sonterra Well 7	10/26/2004 9:04:00 AM	Water	None	None
1147	Sonterra Well 7	10/26/2004 to 10/29/2004	Charcoal	None	None
1167	Sonterra Well 7	11/29/2004 to 12/1/2004	Charcoal	None	None
1194	Sonterra Well 7	12/1/2004 to 12/6/2004	Charcoal	None	None
1101	Sonterra Well 7	12/13/2004 to 12/16/2004	Charcoal	None	None
1318	Sonterra Well 7	12/16/2004 to 12/20/2004	Charcoal	None	None
2022	Sonterra Well 7	12/20/2004 to 12/23/2004	Charcoal	None	None
1410	Sonterra Well 7	12/23/2004 11:00:00 AM	Water	None	None
2084	Sonterra Well 7	1/4/2005 to 1/10/2005	Charcoal	None	None
1926	Sonterra Well 7	1/4/2005 to 1/10/2005	Charcoal	None	None
1703	Sonterra Well 7	1/19/2005 to 1/25/2005	Charcoal	Uranine	0.10
1703	Sonterra Well 7	1/19/2005 to 1/25/2005	Charcoal	Eosin	66.0

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1794	Sonterra Well 7	1/25/2005 10:00:00 AM	Water	Eosin	0.47J*
1925	Sonterra Well 7	1/25/2005 to 1/31/2005	Charcoal	None	None
2026	Sonterra Well 7	1/25/2005 to 1/31/2005	Charcoal	None	None
2062	Sonterra Well 7	1/31/2005 to 2/8/2005	Charcoal	None	None
2149	Sonterra Well 7	2/13/2005 4:40:00 PM	Water	Uranine	0.12
2154	Sonterra Well 7	2/14/2005 12:40:00 AM	Water	Uranine	0.086
2150	Sonterra Well 7	2/14/2005 12:40:00 AM	Water	Uranine	0.11
2154	Sonterra Well 7	2/14/2005 12:40:00 AM	Water	Uranine	0.031J*
2152	Sonterra Well 7	2/14/2005 4:40:00 PM	Water	Uranine	0.054J*
2152	Sonterra Well 7	2/14/2005 4:40:00 PM	Water	Uranine	0.071
2151	Sonterra Well 7	2/14/2005 8:40:00 AM	Water	Uranine	0.037J*
2151	Sonterra Well 7	2/14/2005 8:40:00 AM	Water	Uranine	0.12
2153	Sonterra Well 7	2/15/2005 12:40:00 AM	Water	Uranine	0.12
2153	Sonterra Well 7	2/15/2005 12:40:00 AM	Water	Uranine	0.079
2168	Sonterra Well 7	2/8/2005 to 2/16/2005	Charcoal	Uranine	0.058
541	Sonterra Well 8	10/15/2004 to 10/18/2004	Charcoal	None	None
1583	Sonterra Well 8	10/18/2004 to 11/30/2004	Charcoal	None	None
1606	Sonterra Well 8	1/17/2005 to 1/20/2005	Charcoal	None	None
1699	Sonterra Well 8	1/17/2005 to 1/25/2005	Charcoal	None	None
2095	Sonterra Well 8	1/20/2005 to 2/1/2005	Charcoal	None	None
604	Sonterra Well 9	10/22/2004 5:07:00 PM	Water	None	None
611	Sonterra Well 9	10/22/2004 5:07:00 PM	Water	None	None
605	Sonterra Well 9	10/23/2004 5:07:00 AM	Water	None	None
606	Sonterra Well 9	10/23/2004 9:07:00 PM	Water	None	None
607	Sonterra Well 9	10/24/2004 1:07:00 PM	Water	None	None
608	Sonterra Well 9	10/25/2004 5:07:00 AM	Water	None	None
609	Sonterra Well 9	10/25/2004 9:07:00 PM	Water	None	None
363	Sonterra Well 9	10/26/2004 10:40:00 AM	Water	None	None
610	Sonterra Well 9	10/26/2004 9:07:00 AM	Water	None	None
637	Sonterra Well 9	10/27/2004 10:50:00 PM	Water	None	None
636	Sonterra Well 9	10/27/2004 2:50:00 PM	Water	None	None
635	Sonterra Well 9	10/27/2004 6:50:00 AM	Water	None	None
640	Sonterra Well 9	10/28/2004 10:50:00 PM	Water	None	None
642	Sonterra Well 9	10/28/2004 2:50:00 PM	Water	None	None
639	Sonterra Well 9	10/28/2004 2:50:00 PM	Water	None	None
638	Sonterra Well 9	10/28/2004 6:50:00 AM	Water	None	None
1150	Sonterra Well 9	10/22/2004 to 10/29/2004	Charcoal	None	None
1151	Sonterra Well 9	10/26/2004 to 10/29/2004	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1149	Sonterra Well 9	10/26/2004 to 10/29/2004	Charcoal	None	None
641	Sonterra Well 9	10/29/2004 6:50:00 AM	Water	None	None
676	Sonterra Well 9	10/29/2004 9:40:00 AM	Water	None	None
830	Sonterra Well 9	10/29/2004 to 11/29/2004	Charcoal	None	None
794	Sonterra Well 9	11/29/2004 10:36:00 AM	Water	None	None
801	Sonterra Well 9	11/29/2004 10:36:00 PM	Water	None	None
795	Sonterra Well 9	11/29/2004 10:36:00 PM	Water	None	None
797	Sonterra Well 9	11/30/2004 10:36:00 PM	Water	None	None
796	Sonterra Well 9	11/30/2004 2:36:00 PM	Water	None	None
798	Sonterra Well 9	12/1/2004 10:36:00 AM	Water	None	None
799	Sonterra Well 9	12/1/2004 10:36:00 PM	Water	None	None
813	Sonterra Well 9	12/1/2004 2:15:00 PM	Water	None	None
800	Sonterra Well 9	12/2/2004 6:36:00 AM	Water	None	None
441	Sonterra Well 9	12/2/2004 9:25:00 AM	Water	None	None
434	Sonterra Well 9	12/2/2004 9:25:00 AM	Water	None	None
435	Sonterra Well 9	12/2/2004 9:25:00 PM	Water	None	None
436	Sonterra Well 9	12/3/2004 1:25:00 PM	Water	None	None
437	Sonterra Well 9	12/4/2004 5:25:00 AM	Water	None	None
438	Sonterra Well 9	12/4/2004 9:25:00 PM	Water	None	None
439	Sonterra Well 9	12/5/2004 1:25:00 PM	Water	None	None
1195	Sonterra Well 9	12/2/2004 to 12/6/2004	Charcoal	None	None
903	Sonterra Well 9	12/6/2004 12:57:00 PM	Water	None	None
904	Sonterra Well 9	12/6/2004 4:57:00 PM	Water	None	None
440	Sonterra Well 9	12/6/2004 5:25:00 AM	Water	None	None
911	Sonterra Well 9	12/7/2004 4:57:00 AM	Water	None	None
905	Sonterra Well 9	12/7/2004 4:57:00 AM	Water	None	None
906	Sonterra Well 9	12/7/2004 4:57:00 PM	Water	None	None
907	Sonterra Well 9	12/8/2004 4:57:00 AM	Water	None	None
908	Sonterra Well 9	12/8/2004 4:57:00 PM	Water	None	None
1215	Sonterra Well 9	12/6/2004 to 12/9/2004	Charcoal	None	None
909	Sonterra Well 9	12/9/2004 4:57:00 AM	Water	None	None
910	Sonterra Well 9	12/9/2004 8:57:00 AM	Water	None	None
1013	Sonterra Well 9	12/9/2004 9:37:00 AM	Water	None	None
1011	Sonterra Well 9	12/9/2004 9:37:00 AM	Water	None	None
1012	Sonterra Well 9	12/9/2004 9:37:00 PM	Water	None	None
1014	Sonterra Well 9	12/10/2004 9:37:00 PM	Water	None	None
1015	Sonterra Well 9	12/11/2004 9:37:00 AM	Water	None	None
1016	Sonterra Well 9	12/11/2004 9:37:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1017	Sonterra Well 9	12/12/2004 9:37:00 AM	Water	None	None
1020	Sonterra Well 9	12/12/2004 9:37:00 AM	Water	None	None
1018	Sonterra Well 9	12/12/2004 9:37:00 PM	Water	None	None
1019	Sonterra Well 9	12/13/2004 5:37:00 AM	Water	None	None
1057	Sonterra Well 9	12/13/2004 9:15:00 AM	Water	None	None
1050	Sonterra Well 9	12/13/2004 9:15:00 AM	Water	None	None
1051	Sonterra Well 9	12/13/2004 9:15:00 PM	Water	None	None
1227	Sonterra Well 9	12/9/2004 to 12/13/2004	Charcoal	None	None
1052	Sonterra Well 9	12/14/2004 9:15:00 AM	Water	None	None
1053	Sonterra Well 9	12/14/2004 9:15:00 PM	Water	None	None
1054	Sonterra Well 9	12/15/2004 9:15:00 AM	Water	None	None
1055	Sonterra Well 9	12/15/2004 9:15:00 PM	Water	None	None
1097	Sonterra Well 9	12/13/2004 to 12/16/2004	Charcoal	None	None
1056	Sonterra Well 9	12/16/2004 5:15:00 AM	Water	None	None
1246	Sonterra Well 9	12/16/2004 9:05:00 AM	Water	None	None
1247	Sonterra Well 9	12/16/2004 9:05:00 PM	Water	None	None
1255	Sonterra Well 9	12/17/2004 9:05:00 AM	Water	None	None
1248	Sonterra Well 9	12/17/2004 9:05:00 AM	Water	None	None
1249	Sonterra Well 9	12/17/2004 9:05:00 PM	Water	None	None
1250	Sonterra Well 9	12/18/2004 9:05:00 AM	Water	None	None
1251	Sonterra Well 9	12/18/2004 9:05:00 PM	Water	None	None
1252	Sonterra Well 9	12/19/2004 9:05:00 AM	Water	None	None
1253	Sonterra Well 9	12/19/2004 9:05:00 PM	Water	None	None
1310	Sonterra Well 9	12/16/2004 to 12/20/2004	Charcoal	None	None
1254	Sonterra Well 9	12/20/2004 5:05:00 AM	Water	None	None
1347	Sonterra Well 9	12/20/2004 9:00:00 AM	Water	None	None
1348	Sonterra Well 9	12/20/2004 9:00:00 PM	Water	None	None
1381	Sonterra Well 9	12/21/2004 5:00:00 PM	Water	None	None
1350	Sonterra Well 9	12/21/2004 5:00:00 PM	Water	None	None
1349	Sonterra Well 9	12/21/2004 9:00:00 AM	Water	None	None
1351	Sonterra Well 9	12/21/2004 9:00:00 PM	Water	None	None
1352	Sonterra Well 9	12/22/2004 9:00:00 AM	Water	None	None
1353	Sonterra Well 9	12/22/2004 9:00:00 PM	Water	None	None
2087	Sonterra Well 9	12/20/2004 to 12/23/2004	Charcoal	None	None
1423	Sonterra Well 9	12/23/2004 11:44:00 AM	Water	None	None
1380	Sonterra Well 9	12/23/2004 9:00:00 AM	Water	None	None
1424	Sonterra Well 9	12/24/2004 11:44:00 PM	Water	None	None
1435	Sonterra Well 9	12/25/2004 11:44:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1425	Sonterra Well 9	12/25/2004 11:44:00 AM	Water	None	None
1426	Sonterra Well 9	12/26/2004 11:44:00 AM	Water	None	None
1427	Sonterra Well 9	12/27/2004 11:44:00 AM	Water	None	None
1428	Sonterra Well 9	12/28/2004 11:44:00 AM	Water	None	None
1429	Sonterra Well 9	12/29/2004 11:44:00 AM	Water	None	None
1430	Sonterra Well 9	12/30/2004 11:44:00 AM	Water	None	None
1431	Sonterra Well 9	12/31/2004 11:44:00 AM	Water	None	None
1432	Sonterra Well 9	1/1/2005 11:44:00 AM	Water	None	None
1433	Sonterra Well 9	1/2/2005 11:44:00 AM	Water	None	None
1434	Sonterra Well 9	1/3/2005 11:44:00 AM	Water	None	None
1413	Sonterra Well 9	1/4/2005 9:10:00 AM	Water	None	None
1811	Sonterra Well 9	1/4/2005 9:25:00 AM	Water	None	None
2079	Sonterra Well 9	12/23/2004 to 1/4/2005	Charcoal	None	None
1812	Sonterra Well 9	1/5/2005 9:25:00 AM	Water	None	None
1818	Sonterra Well 9	1/5/2005 9:25:00 PM	Water	None	None
1813	Sonterra Well 9	1/5/2005 9:25:00 PM	Water	None	None
1814	Sonterra Well 9	1/6/2005 9:25:00 PM	Water	None	None
1815	Sonterra Well 9	1/7/2005 9:25:00 PM	Water	None	None
1816	Sonterra Well 9	1/8/2005 9:25:00 PM	Water	None	None
1817	Sonterra Well 9	1/9/2005 9:25:00 PM	Water	None	None
2088	Sonterra Well 9	1/4/2005 to 1/10/2005	Charcoal	None	None
1928	Sonterra Well 9	1/4/2005 to 1/10/2005	Charcoal	None	None
1545	Sonterra Well 9	1/13/2005 9:50:00 AM	Water	None	None
1546	Sonterra Well 9	1/14/2005 3:50:00 AM	Water	None	None
1547	Sonterra Well 9	1/14/2005 9:50:00 PM	Water	None	None
1548	Sonterra Well 9	1/15/2005 3:50:00 PM	Water	None	None
1554	Sonterra Well 9	1/15/2005 3:50:00 PM	Water	None	None
1549	Sonterra Well 9	1/16/2005 9:50:00 AM	Water	None	None
1550	Sonterra Well 9	1/17/2005 3:50:00 AM	Water	None	None
1551	Sonterra Well 9	1/17/2005 9:50:00 PM	Water	None	None
1552	Sonterra Well 9	1/18/2005 3:50:00 PM	Water	None	None
1715	Sonterra Well 9	1/10/2005 to 1/19/2005	Charcoal	None	None
1565	Sonterra Well 9	1/19/2005 12:00:00 PM	Water	None	None
1759	Sonterra Well 9	1/19/2005 12:08:00 PM	Water	None	None
1553	Sonterra Well 9	1/19/2005 3:50:00 AM	Water	None	None
1761	Sonterra Well 9	1/20/2005 12:08:00 AM	Water	None	None
1762	Sonterra Well 9	1/20/2005 6:08:00 PM	Water	None	None
1763	Sonterra Well 9	1/21/2005 12:08:00 PM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1770	Sonterra Well 9	1/21/2005 6:08:00 AM	Water	None	None
1764	Sonterra Well 9	1/22/2005 6:08:00 AM	Water	None	None
1765	Sonterra Well 9	1/22/2005 6:08:00 PM	Water	None	None
1766	Sonterra Well 9	1/23/2005 12:08:00 PM	Water	None	None
1767	Sonterra Well 9	1/24/2005 6:08:00 AM	Water	None	None
1768	Sonterra Well 9	1/24/2005 6:08:00 PM	Water	None	None
1712	Sonterra Well 9	1/19/2005 to 1/25/2005	Charcoal	None	None
1796	Sonterra Well 9	1/25/2005 10:45:00 AM	Water	None	None
1861	Sonterra Well 9	1/25/2005 10:50:00 AM	Water	None	None
1769	Sonterra Well 9	1/25/2005 6:08:00 AM	Water	None	None
1863	Sonterra Well 9	1/26/2005 10:50:00 PM	Water	None	None
1862	Sonterra Well 9	1/26/2005 4:50:00 AM	Water	None	None
1864	Sonterra Well 9	1/27/2005 4:50:00 PM	Water	None	None
1865	Sonterra Well 9	1/28/2005 10:50:00 AM	Water	None	None
1867	Sonterra Well 9	1/29/2005 10:50:00 PM	Water	None	None
1866	Sonterra Well 9	1/29/2005 4:50:00 AM	Water	None	None
1868	Sonterra Well 9	1/30/2005 4:50:00 PM	Water	None	None
1927	Sonterra Well 9	1/25/2005 to 1/31/2005	Charcoal	None	None
2105	Sonterra Well 9	1/25/2005 to 1/31/2005	Charcoal	None	None
1935	Sonterra Well 9	1/31/2005 11:00:00 AM	Water	None	None
1985	Sonterra Well 9	1/31/2005 11:05:00 AM	Water	None	None
1976	Sonterra Well 9	1/31/2005 11:05:00 AM	Water	None	None
1870	Sonterra Well 9	1/31/2005 4:50:00 AM	Water	None	None
1869	Sonterra Well 9	1/31/2005 4:50:00 AM	Water	None	None
1977	Sonterra Well 9	2/1/2005 11:05:00 AM	Water	None	None
1978	Sonterra Well 9	2/2/2005 11:05:00 AM	Water	None	None
1979	Sonterra Well 9	2/3/2005 11:05:00 AM	Water	None	None
1980	Sonterra Well 9	2/4/2005 11:05:00 AM	Water	None	None
1981	Sonterra Well 9	2/5/2005 11:05:00 AM	Water	None	None
1982	Sonterra Well 9	2/6/2005 11:05:00 AM	Water	None	None
1983	Sonterra Well 9	2/7/2005 11:05:00 AM	Water	None	None
2070	Sonterra Well 9	1/31/2005 to 2/8/2005	Charcoal	None	None
2164	Sonterra Well 9	2/8/2005 10:30:00 AM	Water	None	None
2155	Sonterra Well 9	2/8/2005 10:30:00 AM	Water	None	None
1984	Sonterra Well 9	2/8/2005 3:05:00 AM	Water	None	None
2030	Sonterra Well 9	2/8/2005 9:20:00 AM	Water	None	None
2156	Sonterra Well 9	2/9/2005 10:30:00 AM	Water	None	None
2157	Sonterra Well 9	2/10/2005 10:30:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2158	Sonterra Well 9	2/11/2005 10:30:00 AM	Water	None	None
2159	Sonterra Well 9	2/12/2005 10:30:00 AM	Water	None	None
2160	Sonterra Well 9	2/13/2005 10:30:00 AM	Water	None	None
2161	Sonterra Well 9	2/14/2005 10:30:00 AM	Water	None	None
2162	Sonterra Well 9	2/15/2005 10:30:00 AM	Water	None	None
2163	Sonterra Well 9	2/16/2005 1:30:00 AM	Water	None	None
2210	Sonterra Well 9	2/16/2005 10:20:00 AM	Water	None	None
2169	Sonterra Well 9	2/8/2005 to 2/16/2005	Charcoal	None	None
2385	Sonterra Well 9	3/7/2005 11:08:00 AM	Water	None	None
2386	Sonterra Well 9	3/8/2005 8:08:00 AM	Water	None	None
2387	Sonterra Well 9	3/9/2005 5:08:00 AM	Water	None	None
2389	Sonterra Well 9	3/10/2005 11:08:00 PM	Water	None	None
2388	Sonterra Well 9	3/10/2005 2:08:00 AM	Water	None	None
2390	Sonterra Well 9	3/11/2005 9:08:00 PM	Water	None	None
2391	Sonterra Well 9	3/12/2005 6:08:00 PM	Water	None	None
2392	Sonterra Well 9	3/13/2005 10:08:00 PM	Water	None	None
2347	Sonterra Well 9	3/14/2005 11:00:00 AM	Water	None	None
2393	Sonterra Well 9	3/14/2005 5:08:00 AM	Water	None	None
2348	Sonterra Well 9	3/15/2005 8:00:00 AM	Water	None	None
2349	Sonterra Well 9	3/16/2005 5:00:00 AM	Water	None	None
2350	Sonterra Well 9	3/17/2005 3:00:00 AM	Water	None	None
2351	Sonterra Well 9	3/18/2005	Water	None	None
2352	Sonterra Well 9	3/18/2005 9:00:00 PM	Water	None	None
2353	Sonterra Well 9	3/19/2005 6:00:00 PM	Water	None	None
2354	Sonterra Well 9	3/20/2005 3:00:00 PM	Water	None	None
2278	Sonterra Well 9	3/21/2005 11:15:00 AM	Water	None	None
2355	Sonterra Well 9	3/21/2005 5:00:00 AM	Water	None	None
2279	Sonterra Well 9	3/21/2005 6:15:00 PM	Water	None	None
2280	Sonterra Well 9	3/22/2005 1:15:00 AM	Water	None	None
2287	Sonterra Well 9	3/22/2005 10:15:00 PM	Water	None	None
2286	Sonterra Well 9	3/22/2005 3:15:00 PM	Water	None	None
2281	Sonterra Well 9	3/22/2005 8:15:00 AM	Water	None	None
2289	Sonterra Well 9	3/23/2005 12:15:00 PM	Water	None	None
2288	Sonterra Well 9	3/23/2005 5:15:00 AM	Water	None	None
2290	Sonterra Well 9	3/23/2005 7:15:00 PM	Water	None	None
2294	Sonterra Well 9	3/24/2005 11:15:00 PM	Water	None	None
2291	Sonterra Well 9	3/24/2005 2:15:00 AM	Water	None	None
2293	Sonterra Well 9	3/24/2005 4:15:00 PM	Water	None	None

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2292	Sonterra Well 9	3/24/2005 9:15:00 AM	Water	None	None
2296	Sonterra Well 9	3/25/2005 1:15:00 PM	Water	None	None
2295	Sonterra Well 9	3/25/2005 6:15:00 AM	Water	None	None
2297	Sonterra Well 9	3/25/2005 8:15:00 PM	Water	None	None
2299	Sonterra Well 9	3/26/2005 10:15:00 AM	Water	None	None
2298	Sonterra Well 9	3/26/2005 3:15:00 AM	Water	None	None
2300	Sonterra Well 9	3/26/2005 5:15:00 PM	Water	None	None
2301	Sonterra Well 9	3/27/2005 12:15:00 AM	Water	None	None
2303	Sonterra Well 9	3/27/2005 2:15:00 PM	Water	None	None
2302	Sonterra Well 9	3/27/2005 7:15:00 AM	Water	None	None
2304	Sonterra Well 9	3/27/2005 9:15:00 PM	Water	None	None
2305	Sonterra Well 9	3/28/2005 4:15:00 AM	Water	None	None
2462	Sonterra Well 9	8/1/2005 10:10:00 PM	Water	None	None
2463	Sonterra Well 9	8/1/2005 10:40:00 PM	Water	None	None
2464	Sonterra Well 9	8/1/2005 11:10:00 PM	Water	None	None
2465	Sonterra Well 9	8/1/2005 11:40:00 PM	Water	None	None
2446	Sonterra Well 9	8/1/2005 2:10:00 PM	Water	None	None
2447	Sonterra Well 9	8/1/2005 2:40:00 PM	Water	None	None
2448	Sonterra Well 9	8/1/2005 3:10:00 PM	Water	None	None
2449	Sonterra Well 9	8/1/2005 3:40:00 PM	Water	None	None
2450	Sonterra Well 9	8/1/2005 4:10:00 PM	Water	None	None
2451	Sonterra Well 9	8/1/2005 4:40:00 PM	Water	None	None
2452	Sonterra Well 9	8/1/2005 5:10:00 PM	Water	None	None
2453	Sonterra Well 9	8/1/2005 5:40:00 PM	Water	None	None
2454	Sonterra Well 9	8/1/2005 6:10:00 PM	Water	None	None
2455	Sonterra Well 9	8/1/2005 6:40:00 PM	Water	None	None
2456	Sonterra Well 9	8/1/2005 7:10:00 PM	Water	None	None
2457	Sonterra Well 9	8/1/2005 7:40:00 PM	Water	None	None
2458	Sonterra Well 9	8/1/2005 8:10:00 PM	Water	None	None
2459	Sonterra Well 9	8/1/2005 8:40:00 PM	Water	None	None
2460	Sonterra Well 9	8/1/2005 9:10:00 PM	Water	None	None
2461	Sonterra Well 9	8/1/2005 9:40:00 PM	Water	None	None
2468	Sonterra Well 9	8/2/2005 1:10:00 AM	Water	None	None
2515	Sonterra Well 9	8/2/2005 1:10:00 PM	Water	None	None
2469	Sonterra Well 9	8/2/2005 1:40:00 AM	Water	None	None
2516	Sonterra Well 9	8/2/2005 1:40:00 PM	Water	None	None
2527	Sonterra Well 9	8/2/2005 10:00:00 PM	Water	None	None
2509	Sonterra Well 9	8/2/2005 10:10:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2510	Sonterra Well 9	8/2/2005 10:40:00 AM	Water	None	None
2528	Sonterra Well 9	8/2/2005 11:00:00 PM	Water	None	None
2511	Sonterra Well 9	8/2/2005 11:10:00 AM	Water	None	None
2512	Sonterra Well 9	8/2/2005 11:40:00 AM	Water	None	None
2466	Sonterra Well 9	8/2/2005 12:10:00 AM	Water	None	None
2513	Sonterra Well 9	8/2/2005 12:10:00 PM	Water	None	None
2467	Sonterra Well 9	8/2/2005 12:40:00 AM	Water	None	None
2514	Sonterra Well 9	8/2/2005 12:40:00 PM	Water	None	None
2517	Sonterra Well 9	8/2/2005 2:10:00 PM	Water	None	None
2494	Sonterra Well 9	8/2/2005 2:40:00 AM	Water	None	None
2520	Sonterra Well 9	8/2/2005 3:00:00 PM	Water	None	None
2496	Sonterra Well 9	8/2/2005 3:10:00 AM	Water	None	None
2495	Sonterra Well 9	8/2/2005 3:40:00 AM	Water	None	None
2521	Sonterra Well 9	8/2/2005 4:00:00 PM	Water	None	None
2497	Sonterra Well 9	8/2/2005 4:10:00 AM	Water	None	None
2498	Sonterra Well 9	8/2/2005 4:40:00 AM	Water	None	None
2522	Sonterra Well 9	8/2/2005 5:00:00 PM	Water	None	None
2499	Sonterra Well 9	8/2/2005 5:10:00 AM	Water	None	None
2500	Sonterra Well 9	8/2/2005 5:40:00 AM	Water	None	None
2523	Sonterra Well 9	8/2/2005 6:00:00 PM	Water	None	None
2501	Sonterra Well 9	8/2/2005 6:10:00 AM	Water	None	None
2502	Sonterra Well 9	8/2/2005 6:40:00 AM	Water	None	None
2524	Sonterra Well 9	8/2/2005 7:00:00 PM	Water	None	None
2503	Sonterra Well 9	8/2/2005 7:10:00 AM	Water	None	None
2504	Sonterra Well 9	8/2/2005 7:40:00 AM	Water	None	None
2525	Sonterra Well 9	8/2/2005 8:00:00 PM	Water	None	None
2505	Sonterra Well 9	8/2/2005 8:10:00 AM	Water	None	None
2506	Sonterra Well 9	8/2/2005 8:40:00 AM	Water	None	None
2526	Sonterra Well 9	8/2/2005 9:00:00 PM	Water	None	None
2507	Sonterra Well 9	8/2/2005 9:10:00 AM	Water	None	None
2508	Sonterra Well 9	8/2/2005 9:40:00 AM	Water	None	None
2529	Sonterra Well 9	8/3/2005	Water	None	None
2530	Sonterra Well 9	8/3/2005 1:00:00 AM	Water	None	None
2542	Sonterra Well 9	8/3/2005 1:00:00 PM	Water	None	None
2539	Sonterra Well 9	8/3/2005 10:00:00 AM	Water	None	None
2540	Sonterra Well 9	8/3/2005 11:00:00 AM	Water	None	None
2541	Sonterra Well 9	8/3/2005 12:00:00 PM	Water	None	None
2531	Sonterra Well 9	8/3/2005 2:00:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2543	Sonterra Well 9	8/3/2005 2:00:00 PM	Water	None	None
2532	Sonterra Well 9	8/3/2005 3:00:00 AM	Water	None	None
2533	Sonterra Well 9	8/3/2005 4:00:00 AM	Water	None	None
2534	Sonterra Well 9	8/3/2005 5:00:00 AM	Water	None	None
2535	Sonterra Well 9	8/3/2005 6:00:00 AM	Water	None	None
2536	Sonterra Well 9	8/3/2005 7:00:00 AM	Water	None	None
2481	Sonterra Well 9	8/3/2005 7:43:00 AM	Water	None	None
2537	Sonterra Well 9	8/3/2005 8:00:00 AM	Water	None	None
2538	Sonterra Well 9	8/3/2005 9:00:00 AM	Water	None	None
2593	Sonterra Well 9	5/22/2006 to 5/25/2006	Charcoal	None	None
2597	Sonterra Well 9	5/25/2006 to 5/29/2006	Charcoal	None	None
2599	Sonterra Well 9	5/25/2006 to 5/29/2006	Charcoal	None	None
2604	Sonterra Well 9	5/29/2006 to 6/1/2006	Charcoal	None	None
2677	Sonterra Well 9	6/1/2006 to 6/5/2006	Charcoal	None	None
2670	Sonterra Well 9	6/5/2006 8:20:00 AM	Water	None	None
2685	Sonterra Well 9	6/5/2006 to 6/8/2006	Charcoal	None	None
2671	Sonterra Well 9	6/8/2006 8:20:00 AM	Water	None	None
2672	Sonterra Well 9	6/12/2006 8:20:00 AM	Water	None	None
2689	Sonterra Well 9	6/8/2006 to 6/12/2006	Charcoal	None	None
2739	Sonterra Well 9	6/12/2006 to 6/19/2006	Charcoal	Eosin	19.0
2733	Sonterra Well 9	6/19/2006 7:55:00 AM	Water	None	None
2786	Sonterra Well 9	6/19/2006 to 6/26/2006	Charcoal	Eosin	9.4
2778	Sonterra Well 9	6/26/2006 8:15:00 AM	Water	None	None
2813	Sonterra Well 9	6/26/2006 to 7/11/2006	Charcoal	Eosin	12.0
2837	Sonterra Well 9	7/11/2006 11:30:00 AM	Water	None	None
2866	Sonterra Well 9	7/11/2006 to 7/24/2006	Charcoal	None	None
2868	Sonterra Well 9	7/24/2006 8:25:00 AM	Water	None	None
2901	Sonterra Well 9	7/24/2006 to 7/31/2006	Charcoal	None	None
2907	Sonterra Well 9	7/31/2006 9:40:00 AM	Water	None	None
2875	Sonterra Well 9	7/31/2006 to 8/9/2006	Charcoal	Eosin	3.2
2946	Sonterra Well 9	8/9/2005 to 8/16/2006	Charcoal	None	None
547	TC Golf Well	10/15/2004 to 10/18/2004	Charcoal	None	None
543	TC Golf Well	10/18/2004 to 10/22/2004	Charcoal	None	None
574	TC Golf Well	10/22/2004 to 10/26/2004	Charcoal	None	None
367	TC Golf Well	10/26/2004 11:30:00 AM	Water	None	None
1152	TC Golf Well	10/20/2004 to 10/29/2004	Charcoal	None	None
681	TC Golf Well	10/29/2004 11:11:00 AM	Water	None	None
710	TC Golf Well	11/2/2004 10:57:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
711	TC Golf Well	11/4/2004 10:45:00 AM	Water	None	None
1211	TC Golf Well	10/29/2004 to 11/9/2004	Charcoal	None	None
1207	TC Golf Well	11/2/2004 to 11/9/2004	Charcoal	None	None
1162	TC Golf Well	11/9/2004 to 11/24/2004	Charcoal	None	None
1160	TC Golf Well	11/9/2004 to 11/29/2004	Charcoal	None	None
1587	TC Golf Well	10/26/2004 to 11/30/2004	Charcoal	None	None
1197	TC Golf Well	11/29/2004 to 12/6/2004	Charcoal	None	None
1198	TC Golf Well	11/29/2004 to 12/6/2004	Charcoal	None	None
854	TC Golf Well	12/6/2004 12:05:00 PM	Water	None	None
936	TC Golf Well	12/9/2004 11:35:00 AM	Water	None	None
1131	TC Golf Well	12/13/2004 11:00:00 AM	Water	None	None
986	TC Golf Well	12/13/2004 11:00:00 AM	Water	None	None
1313	TC Golf Well	12/9/2004 to 12/20/2004	Charcoal	None	None
2025	TC Golf Well	12/13/2004 to 12/23/2004	Charcoal	None	None
1420	TC Golf Well	1/4/2005 10:20:00 AM	Water	None	None
2069	TC Golf Well	12/20/2004 to 1/4/2005	Charcoal	None	None
1630	TC Golf Well	1/13/2005 11:22:00 AM	Water	None	None
1608	TC Golf Well	1/4/2005 to 1/13/2005	Charcoal	None	None
1603	TC Golf Well	12/23/2004 to 1/13/2005	Charcoal	None	None
1792	TC Golf Well	1/13/2005 to 1/18/2005	Charcoal	None	None
1930	TC Golf Well	1/15/2005 to 1/31/2005	Charcoal	None	None
2101	TC Golf Well	1/15/2005 to 1/31/2005	Charcoal	None	None
1943	TC Golf Well	1/31/2005 9:45:00 AM	Water	None	None
2093	TC Golf Well	1/18/2005 to 2/7/2005	Charcoal	Phloxine B	4.1
2093	TC Golf Well	1/18/2005 to 2/7/2005	Charcoal	Phloxine B	2.2
2036	TC Golf Well	2/7/2005 11:13:00 AM	Water	None	None
2226	TC Golf Well	1/31/2005 to 2/10/2005	Charcoal	None	None
2217	TC Golf Well	2/10/2005 2:58:00 PM	Water	None	None
2212	TC Golf Well	2/16/2005 11:05:00 AM	Water	None	None
2170	TC Golf Well	2/7/2005 to 2/16/2005	Charcoal	Phloxine B	2.9
2341	TC Golf Well	2/16/2005 to 3/21/2005	Charcoal	Phloxine B	4.0
2432	TC Golf Well	3/21/2005 10:20:00 AM	Water	None	None
2346	TC Golf Well	3/7/2005 to 3/21/2005	Charcoal	None	None
3008	TC Golf Well	10/19/2005 to 11/6/2005	Charcoal	None	None
2591	TC Golf Well	5/22/2006 to 5/25/2006	Charcoal	None	None
2598	TC Golf Well	5/25/2006 to 5/29/2006	Charcoal	None	None
2605	TC Golf Well	5/29/2006 to 6/1/2006	Charcoal	None	None
2614	TC Golf Well	6/1/2006 8:30:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
2678	TC Golf Well	6/1/2006 to 6/5/2006	Charcoal	None	None
2668	TC Golf Well	6/5/2006 9:28:00 AM	Water	None	None
2683	TC Golf Well	6/5/2006 to 6/8/2006	Charcoal	None	None
2669	TC Golf Well	6/12/2006 8:00:00 AM	Water	None	None
2688	TC Golf Well	6/8/2006 to 6/12/2006	Charcoal	None	None
2740	TC Golf Well	6/12/2006 to 6/19/2006	Charcoal	None	None
2732	TC Golf Well	6/19/2006 7:30:00 AM	Water	None	None
2785	TC Golf Well	6/19/2006 to 6/26/2006	Charcoal	None	None
2781	TC Golf Well	6/26/2006 9:30:00 AM	Water	None	None
2809	TC Golf Well	6/26/2006 to 7/5/2006	Charcoal	None	None
2838	TC Golf Well	7/11/2006 10:00:00 AM	Water	None	None
2810	TC Golf Well	7/5/2006 to 7/11/2006	Charcoal	None	None
2862	TC Golf Well	7/10/2006 to 7/17/2006	Charcoal	None	None
2865	TC Golf Well	7/17/2006 to 7/24/2006	Charcoal	None	None
2903	TC Golf Well	7/24/2006 to 7/31/2006	Charcoal	None	None
2908	TC Golf Well	7/31/2006 10:50:00 AM	Water	None	None
2877	TC Golf Well	7/31/2006 to 8/9/2006	Charcoal	None	None
2947	TC Golf Well	8/9/2005 to 8/16/2006	Charcoal	None	None
2949	TC Golf Well	8/16/2005 to 8/23/2006	Charcoal	None	None
2967	TC Golf Well	8/23/2005 to 8/28/2006	Charcoal	None	None
2972	TC Golf Well	8/28/2006 11:15:00 AM	Water	None	None
2970	TC Golf Well	8/28/2005 to 9/6/2006	Charcoal	None	None
2998	TC Golf Well	10/11/2006 11:00:00 AM	Water	None	None
2993	TC Golf Well	10/2/2005 to 10/11/2006	Charcoal	None	None
290	Tower Drive Well	10/21/2004 9:45:00 AM	Water	None	None
537	Tower Drive Well	10/18/2004 to 10/22/2004	Charcoal	None	None
291	Tower Drive Well	10/22/2004 10:15:00 AM	Water	None	None
292	Tower Drive Well	10/22/2004 10:22:00 AM	Water	None	None
293	Tower Drive Well	10/23/2004 10:10:00 AM	Water	None	None
294	Tower Drive Well	10/24/2004 8:23:00 AM	Water	None	None
267	Tower Drive Well	10/25/2004 10:45:00 AM	Water	None	None
329	Tower Drive Well	10/26/2004	Water	None	None
582	Tower Drive Well	10/26/2004 10:05:00 AM	Water	None	None
684	Tower Drive Well	10/27/2004 9:55:00 AM	Water	None	None
685	Tower Drive Well	10/28/2004 10:15:00 AM	Water	None	None
1153	Tower Drive Well	10/22/2004 to 10/29/2004	Charcoal	None	None
686	Tower Drive Well	10/29/2004 9:40:00 AM	Water	None	None
687	Tower Drive Well	10/30/2004 9:45:00 AM	Water	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
712	Tower Drive Well	10/31/2004 9:35:00 AM	Water	None	None
716	Tower Drive Well	11/1/2004 9:55:00 AM	Water	None	None
715	Tower Drive Well	11/2/2004 10:35:00 AM	Water	None	None
714	Tower Drive Well	11/3/2004 11:20:00 AM	Water	None	None
713	Tower Drive Well	11/4/2004 10:01:00 AM	Water	None	None
1585	Tower Drive Well	10/26/2004 to 11/30/2004	Charcoal	None	None
1164	Tower Drive Well	10/29/2004 to 11/30/2004	Charcoal	None	None
1158	Tower Drive Well	11/2/2004 to 11/30/2004	Charcoal	None	None
819	Tower Drive Well	11/30/2004 2:25:00 PM	Water	None	None
817	Tower Drive Well	12/1/2004 10:47:00 AM	Water	None	None
1165	Tower Drive Well	11/30/2004 to 12/2/2004	Charcoal	None	None
818	Tower Drive Well	12/2/2004 10:45:00 AM	Water	None	None
1199	Tower Drive Well	11/30/2004 to 12/6/2004	Charcoal	None	None
1200	Tower Drive Well	12/2/2004 to 12/6/2004	Charcoal	None	None
855	Tower Drive Well	12/6/2004 10:00:00 AM	Water	None	None
1214	Tower Drive Well	12/6/2004 to 12/9/2004	Charcoal	None	None
935	Tower Drive Well	12/9/2004 10:40:00 AM	Water	None	None
931	Tower Drive Well	12/10/2004 9:45:00 AM	Water	None	None
990	Tower Drive Well	12/11/2004 9:15:00 AM	Water	None	None
1135	Tower Drive Well	12/11/2004 9:15:00 AM	Water	None	None
1127	Tower Drive Well	12/12/2004 9:10:00 AM	Water	None	None
982	Tower Drive Well	12/12/2004 9:10:00 AM	Water	None	None
991	Tower Drive Well	12/13/2004 10:15:00 AM	Water	None	None
1136	Tower Drive Well	12/13/2004 10:15:00 AM	Water	None	None
1228	Tower Drive Well	12/9/2004 to 12/13/2004	Charcoal	None	None
963	Tower Drive Well	12/14/2004 9:17:00 AM	Water	None	None
966	Tower Drive Well	12/15/2004 10:00:00 AM	Water	None	None
1108	Tower Drive Well	12/16/2004 10:03:00 AM	Water	None	None
1103	Tower Drive Well	12/9/2004 to 12/16/2004	Charcoal	None	None
1319	Tower Drive Well	12/13/2004 to 12/20/2004	Charcoal	None	None
1400	Tower Drive Well	12/21/2004 10:32:00 AM	Water	None	None
2024	Tower Drive Well	12/20/2004 to 12/23/2004	Charcoal	None	None
1399	Tower Drive Well	12/23/2004 10:35:00 AM	Water	None	None
1401	Tower Drive Well	12/28/2004 11:40:00 AM	Water	None	None
1414	Tower Drive Well	1/4/2005 10:01:00 AM	Water	None	None
2078	Tower Drive Well	12/20/2004 to 1/4/2005	Charcoal	None	None
1631	Tower Drive Well	1/13/2005 10:48:00 AM	Water	None	None
1609	Tower Drive Well	1/4/2005 to 1/13/2005	Charcoal	None	None

Appendix B. (cont.) Results of Dye Analyses

Number	Site Name	Sample Date	Sample Type	Dye	Concentration (µg/L)
1791	Tower Drive Well	12/23/2004 to 1/13/2005	Charcoal	None	None
1561	Tower Drive Well	1/17/2005 10:50:00 AM	Water	None	None
1698	Tower Drive Well	1/13/2005 to 1/19/2005	Charcoal	None	None
1711	Tower Drive Well	1/13/2005 to 1/19/2005	Charcoal	None	None
1560	Tower Drive Well	1/19/2005 10:20:00 AM	Water	None	None
1732	Tower Drive Well	1/21/2005 2:40:00 PM	Water	None	None
1700	Tower Drive Well	1/19/2005 to 1/25/2005	Charcoal	None	None
1798	Tower Drive Well	1/25/2005 9:15:00 AM	Water	None	None
1931	Tower Drive Well	1/19/2005 to 1/31/2005	Charcoal	None	None
2008	Tower Drive Well	1/19/2005 to 1/31/2005	Charcoal	None	None
1939	Tower Drive Well	1/31/2005 9:25:00 AM	Water	None	None
2058	Tower Drive Well	1/25/2005 to 2/7/2005	Charcoal	None	None
2035	Tower Drive Well	2/7/2005 10:36:00 AM	Water	None	None
2225	Tower Drive Well	1/31/2005 to 2/11/2005	Charcoal	None	None
2214	Tower Drive Well	2/11/2005 10:31:00 AM	Water	None	None
2338	Tower Drive Well	2/11/2005 to 3/21/2005	Charcoal	None	None
2434	Tower Drive Well	3/21/2005 9:45:00 AM	Water	None	None
2344	Tower Drive Well	3/7/2005 to 3/21/2005	Charcoal	None	None

* J = Estimated concentration between detection limit and quantitation limit.