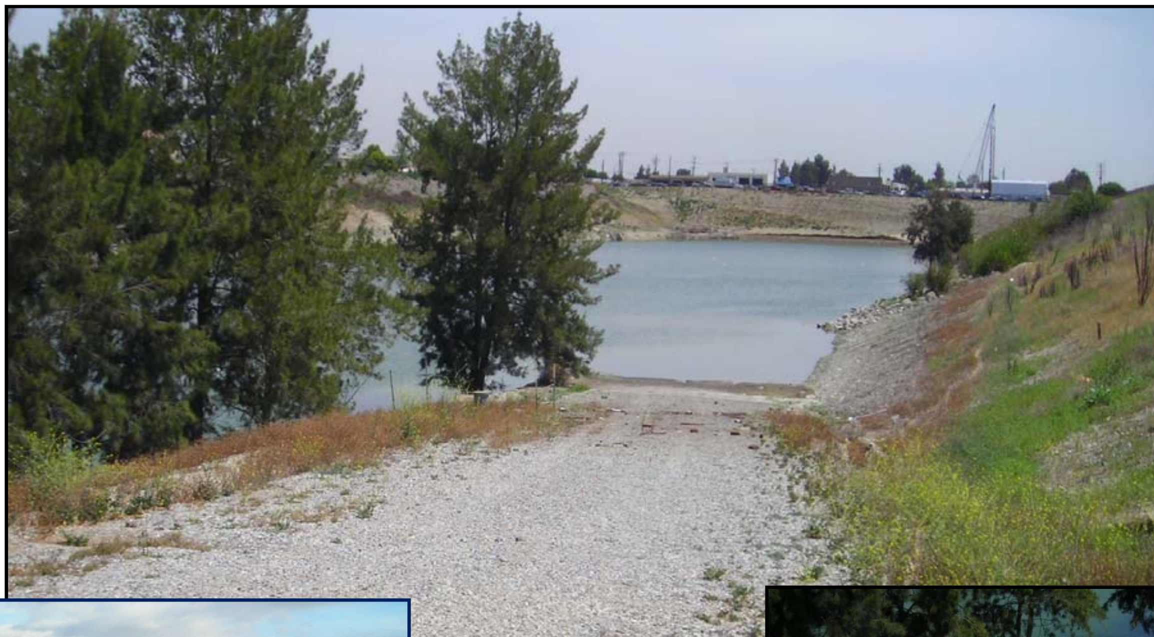
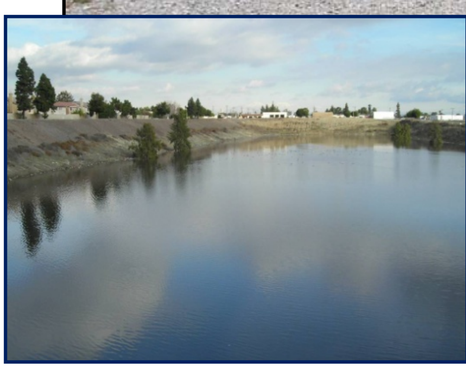
CHINO BASIN
RECYCLED WATER GROUNDWATER RECHARGE PROGRAM

START-UP PERIOD REPORT FOR BROOKS STREET BASIN





July 28, 2010

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July 28, 2010

Regional Water Quality Control Board, Santa Ana Region
Attention: Mr. Gary Stewart
3737 Main Street, Suite 500
Riverside, California 92501-3348

Subject: Transmittal of the Start-Up Report for Brooks Street Basin Chino Basin Recycled Water Groundwater Recharge Program

Dear Mr. Stewart:

The Inland Empire Utilities Agency (IEUA) and the Chino Basin Watermaster (CBWM) hereby submit the *Start-Up Report for Brooks Street Basin* for the *Recycled Water Groundwater Recharge Program* being implemented by IEUA and CBWM. This document is submitted pursuant to requirements in the following documents:

- California Regional Water Quality Control Board, Santa Ana Region, Order No. R8-2007-0039 Water Recycling Requirements for Inland Empire Utilities Agency and Chino Basin Watermaster, Chino Basin Recycled Water Groundwater Recharge Program, Phase I and Phase II Projects, June 29, 2007,
- California Regional Water Quality Control Board, Santa Ana Region, Monitoring and Reporting Program No. R8-2007-0039 for Inland Empire Utilities Agency and Chino Basin Watermaster Chino Basin Recycled Water Groundwater Recharge Program Phase I and Phase II Projects San Bernardino County, and
- IEUA and CBWM, 2008, Start-Up Protocol Plan for Brooks Street Basin, June 13, 2008.

The following items highlight the Start-Up Report findings of the Brooks Street Basin (referred to as "Brooks Basin"):

- The Start-Up Period for Brooks Basin was August 2008 through December 2009 and included extensions for the impact of stormwater inflow and evaluation of the Brooks basin tracer data.
- Infiltration rates of Brooks Basin range from 0.4 and 1.4 feet per day depending on the depth of water in the basin and surface area of wetted sediments in the basin walls.
- Electrical conductivity (EC) is generally an effective tracer of recycled water in samples collected from the 5- to 35-foot deep lysimeters, and is useful for estimating the variable travel times to the lysimeter depths.
- Water recharged at Brooks Basin ultimately reaches all of the lysimeters. Recharge water moves downward over a period of approximately 1 to 2 months and past the 25- and 35-

foot deep lysimeters, but is difficult to track due to the long travel time and dampening of the EC signatures of the surface water.

- Recharge travel time to groundwater is estimated to be approximately 150 days to monitoring well BRK-1/1 from trends in EC, TOC, and chloride (Cl) data.
- For Brooks Basin 25-foot lysimeter, observed soil-aquifer treatment (SAT) efficiencies are equally efficient when the percent recycled water at the lysimeter is between 35 and 95 percent. Under these conditions and at this depth, the observed SAT removal efficiency for total organic carbon (TOC) was generally between 45 and 70 percent and the observed SAT removal efficiency for total nitrogen (TN) was generally between 83 and 95 percent.
- SAT treatment was very effective at removing TOC and TN in the upper 35 feet of sediments with further reductions observed with depth at basin monitoring well BRK-1/1 (screened from 310 to 350 feet below ground surface). With regular operation, Brooks Basin area sediments can reduce TOC through SAT to 2.02 mg/L at the 25-foot lysimeters and 1.20 mg/L at monitoring well BRK-1/1 (based on the 20-sample rolling average). With these two options for compliance point, the maximum recycled water contribution (RWC) limit was chosen as 42 percent at the monitoring well.
- Due to slow travel times to the lysimeters and monitoring well, a compliance monitoring plan with only weekly lysimeter monitoring is not practical. Lysimeter monitoring would require both extended sampling periods and regular recycled water deliveries to discern individual delivery periods and to precisely quantify TOC removal. As such, an alternative monitoring plan is proposed for Brooks Basin using monitoring well BRK-1/1 as the compliance point.
- The proposed alternative monitoring plan for Brooks Basin includes monthly sampling of the Brooks Basin surface water, 25-foot lysimeter and monitoring well BRK-1/1. Sampling will be for EC, TOC, and TN at all the points and will be conducted as long as recycled water has been recharged in the prior 180 days. The 25-foot lysimeter will be the compliance point for TN and the monitoring well will be the compliance point for TOC. During alternate monitoring, chloride will also be analyzed for BRK-1/1 and used to verify the presence of recycled water.
- An RWC Management Plan for Brooks Basin is provided and forecasts 120 months of recharge of stormwater and recycled water to maintain compliance with the proposed 42 percent RWC limit at monitoring well BRK-1/1. Updates to the Brooks Basin RWC Management Plan will be included in subsequent Recycled Water Groundwater Recharge Annual Reports.

If you have any questions, please do not hesitate to call us.

Best regards,

Patrick O. Sheilds
Executive Manager of Operations

Kenneth R. Manning
Chief Executive Officer

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1. Introduction

Inland Empire Utilities Agency (IEUA) and Chino Basin Watermaster (CBWM) are co-permit holders for the Chino Basin Recycled Water Groundwater Recharge Program. IEUA and CBWM maintain and operate the program's recharge facilities together with Chino Basin Water Conservation District and San Bernardino County Flood Control District. The recharge program is an integral part of CBWM's Optimum Basin Management Plan (Wildermuth Environmental, Inc., 1999), and has the goals of enhancing water supply reliability and improving groundwater quality in Chino Basin drinking water wells. The goals are to be met by increasing the recharge of stormwater, imported water, and recycled water.

IEUA initiates groundwater recharge using recycled water at permitted recharge sites by following and reporting on a minimum 6-month Start-Up Period of recycled water delivery and intensive testing. The location of Brooks Street Basin (referred to generally as "Brooks Basin") is shown in Figure 1-1. The Brooks Basin was modified under the Chino Basin Facilities Improvement Project by adding automated water level sensors and construction of automated inlets from San Antonio Channel and State Street Storm Drain. This Start-up Period report documents soil-aquifer treatment (SAT) performance at Brooks Basin for the removal of total organic carbon (TOC) and total nitrogen (TN), and the subsequent determination of the maximum recycled water contribution (RWC) limit associated with the reduced TOC concentrations at a compliance point depth (e.g. a lysimeter or monitoring well).

The Start-Up Period was conducted by IEUA in accordance with the protocols approved by the California Department of Public Health (CDPH) set forth in the Start-Up Protocol Plan for Brooks Basin (IEUA, 2008). The Brooks Basin Start-Up Period was extended beyond the 6 month minimum to evaluate the impact of storms beginning in the fifth month of testing and to incorporate the findings of the Brooks Basin Tracer Experiment (Appendix A). The actual Start-Up Period for Brooks Basin was August 2008 through December 2009.

1.1 Requirements of Order No. R8-2007-0039

The Chino Basin Recycled Water Groundwater Recharge Program is subject to the following requirements of the Regional Water Quality Control Board Santa Ana Region (RWQCB):

- Order No. R8-2007-0039 Water Recycling Requirements for Inland Empire Utilities Agency and Chino Basin Watermaster, Chino Basin Recycled Water Groundwater Recharge Program, Phase I and Phase II Projects, June 29, 2007, and
- Monitoring and Reporting Program No. R8-2007-0039 for Inland Empire Utilities Agency and Chino Basin Watermaster Chino Basin Recycled Water Groundwater Recharge Program Phase I and Phase II Projects, June 29, 2007.

Recharge using recycled water at Brooks Basin is permitted under the order, Order No. R8-2007-0039, which covers both Phase I and Phase II recharge sites. Order No. R8-2007-0039 describes the requirements for the Start-Up Period Report in Section F.4:

> The Start-Up Period report shall include: site specific determinations of percolation rates, soil aquifer treatment efficiency and optimum depths and locations of lysimeters to obtain representative compliance

samples of recycled water after soil aquifer treatment. The report shall specify the date that the Start-Up Period ended. The report shall make recommendations for final compliance lysimeter placement and the monitoring plan to be employed during the initial year of operation, the initial year maximum average RWC and corresponding TOC limit, and generalized method that will be used to track recharge water in the vadose zone. The analytical results from weekly lysimeter samples shall be evaluated and reported along with conclusions regarding soil aquifer treatment (SAT) performance. This report is subject to approval by the CDHS [sic, now CDPH] and the Regional Board Executive Officer. The report recommendations shall be implemented upon approval.

1.2 Organization of the Start-Up Report

Section 2 of this report describes the installation of lysimeters. Section 3 details the recharge operations during the Start-Up Period. Sections 4 and 5 discuss the lysimeter sampling and monitoring results and the SAT efficiency in terms of TOC and TN removal. Section 6 describes the determination of the Start-Up Period and recommendation of the compliance point. Section 7 discusses the determination of the basin's maximum RWC limit and a RWC Management Plan to ensure that the RWC limit is not exceeded in the future. Section 8 is a proposed water quality monitoring plan for the first year after the Start-Up Period, and Section 9 includes cited references.

2. Lysimeter Installation

Figure 2-1 shows the location of the Brooks Basin lysimeter cluster and the general configuration of the Brooks Basin. Also shown on Figure 2-1 are the basin diversion locations from San Antonio Creek and State Street storm drain, unregulated inlet from the Brooks Street storm drain, and the locations of two nested monitoring wells used for quarterly groundwater monitoring. Brooks Basin is approximately 60-feet deep with a basin bottom elevation of approximately 860 feet MSL. The Brooks Basin lysimeters were constructed in September 2007 in the southwest bottom corner of the basin on a soil bench having an elevation of approximately 865 feet MSL.

The Brooks Basin lysimeter cluster is comprised of five individually cased lysimeters at 5-, 10-, 15-, 25-, and 35-feet deep from the soil bench on which they are constructed. The Brooks Basin lysimeter and monitoring well construction drawings are documented in Appendix B. The lysimeter installation and sampling protocols are discussed in Appendix A and B of the *Start-Up Protocol Plan for Brooks Basin (*IEUA, 2008).

Throughout the report text, tables, and figures, water samples from the lysimeters at Brooks Basin are referred to as Brooks-xx, where xx equals the nominal depth of the porous tip of the lysimeter. Depending on context, the surface water samples collected at each lysimeter are referred to as a 0-depth sample or surface water sample. The 0-depth samples were collected from the Brooks Basin surface water near the lysimeter installations and not from the basin bottom. For the purpose of this report, the assumption is made that the water collected at the surface is identical to the water at the basin bottom (i.e. 0-depth). Water depth during the Start-Up Period varied from 5 to 25 feet.

3. Recharge Operations

3.1 Volume of Historical Diluent Water Recharged

Recharge in Brooks Basin prior to the Start-Up Period was estimated from field observations and operations records. Table 3-1 lists the diluent water recharge at Brooks Basin from July 2005 through April 2010. From July 2005 until the start of the Start-Up Period in July 2008, Brooks Basin received 5,999 AF of direct diluent water recharge (4,485 AF of imported water and 1,514 AF of stormwater). Although not tabulated in Table 3-1, groundwater underflow is also credited as diluent water in the 120-month running average RWC calculation (discussed in Section 7). For Brooks Basin, the groundwater underflow was estimated at 6,111 AFY (509 AF per month) using a Darcian calculation (IEUA, 2010) and conservative limits identified by an expert panel (NWRI, 2010)

3.2 Recharge Operations during the Start-Up Period

Water delivered to Brooks Basin during the Start-Up Period included local runoff, stormwater, and recycled water. Both recycled water and imported water are delivered via the concrete-lined San Antonio Channel. Stormwater enters Brooks Basin from the San Antonio Channel, the State Street storm drain, the Brooks Street regional storm drain, and from local street drainages. Dry weather flows occur in State Street storm drain and are typically less than 0.2 AF per day. Stormwater recharge was estimated from storage curves, increases in water elevation, and infiltration rates. Table 3-2 lists the Brooks Basin daily water deliveries during the Start-Up Period for all water sources. Percent recycled water of the surface water shown in Table 3-2 is calculated from the cumulative ratio of water deliveries to the cell minus an infiltrated volume at the previous days percent recycled water. Water volume in storage was determined by the stage-storage curve for Brooks Basin. Infiltrated volumes were estimated as the difference in daily storage minus the volume of daily delivered water. Table 3-2 lists the Brooks Basin daily deliveries of all water sources during the Start-Up Period. Table 3-3 lists the monthly deliveries of all water sources during the Start-Up Period and also the 120-month running average percent recycled water of total recharge, as will ultimately be required for RWC limit compliance.

3.3 Estimated Infiltration Rates

Infiltration rates of Brooks Basin generally range from 0.4 to 1.4 feet per day, and vary by depth of water in the basin and the area of wetted sediments in the basin walls. Table 3-4 contains observed infiltration rates and data. Deeper water can increase the measured infiltration rates by submerging higher infiltration rate soils or submerging native sediments not adversely impacted by a surface coating of mud settled out from a past stormwater. Rates in Table 3-4 are not adjusted for any unquantifiable inflow that may have occurred during the period of measurement, which for Brooks Basin is believed to be negligible.

4. Sampling Results and Recharge Travel Times

4.1 Surface Water, Lysimeter, and Monitoring Well Sampling Results

The monitoring schedule from the CDPH-approved *Start-Up Protocol Plan for Brooks Basin* (IEUA, 2008) includes weekly sampling at Brooks Basin for surface water and lysimeter water, and analyses for:

- EC,
- TOC,
- Nitrate-Nitrogen, Nitrite-Nitrogen, Ammonia, Total Kjeldahl Nitrogen (TKN), and TN.

IEUA supplemented these sampling events with approximately twice monthly sampling of basin monitoring well BRK-1 (two individual casings –screen at 310 to 350 feet and at 520 to 560 feet below ground surface), and monitoring well BRK-2. Table 4-1 and Table 4-2 contain sample results for EC and TOC, respectively. Table 4-3 contains sample results for nitrogen speciation. Table 4-4 contains a summary of TN, which is the sum of nitrate, nitrite, and TKN concentrations. For determining the TN, all non-detect results for nitrogen speciation are summed at half the nitrogen species detection limit. The detection limits for nitrate, nitrite, and TKN are 0.1 mg/L, 0.01 mg/L, and 0.5 mg/L, respectively. TN results that are non-detect (<0.6 mg/L) are graphed on figures and averaged for removal efficiencies at half the detection limit. When not all of the nitrogen species results are non-detect and when their concentration sum is between 0.3 and 0.6 mg/L, then TN is reported as <0.6 mg/L and graphed and averaged at the summed value. Should there be insufficient sample to analyze for TKN, then NH_3-N is substituted in the calculation of TN. Should there be insufficient sample to analyze for nitrate, or TKN, or ammonia, then TN is not calculated.

There is a column in each of Table 4-1a, 4-2a, and 4-4a that provides the percentage of recycled water in the sample from the 25-foot depth lysimeter below the basin bottom of Brooks Basin. The percent recycled water in the sample was calculated (as discussed in Section 5) by comparing the EC values of diluent water and recycled water. The estimate was made for the 25-foot lysimeter as it was determined (as discussed in Section 6.2) to be the potential compliance point lysimeter. That is this lysimeter depth had the lowest overall TOC following SAT and responded consistently (although delayed) to operational changes at Brooks Basin.

Time-series graphs of the lysimeters and monitoring wells collected and tabularized data are presented in this section, but are interpreted and discussed in Sections 5 and 6. Time series graphs of EC from Brooks Basin lysimeters and wells are presented on Figure 4-1a and Figure 4-1b, respectively. Time series graphs of TOC from Brooks Basin lysimeters and wells are presented on Figure 4-2a and Figure 4-2b, respectively. Time series graphs of TN from Brooks Basin lysimeters and wells are presented on Figure 4-3a and Figure 4-3b, respectively. In the upper part of these graphs, horizontal bars denote periods when various sources of water were diverted into Brooks Basin. Delivery dates and volumes represented by these bars are located in Table 3-2. Likewise on these figures, a horizontal bar indicates the Brooks introduced tracer test data collection period.

Time-series EC, TOC, and TN data for monitoring well BRK-2 are presented alongside that of BRK-1 on Figures 4-1b, Figure 4-2b, and Figure 4-3b. The slight variations of each parameter for BRK-2 during the period of monitoring do not support the arrival of recycled water at this location and are thus address no further by this report.

4.2 Recharge Water Times

The travel time for recharge water to reach the various sample depths is critical to the evaluation of the Start-Up Period data and development of future monitoring protocols. Surface water travel time to the lysimeters was evaluated to identify offset times for the pairing of surface and lysimeter data in the estimation of SAT efficiencies for TOC and TN removal. Travel time data are also important for the development of monitoring plans such that the collected lysimeter or monitoring well samples can be referenced to a prior surface water sample. Comparison of water quality time-series variations (predominately in EC) in surface water and in lysimeter and monitoring wells is used to develop travel times along a recharge flow path. It should be noted that the interpretation of intrinsic tracer results for monitoring wells can become problematic when the background trends of groundwater for the intrinsic tracer are not well known.

Exact matching of water parameter concentrations is not always possible for many reasons. Daily recharge volumes over the study period are not constant resulting in the variations in basin water depth and the percent water saturation of the underlying soils. Recharge waters blend with water already in the soil to dampen changes with depth from those observed in the surface water. Seasonal water quality changes (such as in EC) in background groundwater at monitoring wells can overprint changes observed at the overlying lysimeters. The first arrival or indication of a parameter with increased depth can represent the quickest travel time, but the peak arrival may be delayed and be more suitable for purposes of sample comparison. TOC and TN are degraded by SAT with depth.

4.2.1 Lysimeter Monitoring

Recharge travel time to the 5-foot lysimeter is estimated at approximately 1 week by comparison of the delay in EC dilution following the winter storm events on December 2008 and February 2009. The travel times to deeper lysimeters could not be track as well using EC of the surface water and 5-foot lysimeter due to special heterogeneity of the sediments. Recharge travel time to the 10-foot lysimeter is approximately 30 days based on EC decreases following the December 2008 storm event; however the lysimeter does not reflect the surface water EC increase following the storm event. The 15-foot lysimeter failed and was not operational during the Start-Up Period. Recharge travel time to the 25- and 35-foot lysimeters based on EC is longer and more muted than the shallower lysimeters.

Travel time to the 25-foot lysimeter was estimated by correlation of percent recycled water in the basin with percent recycled water in the lysimeter. Percent recycled water in the basin was estimated using the water volume changes in Brooks Basin and the daily delivery volumes and water types (Table 3-2). A mathematical relationship was then determined between percent recycled water in Brooks Basin and the measured surface water EC (%Recycled Water = 0.0014xEC + 0.118 with an R^2 of 90%). With that same relationship, the EC at the 25-foot lysimeter was used to estimate the percent recycled water at the 25-foot lysimeter (Table 4-1a). Figure 4-4 is a time-series graph of the twice monthly estimate of percent recycled water in Brooks Basin and at the 25-foot lysimeter. The figure is annotated with arrows showing correlation points of the two trends and the approximate travel times between these points. Of note on Figure 4-4 is the observation that travel time gradually increases from approximately 27 days to 63 days during the first 6 months of recycled water recharge, then decreases to 42 days when continuous recycled water recharge was halted during the late January to early March 2009 storm season. Once recycled water recharge resumed, the travel time again increased. The increased travel time (slower velocity) can be explained by increased saturation at higher delivery rates with the slowed vertical rates being compensated for by increased horizontal flow of recharge away from Brooks Basin. Lateral spreading and slowing of vertical recharge would cause increased blending of recharge waters over time, and this is what is observed on Figure 4-1a. Comparison of the surface water and the 25-foot lysimeter EC data shows the EC of the 25-foot lysimeter never reaches the high and low EC values of the surface water.

4.2.2 Well Monitoring

The Brooks Basin Tracer Study was conducted during October 2008 through May 2009 (Appendix A), and used sulfur hexafluoride and boron stable isotopes to evaluate the minimal travel time for recycled water recharged at the basin to the nearest potable wells located in the City of Pomona. The experiment was also useful to estimate recharge travel times at the lysimeters. Detection of enriched isotopic borate in the 5-foot lysimeter and possibly at the 10-foot lysimeter provided similar travel time estimates to these depths as the EC data. The enriched borate was however not detected at full concentration at the deeper lysimeters (greater than 5 feet) as the tracer test lysimeter sampling protocol ended after 69 days. Travel time to the 25-foot lysimeter based on EC was later measured as approximately 63 days. Sulfur hexafluoride was not monitored at the lysimeters due to its volatile nature and the lysimeter sampling method of utilizing suction. The introduced tracer sulfur hexafluoride was not detected at the deep monitoring wells or production wells during the testing protocols. Sulfur hexafluoride is highly volatile and due to off gassing was not useful through the thick vadose zone alluvial groundwater basin (295 feet at Brooks Basin). The enriched borate was not detected at BRK-1/1 during the protocols outside the range of analytical uncertainty, perhaps due to blending or lateral flows atop the water table. BRK-1/1 is screened from 310 to 350 feet below ground surface, generally 20 to 60 feet below the water table.

Recharge travel time to groundwater is estimated to be approximately 150 days to monitoring well BRK-1/1 from trends in EC, TOC, and chloride (Cl) data. Figure 4-1b is a time-series graph of EC data for BRK-1/1, with EC of the 25-foot lysimeters also shown for comparison. EC of native groundwater at BRK-1/1 fluctuated between 355 and 540 µmhos/cm during the year prior to start-up. During the first 6-months of the Start-Up Period, EC at BRK-1/1 continued a seasonal variation, ranging from 385 to 580 µmhos/cm. However, for the 5.5 months from mid February through July 2009, the EC of BRK-1/1 showed little seasonal variation and reached a high of 640 µmhos/cm on February 19, 2009. Figure 4-2b shows TOC of BRK-1/1. Similarly to BRK-1/1 EC, small seasonal TOC variations also occur ranging from about 0.2 to 1.3 g/L in the 6-months prior to and following initiation of recycled water recharge. Similar to the EC trend, TOC from mid February through July lacks significant seasonal variation and generally ranges from 0.8 to 1.5 mg/L (averaging 1.2 mg/L). Figure 4-5 is a graph of Cl data from BRK-1/1 and from IEUA's recycled water pipeline. The Cl data are listed in Table 4-5. The Cl of BRK-1/1 prior to recycled water recharge had generally been less than 42 mg/L, but in mid January 2009 began an upward trend towards that of the recharged recycled water. Peak percent recycled water at BRK-1/1 (75 to 90 mg/L Cl) occurred in March 2009 and is estimated to be 60 to70 percent based on the ratio of 1) the difference of Cl in groundwater samples and pre-recharge groundwater (6 month prior to sampling) and 2) the difference in Cl of the pipeline samples and the groundwater sample.

There is a vertical distance of 250 feet from the basin bottom to the top of the BRK-1/1 well screen, therefore 150 days represents a vertical travel time of 1.7 feet per day. The screened interval of BRK1/1 is 310 to 350 feet below ground surface. Travel time is likely less to the groundwater table as the BRK-1/1 well screen is 20 feet below the top of the water table. Depth to groundwater at Brooks Basin during the Start-Up Period ranged from 288 to 296 feet below ground surface (228 to 236 feet below the bottom of Brooks Basin) as measured at on-site monitoring well BRK-1/1. Figure 4-6 is a hydrograph of the two casings at BRK-1. BRK-1/2 is the deeper casing screened from 520 to 560 feet below ground surface. Of note in Figure 4-6 for casing BRK-1/2 are the daily increases and decreases in the water elevation due to pumping. The absence of these water level changes in BRK-1/1 indicates the shallower casing is not drawn on directly by local production wells and may be more representative of the Brooks Basin recharge mound rather than the deeper more regional aquifer more representative of the deeper casing, BRK-1/2.

5. Soil-Aquifer Treatment Efficiency: TOC & TN Removal

SAT is natural biodegradation occurring beneath a recharge basin where TOC and TN concentrations are decreased as recharge water flows through shallow soil. As allowed in Order R8-2007-0039, SAT reductions in TOC concentration ultimately allow for a greater maximum RWC limit based on the formula:

$$TOC_{average} = \frac{0.5 mg / L}{RWC_{average}}$$

Figure 5-1 is a graph of average TOC and TN concentrations as a function of increasing depth at Brooks Basin. Data for this graph comes from Table 4-2a and Table 4-4a and are 20-sample average values from September 3, 2008 through April 28, 2009. This sample range was selected to exclude the pre-start-up data and the period of increasing surface water TOC after recycled water delivery for the Start-Up Period had ended. Pre-start-up TOC have much higher TOC concentrations (8 to 20 mg/L) which reflect the accumulation and possible concentration of dry weather flows from State Street and Brooks Street storm drains (see Figure 4-2a). Figure 5-1 shows a decrease in average TOC concentration with increased depth and suggests that SAT reduction in TOC concentration continues to at least 25-feet and may continue at greater depths. While the 35-foot lysimeter sample results for TOC are less than the TOC of the basin surface water, the 35-foot lysimeters results are slightly higher TOC (+1.7 mg/L) than the 25-foot lysimeter. Review of Figure 4-2a (time-series TOC), specifically the more erratic later-time data, suggests that the 35-foot lysimeter is in soil that is perhaps more stagnant that the other depths which, if anoxic, can create erroneously higher TOC results due to higher inorganic carbon in a sample (Personal conversation with Dr. Jörg Drewes, Colorado School of Mine, February 2010).

At Brooks Basin, SAT removal of TOC and TN continues over time and depth and with a few exceptions generates fairly consistent concentrations paralleling variations in the surface water. Figure 4-2a and Figure 4-2b are time-series graphs of TOC from the (a) Brooks Basin surface water and lysimeters and (b) the monitoring wells casings of BRK-1 and BRK-2. Data graphed in Figure 4-2a and Figure 4-2b come from Table 4-2a and Table 4-2b, respectively. In the upper part of these two graphs, horizontal bars denote periods when various sources of water were diverted into Brooks Basin. Note that the trend of decreasing TOC concentrations continues over time and depth. Figure 4-2b shows TOC of the groundwater at monitoring wells BRK-1 and BRK-2 and indicates TOC of the recharged water at BRK-1/1 is fairly steady and generally less than 1.3 mg/L (February 19, 2009 and on) following the arrival of recharged recycled water.

Figure 4-3a and Figure 4-3b are time-series graphs of TN from the lysimeter and monitoring wells, respectively. Data for these two figures come from Table 4-3a and Table 4-3b, respectively. Decreases in TN concentrations from the lysimeter samples are generally consistent with depth and over time. While TN concentration reduction by SAT does not allow a regulatory increase in the volume of recycled water that can be recharged under Order R8-2007-

0039, it does assist in meeting the compliance metric of 5 mg/L. TN is generally nondetect at the 25- and 35-foot lysimeters. Background TN in groundwater at BRK-1/1 prior to the arrival of recycled water recharge fluctuated seasonally and ranged from 1 to 9 mg/L. For the four months following the arrival of recycled water in mid February 2009 at BRK-1/1, groundwater TN concentration in BRK-1/1 generally stabilized at less than 5 mg/L, representing a blend of recharged water and native groundwater. The difference between the <1 mg/L TN of recharge water at the lysimeters and the 5 mg/L TN at BRK-1/1 can be attributed to Brooks Basin being located in an area having nitrate in the groundwater.

SAT efficiency was estimated for individual samples by comparing surface water TOC and TN with lysimeter sample TOC and TN once an offset had been made for travel time. Estimating the travel time offset from the surface to a lysimeter depth can be made through correlation of time-series trends of percent recycled water in the surface water and percent recycled water at the lysimeter. Percent recycled water in the basin was estimated using the water volume changes in Brooks Basin and the daily delivery volumes and water types (Table 3-2). A mathematical relationship was then determined between percent recycled water in Brooks Basin and the measured surface water EC. With that same relationship, the EC at the 25-foot lysimeter was used to estimate the percent recycled water at the 25-foot lysimeter (Table 4-1a). Table 4-1a, Table 4-2a, and Table 4-4a contain percent recycled water data derived from these earlier recharge volume tables paired with contemporary weekly lysimeter samples. Percent recycled water at the lysimeters is estimated from variations in the EC sampled at depth from the EC of the source waters (recycled, imported, and local runoff).

Figure 4-4 shows the correlation of percent recycled water trends for Brooks Basin. The 25-foot lysimeter is used for correlation as it the deepest lysimeter having a generally consistent TOC data set with no anomalies. Correlations of times of high and low percent recycled water are readily observable and are indicated on Figure 4-4 with arrows and labels of time offset in days. The figure indicates that travel time was not uniform during the Start-Up Period, but slowed as the period progressed. Initial travel time to the 25-foot lysimeter was approximately 1 week, but quickly increased to about 21 days. The travel times to the 25-foot lysimeter generally lengthened to approximately 56 days following 3 months of recharge and continued to increase as recharge kept the basin fairly full of water (greater than 15 feet of water). During February 2009, recycled water recharge was slowed to allow the capture of stormwater. During this time, the travel time decreased to approximately 42 days, but increased again to 56 days once steady recycled water recharge resumed. These changes are likely due to changes in saturation, gradual basin clogging, and variations in water delivery rates.

The time offset data were then used to pair TOC and TN values of surface and lysimeter water. The result of this pairing provides the basis for SAT efficiency calculation by individual samples. Table 5-1 and Table 5-2 list the results of the SAT efficiency estimates for individual correlation of TOC and TN samples, respectively. For ease of comparison in these tables, the offset periods of surface water to lysimeter depth are color coded. The first value in a color for surface water correlates with the first value in the same color for the lysimeter samples.

Figure 5-2 and Figure 5-3 are graphs of percent recycled water at the 25-foot lysimeter and the SAT removal efficiency for TOC and for TN, respectively. These figures indicate that **at**

Brooks Basin (25-foot lysimeter) the SAT removal efficiency for TOC is generally between 45 and 70 percent and the SAT removal efficiency for TN is generally between 83 and 95 percent. Comparison of SAT efficiencies for TOC and TN removal over the range of percent recycled water at the lysimeter indicates SAT is equally efficient over the range of recycled water percentage **(generally 35 to 95 percent recycled water at the 25-foot lysimeter).**

6. Start-Up Period

6.1 Determination of the Start-Up Period

Order R8-2007-0039 establishes a Start-Up Period for each recharge basin in the Chino Basin Recycled Water Groundwater Recharge Program (Finding 11, page 4):

> . . . a Start-Up Period will be used at the outset of recycled water recharge operations. The purposes of each Start-Up Period are to establish site characteristics, including percolation rates, the physical characteristics of the vadose zone and soil aquifer treatment efficiency, and to establish a sampling regime, based on these characteristics, that is representative of recycled water following soil aquifer treatment. The length of the Start-Up Period at each basin will be contingent on site characteristics, including percolation rates and recycled water transit time in the subsurface. The Start-up Period shall last up to 180 days following commencement of recharge of recycled water to each basin, except if recharge of recycled water at that basin is significantly interrupted, for example due to storm event(s). . . . This Order requires IEUA to submit for CDHS [sic, now CDPH] and Regional Board approval a proposed Start-Up Period protocol at least two weeks prior to beginning each Start-Up Period. A Start–Up Period report will be prepared at the close of each Start-Up Period and will include recommendations for the optimum depths and locations for placement of lysimeters that will be used to measure compliance, and for a compliance-monitoring program. The report will also include recommendations for the maximum running monthly average Recycled Water Contribution and maximum running average Total Organic Carbon (TOC) limit for the initial year of recharge operations following the Start-Up Period.

The Start-Up Period for each basin will be long enough to demonstrate effective TOC removal. As long as TOC concentrations continue to decline over time, the basin is still deemed to be in the Start-Up Period, up to 180 days unless interrupted.

Recycled water delivery for the Start-Up Period, began on August 6, 2008. During the Brooks Basin Start-Up Period, storm water interrupted deliveries for approximately one month, but proved useful in providing a diluent water source to track travel times to various depths. The percent recycled water at the 25-foot lysimeter was less than 50% for about 5 months from January to May 2009. The Brooks Basin Start-up Period was also increased in duration to allow incorporation of the Brooks Tracer Experiment. The tracer experiment report was completed by Dr. Jordan Clark of UC Santa Barbara in December 2009. **The actual Start-Up Period for Brooks Basin was August 2008 through December 2009.**

6.2 Compliance Point Selection

Section B.6 of Order R8-2007-00039 allows lysimeters or an "alternative-monitoring plan" be used to demonstrate SAT and for compliance with requirements of the order. However, the compliance point may be any point prior to groundwater that is predominately recycled water. Order R8-2007-0039 states in Section B6:

> . . . An alternative-monitoring plan may be approved upon submission of sampling results that demonstrate that an equal level of public health protection is achieved. (See also Provision G.8 and G.9.) Upon development of a soil-aquifer treatment factor using recharge demonstration studies, lysimeter based compliance monitoring may be replaced with recycled water measurements leaving the treatment plant and the application of the treatment factor with prior approval by the CDHS[sic, now CDPH] and the Regional Board Executive Officer.

The need for an alternate monitoring plan is evidenced by 1) the significant and increasing time delay between delivery of water to the Brooks Basin and percolation to the deeper lysimeters. Only the 5-foot lysimeter has immediate response to changes in surface water EC, while the deeper lysimeters have delayed responses of over 50 days with continuous recharge. IEUA and CBWM therefore propose an alternative sampling plan for monitoring recycled water recharge at Brooks Basin. As discussed in Section 5, the SAT is quite effective to the observed depth of 25 feet and continues as recharge migrates downward to groundwater depths of 310 to 350 feet at monitoring well BRK-1/1 at the basin. While the benefits of SAT are observed at the 35-foot lysimeter, this sample depth does show some anomalous TOC values that make it unsuitable for long-term compliance monitoring. Due to the variability and large number of days of vertical travel time to the 25-foot lysimeter (over 50 days with continual recharge), weekly lysimeter monitoring during recharge is not practical at the shallow depths.

IEUA and CBWM are recommending an alternate monitoring plan to conduct monthly sampling of the Brooks Basin surface water, 25-foot lysimeter and monitoring well BRK-1/1. Sampling will be for EC, TOC, and TN at all the points and will be conducted as long as recycled water has been recharged in the prior 180 days. The 25-foot lysimeter will be the compliance point for TN and the monitoring well will be the compliance point for TOC. The monitoring well cannot be the compliance point for TN as the region has groundwater with TN above the compliance limit for recycled water recharge. During implementation of the alternate monitoring plan, Cl will also be sampled from BRK-1/1 and used to verify the presence of recycled water at approximately 40% or higher (Cl greater than 65 mg/L).

The alternate monitoring plan will provide the "equal level of public protection" required by verifying continued TOC removal with depth. Historical monitoring and quarterly compliance reporting of wells BRK-1/1 has demonstrated TOC concentrations of less than or equal to 1.3 mg/L with recycled water present. The alternative sampling plan will simplify sampling and data evaluation by eliminating the need to manage the progressively changing underground travel-time by tracking and offsetting lysimeter sample events times from the time of water delivery to the basin.

6.3 Maximum RWC Determination

The maximum RWC is determined as specified within Order R8-2007-0039. Finding 12 of the Order states:

> This Order does not establish maximum average recycled water contributions (RWC) at each basin, but requires the users to determine the maximum average RWC through the Start-Up Period for each recharge basin. The determined RWC must be approved by CDHS [sic, now CDPH] and the Regional Board.

Recycled Water Quality Specification Section A.10 states,

> At each recharge basin, the monthly average TOC concentration of the recycled water prior to reaching the regional groundwater table shall not exceed the average TOC value calculated from the following formula:
>
> TOCaverage = 0.5 mg/L ÷ RWCaverage

Section B.6 of Order R8-2007-0039 states:

> Compliance with average TOC concentration limits specified in Recycled Water Quality Specifications A.11., above, shall be determined based on a lysimeter-based monitoring program performed at each individual recharge basin and allowing for recycled water percolation to the lysimeters to demonstrate soil aquifer treatment efficiency, unless recycled water TOC compliance can be demonstrated prior to recharge. Compliance shall be based on the running average of the most recent 20 lysimeter sample test results representative of recycled water samples.

Table 4-2a shows the 20-sample rolling average rolling TOC concentrations for all Brooks Basin lysimeters depths at the end of April 28, 2009. For the 25-foot lysimeter, the running TOC average was 2.02 mg/L and would provide a maximum RWC limit of 25 percent. However, based on the observation of recycled water in monitoring well BRK-1/1 and the continued removal of TOC by SAT of this monitoring point, the proposed monitoring well compliance point running average TOC of 1.2 mg/L would provide a maximum RWC limit of 42 percent. California Draft Groundwater Recharge Regulations and Order No. R8-2007-0039 limit the maximum RWC by basin to 50 percent for recycled water produced by tertiary treatment.

Monitoring well BRK-1/1 water levels do not respond significantly to local pumping, thus use of BRK1/1 as a compliance monitoring point should not be considered part of the regional aquifer and is a suitable recharge mound monitoring location. BRK-1/1 thus meets the intent of the Order that the compliance point reflect the “TOC concentration of the recycled water prior to reaching the regional groundwater table”.

7. RWC Management Plan

RWC management is needed to keep a basin's volume-based RWC within the maximum RWC limit determined by the 20-sample rolling average TOC. A basin's volume-based RWC is determined by a 120-month rolling average ratio of recycled water volume to total recharge volume. Total recharge volume is recharge from all sources including stormwater, local runoff, groundwater underflow, imported water, and recycled water. Per Order No. R8-2009-0057, during the Start-Up Period and up to 120-months of recharge after the initiation of recharge, the volume-based RWC may exceed the maximum RWC limit, but must be within the limit by month 120.

Order No. R8-2009-0057, Section F.20

> The Discharger shall submit a RWC Management Plan to the CDPH and the Regional Board that includes estimates of future average RWCs based on anticipated recharge operations over the first 120 months of recycled water recharge at each recharge site. The RWC Management Plan shall be submitted with the Start-Up Period Report and updated with IEUA's annual report to the Regional Board during the first 120-months and shall clearly identify the plan to achieve compliance with the maximum recycled water contribution by the 120th month at each recharge site. IEUA shall update the basin-specific RWC plans annually to reflect the estimated diluent water and recycled water contributions for the upcoming year. For the purpose of the diluent water projections, implementation of a weighted averaging should be considered when it is known that imported water supplies will not be available for purposes of recharging the aquifer. The underflow of the Chino Basin aquifer may be used as a source of diluent water. CDPH may consider crediting a fraction of the flow as diluent water, which would be dependent on the accuracy of the method used to measure the flow, its distribution, and the ability to meet the other diluent water criteria in the draft regulation.

An RWC Management Plan is developed for a recharge site, by preparing a history of past recharge and then determining future recharge that will keep the volume-based RWC within the maximum RWC limit. Future recharge must be estimated. Estimated future stormwater diluent water is based on the historical averages for each month of the year. Imported water supplies are not forecasted. Recycled water recharge is then added to the plan at regular intervals to keep the RWC in compliance.

The initial RWC Management Plan for Brooks Basin is presented in Table 7-1. A graph of the plan is presented on Figures 7-1 which shows the past 60 months of operational data and a forecast for the following 120 months of the management plan. These RWC Management Plans will be updated with each annual report of the Recycled Water Groundwater Recharge Program.

8. Initial Year Monitoring Plan

Start-up period report requirements include an initial year monitoring plan. As discussed in the prior sections and as shown in the tables and graphs included in this report, TN compliance criteria are met consistently at all lysimeters deeper than 5 feet, and the TOC is reduced 50 percent or more by SAT at depths of 25 feet. **Due to these outstanding results and trends seen in the lysimeter and monitoring well data, IEUA recommends a first year monitoring plan consisting of monthly sampling of TOC, TN, and EC from the basin, EC and TN from the 25-foot lysimeter, and EC, TOC, and Cl from monitoring well BRK-1/1.** This plan is consistent with the alternative monitoring plan presented in Section 6 and consistent with the recharge permit for compliance monitoring. The first year of operation is defined herein to be the 365 days beginning with the resumption of recycled water recharge following submission and acceptance of the Start-Up Period Report.

9. References

California Regional Water Quality Control Board, Santa Ana Region. 2005. Order No. R8-2005-0033, Water Recycling Requirements for Inland Empire Utilities Agency and Chino Basin Watermaster, Phase 1 Chino Basin Recycled Water Groundwater Recharge Project, San Bernardino County, April 15, 2005.

California Regional Water Quality Control Board, Santa Ana Region, 2007a, Order No. R8-2007-0039, Water Recycling Requirements for Inland Empire Utilities Agency and Chino Basin Watermaster, Chino Basin Recycled Water Groundwater Recharge Program, Phase I and Phase II Projects, June 29, 2007.

California Regional Water Quality Control Board, Santa Ana Region, 2007b, Monitoring and Reporting Program No. R8-2007-0039 for Inland Empire Utilities Agency and Chino Basin Watermaster Chino Basin Recycled Water Groundwater Recharge Program Phase I and Phase II Projects San Bernardino County.

IEUA, 2008, Start-Up Protocol Plan for Brooks Street Basin, June 13, 2008.

IEUA, 2010, Chino Basin Recycled Water Groundwater Recharge Program, 2009 Annual Report, May 1, 2010.

National Water Resources Institute, 2010, Final Report of the February 8-9, 2010, Meeting of the Independent Advisory Panel, for the Inland Empire Utilities Agency's Groundwater Recharge Permit Amendment, April 14, 2010.

Wildermuth Environmental, Inc., 1999, Chino Basin Optimum Basin Management Program, Phase 1 Report, Prepared for the Chino Basin Watermaster, 1999.

TABLES

Table 3-1
Brooks Basin Historical Diluent Water Recharge
(acre-feet)

Fiscal Year	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2005/06	32.7	175.3	684.2	127.4	389.5	363.0	257.1	392.6	214.9	261.3	300.7	371.0	3,569.7
2006/07	206.4	151.0	342.5	306.9	287.7	261.8	112.5	129.1	3.5	102.0	4.0	2.0	1,909.5
2007/08	0.0	0.0	25.0	35.0	24.0	42.0	282.0	50.0	9.0	4.0	43.0	3.0	517.0
2008/09	3.0	16.0	0.0	0.0	23.0	162.0	25.0	208.0	30.0	3.0	17.0	0.0	487.0
2009/10	1.0	0.0	0.0	13.0	4.0	129.0	251.0	215.0	27.0	23.0	2.0	1.0	666.0
Total by Mo.	243.1	342.3	1,051.7	482.3	728.2	957.8	927.6	994.7	284.4	393.3	366.7	377.0	7,149.2

Notes:

1) Groundwater underflow (not tabulated in the above) is also credited as diluent water in the 120-month running average RWC calculation. For Brooks Basin, the groundwater underflow was estimated at 6,111 AFY (509 AF per month) using a Darcian calculation and conservative limits identified by an expert panel (Appendix G of IEUA, 2010).
2) Table 7-1 contains a breakdown of stormwater and imported water diluent recharged at Brook Basin.

Table 3-2
Brooks Basin
Brooks Basin Daily Water Deliveries During the Start-Up Period

Date	Diluent Water (AF)			Recycled Water		Brooks Basin	
	Import	Local	Total	(AF)	% in Basin	Water Depth (feet)	Volume (AF)
08/01/08	0.0	0.1	0.1	0.0	0%		
08/02/08	0.0	0.1	0.1	0.0	0%		
08/03/08	0.0	0.1	0.1	0.0	0%		
08/04/08	0.0	0.1	0.1	0.0	0%		
08/05/08	0.0	0.1	0.1	0.0	0%		0.0
08/06/08	0.0	0.1	0.1	0.7	78%		0.9
08/07/08	0.0	0.1	0.1	3.7	96%		4.6
08/08/08	0.0	0.1	0.1	6.0	99%		5.8
08/09/08	0.0	0.1	0.1	6.5	99%		6.9
08/10/08	0.0	0.1	0.1	6.5	99%		8.1
08/11/08	0.0	0.1	0.1	6.6	99%		9.3
08/12/08	0.0	0.1	0.1	6.6	99%		10.4
08/13/08	0.0	0.1	0.1	6.6	99%		11.6
08/14/08	0.0	0.1	0.1	6.6	99%		12.8
08/15/08	0.0	0.1	0.1	6.6	99%		13.9
08/16/08	0.0	0.1	0.1	6.6	99%	6.0	15.1
08/17/08	0.0	3.8	3.8	6.6	84%		15.7
08/18/08	0.0	4.7	4.7	6.6	74%		16.3
08/19/08	0.0	4.7	4.7	6.6	67%		16.9
08/20/08	0.0	0.6	0.6	6.6	75%		17.5
08/21/08	0.0	0.1	0.1	2.5	77%		18.2
08/22/08	0.0	0.1	0.1	2.5	80%		18.8
08/23/08	0.0	0.0	0.0	2.5	82%		19.4
08/24/08	0.0	0.0	0.0	2.5	84%		20.0
08/25/08	0.0	0.0	0.0	2.5	86%		20.6
08/26/08	0.0	0.0	0.0	2.5	87%		21.2
08/27/08	0.0	0.0	0.0	2.5	89%		21.8
08/28/08	0.0	0.0	0.0	2.5	90%		22.5
08/29/08	0.0	0.0	0.0	2.5	91%		23.1
08/30/08	0.0	0.0	0.0	2.5	92%		23.7
08/31/08	0.0	0.0	0.0	2.5	93%		24.3
09/01/08	0.0	0.0	0.0	2.5	93%	8.1	24.9
09/02/08	0.0	0.0	0.0	2.5	94%		23.9
09/03/08	0.0	0.0	0.0	2.5	94%		23.0
09/04/08	0.0	0.0	0.0	1.0	95%		22.0
09/05/08	0.0	0.0	0.0	0.0	95%		21.0
09/06/08	0.0	0.0	0.0	0.0	95%		20.0
09/07/08	0.0	0.0	0.0	0.0	95%		19.1
09/08/08	0.0	0.0	0.0	0.0	95%		18.1
09/09/08	0.0	0.0	0.0	0.0	95%		17.1
09/10/08	0.0	0.0	0.0	1.0	95%		16.1
09/11/08	0.0	0.0	0.0	2.6	96%		15.2
09/12/08	0.0	0.0	0.0	2.6	96%		14.2
09/13/08	0.0	0.0	0.0	2.6	97%		13.2
09/14/08	0.0	0.0	0.0	2.6	97%		12.2
09/15/08	0.0	0.0	0.0	2.6	98%		11.3
09/16/08	0.0	0.0	0.0	2.6	98%	4.9	10.3
09/17/08	0.0	0.0	0.0	2.6	99%		11.5
09/18/08	0.0	0.0	0.0	2.6	99%		12.6
09/19/08	0.0	0.0	0.0	2.6	99%		13.8
09/20/08	0.0	0.0	0.0	2.6	99%		15.0
09/21/08	0.0	0.0	0.0	2.6	99%		16.2
09/22/08	0.0	0.0	0.0	8.6	100%		17.3
09/23/08	0.0	0.0	0.0	8.6	100%		18.5
09/24/08	0.0	0.0	0.0	8.6	100%		19.7
09/25/08	0.0	0.0	0.0	8.6	100%		20.9
09/26/08	0.0	0.0	0.0	3.6	100%		22.0
09/27/08	0.0	0.0	0.0	0.0	100%		23.2
09/28/08	0.0	0.0	0.0	0.0	100%		24.4
09/29/08	0.0	0.0	0.0	2.0	100%		25.5
09/30/08	0.0	0.0	0.0	7.0	100%		26.7
10/01/08	0.0	0.0	0.0	6.0	100%	8.7	27.9
10/02/08	0.0	0.0	0.0	6.1	100%		28.7
10/03/08	0.0	0.0	0.0	2.8	100%		29.4
10/04/08	0.0	0.0	0.0	5.0	100%		30.2
10/05/08	0.0	0.0	0.0	5.1	100%		31.0
10/06/08	0.0	0.0	0.0	5.1	100%		31.7
10/07/08	0.0	0.0	0.0	4.6	100%		32.5
10/08/08	0.0	0.0	0.0	5.1	100%		33.3
10/09/08	0.0	0.0	0.0	5.7	100%		34.0
10/10/08	0.0	0.0	0.0	5.7	100%		34.8
10/11/08	0.0	0.0	0.0	6.0	100%		35.6
10/12/08	0.0	0.0	0.0	5.9	100%		36.3
10/13/08	0.0	0.0	0.0	5.4	100%		37.1
10/14/08	0.0	0.0	0.0	5.0	100%		37.9
10/15/08	0.0	0.0	0.0	4.1	100%		38.6

Table 3-2
Brooks Basin
Brooks Basin Daily Water Deliveries During the Start-Up Period

Date	Diluent Water (AF)			Recycled Water		Brooks Basin	
	Import	Local	Total	(AF)	% in Basin	Water Depth (feet)	Volume (AF)
10/16/08	0.0	0.0	0.0	5.1	100%	10.8	39.4
10/17/08	0.0	0.0	0.0	6.3	100%		39.4
10/18/08	0.0	0.0	0.0	6.5	100%		39.5
10/19/08	0.0	0.0	0.0	6.6	100%		39.5
10/20/08	0.0	0.0	0.0	6.5	100%		39.5
10/21/08	0.0	0.0	0.0	5.4	100%		39.6
10/22/08	0.0	0.0	0.0	5.3	100%		39.6
10/23/08	0.0	0.0	0.0	5.2	100%		39.6
10/24/08	0.0	0.0	0.0	5.1	100%		39.7
10/25/08	0.0	0.0	0.0	5.1	100%		39.7
10/26/08	0.0	0.0	0.0	5.1	100%		39.7
10/27/08	0.0	0.0	0.0	5.2	100%		39.8
10/28/08	0.0	0.0	0.0	5.1	100%		39.8
10/29/08	0.0	0.0	0.0	5.0	100%		39.8
10/30/08	0.0	0.0	0.0	5.3	100%		39.9
10/31/08	0.0	0.0	0.0	5.2	100%		39.9
11/01/08	0.0	0.0	0.0	5.1	100%	10.9	39.9
11/02/08	0.0	0.0	0.0	5.2	100%		39.7
11/03/08	0.0	0.0	0.0	4.6	100%		39.4
11/04/08	0.0	0.0	0.0	0.9	100%		39.2
11/05/08	0.0	0.0	0.0	4.6	100%		38.9
11/06/08	0.0	0.0	0.0	7.0	100%		38.7
11/07/08	0.0	0.0	0.0	8.7	100%		38.4
11/08/08	0.0	0.0	0.0	8.7	100%		38.2
11/09/08	0.0	0.0	0.0	8.7	100%		37.9
11/10/08	0.0	0.0	0.0	8.7	100%		37.7
11/11/08	0.0	0.0	0.0	2.7	100%		37.4
11/12/08	0.0	0.0	0.0	0.0	100%		37.2
11/13/08	0.0	0.0	0.0	0.0	100%		36.9
11/14/08	0.0	0.0	0.0	0.0	100%		36.6
11/15/08	0.0	0.0	0.0	0.0	100%		36.4
11/16/08	0.0	0.0	0.0	0.0	100%	10.3	36.1
11/17/08	0.0	0.0	0.0	7.5	100%		36.7
11/18/08	0.0	0.0	0.0	6.9	100%		37.3
11/19/08	0.0	0.0	0.0	4.2	100%		37.8
11/20/08	0.0	0.0	0.0	4.2	100%		38.4
11/21/08	0.0	0.0	0.0	4.2	100%		38.9
11/22/08	0.0	0.0	0.0	4.2	100%		39.5
11/23/08	0.0	0.0	0.0	4.2	100%		40.1
11/24/08	0.0	0.0	0.0	2.6	100%		40.6
11/25/08	0.0	0.0	0.0	0.0	100%		41.2
11/26/08	0.0	18.7	18.7	0.0	69%		41.7
11/27/08	0.0	4.1	4.1	0.0	63%		42.3
11/28/08	0.0	0.0	0.0	0.0	63%		42.8
11/29/08	0.0	0.0	0.0	0.0	63%		43.4
11/30/08	0.0	0.0	0.0	0.0	63%		44.0
12/01/08	0.0	0.1	0.1	5.0	66%	11.8	44.5
12/02/08	0.0	0.1	0.1	4.3	69%		49.9
12/03/08	0.0	0.1	0.1	6.7	73%		55.3
12/04/08	0.0	0.1	0.1	7.4	76%		60.7
12/05/08	0.0	0.1	0.1	7.4	78%		66.0
12/06/08	0.0	0.1	0.1	7.4	80%		71.4
12/07/08	0.0	0.1	0.1	7.4	82%		76.8
12/08/08	0.0	0.1	0.1	7.4	84%		82.2
12/09/08	0.0	0.1	0.1	4.8	84%		87.5
12/10/08	0.0	0.1	0.1	0.0	84%		92.9
12/11/08	0.0	0.1	0.1	0.0	84%		98.3
12/12/08	0.0	0.1	0.1	0.0	84%		103.7
12/13/08	0.0	0.1	0.1	0.0	84%		109.0
12/14/08	0.0	0.1	0.1	0.0	84%		114.4
12/15/08	0.0	89.0	89.0	0.0	47%		119.8
12/16/08	0.0	0.1	0.1	0.0	47%	22.8	125.2
12/17/08	0.0	49.8	49.8	0.0	34%		123.8
12/18/08	0.0	0.1	0.1	0.0	34%		122.5
12/19/08	0.0	0.1	0.1	0.0	34%		121.1
12/20/08	0.0	0.1	0.1	0.0	34%		119.8
12/21/08	0.0	0.1	0.1	0.0	34%		118.4
12/22/08	0.0	0.1	0.1	0.0	34%		117.1
12/23/08	0.0	0.1	0.1	0.0	34%		115.8
12/24/08	0.0	0.1	0.1	0.0	34%		114.4
12/25/08	0.0	20.0	20.0	0.0	29%		113.1
12/26/08	0.0	0.1	0.1	0.0	29%		111.7
12/27/08	0.0	0.1	0.1	0.0	29%		110.4
12/28/08	0.0	0.1	0.1	0.0	28%		109.0
12/29/08	0.0	0.1	0.1	6.9	33%		107.7
12/30/08	0.0	0.1	0.1	11.6	39%		106.3
12/31/08	0.0	0.1	0.1	11.6	45%		105.0

Table 3-2
Brooks Basin
Brooks Basin Daily Water Deliveries During the Start-Up Period

Date	Diluent Water (AF)			Recycled Water		Brooks Basin	
	Import	Local	Total	(AF)	% in Basin	Water Depth (feet)	Volume (AF)
01/01/09	0.0	0.1	0.1	11.4	50%	20.2	103.6
01/02/09	0.0	0.1	0.1	11.1	55%		106.4
01/03/09	0.0	0.1	0.1	10.7	59%		109.1
01/04/09	0.0	0.1	0.1	10.7	63%		111.8
01/05/09	0.0	0.1	0.1	10.5	66%		114.5
01/06/09	0.0	0.1	0.1	11.0	69%		117.3
01/07/09	0.0	0.1	0.1	11.0	72%		120.0
01/08/09	0.0	0.1	0.1	11.0	74%		122.7
01/09/09	0.0	4.0	4.0	11.0	74%		125.4
01/10/09	0.0	4.5	4.5	11.0	74%		128.2
01/11/09	0.0	4.5	4.5	13.4	74%		130.9
01/12/09	0.0	4.5	4.5	13.4	74%		133.6
01/13/09	0.0	0.5	0.5	13.4	76%		136.3
01/14/09	0.0	0.1	0.1	13.4	78%		139.1
01/15/09	0.0	0.1	0.1	13.5	80%		141.8
01/16/09	0.0	0.1	0.1	13.7	82%	25.0	144.5
01/17/09	0.0	0.1	0.1	13.7	83%		142.2
01/18/09	0.0	0.1	0.1	13.7	85%		139.9
01/19/09	0.0	0.1	0.1	13.6	86%		137.6
01/20/09	0.0	0.1	0.1	6.0	86%		135.3
01/21/09	0.0	0.1	0.1	0.0	86%		133.0
01/22/09	0.0	0.1	0.1	0.0	86%		130.7
01/23/09	0.0	1.4	1.4	0.0	85%		128.4
01/24/09	0.0	0.1	0.1	0.0	85%		126.1
01/25/09	0.0	0.1	0.1	0.0	85%		123.8
01/26/09	0.0	3.3	3.3	7.7	84%		121.5
01/27/09	0.0	0.1	0.1	13.7	86%		119.2
01/28/09	0.0	0.1	0.1	13.2	87%		116.9
01/29/09	0.0	0.1	0.1	4.6	87%		114.6
01/30/09	0.0	0.5	0.5	0.0	87%		112.3
01/31/09	0.0	0.1	0.1	0.0	87%		110.0
02/01/09	0.0	0.1	0.1	0.0	87%	20.7	107.7
02/02/09	0.0	0.1	0.1	4.8	87%		109.9
02/03/09	0.0	0.1	0.1	10.5	88%		112.1
02/04/09	0.0	0.1	0.1	4.4	89%		114.3
02/05/09	0.0	29.2	29.2	0.0	71%		116.5
02/06/09	0.0	54.3	54.3	0.0	48%		118.8
02/07/09	0.0	17.0	17.0	0.0	42%		121.0
02/08/09	0.0	0.1	0.1	0.0	42%		123.2
02/09/09	0.0	29.1	29.1	0.0	34%		125.4
02/10/09	0.0	0.1	0.1	0.0	34%		127.6
02/11/09	0.0	0.1	0.1	0.0	34%		129.8
02/12/09	0.0	0.1	0.1	0.0	34%		132.1
02/13/09	0.0	21.2	21.2	0.0	29%		134.3
02/14/09	0.0	0.1	0.1	0.0	29%		136.5
02/15/09	0.0	0.1	0.1	0.0	29%		138.7
02/16/09	0.0	39.7	39.7	0.0	23%	24.6	140.9
02/17/09	0.0	15.1	15.1	0.0	21%		138.4
02/18/09	0.0	0.1	0.1	0.0	21%		135.8
02/19/09	0.0	0.1	0.1	0.0	21%		133.3
02/20/09	0.0	0.1	0.1	0.0	21%		130.7
02/21/09	0.0	0.1	0.1	0.0	20%		128.1
02/22/09	0.0	0.1	0.1	0.0	20%		125.6
02/23/09	0.0	0.1	0.1	0.0	20%		123.0
02/24/09	0.0	0.1	0.1	0.0	20%		120.5
02/25/09	0.0	0.1	0.1	0.0	20%		117.9
02/26/09	0.0	0.1	0.1	0.0	20%		115.3
02/27/09	0.0	0.1	0.1	0.0	20%		112.8
02/28/09	0.0	0.1	0.1	0.0	20%		110.2
03/01/09	0.0	0.1	0.1	0.0	20%	19.8	107.7
03/02/09	0.0	0.1	0.1	0.0	20%		106.4
03/03/09	0.0	0.1	0.1	0.0	20%		105.1
03/04/09	0.0	3.0	3.0	0.0	20%		103.7
03/05/09	0.0	1.4	1.4	0.0	19%		102.4
03/06/09	0.0	4.5	4.5	0.0	19%		101.1
03/07/09	0.0	4.5	4.5	0.0	18%		99.8
03/08/09	0.0	4.5	4.5	0.0	17%		98.5
03/09/09	0.0	4.5	4.5	0.0	16%		97.2
03/10/09	0.0	2.3	2.3	0.0	16%		95.9
03/11/09	0.0	0.1	0.1	0.0	16%		94.6
03/12/09	0.0	0.1	0.1	6.0	21%		93.3
03/13/09	0.0	0.1	0.1	12.0	30%		92.0
03/14/09	0.0	0.1	0.1	12.0	38%		90.7
03/15/09	0.0	0.1	0.1	12.0	45%		89.3

Table 3-2
Brooks Basin
Brooks Basin Daily Water Deliveries During the Start-Up Period

Date	Diluent Water (AF)			Recycled Water		Brooks Basin	
	Import	Local	Total	(AF)	% in Basin	Water Depth (feet)	Volume (AF)
03/16/09	0.0	0.1	0.1	12.0	52%	18.2	88.0
03/17/09	0.0	0.1	0.1	12.0	57%		88.0
03/18/09	0.0	0.1	0.1	12.0	62%		87.9
03/19/09	0.0	0.1	0.1	12.7	67%		87.9
03/20/09	0.0	0.1	0.1	6.0	69%		87.8
03/21/09	0.0	0.1	0.1	6.0	71%		87.8
03/22/09	0.0	2.9	2.9	6.0	71%		87.8
03/23/09	0.0	0.1	0.1	6.0	72%		87.7
03/24/09	0.0	0.1	0.1	6.0	74%		87.7
03/25/09	0.0	0.1	0.1	11.1	77%		87.6
03/26/09	0.0	0.1	0.1	7.5	79%		87.6
03/27/09	0.0	0.1	0.1	0.0	79%		87.5
03/28/09	0.0	0.1	0.1	0.0	79%		87.5
03/29/09	0.0	0.1	0.1	0.0	78%		87.4
03/30/09	0.0	0.1	0.1	8.0	80%		87.4
03/31/09	0.0	0.1	0.1	12.0	82%		87.3
04/01/09	0.0	0.0	0.0	12.0	85%	18.1	87.3
04/02/09	0.0	0.0	0.0	11.0	86%		86.9
04/03/09	0.0	0.0	0.0	10.2	88%		86.6
04/04/09	0.0	0.0	0.0	9.9	89%		86.2
04/05/09	0.0	0.0	0.0	9.9	90%		85.9
04/06/09	0.0	0.0	0.0	10.0	91%		85.5
04/07/09	0.0	0.0	0.0	6.3	92%		85.2
04/08/09	0.0	0.0	0.0	0.7	92%		84.8
04/09/09	0.0	0.0	0.0	3.4	92%		84.5
04/10/09	0.0	1.1	1.1	0.8	91%		84.1
04/11/09	0.0	0.0	0.0	0.0	91%		83.8
04/12/09	0.0	0.0	0.0	0.0	91%		83.4
04/13/09	0.0	0.0	0.0	9.0	92%		83.1
04/14/09	0.0	0.0	0.0	13.9	93%		82.7
04/15/09	0.0	0.0	0.0	15.1	94%		82.4
04/16/09	0.0	0.0	0.0	15.6	95%	17.4	82.0
04/17/09	0.0	0.0	0.0	13.0	96%		86.0
04/18/09	0.0	0.0	0.0	13.6	96%		89.9
04/19/09	0.0	0.0	0.0	14.1	97%		93.8
04/20/09	0.0	0.0	0.0	14.1	97%		97.8
04/21/09	0.0	0.0	0.0	13.3	98%		101.7
04/22/09	0.0	0.0	0.0	13.9	98%		105.6
04/23/09	0.0	0.0	0.0	11.5	98%		109.5
04/24/09	0.0	0.0	0.0	8.3	98%		113.5
04/25/09	0.0	0.0	0.0	8.0	98%		117.4
04/26/09	0.0	0.0	0.0	8.2	98%		121.3
04/27/09	0.0	0.0	0.0	13.8	99%		125.2
04/28/09	0.0	0.0	0.0	14.9	99%		129.2
04/29/09	0.0	0.0	0.0	12.1	99%		133.1
04/30/09	0.0	0.0	0.0	9.2	99%		137.0
05/01/09	0.0	0.0	0.0	0.0	99%	22.3	140.9
05/02/09	0.0	0.0	0.0	0.0	99%		137.2
05/03/09	0.0	0.0	0.0	0.0	99%		133.5
05/04/09	0.0	0.0	0.0	0.0	99%		129.8
05/05/09	0.0	0.0	0.0	1.2	99%		126.0
05/06/09	0.0	0.0	0.0	6.0	99%		122.3
05/07/09	0.0	0.0	0.0	6.2	99%		118.6
05/08/09	0.0	3.2	3.2	6.1	97%		114.8
05/09/09	0.0	3.3	3.3	6.3	94%		111.1
05/10/09	0.0	3.3	3.3	6.1	92%		107.4
05/11/09	0.0	3.3	3.3	8.6	90%		103.7
05/12/09	0.0	3.3	3.3	3.6	88%		99.9
05/13/09	0.0	0.3	0.3	3.2	88%		96.2
05/14/09	0.0	0.0	0.0	5.0	88%		92.5
05/15/09	0.0	0.0	0.0	5.4	89%		88.7
05/16/09	0.0	0.0	0.0	5.2	90%	17.8	85.0
05/17/09	0.0	0.0	0.0	5.0	90%		82.9
05/18/09	0.0	0.0	0.0	5.3	91%		80.8
05/19/09	0.0	0.0	0.0	4.8	91%		78.7
05/20/09	0.0	0.0	0.0	5.3	92%		76.5
05/21/09	0.0	0.0	0.0	4.8	92%		74.4
05/22/09	0.0	0.0	0.0	5.3	93%		72.3
05/23/09	0.0	0.0	0.0	5.1	93%		70.2
05/24/09	0.0	0.0	0.0	4.9	94%		68.1
05/25/09	0.0	0.0	0.0	5.2	94%		66.0
05/26/09	0.0	0.0	0.0	1.7	94%		63.8
05/27/09	0.0	0.0	0.0	2.9	95%		61.7
05/28/09	0.0	0.0	0.0	2.2	95%		59.6
05/29/09	0.0	0.0	0.0	0.0	95%		57.5
05/30/09	0.0	0.0	0.0	0.0	95%		55.4
05/31/09	0.0	0.0	0.0	0.0	95%		53.2

Table 3-2
Brooks Basin
Brooks Basin Daily Water Deliveries During the Start-Up Period

Date	Diluent Water (AF)			Recycled Water		Brooks Basin	
	Import	Local	Total	(AF)	% in Basin	Water Depth (feet)	Volume (AF)
06/01/09	0.0	0.0	0.0	0.0	95%	12.9	51.1
06/02/09	0.0	0.0	0.0	0.0	95%		51.8
06/03/09	0.0	0.0	0.0	0.0	95%		52.4
06/04/09	0.0	0.0	0.0	5.4	95%		53.1
06/05/09	0.0	0.0	0.0	12.2	96%		53.7
06/06/09	0.0	0.0	0.0	12.0	97%		54.4
06/07/09	0.0	0.0	0.0	12.1	97%		55.0
06/08/09	0.0	0.0	0.0	11.9	98%		55.7
06/09/09	0.0	0.0	0.0	12.4	98%		56.3
06/10/09	0.0	0.0	0.0	11.0	99%		56.9
06/11/09	0.0	0.0	0.0	7.2	99%		57.6
06/12/09	0.0	0.0	0.0	0.0	99%		58.2
06/13/09	0.0	0.0	0.0	0.0	99%		58.9
06/14/09	0.0	0.0	0.0	0.0	99%		59.5
06/15/09	0.0	0.0	0.0	8.0	99%		60.2
06/16/09	0.0	0.0	0.0	15.7	99%	14.4	60.8
06/17/09	0.0	0.0	0.0	6.0	99%		60.2
06/18/09	0.0	0.0	0.0	3.0	99%		59.6
06/19/09	0.0	0.0	0.0	6.1	99%		59.0
06/20/09	0.0	0.0	0.0	5.8	99%		58.4
06/21/09	0.0	0.0	0.0	6.2	99%		57.8
06/22/09	0.0	0.0	0.0	8.4	99%		57.2
06/23/09	0.0	0.0	0.0	13.3	100%		56.6
06/24/09	0.0	0.0	0.0	4.6	100%		56.0
06/25/09	0.0	0.0	0.0	0.0	100%		55.4
06/26/09	0.0	0.0	0.0	2.8	100%		54.8
06/27/09	0.0	0.0	0.0	2.6	100%		54.2
06/28/09	0.0	0.0	0.0	0.0	100%		53.6
06/29/09	0.0	0.0	0.0	5.4	100%		52.9
06/30/09	0.0	0.0	0.0	6.0	100%		52.3
07/01/09	0.0	0.0	0.0	6.0	100%	13.0	51.7
07/02/09	0.0	0.0	0.0	0.0	100%		49.3
07/03/09	0.0	0.0	0.0	0.0	100%		46.8
07/04/09	0.0	0.0	0.0	0.0	100%		44.3
07/05/09	0.0	0.0	0.0	0.0	100%		41.8
07/06/09	0.0	0.0	0.0	0.0	100%		39.4
07/07/09	0.0	0.0	0.0	0.0	100%		36.9
07/08/09	0.0	0.0	0.0	0.0	100%		34.4
07/09/09	0.0	0.0	0.0	0.0	100%		32.0
07/10/09	0.0	0.0	0.0	0.0	100%		29.5
07/11/09	0.0	0.0	0.0	0.0	100%		27.0
07/12/09	0.0	0.0	0.0	0.0	100%		24.5
07/13/09	0.0	0.0	0.0	0.0	100%		22.1
07/14/09	0.0	0.0	0.0	0.0	100%		19.6
07/15/09	0.0	0.0	0.0	0.0	100%		17.1
07/16/09	0.0	0.0	0.0	0.0	100%	5.9	14.6
07/17/09	0.0	0.0	0.0	0.0			
07/18/09	0.0	0.0	0.0	0.0			
07/19/09	0.0	0.0	0.0	0.0		<4.7	
07/20/09	0.0	0.0	0.0	0.0			
07/21/09	0.0	0.0	0.0	0.0			
07/22/09	0.0	0.0	0.0	0.0			
07/23/09	0.0	0.0	0.0	0.0			
07/24/09	0.0	0.0	0.0	0.0			
07/25/09	0.0	0.0	0.0	0.0			
07/26/09	0.0	0.0	0.0	0.0			
07/27/09	0.0	0.0	0.0	0.0			
07/28/09	0.0	0.0	0.0	0.0			
07/29/09	0.0	0.0	0.0	0.0			
07/30/09	0.0	0.0	0.0	0.0			
07/31/09	0.0	0.0	0.0	0.0			
08/01/09	0.0	0.0	0.0	0.0		<4.7	
08/02/09	0.0	0.0	0.0	0.0			
08/03/09	0.0	0.0	0.0	3.3			
08/04/09	0.0	0.0	0.0	2.4			
08/05/09	0.0	0.0	0.0	1.8			
08/06/09	0.0	0.0	0.0	0.0			
08/07/09	0.0	0.0	0.0	0.0			
08/08/09	0.0	0.0	0.0	0.0			
08/09/09	0.0	0.0	0.0	0.0			
08/10/09	0.0	0.0	0.0	0.0			
08/11/09	0.0	0.0	0.0	0.0			
08/12/09	0.0	0.0	0.0	0.0			
08/13/09	0.0	0.0	0.0	0.0			
08/14/09	0.0	0.0	0.0	0.0			
08/15/09	0.0	0.0	0.0	0.0		<4.7	

NOTE: Total volume of water in Brooks Basin were obtained using the stage-storage curves for the basin contained in the CBWM Operations Manual, where a known water depth is used to look up a corresponding basin volume. The daily percent recycled water volume was calculated by dividing the daily volume of recycled water in basin storage by the total water volume in storage. The daily recycled water volume in basin storage was calculated by the prior day's volume of recycled water in storage + the next day's added recycled water volume, then dividing that sum by the sum of the prior days storage volume + the next day's water diversions and multiplying by the total volume in basin storage.

Table 3-3
Brooks Basin Historical Monthly Water Deliveries and RWC

Date		No. Mos. Since Initial RW Delivery	SW (AF)	MWD (AF)	Underflow (AF)	DW Total (AF)	DW 120-Month Total (AF)	RW (AF)	RW 120-Month Total (AF)	DW + RW 120-Month Total (AF)	RWC	Source
2005/06	Jul '05	-36	32.7	0.		33						MEASURED
	Aug '05	-35	0.	175.3		175						
	Sep '05	-34	0.	684.2		684						
	Oct '05	-33	5.5	121.9		127						
	Nov '05	-32	59.5	330.		390						
	Dec '05	-31	31.8	331.2		363						
	Jan '06	-30	12.	245.1		257						
	Feb '06	-29	160.4	232.2		393						
	Mar '06	-28	204.9	10.		215						
	Apr '06	-27	156.3	105.		261						
	May '06	-26	16.6	284.1		301						
	Jun '06	-25	0.	371.		371						
2006/07	Jul '06	-24	0.	206.4		206						
	Aug '06	-23	20.	131.		151						
	Sep '06	-22	21.	321.5		343						
	Oct '06	-21	14.	292.9		307						
	Nov '06	-20	30.	257.7		288						
	Dec '06	-19	30.8	231.		262						
	Jan '07	-18	25.3	87.2		113						
	Feb '07	-17	62.2	66.9		129						
	Mar '07	-16	3.5	0.		4						
	Apr '07	-15	102.	0.		102						
	May '07	-14	4.	0.		4						
	Jun '07	-13	2.	0.		2						
2007/08	Jul '07	-12	0.	0.		0						MEASURED
	Aug '07	-11	0.	0.		0						
	Sep '07	-10	25.	0.		25						
	Oct '07	-9	35.	0.		35						
	Nov '07	-8	24.	0.		24						
	Dec '07	-7	42.	0.		42						
	Jan '08	-6	282.	0.		282						
	Feb '08	-5	50.	0.		50						
	Mar '08	-4	9.	0.		9						
	Apr '08	-3	4.	0.		4						
	May '08	-2	43.	0.		43						
	Jun '08	-1	3.	0.		3						
2008/09	Jul '08	0	3.	0.		3	5,999	0	0	5,999	0%	
	Aug '08	1	16.	0.	509	525	6,524	117	117	6,641	2%	START-UP
	Sep '08	2	0.	0.	509	509	7,033	86	203	7,236	3%	
	Oct '08	3	0.	0.	509	509	7,542	166	369	7,911	5%	
	Nov '08	4	23.	0.	509	532	8,074	103	472	8,546	6%	
	Dec '08	5	162.	0.	509	671	8,745	88	560	9,305	6%	
	Jan '09	6	25.	0.	509	534	9,279	277	837	10,116	8%	
	Feb '09	7	208.	0.	509	717	9,996	20	857	10,853	8%	
	Mar '09	8	30.	0.	509	539	10,535	159	1,016	11,551	9%	
	Apr '09	9	1.	0.	509	510	11,045	296	1,312	12,357	11%	
	May '09	10	17.	0.	509	526	11,571	115	1,427	12,998	11%	
	Jun '09	11	0.	0.	509	509	12,080	178	1,605	13,685	12%	
2009/10	Jul '09	12	1.	0.	509	510	12,590	6	1,611	14,201	11%	
	Aug '09	13	0.	0.	509	509	13,099	8	1,619	14,718	11%	
	Sep '09	14	0.	0.	509	509	13,608	0	1,619	15,227	11%	
	Oct '09	15	13.	0.	509	522	14,130	184	1,803	15,933	11%	
	Nov '09	16	4.	0.	509	513	14,643	246	2,049	16,692	12%	
	Dec '09	17	129.	0.	509	638	15,281	144	2,193	17,474	13%	
	Jan '10	18	251.	0.	509	760	16,041	74	2,267	18,308	12%	
	Feb '10	19	215.	0.	509	724	16,765	54	2,321	19,086	12%	
	Mar '10	20	27.	0.	509	536	17,301	180	2,501	19,802	13%	
	Apr '10	21	23.	0.	509	532	17,833	235	2,736	20,569	13%	
	May '10	22	2.	0.	509	511	18,349	356	3,092	21,441	14%	
	Jun '10	23										

Notes:
DW = Diluent Water; Total DW is the sum of Stormwater & Local Runoff (SW), Imported Water from the State Water Project (MWD), and groundwater underflow.
RW = Recycled Water
RWC = 120-month running total of recycled water / 120-month running total of all diluent and recycled water.
RWC maximum = 0.5 mg/L / the Running Average of Total Organic Carbon (TOC) determined from a recharge site's start-up period

Table 3-4
Brooks Basin Infiltration Rate Measurements

Start Date/Time	Water Depth, H (feet)	End Date/Time	Water Depth, H (feet)	dT (days)	dH (feet)	Observed Infiltration (dH/dT) (feet/day)
09/20/05 00:00	21.66	09/21/05 18:00	19.33	1.75	2.33	1.33
10/07/05 00:07	24.01	10/08/05 00:08	22.47	1.00	1.54	1.54
10/08/05 00:08	22.47	10/09/05 00:17	21.18	1.01	1.29	1.28
10/09/05 00:17	21.18	10/10/05 00:03	19.80	0.99	1.38	1.39
10/10/05 00:03	19.80	10/11/05 00:07	18.59	1.00	1.21	1.21
10/11/05 00:07	18.59	10/12/05 00:12	17.36	1.00	1.23	1.23
10/12/05 00:12	17.36	10/13/05 00:07	16.20	1.00	1.16	1.16
10/15/05 00:05	19.93	10/16/05 00:10	18.46	1.00	1.47	1.46
10/16/05 00:10	18.46	10/17/05 00:05	17.17	1.00	1.29	1.29
12/26/05 01:30	17.30	12/27/05 06:30	16.60	1.21	0.70	0.58
12/27/05 06:30	16.60	12/28/05 13:30	15.40	1.29	1.20	0.93
12/28/05 13:30	15.40	12/29/05 11:30	14.50	0.92	0.90	0.98
01/10/06 08:03	21.99	01/11/06 00:00	21.03	0.66	0.96	1.44
01/11/06 12:48	21.03	01/11/06 20:26	19.99	0.32	1.04	3.27
01/11/06 20:26	19.99	01/12/06 15:56	19.04	0.81	0.95	1.17
01/12/06 15:56	19.04	01/13/06 15:33	18.01	0.98	1.03	1.05
01/13/06 15:33	18.01	01/14/06 15:19	17.05	0.99	0.96	0.97
01/14/06 15:19	17.05	01/15/06 19:48	16.02	1.19	1.03	0.87
01/15/06 19:48	16.02	01/17/06 05:03	14.83	1.39	1.19	0.86
01/23/06 14:02	24.36	01/23/06 19:04	24.03	0.21	0.33	1.57
01/23/06 19:04	24.03	01/24/06 11:08	22.99	0.67	1.04	1.55
01/24/06 11:08	22.99	01/25/06 05:40	22.01	0.77	0.98	1.27
03/01/06 18:54	21.99	03/02/06 13:14	21.03	0.76	0.96	1.26
03/02/06 13:14	21.03	03/03/06 11:19	20.03	0.92	1.00	1.09
03/08/06 12:39	21.08	03/10/06 16:26	18.42	2.16	2.66	1.23
07/07/06 00:00	21.45	07/07/06 23:59	20.41	1.00	1.04	1.04
10/04/06 14:10	20.25	10/05/06 07:54	19.40	0.74	0.85	1.15
10/12/06 22:09	19.02	10/13/06 21:09	18.00	0.96	1.02	1.06
10/13/06 21:09	18.00	10/14/06 22:39	17.01	1.06	0.99	0.93
10/14/06 22:39	17.01	10/16/06 01:34	16.00	1.12	1.01	0.90
11/26/06 16:01	21.97	11/27/06 19:52	21.04	1.16	0.93	0.80
11/27/06 19:52	21.04	11/28/06 10:27	20.35	0.61	0.69	1.14
12/08/06 10:31	23.57	12/09/06 09:31	22.46	0.96	1.11	1.16
12/09/06 06:36	21.96	12/10/06 17:51	21.47	1.47	0.49	0.33
12/11/06 06:01	21.00	12/11/06 20:26	20.45	0.60	0.55	0.92
12/11/06 20:26	20.45	12/12/06 10:11	19.95	0.57	0.50	0.87
12/17/06 06:13	20.01	12/17/06 19:07	19.52	0.54	0.49	0.91
12/18/06 11:08	18.94	12/19/06 01:33	18.49	0.60	0.45	0.75
12/20/06 13:28	18.52	12/21/06 06:23	17.91	0.70	0.61	0.87
01/03/07 21:30	22.28	01/04/07 17:30	21.37	0.83	0.91	1.09
01/07/07 08:46	20.77	01/08/07 07:11	20.12	0.93	0.65	0.70
01/11/07 09:43	22.03	01/11/07 22:34	21.50	0.54	0.53	0.99
01/11/07 22:34	21.50	01/12/07 12:29	21.01	0.58	0.49	0.85
01/12/07 12:29	21.01	01/13/07 01:59	20.51	0.56	0.50	0.89
01/15/07 21:04	19.69	01/16/07 18:24	19.00	0.89	0.69	0.78
01/16/07 18:24	19.00	01/17/07 11:09	18.50	0.70	0.50	0.72
01/17/07 11:09	18.50	01/18/07 04:14	18.00	0.71	0.50	0.70
01/18/07 21:40	17.49	01/19/07 16:40	16.97	0.79	0.52	0.66
01/19/07 16:40	16.97	01/20/07 10:40	16.50	0.75	0.47	0.63
01/20/07 10:40	16.50	01/21/07 06:40	15.98	0.83	0.52	0.62
01/21/07 06:40	15.98	01/22/07 01:40	15.50	0.79	0.48	0.61
02/02/07 11:58	14.05	02/03/07 08:18	13.52	0.85	0.53	0.63
02/04/07 12:18	13.49	02/05/07 10:18	13.02	0.92	0.47	0.51
02/06/07 07:18	12.51	02/07/07 05:18	12.00	0.92	0.51	0.56

Table 3-4
Brooks Basin Infiltration Rate Measurements

Start Date/Time	Water Depth, H (feet)	End Date/Time	Water Depth, H (feet)	dT (days)	dH (feet)	Observed Infiltration (dH/dT) (feet/day)
02/07/07 05:18	21.26	02/09/07 02:18	20.63	1.88	0.63	0.34
02/09/07 02:18	20.63	02/11/07 03:18	19.64	2.04	0.99	0.48
02/14/07 17:18	24.68	02/16/07 09:18	23.68	1.67	1.00	0.60
02/16/07 09:18	23.68	02/18/07 02:42	22.63	1.73	1.05	0.61
02/18/07 02:42	22.63	02/19/07 01:42	22.10	0.96	0.53	0.55
02/20/07 07:42	23.68	02/22/07 02:18	22.65	1.78	1.03	0.58
02/23/07 22:18	22.74	02/25/07 23:18	21.62	2.04	1.12	0.55
02/25/07 23:18	21.62	02/27/07 04:37	20.96	1.22	0.66	0.54
02/27/07 14:37	21.52	03/01/07 05:37	20.66	1.63	0.86	0.53
03/01/07 05:37	20.66	03/03/07 05:37	19.65	2.00	1.01	0.51
03/03/07 05:37	19.65	03/05/07 07:37	18.65	2.08	1.00	0.48
03/05/07 07:37	18.65	03/07/07 06:14	17.50	1.94	1.15	0.59
03/07/07 06:14	17.50	03/08/07 12:14	17.01	1.25	0.49	0.39
03/08/07 12:14	17.01	03/10/07 22:21	16.02	2.42	0.99	0.41
03/10/07 22:21	16.02	03/13/07 10:21	15.05	2.50	0.97	0.39
03/13/07 10:21	15.05	03/16/07 12:10	14.08	3.08	0.97	0.32
01/07/08 07:14	27.00	01/08/08 00:01	26.01	0.70	0.99	1.42
01/08/08 00:01	26.01	01/08/08 15:41	25.03	0.65	0.98	1.50
01/08/08 15:41	25.03	01/09/08 12:41	23.93	0.88	1.10	1.26
01/09/08 12:41	23.93	01/10/08 08:41	23.06	0.83	0.87	1.04
01/10/08 08:41	23.06	01/11/08 09:42	21.98	1.04	1.08	1.04
01/11/08 09:42	21.98	01/12/08 12:42	20.97	1.13	1.01	0.90
01/12/08 12:42	20.97	01/13/08 21:42	20.05	1.38	0.92	0.67
01/13/08 21:42	20.05	01/15/08 07:42	19.03	1.42	1.02	0.72
01/15/08 07:42	19.03	01/16/08 19:42	17.95	1.50	1.08	0.72
01/28/08 16:04	23.48	01/29/08 06:04	23.03	0.58	0.45	0.77
01/29/08 06:04	23.03	01/30/08 08:18	21.99	1.09	1.04	0.95
02/05/08 00:05	19.02	02/07/08 10:05	18.03	2.42	0.99	0.41
02/07/08 10:05	18.03	02/08/08 15:11	17.00	1.21	1.03	0.85
02/08/08 15:11	17.00	02/10/08 02:11	15.99	1.46	1.01	0.69
02/10/08 02:11	15.99	02/11/08 10:11	14.98	1.33	1.01	0.76
02/11/08 10:11	14.98	02/12/08 18:11	14.00	1.33	0.98	0.73
02/25/08 11:40	14.89	02/26/08 18:40	13.94	1.29	0.95	0.74
02/25/08 18:40	13.94	02/28/08 02:48	13.00	2.34	0.94	0.40
02/28/08 02:48	13.00	03/01/08 20:57	11.99	2.76	1.01	0.37
09/04/08 11:07	7.95	09/05/08 08:41	7.48	0.90	0.47	0.52
09/05/08 08:41	7.48	09/06/08 07:08	6.99	0.94	0.49	0.52
09/06/08 07:08	6.99	09/07/08 07:08	6.48	1.00	0.51	0.51
09/07/08 07:08	6.48	09/08/08 07:08	5.99	1.00	0.49	0.49
09/08/08 07:08	5.99	09/09/08 07:57	5.50	1.03	0.49	0.47
09/09/08 07:57	5.50	09/10/08 09:57	5.00	1.08	0.50	0.46
09/26/08 10:20	9.51	09/27/08 03:20	8.99	0.71	0.52	0.73
09/27/08 03:20	8.99	09/27/08 20:24	8.52	0.71	0.47	0.66
09/27/08 20:24	8.52	09/28/08 18:20	7.98	0.91	0.54	0.59
09/28/08 18:20	7.98	09/29/08 16:20	7.49	0.92	0.49	0.53
10/03/08 06:40	9.71	10/03/08 17:50	9.42	0.47	0.29	0.62
11/11/08 11:52	13.19	11/11/08 17:23	13.00	0.23	0.19	0.83
11/11/08 17:23	13.00	11/12/08 09:10	12.51	0.66	0.49	0.75
11/12/08 09:10	12.51	11/13/08 02:13	12.00	0.71	0.51	0.72
11/13/08 02:13	12.00	11/13/08 20:13	11.51	0.75	0.49	0.65
11/13/08 20:13	11.51	11/14/08 17:13	10.99	0.88	0.52	0.59
11/14/08 17:13	10.99	11/15/08 15:14	10.47	0.92	0.52	0.57
11/15/08 15:14	10.47	11/16/08 13:14	9.97	0.92	0.50	0.55
11/16/08 13:14	9.97	11/17/08 09:14	9.54	0.83	0.43	0.52

Table 3-4
Brooks Basin Infiltration Rate Measurements

Start Date/Time	Water Depth, H (feet)	End Date/Time	Water Depth, H (feet)	dT (days)	dH (feet)	Observed Infiltration (dH/dT) (feet/day)
11/27/08 00:01	14.22	11/27/08 12:07	13.87	0.50	0.35	0.69
11/27/08 15:07	13.87	11/28/08 00:01	13.61	0.37	0.26	0.70
11/28/08 00:01	13.61	11/29/08 00:01	12.92	1.00	0.69	0.69
11/29/08 00:01	12.92	11/30/08 00:01	12.30	1.00	0.62	0.62
11/30/08 00:01	12.30	12/01/08 00:01	11.76	1.00	0.54	0.54
12/01/08 00:01	11.76	12/01/08 09:08	11.57	0.38	0.19	0.50
01/30/09 13:01	22.00	01/31/09 16:01	21.00	1.13	1.00	0.89
01/31/09 16:01	21.00	02/01/09 22:01	20.01	1.25	0.99	0.79
02/09/09 23:03	29.53	02/10/09 06:03	29.06	0.29	0.47	1.61
02/10/09 06:03	29.06	02/10/09 22:40	28.00	0.69	1.06	1.53
02/10/09 22:40	28.00	02/11/09 16:40	27.00	0.75	1.00	1.33
02/11/09 16:40	27.00	02/12/09 13:40	25.99	0.88	1.01	1.15
02/12/09 13:40	25.99	02/13/09 08:41	25.15	0.79	0.84	1.06
02/13/09 09:30	26.98	02/14/09 15:30	25.98	1.25	1.00	0.80
02/14/09 15:30	25.98	02/15/09 14:30	24.95	0.96	1.03	1.07
02/15/09 14:30	24.95	02/16/09 06:09	24.47	0.65	0.48	0.74
02/17/09 13:09	28.99	02/18/09 06:10	27.99	0.71	1.00	1.41
02/18/09 06:10	27.99	02/19/09 00:02	27.03	0.74	0.96	1.29
02/19/09 00:02	27.03	02/19/09 21:02	26.02	0.88	1.01	1.15
02/19/09 21:02	26.02	02/20/09 22:02	24.98	1.04	1.04	1.00
02/20/09 22:02	24.98	02/22/09 03:02	23.97	1.21	1.01	0.84
02/22/09 03:02	23.97	02/23/09 12:02	22.99	1.38	0.98	0.71
02/23/09 12:02	22.99	02/25/09 00:01	21.99	1.50	1.00	0.67
02/25/09 00:01	21.99	02/26/09 13:44	21.00	1.57	0.99	0.63
02/26/09 13:44	21.00	02/28/09 05:44	20.00	1.67	1.00	0.60
02/28/09 05:44	20.00	03/01/09 19:45	19.00	1.58	1.00	0.63
03/01/09 19:45	19.00	03/03/09 11:33	18.00	1.66	1.00	0.60
03/03/09 11:33	18.00	03/04/09 14:07	17.38	1.11	0.62	0.56
03/09/09 12:43	16.71	03/10/09 16:43	16.01	1.17	0.70	0.60
03/10/09 16:43	16.01	03/12/09 11:43	15.02	1.79	0.99	0.55
04/07/09 16:56	19.64	04/08/09 13:57	18.99	0.88	0.65	0.74
04/08/09 20:23	19.02	04/09/09 13:08	18.47	0.70	0.55	0.79
04/10/09 08:57	18.24	04/10/09 16:57	17.99	0.33	0.25	0.75
04/10/09 16:57	17.99	04/12/09 01:57	17.01	1.38	0.98	0.71
04/12/09 01:57	17.01	04/13/09 07:57	16.15	1.25	0.86	0.69
05/01/09 04:21	22.02	05/02/09 10:21	21.00	1.25	1.02	0.82
05/02/09 10:21	21.00	05/03/09 17:21	19.99	1.29	1.01	0.78
05/03/09 17:21	19.99	05/05/09 01:00	19.01	1.32	0.98	0.74
05/28/09 22:00	14.96	05/29/09 22:14	14.01	1.01	0.95	0.94
06/01/09 08:15	12.98	06/03/09 03:56	11.99	1.82	0.99	0.54
06/11/09 22:41	15.50	06/12/09 16:41	14.99	0.75	0.51	0.68
06/12/09 16:41	14.99	06/13/09 10:42	14.50	0.75	0.49	0.65
06/13/09 10:42	14.50	06/14/09 05:42	14.01	0.79	0.49	0.62
06/14/09 05:42	14.01	06/15/09 01:00	13.51	0.80	0.50	0.62
06/15/09 01:00	13.51	06/15/09 10:13	13.25	0.38	0.26	0.68

Table 4-1a
Brooks Basin Surface Water and Lysimeter Results
Electrical Conductivity
(µmhos/cm)

Date	Surface Water	Lysimeter Depth (feet)					% RW at 25 ft bgs Lysimeter	% RW in Basin
	0	5	10	15	25	35		
07/08/08	1270	1350	835	7600	480	635	0%	0%
07/15/08	1000	1330	830	IS	1020	500	0%	0%
07/22/08	980	1320	835	IS	IS	510	0%	0%
07/30/08	720	IS	830	IS	1100	480	0%	0%
08/05/08	750	1285	815	IS	1045	435	0%	0%
08/13/08	825	1315	845	IS	345	450	0%	99%
08/19/08	665	795	730	5500	520	395	61%	67%
08/26/08	750	710	700	5200	600	435	72%	87%
09/03/08	750	740	700	IS	640	370	78%	94%
09/09/08	745	780	670	3890	700	455	86%	95%
09/16/08	770	870	680	IS	630	410	76%	98%
09/23/08	820	980	725	IS	655	620	80%	100%
09/30/08	815	830	685	IS	645	600	79%	100%
10/07/08	820	810	670	IS	650	610	79%	100%
10/14/08	845	810	675	IS	685	590	84%	100%
10/21/08	880	840	685	IS	650	705	79%	100%
10/28/08	840	840	690	IS	635	710	77%	100%
11/04/08	855	845	700	IS	705	740	87%	100%
11/12/08	830	830	705	IS	740	790	92%	100%
11/18/08	815	830	730	IS	770	810	96%	100%
11/25/08	820	825	715	IS	780	800	97%	100%
12/02/08	735	635	705	IS	760	800	95%	69%
12/10/08	705	690	670	IS	750	785	93%	84%
12/16/08	330	670	IS	IS	740	755	92%	47%
12/23/08	260	312	613	IS	715	745	88%	34%
12/30/08	410	275	550	IS	660	710	81%	39%
01/06/09	595	280	470	IS	650	665	79%	69%
01/13/09	675	450	430	IS	665	640	81%	76%
01/20/09	730	560	400	IS	670	570	82%	86%
01/27/09	710	645	405	IS	375	515	41%	86%
02/03/09	655	665	390	IS	590	460	71%	88%
02/10/09	645	470	405	IS	500	430	58%	34%
02/18/09	250	390	395	IS	390	440	43%	21%
02/24/09	250	305	390	IS	345	425	37%	20%
03/03/09	250	280	390	IS	365	430	39%	20%
03/10/09	270	305	390	IS	385	395	42%	16%
03/18/09	530	375	390	IS	410	370	46%	62%
03/24/09	530	485	385	IS	395	360	44%	74%
03/31/09	570	540	370	IS	355	365	38%	82%
04/07/09	650	610	380	IS	350	355	37%	92%
04/14/09	665	600	370	IS	340	370	36%	93%
04/21/09	695	655	395	IS	340	425	36%	98%
04/28/09	700	695	410	IS	360	420	39%	99%
05/05/09	680	690	420	IS	405	440	45%	99%
05/12/09	680	700	430	IS	465	415	53%	88%
05/19/09	685	730	455	IS	510	440	60%	91%
05/27/09	710	740	480	IS	530	480	62%	95%
06/02/09	705	720	500	IS	530	495	62%	95%
06/09/09	755	730	525	2170	605	490	73%	98%
06/16/09	765	755	545	IS	650	525	79%	99%
06/23/09	760	795	550	IS	660	575	81%	100%
06/30/09	780	790	575	IS	700	600	86%	100%
07/07/09	765	790	565	IS	620	525	75%	100%
07/14/09	800	860	650	IS	730	600	90%	100%
07/21/09	780	940	IS	IS	740	605	92%	100%
07/28/09	785	1010	780	IS	750	550	93%	100%
08/04/09	790	1090	860	IS	680	530	83%	100%
08/11/09	770	1140	910	IS	800	520	100%	100%

Notes IS: Insufficient sample from lysimeter result in parameter not being analyzed

Table 4-1b
Brooks Basin Monitoring Wells Results
Electrical Conductivity
(µmhos/cm)

Date	BRK-1/1	BRK-1/2	BRK-2/1	BRK2/2
03/15/07		470		
07/19/07			625	
07/24/07				305
10/11/07	470	530	590	321
01/14/08	540	I0	545	305
04/10/08	355	530	555	315
07/10/08	378	535	570	330
08/13/08	520	530		
08/25/08	530	535		
09/08/08	580	540		
09/22/08	550	595		
10/06/08	560	520	550	315
10/20/08	580	535		
11/03/08	505	535		
11/05/08			530	315
11/19/08	385	535		
12/01/08	400	530		
12/03/08			515	315
12/17/08	440	540	535	325
12/18/08	455			
12/29/08	510	530		
01/15/09	530	530	535	320
02/03/09	555	520		
02/19/09	640	525	560	315
03/03/09	565	520	550	315
03/11/09	555			
03/19/09	595			
03/25/09	600	525	555	320
03/31/09	580	525		
04/08/09	570	520		
04/13/09	575	515	560	320
04/27/09	560	520		
05/11/09	530	530	580	320
05/26/09	510	550		
06/08/09	510	545	600	340
06/22/09	515	540		
07/06/09	535	540		
07/20/09	540	540	605	330
08/03/09	545	555		
08/17/09	515	540		
08/31/09	475	540		

Table 4-2a
Brooks Basin Surface Water and Lysimeter Results
Total Organic Carbon
(mg/L)

Date	Surface Water	Lysimeter Depth (feet)					% RW at 25-foot Lysimeter	% RW in Basin
	0	5	10	15	25	35		
07/08/08	13.9	4.87	17.1	107	20.1	11.7	0%	0%
07/15/08	76.9	4.89	12.2	IS	31.5	15.5	0%	0%
07/22/08	44.0	3.88	12.1	IS	15.2	12.0	0%	0%
07/30/08	16.9	IS	11.8	IS	17.8	7.20	0%	0%
08/05/08	IS	4.07	11.5	IS	IS	7.88	0%	0%
08/13/08	13.5	3.10	9.34	IS	0.97	4.69	0%	99%
08/19/08	6.42	6.99	7.70	55.1	1.69	8.79	61%	67%
08/26/08	7.83	7.08	7.46	28.4	3.56	5.61	72%	87%
09/03/08	8.24	8.06	7.67	IS	2.48	4.21	78%	94%
09/09/08	7.58	9.31	7.36	IS	3.56	3.95	86%	95%
09/16/08	6.27	10.3	7.12	IS	2.44	24.4	76%	98%
09/23/08	5.27	8.96	7.46	IS	2.15	4.09	80%	100%
09/30/08	5.16	6.29	6.90	IS	2.30	4.22	79%	100%
10/07/08	5.84	5.44	6.27	IS	2.36	3.80	79%	100%
10/14/08	5.22	4.57	6.02	IS	3.21	3.82	84%	100%
10/21/08	5.06	4.30	5.04	IS	3.02	5.93	79%	100%
10/28/08	4.83	4.13	4.88	IS	3.81	4.81	77%	100%
11/04/08	5.48	4.21	4.65	IS	3.19	4.23	87%	100%
11/12/08	5.09	3.95	4.58	IS	2.94	3.35	92%	100%
11/18/08	5.17	4.19	3.87	IS	2.73	3.03	96%	100%
11/25/08	4.63	3.17	3.91	IS	2.57	3.50	97%	100%
12/02/08	5.23	4.40	3.67	IS	2.42	2.64	95%	69%
12/10/08	5.52	3.77	3.95	IS	2.20	2.68	93%	84%
12/16/08	6.69	3.52	IS	IS	2.20	3.01	92%	47%
12/23/08	4.72	2.77	3.75	IS	2.18	2.70	88%	34%
12/30/08	4.49	2.83	3.87	IS	2.29	2.74	81%	39%
01/06/09	4.68	2.98	3.99	IS	2.36	3.03	79%	69%
01/13/09	3.86	3.21	3.88	IS	2.29	3.45	81%	76%
01/20/09	4.08	3.05	3.83	IS	2.17	2.54	82%	86%
01/27/09	4.43	3.31	3.89	IS	2.13	2.70	41%	86%
02/03/09	4.21	3.03	3.63	IS	2.14	2.73	71%	88%
02/10/09	4.32	2.99	3.66	IS	2.29	4.76	58%	34%
02/18/09	3.85	3.45	3.87	IS	2.18	2.78	43%	21%
02/24/09	3.35	2.72	3.93	IS	1.77	2.41	37%	20%
03/03/09	3.80	2.25	3.81	IS	1.66	4.66	39%	20%
03/10/09	4.85	2.70	4.06	IS	2.54	4.63	42%	16%
03/18/09	4.01	3.09	3.84	IS	1.71	2.73	46%	62%
03/24/09	4.95	3.74	4.35	IS	2.07	3.17	44%	74%
03/31/09	5.04	4.15	4.19	IS	2.13	2.73	38%	82%
04/07/09	4.43	3.20	3.90	IS	1.50	2.97	37%	92%
04/14/09	4.93	3.74	4.26	IS	1.83	2.74	36%	93%
04/21/09	6.05	5.36	3.84	IS	1.46	2.88	36%	98%
04/28/09	5.21	3.02	3.75	IS	1.52	3.45	39%	99%
05/05/09	5.75	2.93	4.44	IS	1.69	4.57	45%	99%
05/12/09	5.00	3.64	4.14	IS	2.38	8.29	53%	88%
05/19/09	5.75	3.95	3.84	IS	2.03	5.64	60%	91%
05/27/09	5.63	4.63	4.18	IS	1.98	7.17	62%	95%
06/02/09	5.55	5.73	4.53	IS	2.32	6.50	62%	95%
06/09/09	4.57	5.96	4.33	6.26	2.04	8.70	73%	98%
06/16/09	4.92	5.59	4.85	IS	2.46	5.78	79%	99%
06/23/09	5.21	5.29	4.76	IS	2.82	4.55	81%	100%
06/30/09	6.12	5.39	4.61	IS	2.95	3.65	86%	100%
07/07/09	7.81	6.42	4.48	IS	3.10	3.49	75%	100%
07/14/09	6.51	7.71	4.28	IS	3.02	4.24	90%	100%
07/21/09	7.18	7.74	IS	IS	2.76	2.66		
07/28/09	8.23	8.90	5.11	IS	2.95	8.25		
08/04/09	7.29	7.46	4.98	IS	3.78	11.2		
08/11/09	8.87	5.98	4.96	IS	11.2	3.16		
20-Sample Average from Dec 16, 2008 through April 28, 2009								
TOC	4.60	3.26	3.91		2.02	3.14		

Note: IS: Insufficient sample from lysimeter result in parameter not being analyzed

Table 4-2b
Brooks Basin Monitoring Wells Results
Total Organic Carbon
(mg/L)

Date	BRK-1/1	BRK-1/2	BRK-2/1	BRK2/2
03/15/07		0.17		
07/19/07			0.66	
07/24/07				0.14
10/11/07	0.25	0.27	0.31	0.21
01/14/08	0.22	0.34	0.16	2.01
04/10/08	1.50	0.59	0.48	0.22
07/10/08	1.32	0.14	0.22	<0.10
08/13/08	0.48	0.10		
08/25/08	0.47	<0.10		
09/08/08	0.51	0.13		
09/22/08	0.42	0.25		
10/06/08	0.45	0.25	0.55	0.37
10/20/08	0.68	0.51		
11/03/08	1.22	0.63		
11/05/08			0.67	0.23
11/19/08	0.70	<0.10		
12/01/08	1.33	0.84		
12/03/08			0.56	<0.10
12/09/08	0.13	0.27		
12/17/08	0.76	<0.10	0.83	<0.10
12/29/08	0.57	<0.10		
01/15/09	0.73	<0.10	0.40	0.11
02/03/09	0.55	0.11		
02/19/09	2.57	<0.10	0.16	<0.10
03/03/09	0.83	0.44	0.27	0.21
03/11/09	1.16			
03/19/09	1.22			
03/25/09	1.26	0.57	0.27	0.28
03/31/09	1.44	0.86		
04/08/09	1.06	0.52		
04/13/09	1.08	0.30	0.28	<0.10
04/27/09	0.48	1.32		
05/11/09	1.31	0.51	0.60	0.12
05/26/09	1.32	0.18		
06/08/09	0.97	0.19	0.26	0.18
06/22/09	1.03	0.21		
07/06/09	1.23	0.12		
07/20/09	0.71	<0.10	0.14	<0.10
08/03/09	1.45	0.85		

Table 4-3a
Brooks Basin Surface Water and Lysimeter Results
Nitrogen Speciation

Date	Surface Water					Lysimeter Depth (feet)																								
	0					5					10					15					25					35				
	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L
07/08/08	0.4	0.9	0.05	5.5	6.5	<0.1	108.0	0.02	<0.5	108.3	0.5	3.5	4.70	2.0	10.3	IS	IS	IS	IS	IS	0.2	0.4	2.27	1.2	3.8	<0.1	<0.1	0.05	<0.5	<0.6
07/15/08	0.2	0.2	0.04	5.3	5.5	<0.1	111.0	<0.01	<0.5	111.3	<0.1	7.2	3.40	1.5	12.1	IS	IS	IS	IS	IS	IS	0.4	2.02	IS	2.4	<0.1	<0.1	<0.01	<0.5	<0.6
07/22/08	0.7	<0.1	<0.01	3.5	3.5	<0.1	91.5	<0.01	<0.5	91.8	0.2	5.6	1.91	1.5	9.0	IS	IS	IS	IS	IS	0.1	IS	IS	1.1	1.1	<0.1	<0.1	0.02	<0.5	<0.6
07/30/08	<0.1	0.9	0.03	IS	0.9	IS	IS	IS	IS	IS	0.2	7.6	1.46	IS	9.1	IS	IS	IS	IS	IS	IS	0.5	1.42	IS	1.9	<0.1	0.7	<0.01	IS	0.7
08/05/08	0.3	<0.1	<0.01	2.4	2.4	<0.1	104.3	<0.01	<0.5	104.5	0.1	10.4	1.44	1.3	13.2	IS	IS	IS	IS	IS	IS	0.4	1.55	IS	1.9	<0.1	<0.1	0.02	<0.5	<0.6
08/13/08	0.1	4.4	<0.01	1.2	5.6	<0.1	110.1	<0.01	<0.5	110.4	0.2	11.3	1.22	1.7	14.1	IS	IS	IS	IS	IS	<0.1	1.2	0.04	<0.5	1.5	<0.1	<0.1	<0.01	<0.5	<0.6
08/19/08	<0.1	1.7	0.04	2.0	3.7	0.2	1.3	<0.01	0.7	2.0	0.1	7.1	2.30	1.6	11.0	IS	IS	IS	IS	IS	<0.1	7.1	0.06	0.6	7.7	<0.1	0.1	<0.01	0.6	0.8
08/26/08	<0.1	1.7	0.02	2.1	3.8	0.7	<0.1	<0.01	1.3	1.3	0.3	1.0	2.02	1.2	4.2	IS	IS	IS	IS	IS	0.1	4.4	0.22	0.7	5.4	<0.1	<0.1	<0.01	<0.5	<0.6
09/03/08	<0.1	0.7	0.07	2.2	3.0	0.7	<0.1	<0.01	1.6	1.6	0.2	<0.1	0.38	1.3	1.7	IS	IS	IS	IS	IS	<0.1	1.7	0.16	0.8	2.7	<0.1	<0.1	<0.01	<0.5	<0.6
09/09/08	0.1	<0.1	0.12	1.7	1.9	0.9	<0.1	<0.01	1.5	1.6	0.3	<0.1	0.02	0.8	0.8	IS	IS	IS	IS	IS	<0.1	1.4	0.08	<0.5	1.7	<0.1	<0.1	<0.01	<0.5	<0.6
09/16/08	<0.1	1.0	0.11	1.4	2.5	1.18	<0.1	<0.01	1.7	1.7	0.2	<0.1	<0.01	1.0	1.0	IS	IS	IS	IS	IS	<0.1	0.3	0.05	<0.5	0.6	<0.1	0.2	<0.01	<0.5	0.4
09/23/08	<0.1	3.6	<0.01	IS	3.6	1.07	<0.1	<0.01	IS	<0.1	0.2	<0.1	<0.01	IS	<0.1	IS	IS	IS	IS	IS	<0.1	0.2	0.04	IS	0.2	<0.1	<0.1	<0.01	IS	<0.1
09/30/08	IS	2.8	0.03	IS	2.8	IS	0.1	0.06	IS	0.2	IS	<0.1	<0.01	IS	<0.1	IS	IS	IS	IS	IS	IS	<0.1	0.03	IS	<0.1	IS	0.2	<0.01	IS	0.2
10/07/08	0.1	4.4	0.06	0.7	5.2	0.85	0.4	0.08	1.2	1.7	0.3	<0.1	<0.01	0.7	0.8	IS	IS	IS	IS	IS	<0.1	<0.1	0.03	<0.5	0.3	<0.1	0.3	<0.01	<0.5	<0.6
10/14/08	<0.1	7.3	0.06	0.8	8.2	0.79	1.7	0.24	1.0	2.9	0.2	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	0.03	4.0	4.1
10/21/08	0.2	9.2	<0.01	1.1	10.3	0.64	4.3	0.72	1.5	6.5	0.3	0.4	0.14	<0.5	0.8	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	0.2	<0.1	<0.01	<0.5	<0.6
10/28/08	<0.1	6.9	0.03	<0.5	7.2	0.49	5.0	0.63	0.8	6.5	0.3	0.2	0.17	<0.5	0.6	IS	IS	IS	IS	IS	0.3	0.2	0.07	<0.5	0.5	0.2	<0.1	<0.01	<0.5	<0.6
11/04/08	0.1	6.5	0.02	1.2	7.8	0.43	4.1	0.42	1.0	5.5	0.3	0.2	0.11	<0.5	0.6	IS	IS	IS	IS	IS	<0.1	0.6	0.02	<0.5	0.9	<0.1	<0.1	<0.01	<0.5	<0.6
11/12/08	0.2	5.6	0.02	0.8	6.4	0.34	3.5	0.48	0.9	4.8	0.2	0.2	0.16	<0.5	0.6	IS	IS	IS	IS	IS	<0.1	1.1	0.06	<0.5	1.4	<0.1	<0.1	<0.01	<0.5	<0.6
11/18/08	<0.1	3.6	<0.01	<0.5	3.8	0.28	2.9	0.52	<0.5	3.7	0.2	0.3	0.08	<0.5	0.6	IS	IS	IS	IS	IS	<0.1	1.1	0.05	<0.5	1.5	<0.1	<0.1	<0.01	0.7	0.7
11/25/08	<0.1	4.2	<0.01	1.1	5.3	0.19	3.1	0.21	<0.5	3.6	0.2	0.2	0.12	<0.5	0.6	IS	IS	IS	IS	IS	<0.1	0.8	0.12	<0.5	1.2	<0.1	<0.1	<0.01	<0.5	<0.6
12/02/08	0.2	3.4	<0.01	<0.5	3.7	0.19	0.8	0.24	<0.5	1.3	0.2	<0.1	0.04	<0.5	0.3	IS	IS	IS	IS	IS	<0.1	0.6	0.07	<0.5	0.9	<0.1	<0.1	<0.01	<0.5	<0.6
12/10/08	<0.1	4.1	<0.01	<0.5	4.4	0.29	2.1	0.26	<0.5	2.6	0.2	<0.1	0.02	<0.5	0.3	IS	IS	IS	IS	IS	<0.1	0.7	0.04	<0.5	1.0	<0.1	<0.1	<0.01	<0.5	<0.6
12/16/08	0.3	2.0	0.01	0.8	2.8	0.33	2.1	0.28	<0.5	2.6	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	0.2	0.03	<0.5	0.5	<0.1	<0.1	<0.01	<0.5	<0.6
12/23/08	0.2	1.7	0.02	<0.5	1.9	0.14	0.8	0.12	<0.5	1.2	0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
12/30/08	0.2	2.3	<0.01	1.5	3.8	0.15	0.3	0.12	0.9	1.2	0.2	<0.1	<0.01	1.1	1.1	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	0.5	0.6	<0.1	<0.1	<0.01	0.8	0.8
01/06/09	0.2	3.4	<0.01	1.6	5.0	0.16	<0.1	0.06	1.0	1.1	0.1	<0.1	<0.01	1.2	1.3	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	0.8	0.8	<0.1	<0.1	<0.01	<0.5	<0.6
01/13/09	<0.1	4.1	<0.01	1.1	5.2	0.27	<0.1	<0.01	1.0	1.1	0.1	<0.1	<0.01	1.0	1.1	IS	IS	IS	IS	IS	<0.1	0.8	<0.01	1.4	2.2	<0.1	<0.1	<0.01	1.6	1.7
01/20/09	<0.1	4.2	<0.01	<0.5	4.5	0.27	0.4	0.13	<0.5	0.7	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
01/27/09	<0.1	4.0	<0.01	0.7	4.7	0.32	0.4	0.12	0.9	1.4	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6

Table 4-3a
Brooks Basin Surface Water and Lysimeter Results
Nitrogen Speciation

Date	Surface Water 0 NH3-N mg/L	Surface Water 0 NO3-N mg/L	Surface Water 0 NO2-N mg/L	Surface Water 0 TKN mg/L	Surface Water 0 TN mg/L	Lysimeter Depth (feet) 5 NH3-N mg/L	5 NO3-N mg/L	5 NO2-N mg/L	5 TKN mg/L	5 TN mg/L	10 NH3-N mg/L	10 NO3-N mg/L	10 NO2-N mg/L	10 TKN mg/L	10 TN mg/L	15 NH3-N mg/L	15 NO3-N mg/L	15 NO2-N mg/L	15 TKN mg/L	15 TN mg/L	25 NH3-N mg/L	25 NO3-N mg/L	25 NO2-N mg/L	25 TKN mg/L	25 TN mg/L	35 NH3-N mg/L	35 NO3-N mg/L	35 NO2-N mg/L	35 TKN mg/L	35 TN mg/L
02/03/09	<0.1	3.9	<0.01	0.8	4.7	0.3	1.4	0.14	<0.5	1.8	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
02/10/09	0.1	2.0	<0.01	0.7	2.7	0.3	1.0	0.09	<0.5	1.3	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	3.8	3.9	<0.1	<0.1	<0.01	<0.5	<0.6
02/18/09	0.3	1.4	0.01	0.9	2.4	0.5	0.3	0.02	0.6	0.9	0.2	<0.1	0.10	<0.5	0.4	IS	IS	IS	IS	IS	0.1	<0.1	0.11	<0.5	0.4	<0.1	<0.1	0.13	<0.5	0.4
02/24/09	<0.1	1.8	0.01	<0.5	2.1	0.2	<0.1	0.04	<0.5	0.3	0.2	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
03/03/09	0.1	1.2	0.04	0.5	1.8	0.2	<0.1	0.05	<0.5	0.4	0.1	<0.1	0.01	<0.5	0.3	IS	IS	IS	IS	IS	<0.1	<0.1	0.01	<0.5	0.3	<0.1	<0.1	<0.01	<0.5	<0.6
03/10/09	<0.1	1.4	0.02	0.5	1.9	0.2	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
03/18/09	0.1	1.5	<0.01	<0.5	1.8	0.4	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	1.1	1.2
03/24/09	<0.1	3.7	<0.01	<0.5	4.0	0.5	<0.1	<0.01	0.7	0.7	0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
03/31/09	<0.1	1.2	0.01	<0.5	1.5	0.6	<0.1	0.01	<0.5	0.6	0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
04/07/09	0.1	1.4	0.01	0.3	1.6	0.7	<0.1	0.01	<0.5	0.3	0.1	<0.1	0.01	<0.5	0.8	IS	IS	IS	IS	IS	<0.1	<0.1	0.01	<0.5	0.3	<0.1	<0.1	<0.01	<0.5	<0.6
04/14/09	<0.1	1.2	<0.01	0.6	1.8	0.6	<0.1	<0.01	1.3	1.4	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	0.6	0.6
04/21/09	<0.1	1.3	<0.01	1.1	2.4	0.5	0.4	<0.01	0.8	1.3	<0.1	<0.1	<0.01	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	<0.01	<0.5	<0.6	<0.1	<0.1	<0.01	<0.5	<0.6
04/28/09	<0.1	1.4	0.14	2.5	4.0	<0.1	<0.1	0.14	1.7	1.9	<0.1	<0.1	0.09	0.6	0.7	IS	IS	IS	IS	IS	<0.1	<0.1	0.10	<0.5	<0.6	<0.1	<0.1	0.11	0.6	0.7
05/05/09	<0.1	0.6	0.10	1.9	2.6	0.5	<0.1	0.12	1.4	1.5	<0.1	<0.1	0.09	IS	0.1	IS	IS	IS	IS	IS	<0.1	<0.1	0.11	<0.5	<0.6	<0.1	<0.1	0.11	<0.5	<0.6
05/12/09	<0.1	<0.1	0.06	<0.5	<0.6	0.5	<0.1	0.08	<0.5	<0.6	<0.1	<0.1	0.05	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	0.07	<0.5	<0.6	<0.1	<0.1	0.06	<0.5	<0.6
05/19/09	<0.1	<0.1	0.05	0.9	1.0	0.8	<0.1	0.08	1.1	1.2	0.1	<0.1	0.04	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	0.07	<0.5	<0.6	<0.1	<0.1	0.06	<0.5	<0.6
05/27/09	<0.1	<0.1	0.06	1.2	1.3	1.2	<0.1	0.08	1.5	1.6	0.2	<0.1	0.04	<0.5	<0.6	IS	IS	IS	IS	IS	<0.1	<0.1	0.07	1.7	1.8	<0.1	<0.1	0.06	<0.5	<0.6
06/02/09	<0.1	<0.1	0.07	1.7	1.8	1.2	<0.1	0.08	1.9	2.1	<0.1	0.1	0.05	2.4	2.5	IS	IS	IS	IS	IS	<0.1	<0.1	0.08	0.9	1.1	<0.1	<0.1	0.13	0.7	0.9
06/09/09	<0.1	2.8	0.06	0.9	3.8	1.3	<0.1	0.08	2.3	2.4	IS	0.2	0.05	IS	IS	0.3	0.1	0.22	0.8	1.0	<0.1	<0.1	0.09	<0.5	<0.6	<0.1	<0.1	0.08	<0.5	<0.6
06/16/09	<0.1	4.2	0.06	1.3	5.5	1.3	<0.1	0.08	2.3	2.5	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.08	<0.5	<0.6	<0.1	<0.1	0.09	<0.5	<0.6
06/23/09	<0.1	2.7	0.09	1.8	4.6	1.5	<0.1	0.09	1.6	1.8	IS	0.1	0.05	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.09	<0.5	<0.6	<0.1	<0.1	0.08	<0.5	<0.6
06/30/09	<0.1	3.7	0.10	2.2	6.0	<0.1	<0.1	0.08	3.9	4.1	IS	0.1	0.04	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.08	<0.5	<0.6	<0.1	<0.1	0.07	<0.5	<0.6
07/07/09	<0.1	1.5	0.13	3.8	5.4	1.6	0.1	0.08	2.7	2.8	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.08	0.5	0.6	<0.1	<0.1	0.07	<0.5	<0.6
07/14/09	<0.1	0.2	0.10	3.0	3.3	1.7	0.1	0.10	2.5	2.8	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	0.2	0.07	0.7	1.0	<0.1	<0.1	0.03	<0.5	<0.6
07/21/09	<0.1	<0.1	<0.01	3.1	3.2	1.9	0.1	0.09	2.1	2.3	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.05	<0.5	<0.6	<0.1	<0.1	0.04	<0.5	<0.6
07/28/09	<0.1	<0.1	0.02	1.2	1.2	1.8	<0.1	0.09	1.4	1.6	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.07	<0.5	<0.6	<0.1	<0.1	0.06	0.5	0.6
08/04/09	0.2	1.4	0.07	1.0	2.5	1.9	0.4	0.07	1.4	1.9	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	<0.1	<0.1	0.05	0.9	1.0	IS	IS	IS	IS	IS
08/11/09	<0.1	0.1	0.06	2.4	2.6	0.9	3.6	0.16	1.5	5.2	IS	IS	IS	IS	IS	IS	IS	IS	IS	IS	0.1	0.2	0.11	<0.5	<0.6	IS	IS	IS	IS	IS

Notes IS: Insufficient sample from lysimeter result in parameter not being analyzed

Table 4-3b
Brooks Basin Monitoring Well Results
Nitrogen Speciation

Date	BRK-1/1					BRK-1/2					BRK-2/1					BRK-2/2				
	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L	NH3-N mg/L	NO3-N mg/L	NO2-N mg/L	TKN mg/L	TN mg/L
07/10/2008	0.3	0.1	<0.01	<0.5	0.7	<0.1	18.1	<0.01	<0.5	18.4	0.4	8.4	<0.01	0.6	9.4	<0.1	3.7	<0.01	<0.5	4.0
08/13/2008	<0.1	7.0	<0.01	<0.5	7.3	<0.1	20.9	<0.01	<0.5	21.2										
08/25/2008	<0.1	6.5	<0.01	<0.5	6.8	<0.1	17.8	<0.01	<0.5	18.1										
09/08/2008	<0.1	8.6	<0.01	<0.5	8.9	<0.1	18.8	<0.01	<0.5	19.1										
09/22/2008	<0.1	8.3	<0.01	<0.5	8.6	<0.1	17.8	<0.01	<0.5	18.1										
10/06/2008	0.1	8.7	<0.01	<0.5	9.1	0.3	18.3	<0.01	<0.5	18.9	<0.1	7.2	<0.01	<0.5	7.5	<0.1	4.0	<0.01	<0.5	4.3
10/20/2008	<0.1	8.5	<0.01	<0.5	8.8	<0.1	17.6	<0.01	<0.5	17.9										
11/03/2008	<0.1	5.9	<0.01	2.7	8.7	0.1	18.3	<0.01	<0.5	18.7										
11/05/2008											<0.1	6.5	<0.01	<0.5	6.8	<0.1	4.1	<0.01	<0.5	4.4
11/19/2008	<0.1	2.2	0.01	<0.5	2.5	<0.1	18.0	0.04	<0.5	18.3										
12/01/2008	0.1	2.1	<0.01	<0.5	2.5	<0.1	18.1	0.05	<0.5	18.5										
12/03/2008											<0.1	5.6	<0.01	<0.5	5.9	<0.1	4.0	<0.01	<0.5	4.3
12/09/2008	<0.1	0.9	0.04	<0.5	1.2	<0.1	6.7	0.03	<0.5	7.0										
12/17/2008	<0.1	1.1	<0.01	<0.5	1.4	<0.1	17.7	0.03	<0.5	18.0	<0.1	5.5	<0.01	<0.5	5.8	<0.1	3.9	0.06	<0.5	4.3
12/29/2008	<0.1	3.8	<0.01	<0.5	4.1	<0.1	14.7	<0.01	<0.5	15.0										
01/15/2009	<0.1	3.0	<0.01	<0.5	3.3	<0.1	17.7	0.01	<0.5	18.0	<0.1	5.8	<0.01	<0.5	6.1	<0.1	4.0	0.05	<0.5	4.4
02/03/2009	<0.1	5.7	<0.01	<0.5	6.0	<0.1	18.1	<0.01	<0.5	18.4										
02/19/2009	<0.1	1.9	<0.01	1.6	3.6	<0.1	18.1	<0.01	<0.5	18.4	0.1	7.5	<0.01	0.6	8.2	0.3	4.4	<0.01	<0.5	5.0
03/03/2009	0.1	1.3	<0.01	0.7	2.1	<0.1	19.3	0.06	<0.5	19.7	0.2	7.6	0.01	<0.5	8.1	<0.1	4.4	0.08	<0.5	4.8
03/11/2009	<0.1	1.9	<0.01	2.6	4.6															
03/19/2009	<0.1	1.4	0.08	0.6	2.1															
03/25/2009	<0.1	0.9	<0.01	<0.5	1.2	<0.1	18.5	<0.01	<0.5	18.8	<0.1	7.7	<0.01	<0.5	8.0	<0.1	4.6	0.06	<0.5	5.0
03/31/2009	<0.1	1.4	<0.01	<0.5	1.7	<0.1	18.0	<0.01	<0.5	18.3										
04/08/2009	<0.1	1.7	<0.01	<0.5	2.0	<0.1	18.9	<0.01	<0.5	19.2										
04/13/2009	<0.1	1.1	<0.01	<0.5	1.4	<0.1	18.3	<0.01	<0.5	18.6	<0.1	9.0	<0.01	<0.5	9.3	<0.1	4.9	<0.01	<0.5	5.2
04/27/2009	0.0	3.5	<0.01	<0.5	3.8	<0.1	18.4	<0.01	<0.5	18.7										
05/11/2009	<0.1	3.9	<0.01	1.1	5.0	<0.1	19.2	<0.01	<0.5	19.5	<0.1	9.8	<0.01	<0.5	10.1	<0.1	5.1	<0.01	<0.5	5.4
05/26/2009	0.4	1.5	0.08	<0.5	2.2	<0.1	17.2	0.10	<0.5	17.6										
06/08/2009	0.2	1.8	<0.01	<0.5	2.2	<0.1	18.2	<0.01	<0.5	18.5	<0.1	8.8	<0.01	<0.5	9.1	<0.1	4.9	<0.01	<0.5	5.2
06/22/2009	0.1	1.5	0.01	11.0	12.6	<0.1	18.3	0.01	<0.5	18.6										
07/06/2009	0.3	1.7	<0.01	3.8	5.5	<0.1	18.1	<0.01	<0.5	18.3										
07/20/2009	<0.1	0.4	0.03	<0.5	0.7	<0.1	13.8	0.07	<0.5	14.1	0.05	8.7	0.08	<0.5	9.0	0.05	4.8	0.08	<0.5	5.1
08/03/2009	0.2	1.9	<0.11	1.8	3.7	<0.1	18.6	<0.11	<0.5	18.9										
08/17/2009	0.4	2.0	0.08	<0.5	2.3	<0.1	17.3	0.10	<0.5	17.7										
08/31/2009	<0.1	2.3	0.07	<0.5	2.6	<0.1	17.9	0.09	<0.5	18.2										
09/14/2009	<0.1	1.9	<0.01	<0.5	2.2	<0.1	19.7	0.01	<0.5	19.9										
09/28/2009	<0.1	1.4	<0.01	0.8	2.2	<0.1	17.8	0.05	<0.5	18.1										
10/05/2009	<0.1	1.2	0.05	<0.5	1.5	<0.1	18.4	0.11	<0.5	18.7	<0.1	9.4	0.10	0.9	10.4	<0.1	5.0	0.11	<0.5	5.4
10/12/2009	<0.1	1.3	<0.01	<0.5	1.6	<0.1	18.3	0.07	<0.5	18.7										
10/28/2009											<0.1	9.0	0.05	<0.5	9.3	<0.1	5.4	0.10	<0.5	5.7
01/14/2010	<0.1	0.7	<0.01	<0.5	1.0	<0.1	17.1	<0.01	<0.5	17.4	<0.1	9.6	<0.01	<0.5	9.9	<0.1	7.0	0.09	<0.5	7.3

Table 4-4a
Brooks Street Basin Surface Water and Lysimeter Results
Total Nitrogen
(mg/L)

Date	Surface Water	Lysimeter Depth (feet)					% RW at 25-foot Lysimeter	% RW in Basin
	0	5	10	15	25	35		
07/08/08	6.5	108.3	10.3	IS	3.8	<0.6	0%	0%
07/15/08	5.5	111.3	12.1	IS	2.4	<0.6	0%	0%
07/22/08	3.5	91.8	9.0	IS	1.1	<0.6	0%	0%
07/30/08	2.8	IS	9.1	IS	1.9	0.7	0%	0%
08/05/08	2.4	104.5	13.2	IS	1.9	<0.6	0%	0%
08/13/08	5.6	110.4	14.1	IS	1.5	<0.6	0%	99%
08/19/08	3.7	2.0	11.0	IS	7.7	0.8	61%	67%
08/26/08	3.8	1.3	4.2	IS	5.4	<0.6	72%	87%
09/03/08	3.0	1.6	1.7	IS	2.7	<0.6	78%	94%
09/09/08	1.9	1.6	0.8	IS	1.7	<0.6	86%	95%
09/16/08	2.5	1.7	1.0	IS	0.6	<0.6	76%	98%
09/23/08	3.9	1.1	<0.6	IS	<0.6	<0.6	80%	100%
09/30/08	3.4	IS	IS	IS	IS	IS	79%	100%
10/07/08	5.2	1.7	0.8	IS	<0.6	<0.6	79%	100%
10/14/08	8.2	2.9	<0.6	IS	<0.6	4.1	84%	100%
10/21/08	10.3	6.5	0.8	IS	<0.6	<0.6	79%	100%
10/28/08	7.2	6.5	0.6	IS	0.5	<0.6	77%	100%
11/04/08	7.8	5.5	0.6	IS	0.9	<0.6	87%	100%
11/12/08	6.4	4.8	0.6	IS	1.4	<0.6	92%	100%
11/18/08	3.8	3.7	0.6	IS	1.5	0.7	96%	100%
11/25/08	5.3	3.6	0.6	IS	1.2	<0.6	97%	100%
12/02/08	3.7	1.3	<0.6	IS	0.9	<0.6	95%	69%
12/10/08	4.4	2.6	<0.6	IS	1.0	<0.6	93%	84%
12/16/08	2.8	2.6	IS	IS	0.5	<0.6	92%	47%
12/23/08	1.9	1.2	<0.6	IS	<0.6	<0.6	88%	34%
12/30/08	3.8	1.2	1.1	IS	0.6	0.8	81%	39%
01/06/09	5.0	1.1	1.3	IS	0.8	<0.6	79%	69%
01/13/09	5.2	1.1	1.1	IS	2.2	1.7	81%	76%
01/20/09	4.5	0.7	<0.6	IS	<0.6	<0.6	82%	86%
01/27/09	4.7	1.4	<0.6	IS	<0.6	<0.6	41%	86%
02/03/09	4.7	1.8	<0.6	IS	<0.6	<0.6	71%	88%
02/10/09	2.7	1.3	<0.6	IS	3.9	<0.6	58%	34%
02/18/09	2.4	0.9	<0.6	IS	<0.6	<0.6	43%	21%
02/24/09	2.1	<0.6	<0.6	IS	<0.6	<0.6	37%	20%
03/03/09	1.8	<0.6	<0.6	IS	<0.6	<0.6	39%	20%
03/10/09	1.9	<0.6	<0.6	IS	<0.6	<0.6	42%	16%
03/18/09	1.8	<0.6	<0.6	IS	<0.6	1.2	46%	62%
03/24/09	4.0	0.7	<0.6	IS	<0.6	<0.6	44%	74%
03/31/09	1.5	0.6	<0.6	IS	<0.6	<0.6	38%	82%
04/07/09	1.6	<0.6	0.8	IS	<0.6	<0.6	37%	92%
04/14/09	1.8	1.4	<0.6	IS	<0.6	0.6	36%	93%
04/21/09	2.4	1.3	<0.6	IS	<0.6	<0.6	36%	98%
04/28/09	4.0	1.9	0.7	IS	<0.6	0.7	39%	99%
05/05/09	2.6	1.5	<0.6	IS	<0.6	<0.6	45%	99%
05/12/09	<0.6	<0.6	<0.6	IS	<0.6	<0.6	53%	88%
05/19/09	1.0	1.2	<0.6	IS	<0.6	<0.6	60%	91%
05/27/09	1.3	1.6	<0.6	IS	1.8	<0.6	62%	95%
06/02/09	1.8	2.1	2.5	IS	1.1	0.9	62%	95%
06/09/09	3.8	2.4	IS	1.0	<0.6	<0.6	73%	98%
06/16/09	5.5	2.5	IS	IS	<0.6	<0.6	79%	99%
06/23/09	4.6	1.8	IS	IS	<0.6	<0.6	81%	100%
06/30/09	6.0	4.1	IS	IS	<0.6	<0.6	86%	100%
07/07/09	5.4	2.8	IS	IS	0.6	<0.6	75%	100%
07/14/09	3.3	2.8	IS	IS	1.0	<0.6	90%	100%
07/21/09	3.2	2.3	IS	IS	<0.6	<0.6		
07/28/09	1.2	1.6	IS	IS	<0.6	0.6		
08/04/09	2.5	1.9	IS	IS	1.0	IS		
08/11/09	2.6	5.2	IS	IS	<0.6	IS		

20-Sample Average from Dec 16, 2008 through April 28, 2009

TOC	3.03	1.05	0.49		0.64	0.49

Notes IS: Insufficient sample from lysimeter result in parameter not being analyzed

Table 4-4b
Brooks Basin Monitoring Wells Results
Total Nitrogen
(mg/L)

Date	BRK-1/1	BRK-1/2	Date	BRK-2/1	BRK-2/2
07/10/08	0.7	18.4	07/10/08	9.4	4.0
08/13/08	7.3	21.2			
08/25/08	6.8	18.1			
09/08/08	8.9	19.1			
09/22/08	8.6	18.1			
10/06/08	9.1	18.9	10/06/08	7.5	4.3
10/20/08	8.8	17.9			
11/03/08	8.7	18.7	11/05/08	6.8	4.4
11/19/08	2.5	18.3			
12/01/08	2.5	18.5	12/03/08	5.9	4.3
12/09/08	1.2	7.0			
12/17/08	1.4	18.0	12/17/08	5.8	4.3
12/29/08	4.1	15.0			
01/15/09	3.3	18.0	01/15/09	6.1	4.4
02/03/09	6.0	18.4			
02/19/09	3.6	18.4	02/19/09	8.2	5.0
03/03/09	2.1	19.7	03/03/09	8.1	4.8
03/11/09	4.6				
03/19/09	2.1				
03/25/09	1.2	18.8	03/25/09	8.0	5.0
03/31/09	1.7	18.3			
04/08/09	2.0	19.2			
04/13/09	1.4	18.6	04/13/09	9.3	5.2
04/27/09	3.8	18.7			
05/11/09	5.0	19.5	05/11/09	10.1	5.4
05/26/09	2.2	17.6			
06/08/09	2.2	18.5	06/08/09	9.1	5.2
06/22/09	12.6				
07/06/09	5.5				
07/20/09	0.7				
08/03/09	3.7				
07/20/09	0.7				
08/03/09	3.7				

Table 4-5

Brooks Monitoring Well and Pipeline Chloride

Sample Location	Date	Chloride (mg/L)	Baseline RW Aug-Dec. 2008 Cl (mg/L)	Groundwater 6 months prior Cl (mg/L)	Percent RW as indicate from Cl
Monitoring Well Samples					
BRK-1/1	10/11/07	36			
BRK-1/1	01/14/08	36			
BRK-1/1	04/10/08	16			
BRK-1/1	07/10/08	6.0			
BRK-1/1	10/06/08	42			
BRK-1/1	11/19/08	36			
BRK-1/1	12/18/08	16			
BRK-1/1	01/15/09	56	120	25	33%
BRK-1/1	03/03/09	77	120	25	55%
BRK-1/1	03/11/09	79	120	20	59%
BRK-1/1	03/19/09	89	120	16	70%
BRK-1/1	03/25/09	82	120	13	65%
BRK-1/1	03/31/09	79	120	11	63%
BRK-1/1	04/08/09	85	120	9	69%
BRK-1/1	04/13/09	78			
BRK-1/1	07/20/09	18			
BRK-1/1	10/05/09	50			
BRK-1/1	01/14/10	66			
Recycled Water Pipeline Samples					
RP-1/RP-4 Reliant	04/12/07	115			
RP-1/RP-4 Reliant	10/10/07	124			
RP-1/RP-4 Reliant	01/16/08	119			
RP-1/RP-4 Reliant	04/24/08	134			
RP-1/RP-4 Reliant	08/20/08	122			
RP-1/RP-4 Reliant	11/25/08	118			
RP-1/RP-4 Reliant	01/06/09	110			
RP-1/RP-4 Reliant	04/07/09	91			
RP-1/RP-4 Reliant	08/25/09	101			
RP-1/RP-4 Reliant	12/02/09	101			
RP-1/RP-4 Reliant	03/09/10	99			

Note

Recycled Water (RW) is interpreted to have arrived at BRK-1/1 between 12/18/2008 and to 1/15/2009 approximately 6 month following recharge based on correlation of peak Cl concentrations.

Table 5-1
Brooks Basin: Total Organic Carbon Removal Efficiency

Date	TOC (mg/L) Surface Water 0	TOC (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TOC Removal	Travel Time Offset (days)
07/30/08	16.9	17.8	0%	No Deliveries	
07/31/08					
08/01/08					
08/02/08					
08/03/08					
08/04/08					
08/05/08					
08/06/08					
08/07/08					
08/08/08					
08/09/08					
08/10/08					
08/11/08					
08/12/08					
08/13/08	13.5	0.97	0%	Purging soils	27
08/14/08					
08/15/08					
08/16/08					
08/17/08					
08/18/08					
08/19/08	6.42	1.69	61%	Purging soils	*29*
08/20/08					
08/21/08					
08/22/08					
08/23/08					
08/24/08					
08/25/08					
08/26/08	7.83	3.56	72%	Purging soils	*30*
08/27/08					
08/28/08					
08/29/08					
08/30/08					
08/31/08					
09/01/08					
09/02/08					
09/03/08	8.24	2.48	78%	Purging soils	*32*
09/04/08					
09/05/08					
09/06/08					
09/07/08					
09/08/08					
09/09/08	7.58	3.56	86%	73.6%	*34*
09/10/08					
09/11/08					
09/12/08					
09/13/08					
09/14/08					
09/15/08					
09/16/08	6.27	2.44	76%	62.0%	*35*
09/17/08					
09/18/08					
09/19/08					
09/20/08					
09/21/08					
09/22/08					
09/23/08	5.27	2.15	80%	72.5%	*37*
09/24/08					
09/25/08					
09/26/08					
09/27/08					
09/28/08					
09/29/08					
09/30/08	5.16	2.30	79%	71.4%	*39*
10/01/08					
10/02/08					
10/03/08					
10/04/08					
10/05/08					
10/06/08					
10/07/08	5.84	2.36	79%	71.4%	*40*
10/08/08					
10/09/08					
10/10/08					
10/11/08					
10/12/08					
10/13/08					
10/14/08	5.22	3.21	84%	57.7%	42
10/15/08					

Table 5-1
Brooks Basin: Total Organic Carbon Removal Efficiency

Date	TOC (mg/L) Surface Water 0	TOC (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TOC Removal	Travel Time Offset (days)
10/16/08					
10/17/08					
10/18/08					
10/19/08					
10/20/08					
10/21/08	5.06	3.02	79%	51.8%	*44*
10/22/08					
10/23/08					
10/24/08					
10/25/08					
10/26/08					
10/27/08					
10/28/08	4.83	3.81	77%	27.7%	*47*
10/29/08					
10/30/08					
10/31/08					
11/01/08					
11/02/08					
11/03/08					
11/04/08	5.48	3.19	87%	38.2%	*49*
11/05/08					
11/06/08					
11/07/08					
11/08/08					
11/09/08					
11/10/08					
11/11/08					
11/12/08	5.09	2.94	92%	46.5%	*51*
11/13/08					
11/14/08					
11/15/08					
11/16/08					
11/17/08					
11/18/08	5.17	2.73	96%	53.3%	*54*
11/19/08					
11/20/08					
11/21/08					
11/22/08					
11/23/08					
11/24/08					
11/25/08	4.63	2.57	97%	50.8%	56
11/26/08					
11/27/08					
11/28/08					
11/29/08					
11/30/08					
12/01/08					
12/02/08	5.23	2.42	95%	52.2%	*58*
12/03/08					
12/04/08					
12/05/08					
12/06/08					
12/07/08					
12/08/08					
12/09/08					
12/10/08	5.52	2.20	93%	54.5%	*60*
12/11/08					
12/12/08					
12/13/08					
12/14/08					
12/15/08					
12/16/08	6.69	2.20	92%	54.5%	*61*
12/17/08					
12/18/08					
12/19/08					
12/20/08					
12/21/08					
12/22/08					
12/23/08	4.72	2.18	88%	60.2%	63
12/24/08					
12/25/08					
12/26/08					
12/27/08					
12/28/08					
12/29/08					
12/30/08	4.49	2.29	81%	55.0%	*60*
12/31/08					

Table 5-1
Brooks Basin: Total Organic Carbon Removal Efficiency

Date	TOC (mg/L) Surface Water 0	TOC (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TOC Removal	Travel Time Offset (days)
01/01/09					
01/02/09					
01/03/09					
01/04/09					
01/05/09					
01/06/09	4.68	2.36	79%	54.0%	*56*
01/07/09					
01/08/09					
01/09/09					
01/10/09					
01/11/09					
01/12/09					
01/13/09	3.86	2.29	81%	55.7%	*53*
01/14/09					
01/15/09					
01/16/09					
01/17/09					
01/18/09					
01/19/09					
01/20/09	4.08	2.17	82%	53.1%	49
01/21/09					
01/22/09					
01/23/09					
01/24/09					
01/25/09					
01/26/09					
01/27/09	4.43	2.13	41%	59.3%	*46*
01/28/09					
01/29/09					
01/30/09					
01/31/09					
02/01/09					
02/02/09					
02/03/09	4.21	2.14	71%	61.2%	43
02/04/09					
02/05/09					
02/06/09					
02/07/09					
02/08/09					
02/09/09					
02/10/09	4.32	2.29	58%	65.8%	*43*
02/11/09					
02/12/09					
02/13/09					
02/14/09					
02/15/09					
02/16/09					
02/17/09					
02/18/09	3.85	2.18	43%	61.8%	*43*
02/19/09					
02/20/09					
02/21/09					
02/22/09					
02/23/09					
02/24/09	3.35	1.77	37%	62.5%	*42*
02/25/09					
02/26/09					
02/27/09					
02/28/09					
03/01/09					
03/02/09					
03/03/09	3.80	1.66	39%	64.5%	42
03/04/09					
03/05/09					
03/06/09					
03/07/09					
03/08/09					
03/09/09					
03/10/09	4.85	2.54	42%	37.7%	*44*
03/11/09					
03/12/09					
03/13/09					
03/14/09					
03/15/09					

Table 5-1
Brooks Basin: Total Organic Carbon Removal Efficiency

Date	TOC (mg/L) Surface Water 0	TOC (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TOC Removal	Travel Time Offset (days)
03/16/09					
03/17/09					
03/18/09	4.01	1.71	46%	59.4%	45
03/19/09					
03/20/09					
03/21/09					
03/22/09					
03/23/09					
03/24/09	4.95	2.07	44%	52.1%	47
03/25/09					
03/26/09					
03/27/09					
03/28/09					
03/29/09					
03/30/09					
03/31/09	5.04	2.13	38%	44.7%	48
04/01/09					
04/02/09					
04/03/09					
04/04/09					
04/05/09					
04/06/09					
04/07/09	4.43	1.50	37%	55.2%	50
04/08/09					
04/09/09					
04/10/09					
04/11/09					
04/12/09					
04/13/09					
04/14/09	4.93	1.83	36%	51.8%	51
04/15/09					
04/16/09					
04/17/09					
04/18/09					
04/19/09					
04/20/09					
04/21/09	6.05	1.46	36%	69.9%	53
04/22/09					
04/23/09					
04/24/09					
04/25/09					
04/26/09					
04/27/09					
04/28/09	5.21	1.52	39%	65.7%	54
04/29/09					
04/30/09					
05/01/09					
05/02/09					
05/03/09					
05/04/09					
05/05/09	5.75	1.69	45%	62.3%	56
05/06/09					
05/07/09					
05/08/09					
05/09/09					
05/10/09					
05/11/09					
05/12/09	5.00	2.38	53%	51.9%	56
05/13/09					
05/14/09					
05/15/09					
05/16/09					
05/17/09					
05/18/09					
05/19/09	5.75	2.03	60%	59.7%	56
05/20/09					
05/21/09					
05/22/09					
05/23/09					
05/24/09					
05/25/09					
05/26/09					
05/27/09	5.63	1.98	62%	55.3%	56
05/28/09					
05/29/09					
05/30/09					
05/31/09					

Table 5-1
Brooks Basin: Total Organic Carbon Removal Efficiency

Date	TOC (mg/L) Surface Water 0	TOC (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TOC Removal	Travel Time Offset (days)
06/01/09					
06/02/09	5.55	2.32	62%	52.9%	*56*
06/03/09					
06/04/09					
06/05/09					
06/06/09					
06/07/09					
06/08/09					
06/09/09	4.57	2.04	73%	66.3%	*56*
06/10/09					
06/11/09					
06/12/09					
06/13/09					
06/14/09					
06/15/09					
06/16/09	4.92	2.46	79%	56.3%	
06/17/09					
06/18/09					
06/19/09					
06/20/09					
06/21/09					
06/22/09					
06/23/09	5.21	2.82	81%	45.9%	
06/24/09					
06/25/09					
06/26/09					
06/27/09					
06/28/09					
06/29/09					
06/30/09	6.12	2.95	86%	48.7%	
07/01/09					
07/02/09					
07/03/09					
07/04/09					
07/05/09					
07/06/09					
07/07/09	7.81	3.10	75%	38.0%	
07/08/09					
07/09/09					
07/10/09					
07/11/09					
07/12/09					
07/13/09					
07/14/09	6.51	3.02	90%	47.5%	
07/15/09					
07/16/09					
07/17/09					
07/18/09					
07/19/09					
07/20/09					
07/21/09	7.18	2.76	92%	51.0%	
07/22/09					
07/23/09					
07/24/09					
07/25/09					
07/26/09					
07/27/09					
07/28/09	8.23	2.95	93%	46.8%	
07/29/09					
07/30/09					
07/31/09					
08/01/09					
08/02/09					
08/03/09					
08/04/09	7.29	3.78	83%	17.3%	
08/05/09					
08/06/09					
08/07/09					
08/08/09					
08/09/09					
08/10/09					
08/11/09	8.87	11.2	100%	Anomalous TOC	
08/12/09					

Table 5-2
Brooks Basin: Total Nitrogen Removal Efficiency

Date	TN (mg/L) Surface Water 0	TN (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TN Removal	Travel Time Offset (days)
07/30/08	0.9	1.9	0%	No Deliveries	
07/31/08					
08/01/08					
08/02/08					
08/03/08					
08/04/08					
08/05/08	2.4	1.9			
08/06/08					
08/07/08					
08/08/08					
08/09/08					
08/10/08					
08/11/08					
08/12/08					
08/13/08	5.6	1.47	0%	Purging soils	27
08/14/08					
08/15/08					
08/16/08					
08/17/08					
08/18/08					
08/19/08	3.71	7.68	61%	Purging soils	*29*
08/20/08					
08/21/08					
08/22/08					
08/23/08					
08/24/08					
08/25/08					
08/26/08	3.84	5.37	72%	Purging soils	*30*
08/27/08					
08/28/08					
08/29/08					
08/30/08					
08/31/08					
09/01/08					
09/02/08					
09/03/08	2.96	2.68	78%	Purging soils	*32*
09/04/08					
09/05/08					
09/06/08					
09/07/08					
09/08/08					
09/09/08	1.87	1.71	86%	69.7%	*34*
09/10/08					
09/11/08					
09/12/08					
09/13/08					
09/14/08					
09/15/08					
09/16/08	2.47	0.56	76%	84.8%	*35*
09/17/08					
09/18/08					
09/19/08					
09/20/08					
09/21/08					
09/22/08					
09/23/08	3.62	0.22	80%	94.3%	*37*
09/24/08					
09/25/08					
09/26/08					
09/27/08					
09/28/08					
09/29/08					
09/30/08	2.82	0.08	79%	97.6%	*39*
10/01/08					
10/02/08					
10/03/08					
10/04/08					
10/05/08					
10/06/08					
10/07/08	5.20	0.33	79%	89.0%	*40*
10/08/08					
10/09/08					
10/10/08					
10/11/08					
10/12/08					
10/13/08					
10/14/08	8.17	0.31	84%	83.7%	42
10/15/08					

Table 5-2
Brooks Basin: Total Nitrogen Removal Efficiency

Date	TN (mg/L) Surface Water 0	TN (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TN Removal	Travel Time Offset (days)
10/16/08					
10/17/08					
10/18/08					
10/19/08					
10/20/08					
10/21/08	10.27	0.31	79%	87.7%	*44*
10/22/08					
10/23/08					
10/24/08					
10/25/08					
10/26/08					
10/27/08					
10/28/08	7.20	0.54	77%	85.0%	*47*
10/29/08					
10/30/08					
10/31/08					
11/01/08					
11/02/08					
11/03/08					
11/04/08	7.80	0.88	87%	68.8%	*49*
11/05/08					
11/06/08					
11/07/08					
11/08/08					
11/09/08					
11/10/08					
11/11/08					
11/12/08	6.45	1.39	92%	65.3%	*51*
11/13/08					
11/14/08					
11/15/08					
11/16/08					
11/17/08					
11/18/08	3.85	1.45	96%	72.1%	*54*
11/19/08					
11/20/08					
11/21/08					
11/22/08					
11/23/08					
11/24/08					
11/25/08	5.32	1.20	97%	85.3%	56
11/26/08					
11/27/08					
11/28/08					
11/29/08					
11/30/08					
12/01/08					
12/02/08	3.69	0.88	95%	91.4%	*58*
12/03/08					
12/04/08					
12/05/08					
12/06/08					
12/07/08					
12/08/08					
12/09/08					
12/10/08	4.38	1.00	93%	86.1%	*60*
12/11/08					
12/12/08					
12/13/08					
12/14/08					
12/15/08					
12/16/08	2.80	0.53	92%	92.7%	*61*
12/17/08					
12/18/08					
12/19/08					
12/20/08					
12/21/08					
12/22/08					
12/23/08	1.94	0.31	88%	96.1%	63
12/24/08					
12/25/08					
12/26/08					
12/27/08					
12/28/08					
12/29/08					
12/30/08	3.82	0.57	81%	91.2%	*60*
12/31/08					

Table 5-2
Brooks Basin: Total Nitrogen Removal Efficiency

Date	TN (mg/L) Surface Water 0	TN (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TN Removal	Travel Time Offset (days)
01/01/09					
01/02/09					
01/03/09					
01/04/09					
01/05/09					
01/06/09	5.01	0.81	79%	84.4%	*56*
01/07/09					
01/08/09					
01/09/09					
01/10/09					
01/11/09					
01/12/09					
01/13/09	5.16	2.16	81%	43.9%	*53*
01/14/09					
01/15/09					
01/16/09					
01/17/09					
01/18/09					
01/19/09					
01/20/09	4.46	0.31	82%	94.3%	49
01/21/09					
01/22/09					
01/23/09					
01/24/09					
01/25/09					
01/26/09					
01/27/09	4.67	0.31	41%	91.7%	*46*
01/28/09					
01/29/09					
01/30/09					
01/31/09					
02/01/09					
02/02/09					
02/03/09	4.67	0.31	71%	93.0%	43
02/04/09					
02/05/09					
02/06/09					
02/07/09					
02/08/09					
02/09/09				Anomalously	
02/10/09	2.73	3.90	58%	-39.2%	*43*
02/11/09				High Lsyim. TN	
02/12/09					
02/13/09					
02/14/09					
02/15/09					
02/16/09					
02/17/09					
02/18/09	2.37	0.41	43%	82.7%	*43*
02/19/09					
02/20/09					
02/21/09					
02/22/09					
02/23/09					
02/24/09	2.09	0.31	37%	84.3%	*42*
02/25/09					
02/26/09					
02/27/09					
02/28/09					
03/01/09					
03/02/09					
03/03/09	1.79	0.31	39%	93.8%	42
03/04/09					
03/05/09					
03/06/09					
03/07/09					
03/08/09					
03/09/09					
03/10/09	1.89	0.31	42%	93.2%	*44*
03/11/09					
03/12/09					
03/13/09					
03/14/09					
03/15/09					

Table 5-2
Brooks Basin: Total Nitrogen Removal Efficiency

Date	TN (mg/L) Surface Water 0	TN (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TN Removal	Travel Time Offset (days)
03/16/09					
03/17/09					
03/18/09	1.76	0.31	46%	93.5%	45
03/19/09					
03/20/09					
03/21/09					
03/22/09					
03/23/09					
03/24/09	4.00	0.31	44%	88.8%	47
03/25/09					
03/26/09					
03/27/09					
03/28/09					
03/29/09					
03/30/09					
03/31/09	1.47	0.31	38%	87.1%	48
04/01/09					
04/02/09					
04/03/09					
04/04/09					
04/05/09					
04/06/09	Initial and Paired				
04/07/09	1.61	0.31	37%	85.4%	50
04/08/09	TN are about =				
04/09/09					
04/10/09					
04/11/09					
04/12/09					
04/13/09					
04/14/09	1.84	0.31	36%	83.0%	51
04/15/09					
04/16/09					
04/17/09					
04/18/09					
04/19/09					
04/20/09					
04/21/09	2.43	0.31	36%	83.8%	53
04/22/09					
04/23/09					
04/24/09					
04/25/09					
04/26/09					
04/27/09					
04/28/09	4.04	0.31	39%	83.3%	54
04/29/09					
04/30/09					
05/01/09					
05/02/09					
05/03/09					
05/04/09					
05/05/09	2.62	0.31	45%	89.4%	56
05/06/09					
05/07/09					
05/08/09					
05/09/09					
05/10/09					
05/11/09	Anomalously				
05/12/09	0.36	0.31	53%	92.4%	56
05/13/09	Low Initial TN				
05/14/09					
05/15/09					
05/16/09					
05/17/09					
05/18/09					
05/19/09	1.01	0.31	60%	79.2%	56
05/20/09					
05/21/09					
05/22/09					
05/23/09					
05/24/09					
05/25/09					
05/26/09				Initial and Paired	
05/27/09	1.33	1.84	62%	-14.1%	56
05/28/09				TN are about =	
05/29/09					
05/30/09					
05/31/09					

Table 5-2
Brooks Basin: Total Nitrogen Removal Efficiency

Date	TN (mg/L) Surface Water 0	TN (mg/L) Lysimeter 25	% RW at 25-ft bgs Lysimeter	% TN Removal	Travel Time Offset (days)
06/01/09					
06/02/09	1.84	1.07	62%	41.8%	56
06/03/09					
06/04/09					
06/05/09					
06/06/09					
06/07/09					
06/08/09					
06/09/09	3.80	0.39	73%	84.0%	56
06/10/09					
06/11/09					
06/12/09					
06/13/09					
06/14/09					
06/15/09					
06/16/09	5.53	0.38	79%	88.3%	
06/17/09					
06/18/09					
06/19/09					
06/20/09					
06/21/09					
06/22/09					
06/23/09	4.56	0.39	81%	90.4%	
06/24/09					
06/25/09					
06/26/09					
06/27/09					
06/28/09					
06/29/09					
06/30/09	5.98	0.38	86%	85.4%	
07/01/09					
07/02/09					
07/03/09					
07/04/09					
07/05/09					
07/06/09				Anomalously	
07/07/09	5.44	0.64	75%	-77.4%	
07/08/09				Low Initial TN	
07/09/09					
07/10/09					
07/11/09					
07/12/09					
07/13/09				Low TN	
07/14/09	3.28	1.00	90%	1.0%	
07/15/09				In Surface Water	
07/16/09					
07/17/09					
07/18/09					
07/19/09					
07/20/09					
07/21/09	3.20	0.35		73.7%	
07/22/09					
07/23/09					
07/24/09					
07/25/09					
07/26/09					
07/27/09					
07/28/09	1.23	0.37		80.2%	
07/29/09					
07/30/09					
07/31/09					
08/01/09					
08/02/09					
08/03/09					
08/04/09	2.52	1.03		72.8%	
08/05/09					
08/06/09					
08/07/09					
08/08/09					
08/09/09					
08/10/09					
08/11/09	2.56	0.5		90.5%	
08/12/09					

Table 7-1

Brooks Basin RWC Management Plan

(120-month averaging period)

Calculation of Recycled Water Contribution (RWC) from Historical Diluent Water (DW) and Recycled Water (RW) Deliveries

Date		No. Mos. Since Initial RW Delivery	SW (AF)	MWD (AF)	Underflow (AF)	DW Total (AF)	DW 120-Month Total (AF)	RW (AF)	RW 120-Month Total (AF)	DW + RW 120-Month Total (AF)	RWC	Source
2005/06	Jul '05	-36	32.7	0.		32.7		0.				
	Aug '05	-35	0.	175.3		175.3		0.				
	Sep '05	-34	0.	684.2		684.2		0.				
	Oct '05	-33	5.5	121.9		127.4		0.				
	Nov '05	-32	59.5	330.		389.5		0.				
	Dec '05	-31	31.8	331.2		363.		0.				MEASURED
	Jan '06	-30	12.	245.1		257.1		0.				
	Feb '06	-29	160.4	232.2		392.6		0.				
	Mar '06	-28	204.9	10.		214.9		0.				
	Apr '06	-27	156.3	105.		261.3		0.				
	May '06	-26	16.6	284.1		300.7		0.				
	Jun '06	-25	0.	371.		371.		0.				
2006/07	Jul '06	-24	0.	206.4		206.4	3776	0.	0	3776	0%	
	Aug '06	-23	20.	131.		151.	3927	0.	0	3927	0%	
	Sep '06	-22	21.	321.5		342.5	4270	0.	0	4270	0%	
	Oct '06	-21	14.	292.9		306.9	4577	0.	0	4577	0%	
	Nov '06	-20	30.	257.7		287.7	4864	0.	0	4864	0%	
	Dec '06	-19	30.8	231.		261.8	5126	0.	0	5126	0%	
	Jan '07	-18	25.3	87.2		112.5	5239	0.	0	5239	0%	
	Feb '07	-17	62.2	66.9		129.1	5368	0.	0	5368	0%	
	Mar '07	-16	3.5	0.		3.5	5371	0.	0	5371	0%	
	Apr '07	-15	102.	0.		102.	5473	0.	0	5473	0%	
	May '07	-14	4.	0.		4.	5477	0.	0	5477	0%	
	Jun '07	-13	2.	0.		2.	5479	0.	0	5479	0%	
2007/08	Jul '07	-12	0.	0.		0.	5479	0.	0	5479	0%	
	Aug '07	-11	0.	0.		0.	5479	0.	0	5479	0%	
	Sep '07	-10	25.	0.		25.	5504	0.	0	5504	0%	
	Oct '07	-9	35.	0.		35.	5539	0.	0	5539	0%	
	Nov '07	-8	24.	0.		24.	5563	0.	0	5563	0%	
	Dec '07	-7	42.	0.		42.	5605	0.	0	5605	0%	MEASURED
	Jan '08	-6	282.	0.		282.	5887	0.	0	5887	0%	
	Feb '08	-5	50.	0.		50.	5937	0.	0	5937	0%	
	Mar '08	-4	9.	0.		9.	5946	0.	0	5946	0%	
	Apr '08	-3	4.	0.		4.	5950	0.	0	5950	0%	
	May '08	-2	43.	0.		43.	5993	0.	0	5993	0%	
	Jun '08	-1	3.	0.		3.	5996	0.	0	5996	0%	
2008/09	Jul '08	0	3.	0.		3.	5999	0.	0	5999	0%	
	Aug '08	1	16.	0.	509.2	525.2	6524	117.	117	6641	2%	
	Sep '08	2	0.	0.	509.2	509.2	7034	86.	203	7237	3%	
	Oct '08	3	0.	0.	509.2	509.2	7543	166.	369	7912	5%	
	Nov '08	4	23.	0.	509.2	532.2	8075	103.	472	8547	6%	
	Dec '08	5	162.	0.	509.2	671.2	8746	88.	560	9306	6%	
	Jan '09	6	25.	0.	509.2	534.2	9281	277.	837	10118	8%	START-UP
	Feb '09	7	208.	0.	509.2	717.2	9998	20.	857	10855	8%	
	Mar '09	8	30.	0.	509.2	539.2	10537	159.	1016	11553	9%	
	Apr '09	9	1.	0.	509.2	510.2	11047	296.	1312	12359	11%	
	May '09	10	17.	0.	509.2	526.2	11573	115.	1427	13000	11%	
	Jun '09	11	0.	0.	509.2	509.2	12083	178.	1605	13688	12%	
2009/10	Jul '09	12	1.	0.	509.2	510.2	12593	6.	1611	14204	11%	
	Aug '09	13	0.	0.	509.2	509.2	13102	8.	1619	14721	11%	
	Sep '09	14	0.	0.	509.2	509.2	13611	0.	1619	15230	11%	
	Oct '09	15	13.	0.	509.2	522.2	14134	184.	1803	15937	11%	
	Nov '09	16	4.	0.	509.2	513.2	14647	246.	2049	16696	12%	
	Dec '09	17	129.	0.	509.2	638.2	15285	144.	2193	17478	13%	
	Jan '10	18	251.	0.	509.2	760.2	16045	74.	2267	18312	12%	
	Feb '10	19	215.	0.	509.2	724.2	16769	54.	2321	19090	12%	
	Mar '10	20	27.	0.	509.2	536.2	17306	180.	2501	19807	13%	
	Apr '10	21	23.	0.	509.2	532.2	17838	235.	2736	20574	13%	
	May '10	22	2.	0.	509.2	511.2	18349	356.	3092	21441	14%	
	Jun '10	23	1.		509.2	510.2	18859	300.	3392	22251	15%	
2010/11	Jul '10	24	7.		509.2	516.2	19376	0.	3392	22768	15%	
	Aug '10	25	7.		509.2	516.2	19892	0.	3392	23284	15%	
	Sep '10	26	9.		509.2	518.2	20410	290.	3682	24092	15%	
	Oct '10	27	14.		509.2	523.2	20933	280.	3962	24895	16%	
	Nov '10	28	28.		509.2	537.2	21470	260.	4222	25692	16%	
	Dec '10	29	79.		509.2	588.2	22059	210.	4432	26491	17%	PLANNED
	Jan '11	30	119.		509.2	628.2	22687	180.	4612	27299	17%	
	Feb '11	31	139.		509.2	648.2	23335	130.	4742	28077	17%	
	Mar '11	32	62.		509.2	571.2	23906	200.	4942	28848	17%	
	Apr '11	33	66.		509.2	575.2	24482	200.	5142	29624	17%	
	May '11	34	20.		509.2	529.2	25011	250.	5392	30403	18%	
	Jun '11	35	1.		509.2	510.2	25521	300.	5692	31213	18%	

Table 7-1

Brooks Basin RWC Management Plan

(120-month averaging period)

Calculation of Recycled Water Contribution (RWC) from Historical Diluent Water (DW) and Recycled Water (RW) Deliveries

Date		No. Mos. Since Initial RW Delivery	SW (AF)	MWD (AF)	Underflow (AF)	DW Total (AF)	DW 120-Month Total (AF)	RW (AF)	RW 120-Month Total (AF)	DW + RW 120-Month Total (AF)	RWC	Source
2011/12	Jul '11	36	7.		509.2	516.2	26037	0.	5692	31729	18%	PLANNED
	Aug '11	37	7.		509.2	516.2	26553	0.	5692	32245	18%	
	Sep '11	38	9.		509.2	518.2	27072	290.	5982	33054	18%	
	Oct '11	39	14.		509.2	523.2	27595	280.	6262	33857	18%	
	Nov '11	40	28.		509.2	537.2	28132	260.	6522	34654	19%	
	Dec '11	41	79.		509.2	588.2	28720	210.	6732	35452	19%	
	Jan '12	42	119.		509.2	628.2	29349	180.	6912	36261	19%	
	Feb '12	43	139.		509.2	648.2	29997	130.	7042	37039	19%	
	Mar '12	44	62.		509.2	571.2	30568	200.	7242	37810	19%	
	Apr '12	45	66.		509.2	575.2	31143	200.	7442	38585	19%	
	May '12	46	20.		509.2	529.2	31673	250.	7692	39365	20%	
	Jun '12	47	1.		509.2	510.2	32183	300.	7992	40175	20%	
2012/13	Jul '12	48	7.		509.2	516.2	32699	0.	7992	40691	20%	
	Aug '12	49	7.		509.2	516.2	33215	0.	7992	41207	19%	
	Sep '12	50	9.		509.2	518.2	33733	290.	8282	42015	20%	
	Oct '12	51	14.		509.2	523.2	34257	280.	8562	42819	20%	
	Nov '12	52	28.		509.2	537.2	34794	260.	8822	43616	20%	
	Dec '12	53	79.		509.2	588.2	35382	210.	9032	44414	20%	
	Jan '13	54	119.		509.2	628.2	36010	180.	9212	45222	20%	
	Feb '13	55	139.		509.2	648.2	36659	130.	9342	46001	20%	
	Mar '13	56	62.		509.2	571.2	37230	200.	9542	46772	20%	
	Apr '13	57	66.		509.2	575.2	37805	200.	9742	47547	20%	
	May '13	58	20.		509.2	529.2	38334	250.	9992	48326	21%	
	Jun '13	59	1.		509.2	510.2	38844	300.	10292	49136	21%	
2013/14	Jul '13	60	7.		509.2	516.2	39361	0.	10292	49653	21%	
	Aug '13	61	7.		509.2	516.2	39877	0.	10292	50169	21%	
	Sep '13	62	9.		509.2	518.2	40395	290.	10582	50977	21%	
	Oct '13	63	14.		509.2	523.2	40918	280.	10862	51780	21%	
	Nov '13	64	28.		509.2	537.2	41456	260.	11122	52578	21%	
	Dec '13	65	79.		509.2	588.2	42044	210.	11332	53376	21%	
	Jan '14	66	119.		509.2	628.2	42672	180.	11512	54184	21%	
	Feb '14	67	139.		509.2	648.2	43320	130.	11642	54962	21%	
	Mar '14	68	62.		509.2	571.2	43891	200.	11842	55733	21%	
	Apr '14	69	66.		509.2	575.2	44467	200.	12042	56509	21%	
	May '14	70	20.		509.2	529.2	44996	250.	12292	57288	21%	
	Jun '14	71	1.		509.2	510.2	45506	300.	12592	58098	22%	
2014/15	Jul '14	72	7.		509.2	516.2	46022	0.	12592	58614	21%	
	Aug '14	73	7.		509.2	516.2	46539	0.	12592	59131	21%	
	Sep '14	74	9.		509.2	518.2	47057	290.	12882	59939	21%	
	Oct '14	75	14.		509.2	523.2	47580	280.	13162	60742	22%	
	Nov '14	76	28.		509.2	537.2	48117	260.	13422	61539	22%	
	Dec '14	77	79.		509.2	588.2	48705	210.	13632	62337	22%	
	Jan '15	78	119.		509.2	628.2	49334	180.	13812	63146	22%	
	Feb '15	79	139.		509.2	648.2	49982	130.	13942	63924	22%	
	Mar '15	80	62.		509.2	571.2	50553	200.	14142	64695	22%	
	Apr '15	81	66.		509.2	575.2	51128	200.	14342	65470	22%	
	May '15	82	20.		509.2	529.2	51658	250.	14592	66250	22%	
	Jun '15	83	1.		509.2	510.2	52168	300.	14892	67060	22%	
2015/16	Jul '15	84	7.		509.2	516.2	52651	0.	14892	67543	22%	
	Aug '15	85	7.		509.2	516.2	52992	0.	14892	67884	22%	
	Sep '15	86	9.		509.2	518.2	52826	290.	15182	68008	22%	
	Oct '15	87	14.		509.2	523.2	53222	280.	15462	68684	23%	
	Nov '15	88	28.		509.2	537.2	53370	260.	15722	69092	23%	
	Dec '15	89	79.		509.2	588.2	53595	210.	15932	69527	23%	
	Jan '16	90	119.		509.2	628.2	53966	180.	16112	70078	23%	
	Feb '16	91	139.		509.2	648.2	54222	130.	16242	70464	23%	
	Mar '16	92	62.		509.2	571.2	54578	200.	16442	71020	23%	
	Apr '16	93	66.		509.2	575.2	54892	200.	16642	71534	23%	
	May '16	94	20.		509.2	529.2	55121	250.	16892	72013	23%	
	Jun '16	95	1.		509.2	510.2	55260	300.	17192	72452	24%	
2016/17	Jul '16	96	7.		509.2	516.2	55570	0.	17192	72762	24%	
	Aug '16	97	7.		509.2	516.2	55935	0.	17192	73127	24%	
	Sep '16	98	9.		509.2	518.2	56111	290.	17482	73593	24%	
	Oct '16	99	14.		509.2	523.2	56327	280.	17762	74089	24%	
	Nov '16	100	28.		509.2	537.2	56576	260.	18022	74598	24%	
	Dec '16	101	79.		509.2	588.2	56903	210.	18232	75135	24%	
	Jan '17	102	119.		509.2	628.2	57419	180.	18412	75831	24%	
	Feb '17	103	139.		509.2	648.2	57938	130.	18542	76480	24%	
	Mar '17	104	62.		509.2	571.2	58505	200.	18742	77247	24%	
	Apr '17	105	66.		509.2	575.2	58979	200.	18942	77921	24%	
	May '17	106	20.		509.2	529.2	59504	250.	19192	78696	24%	
	Jun '17	107	1.		509.2	510.2	60012	300.	19492	79504	25%	

Table 7-1

Brooks Basin RWC Management Plan

(120-month averaging period)

Calculation of Recycled Water Contribution (RWC) from Historical Diluent Water (DW) and Recycled Water (RW) Deliveries

Date		No. Mos. Since Initial RW Delivery	SW (AF)	MWD (AF)	Underflow (AF)	DW Total (AF)	DW 120-Month Total (AF)	RW (AF)	RW 120-Month Total (AF)	DW + RW 120-Month Total (AF)	RWC	Source
2017/18	Jul '17	108	7.		509.2	516.2	60528	0.	19492	80020	24%	PLANNED
	Aug '17	109	7.		509.2	516.2	61045	0.	19492	80537	24%	
	Sep '17	110	9.		509.2	518.2	61538	290.	19782	81320	24%	
	Oct '17	111	14.		509.2	523.2	62026	280.	20062	82088	24%	
	Nov '17	112	28.		509.2	537.2	62539	260.	20322	82861	25%	
	Dec '17	113	79.		509.2	588.2	63085	210.	20532	83617	25%	
	Jan '18	114	119.		509.2	628.2	63432	180.	20712	84144	25%	
	Feb '18	115	139.		509.2	648.2	64030	130.	20842	84872	25%	
	Mar '18	116	62.		509.2	571.2	64592	200.	21042	85634	25%	
	Apr '18	117	66.		509.2	575.2	65163	200.	21242	86405	25%	
	May '18	118	20.		509.2	529.2	65650	250.	21492	87142	25%	
	Jun '18	119	1.		509.2	510.2	66157	300.	21792	87949	25%	
2018/19	Jul '18	120	7.		509.2	516.2	66670	0.	21792	88462	25%	
	Aug '18	121	7.		509.2	516.2	66661	0.	21675	88336	25%	
	Sep '18	122	9.		509.2	518.2	66670	290.	21879	88549	25%	
	Oct '18	123	14.		509.2	523.2	66684	280.	21993	88677	25%	
	Nov '18	124	28.		509.2	537.2	66689	260.	22150	88839	25%	
	Dec '18	125	79.		509.2	588.2	66606	210.	22272	88878	25%	
	Jan '19	126	119.		509.2	628.2	66700	180.	22175	88875	25%	
	Feb '19	127	139.		509.2	648.2	66631	130.	22285	88916	25%	
	Mar '19	128	62.		509.2	571.2	66663	200.	22326	88989	25%	
	Apr '19	129	66.		509.2	575.2	66728	200.	22230	88958	25%	
	May '19	130	20.		509.2	529.2	66731	250.	22365	89096	25%	
	Jun '19	131	1.		509.2	510.2	66732	300.	22487	89219	25%	
2019/20	Jul '19	132	7.		509.2	516.2	66738	0.	22481	89219	25%	
	Aug '19	133	7.		509.2	516.2	66745	0.	22473	89218	25%	
	Sep '19	134	9.		509.2	518.2	66754	290.	22763	89517	25%	
	Oct '19	135	14.		509.2	523.2	66755	280.	22859	89614	26%	
	Nov '19	136	28.		509.2	537.2	66779	260.	22873	89652	26%	
	Dec '19	137	79.		509.2	588.2	66729	210.	22939	89668	26%	
	Jan '20	138	119.		509.2	628.2	66597	180.	23045	89642	26%	
	Feb '20	139	139.		509.2	648.2	66521	130.	23121	89642	26%	
	Mar '20	140	62.		509.2	571.2	66556	200.	23141	89697	26%	
	Apr '20	141	66.		509.2	575.2	66599	200.	23106	89705	26%	
	May '20	142	20.		509.2	529.2	66617	250.	23000	89617	26%	
	Jun '20	143	1.		509.2	510.2	66617	300.	23000	89617	26%	

Notes:

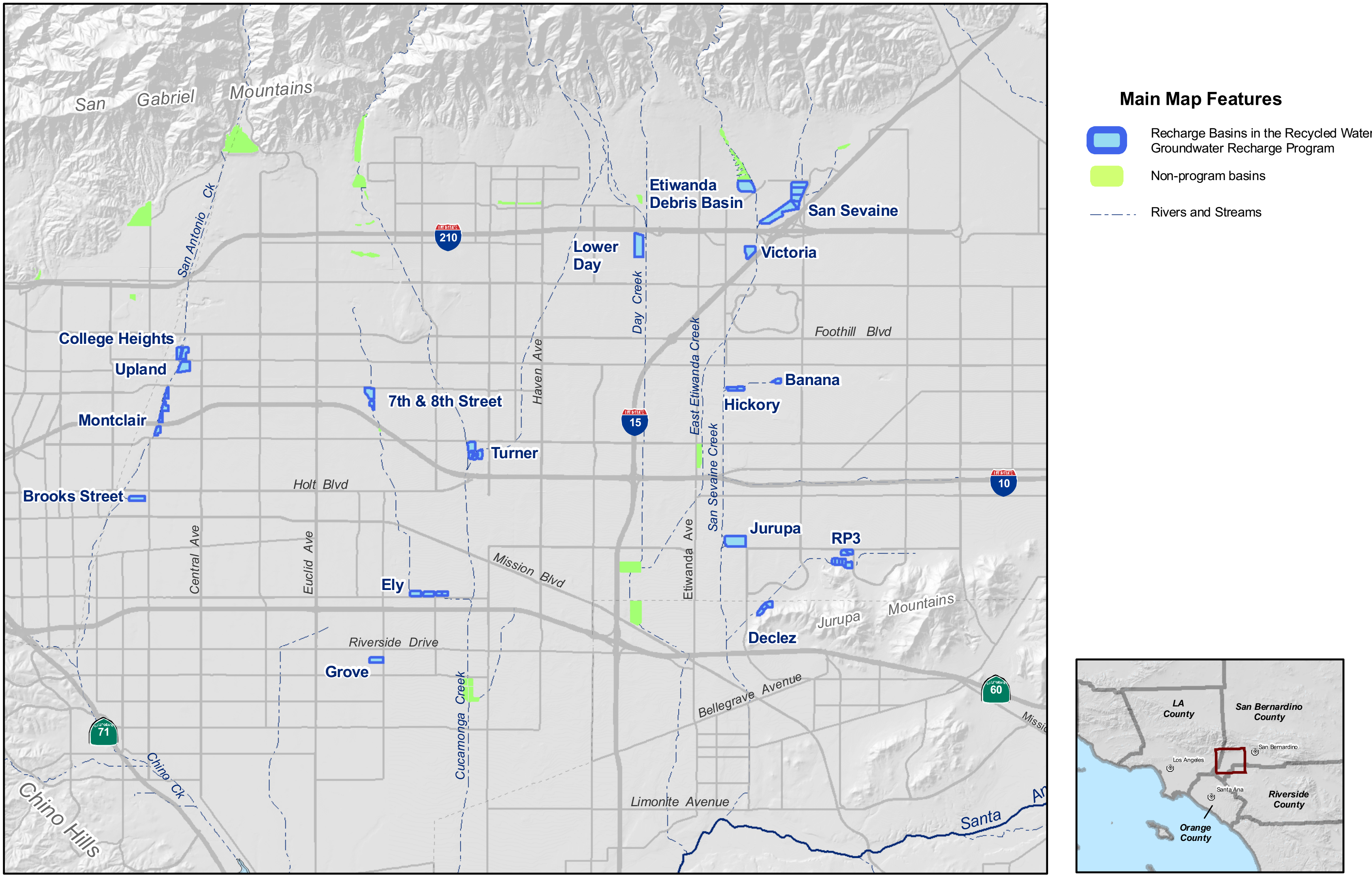
DW = Diluent Water; Total DW is the sum of Stormwater & Local Runoff (SW), Imported Water from the State Water Project (MWD), and groundwater underflow.

RW = Recycled Water

RWC = 120-month running total of recycled water / 120-month running total of all diluent and recycled water.

RWC maximum = 0.5 mg/L / the Running Average of Total Organic Carbon (TOC) determined from a recharge site's start-up period

FIGURES



0 2 4 Miles

0 4 8 Kilometers

Inland Empire Utilities Agency
A MUNICIPAL WATER DISTRICT

Chino Basin Recycled Water Groundwater Recharge Programs

Basin Locations

Figure 1-1

Location of Facilities
at Brooks Street Basin

Figure 2-1

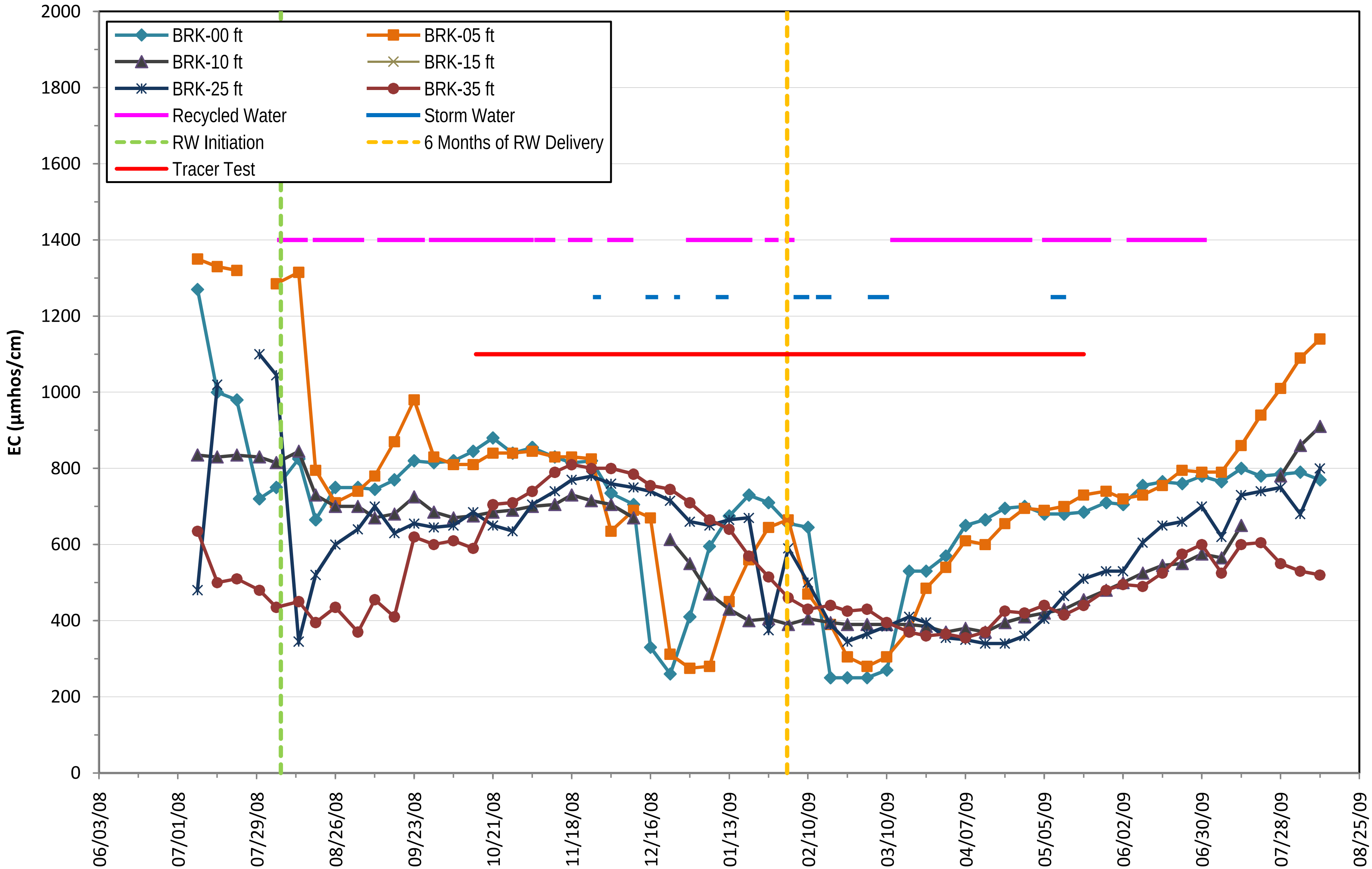


FIGURE 4-1a
BROOKS BASIN LYSIMETERS
ELECTRICAL CONDUCTIVITY TIME SERIES

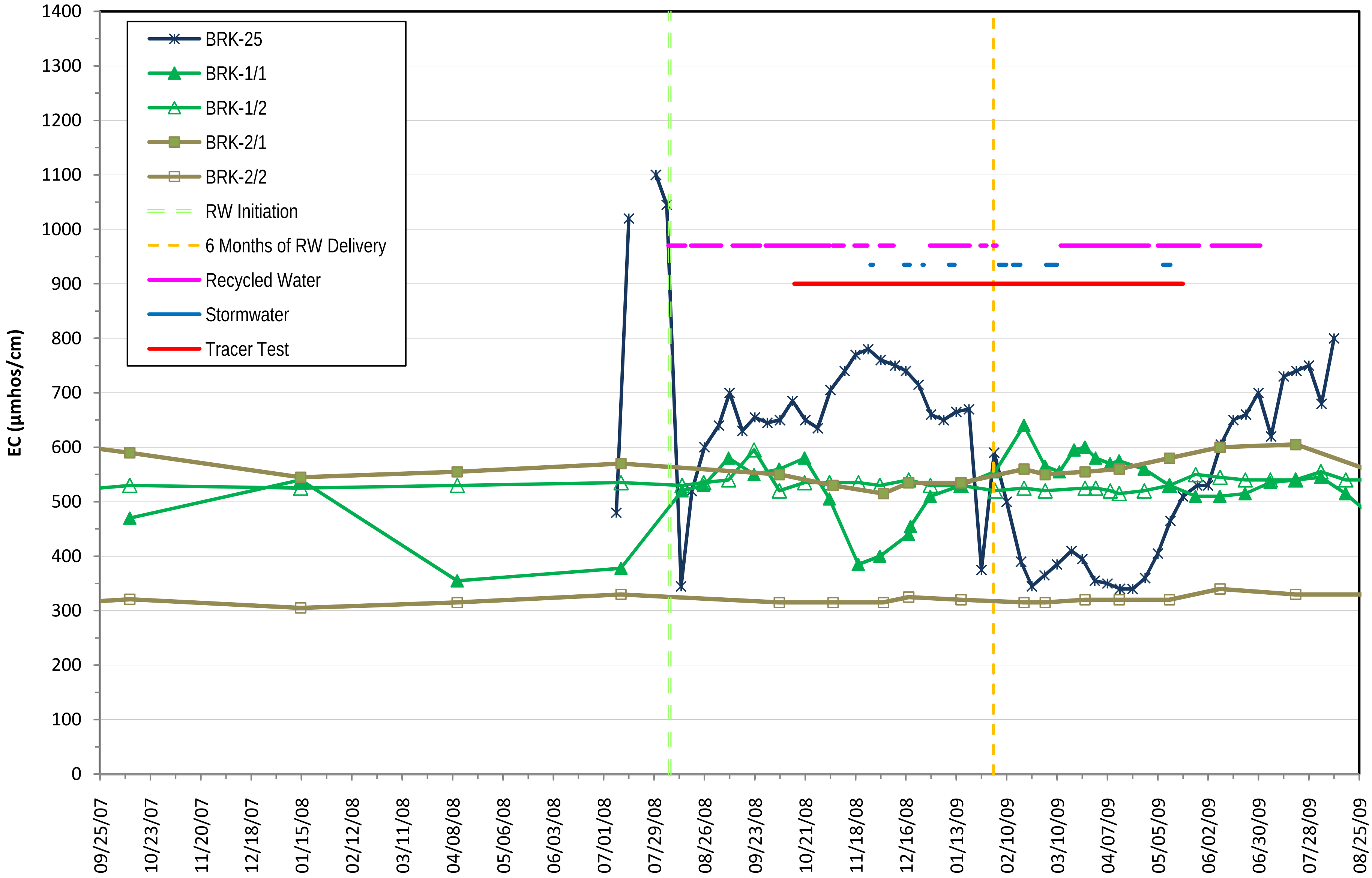


FIGURE 4-1b
BROOKS BASIN MONITORING WELLS
ELECTRICAL CONDUCTIVITY TIME SERIES

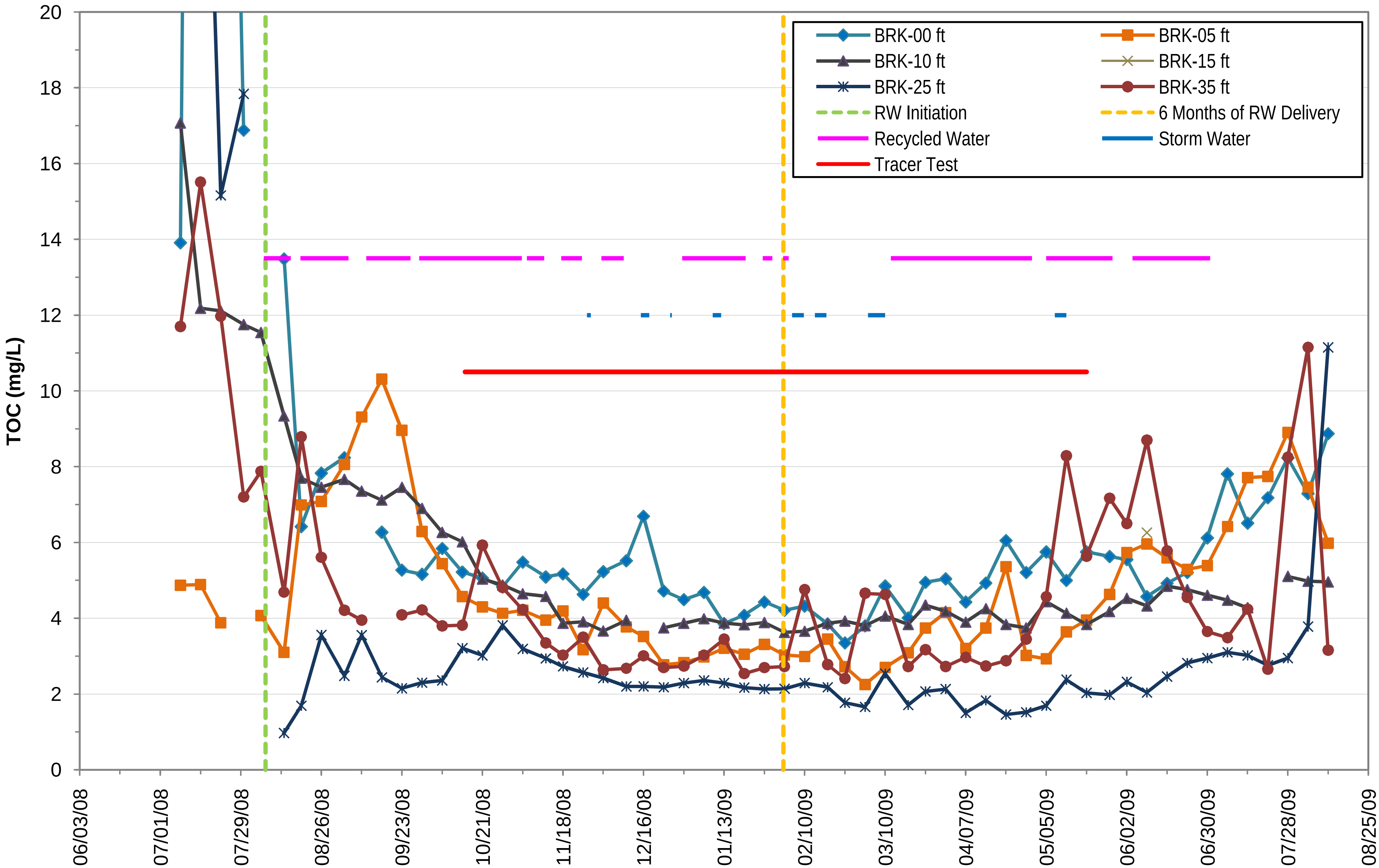


FIGURE 4-2a
BROOKS BASIN LYSIMETERS
TOTAL ORGANIC CARBON TIME SERIES

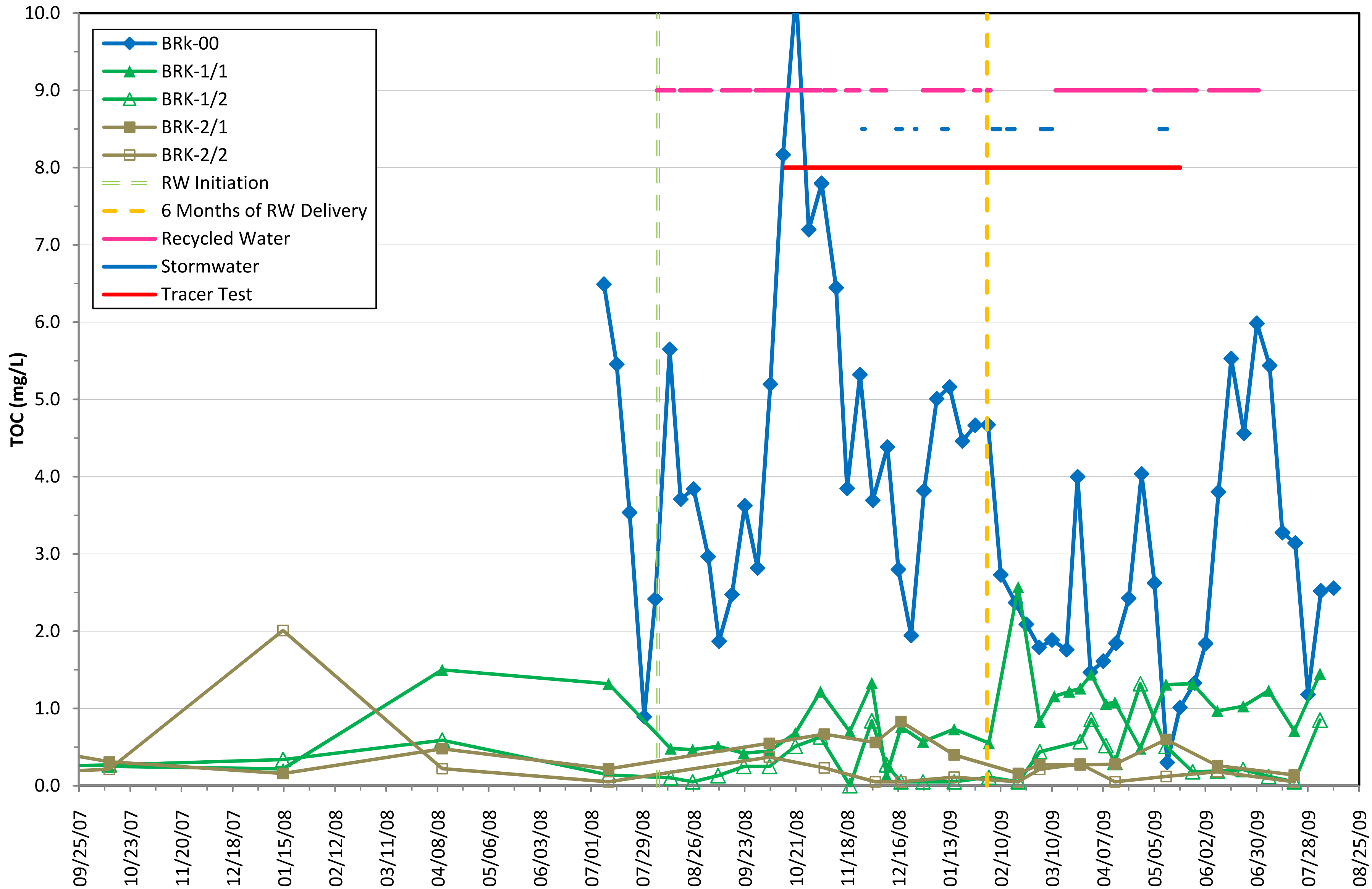


FIGURE 4-2b
BROOKS BASIN MONITORING WELLS
TOTAL ORGANIC CARBON TIME SERIES

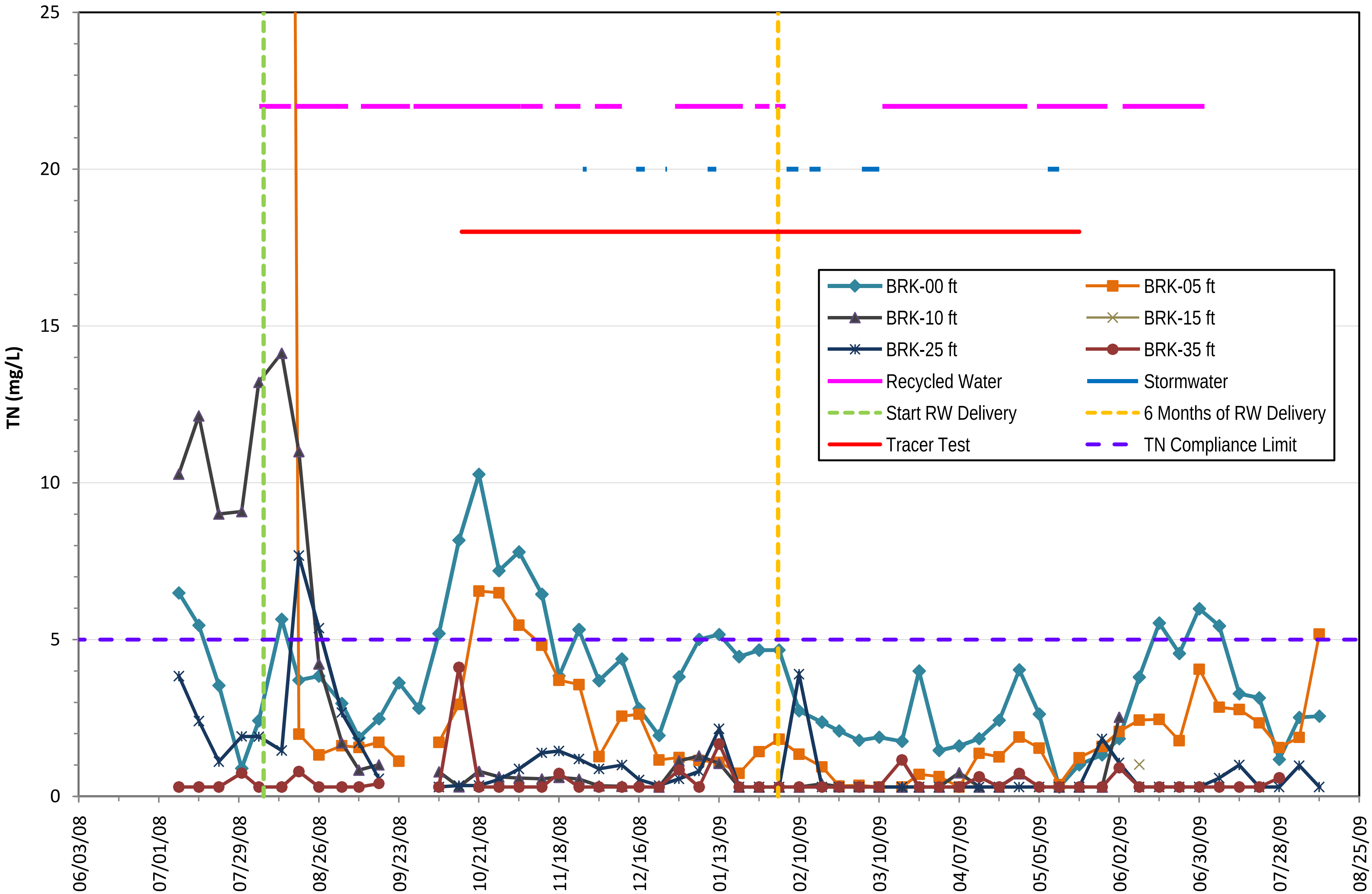


FIGURE 4-3a
BROOKS BASIN LYSIMETERS
TOTAL NITROGEN TIME SERIES

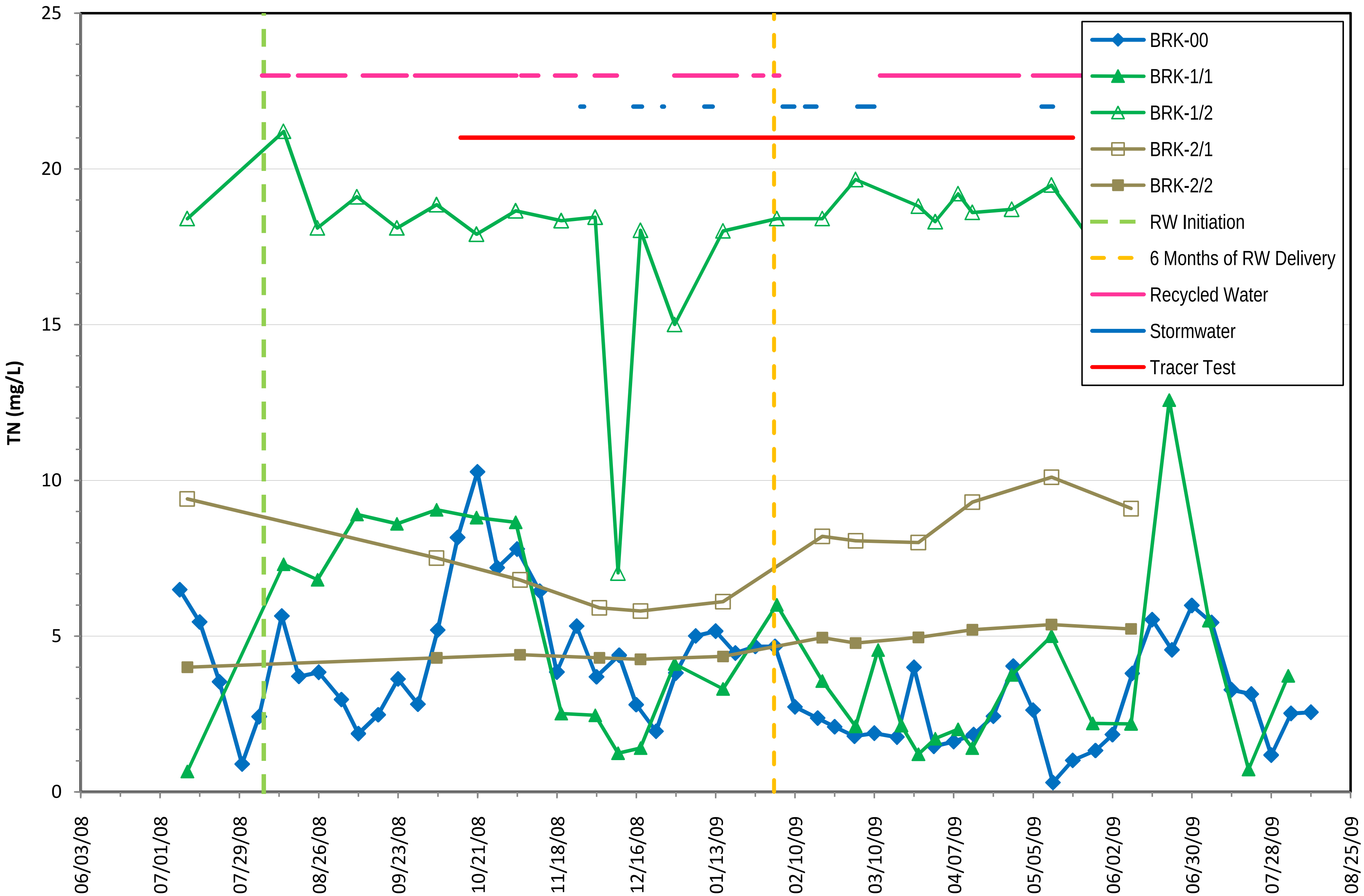


FIGURE 4-3b
BROOKS BASIN MONITORING WELLS
TOTAL NITROGEN TIME SERIES

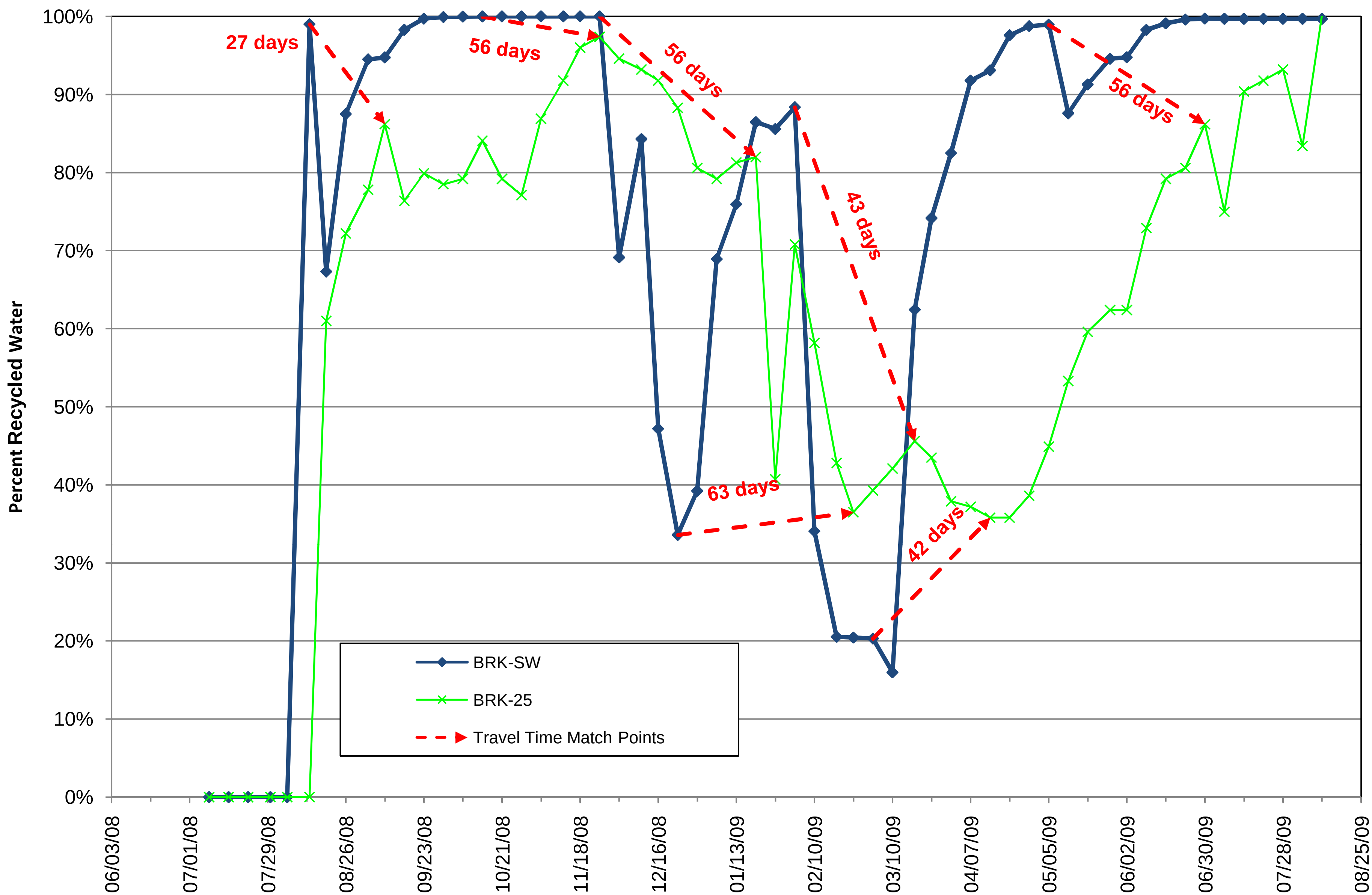


FIGURE 4-4
BROOKS BASIN SURFACE & LYSIMETER SAMPLES
CORRELATION OF PERCENT RECYCLED WATER

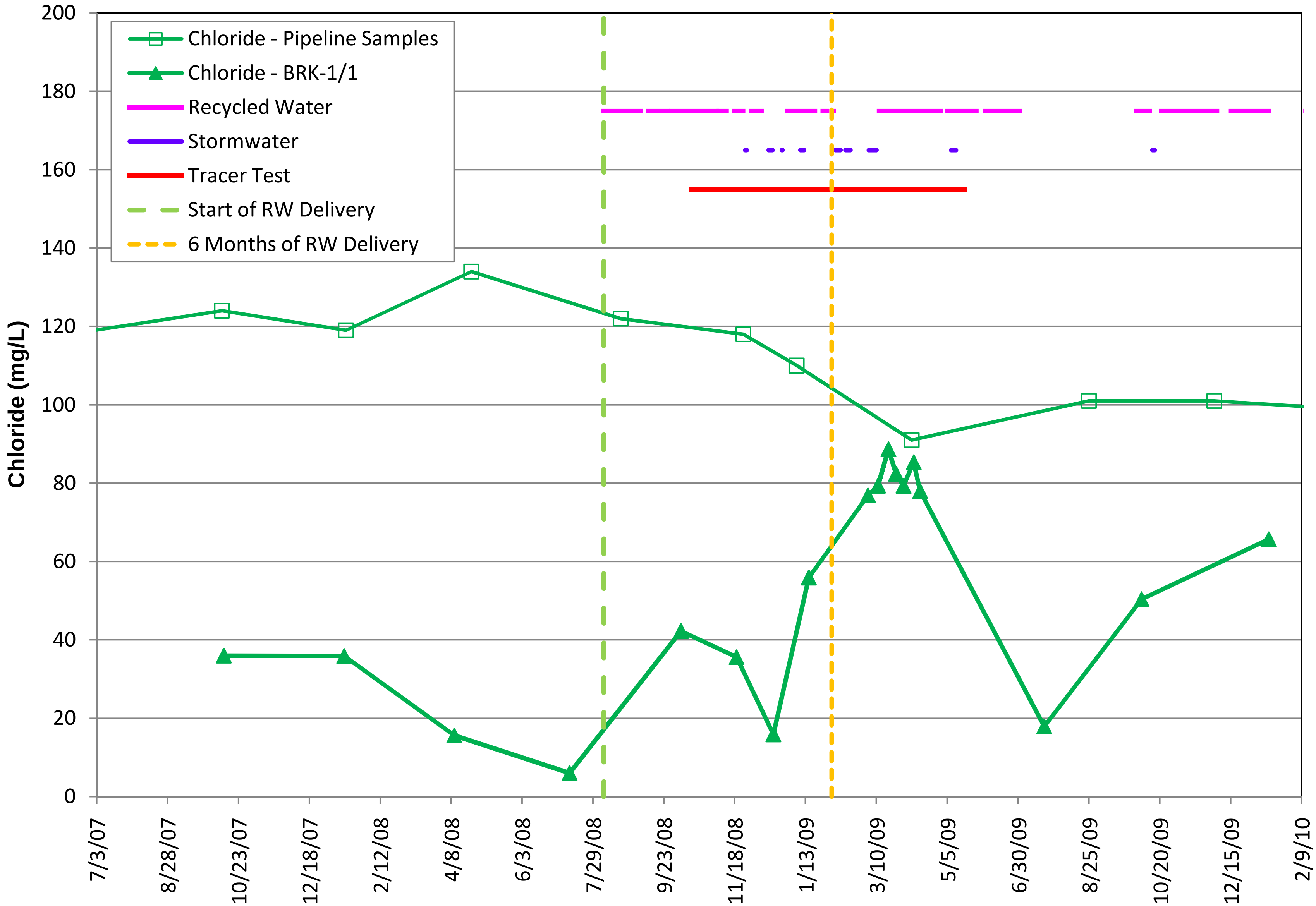


FIGURE 4-5
BROOKS BASIN MONITORING WELL BRK-1/1
CHLORIDE TIME SERIES

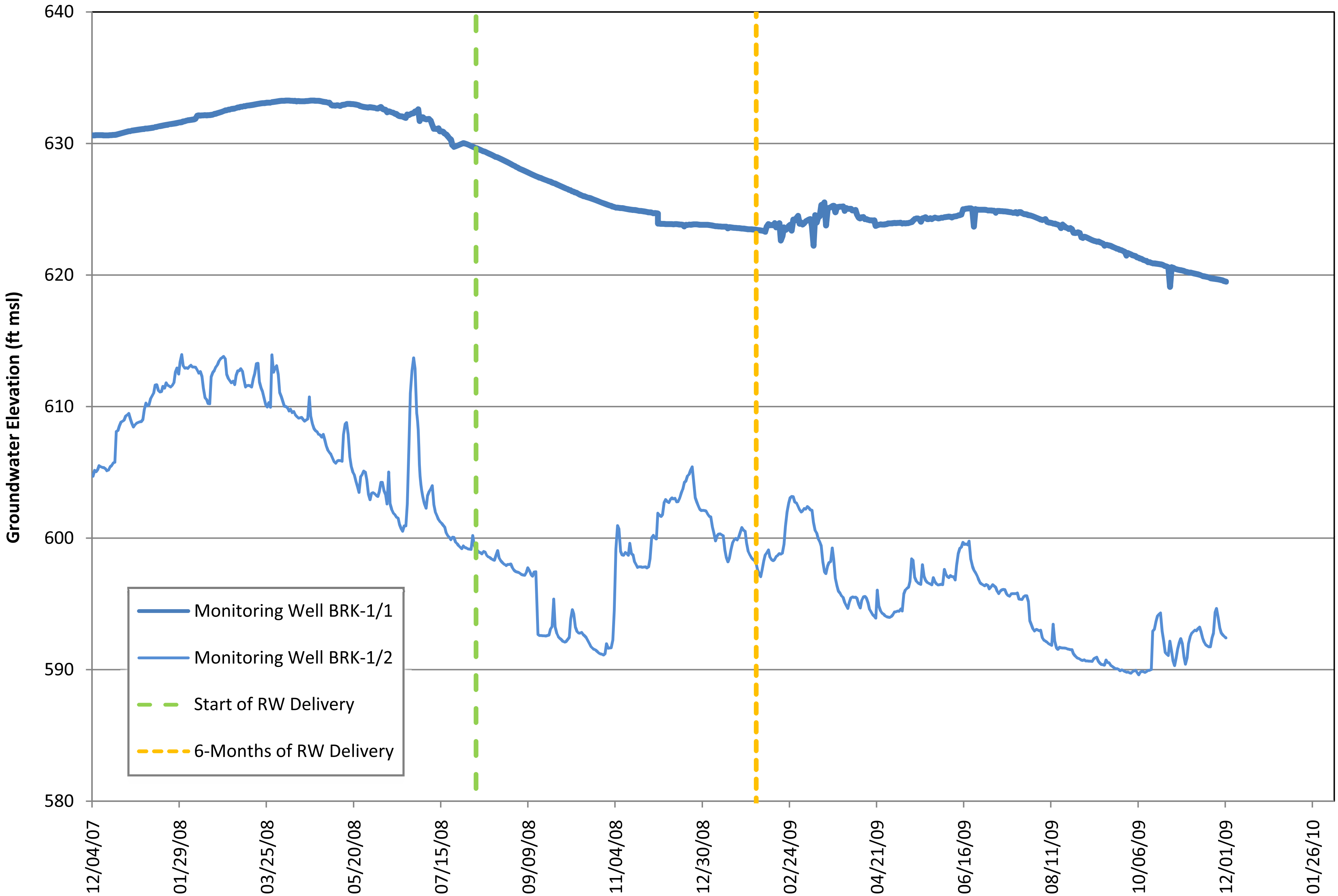


FIGURE 4-6
BROOKS MONITORING WELL BRK-1
HYDROGRAPH

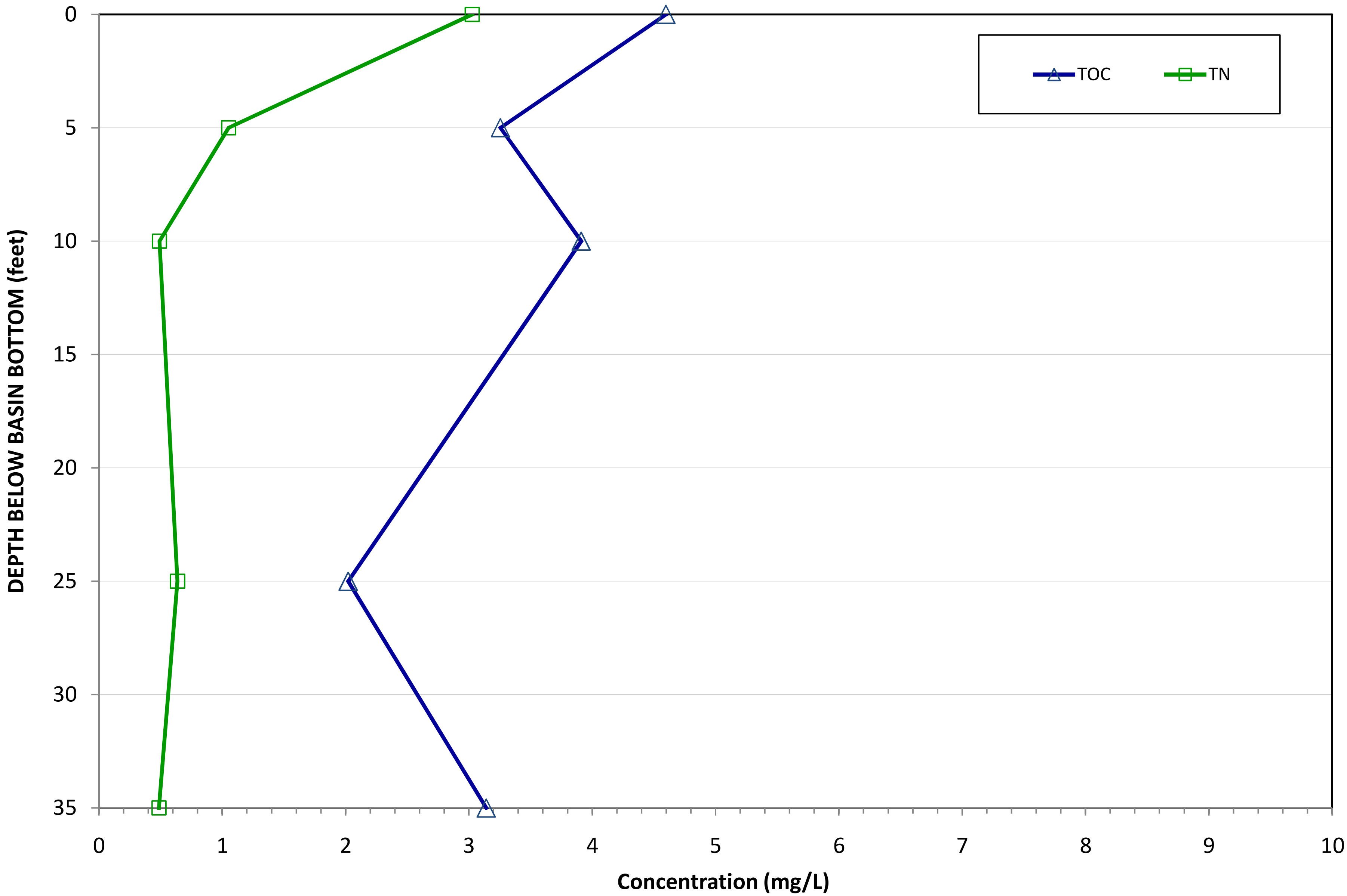


FIGURE 5-1
BROOKS BASIN
DEPTH PROFILE OF AVERAGE TOC AND TN

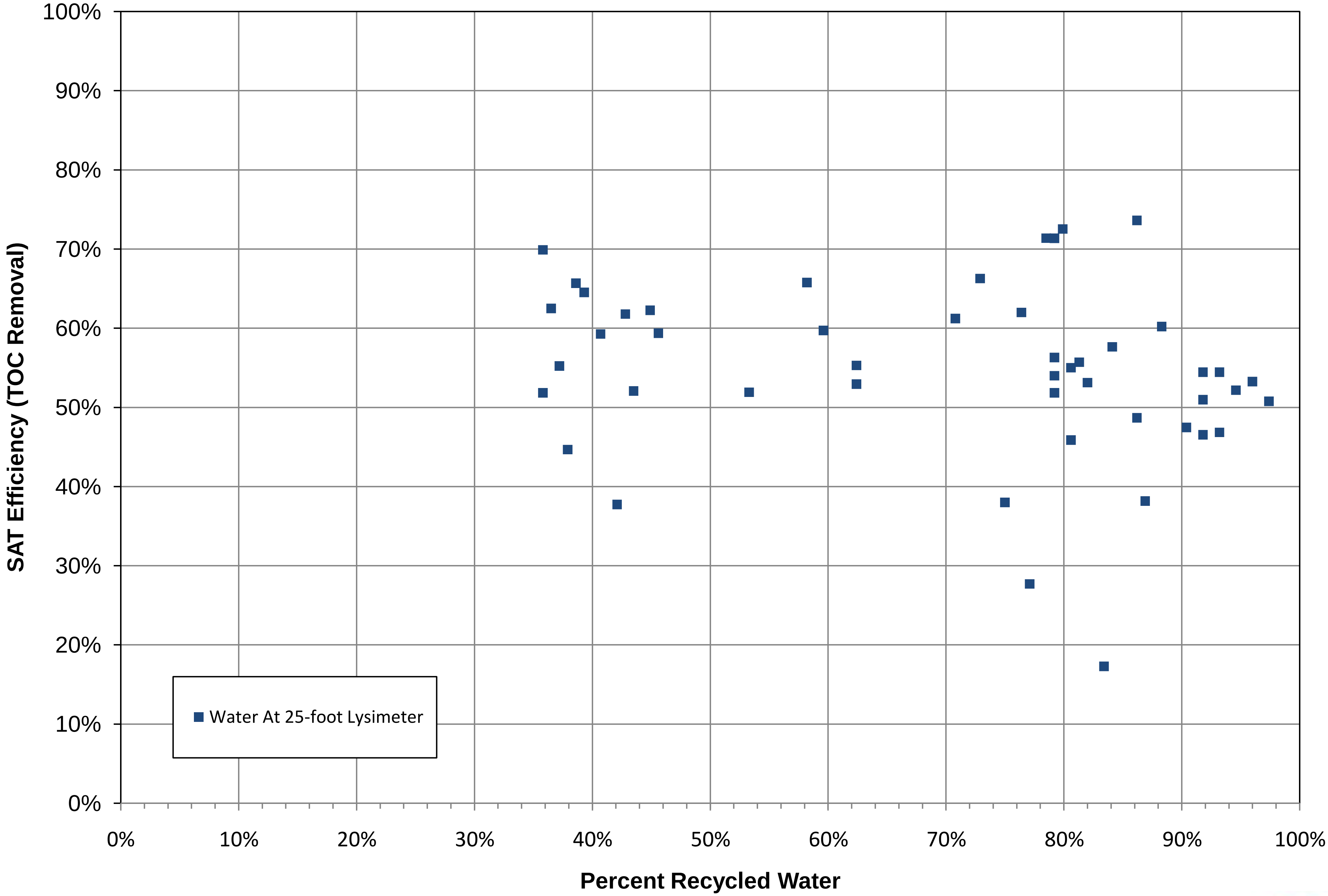


FIGURE 5-2
BROOKS BASIN 25-FOOT LYSIMETER
PERCENT RECYCLED WATER VS. TOC REMOVAL

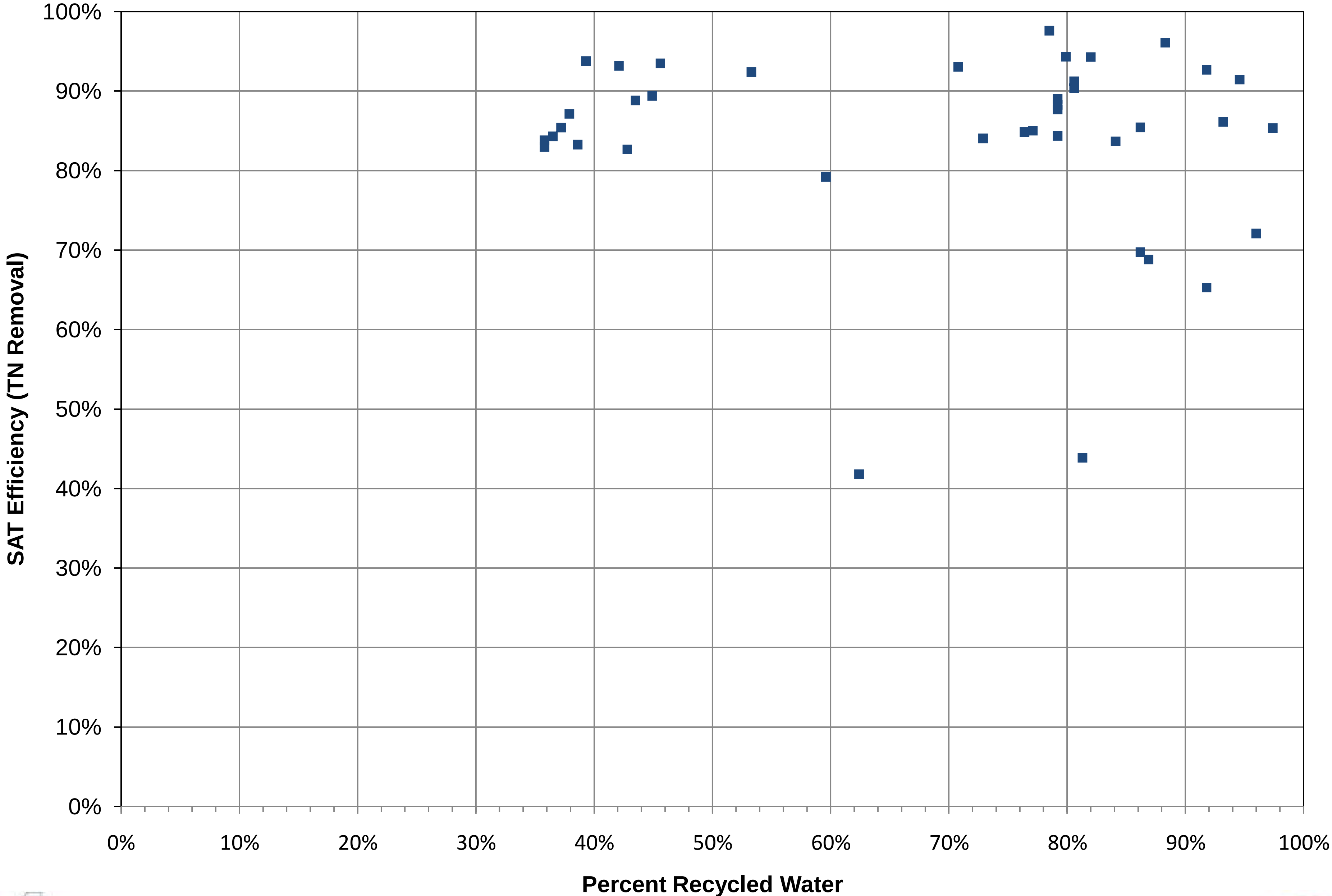


FIGURE 5-3
BROOKS BASIN 25-FOOT LYSIMETER
PERCENT RECYCLED WATER VS. TN REMOVAL

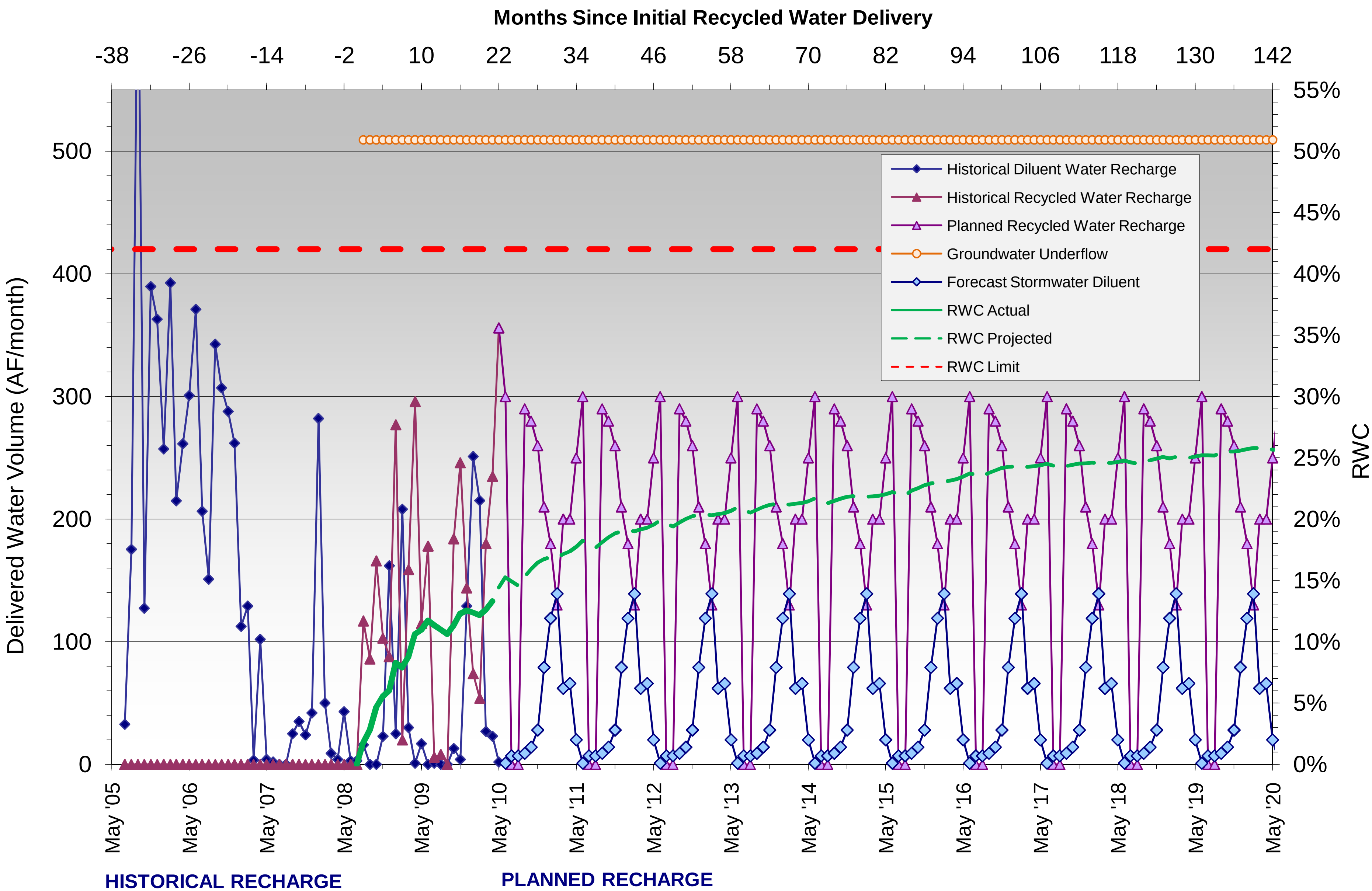


FIGURE 7-1
BROOKS BASIN
RWC MANAGEMENT PLAN

APPENDIX A

BROOKS STREET BASIN TRACER EXPERIMENT REPORT

Brooks Street Basin Tracer Experiment

Chino Groundwater Basin, CA

Final Report

Dec 7, 2009

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Dept. of Earth Science, University of California, Santa Barbara

From October 2008 to May 2009, Inland Empire Utilities Agency (IEUA) conducted an introduced tracer test of Brooks Street Basin utilizing the expertise of University of California, Santa Barbara and sampling staff of URS Corporation and IEUA. The purpose of the Brooks tracer experiment was to evaluate whether the travel time of groundwater recharge from Brooks Basin to the nearest potable use production well is greater than or less than the 6-month minimum travel time required for recycled water recharge as allowed by California Department of Public Health draft Groundwater Recharge Regulations. Brooks Basin is owned by the Chino Basin Water Conservation District and is located in the Chino Groundwater Basin near Holt Ave and San Antonio Creek in the City of Montclair, California. The Chino Groundwater Basin is an alluvial groundwater basin that in the vicinity of Brooks Basin has a depth to water of approximately 340 feet and a depth to bedrock of approximately 900 feet. Two shallow depth (less than 150 feet in a perched aquifer layer) and four moderately deep (350 to 600 feet deep in the regional water table) monitoring wells were sampled during the experiment. These wells are located at Brooks Basin and west of the basin in the City of Pomona. Sampling was also conducted at three City of Pomona active production wells. Figure 1 is a location map of the basin and wells sampled during the test, namely MW-A, MW-H, and BRK-1 (located at Brooks Basin) and BRK-2, P-02, P-10, and P-34 located up to a mile west of Brooks Basin (Figure 1). Sampling events were staggered based on the expected arrival of the tracers at the wells.

The Brooks tracer experiment was a dual tracer experiment using sulfur hexafluoride (SF_6) and boron isotopes ($^{11}B/^{10}B$) and methods developed during earlier experiments at other spreading ponds (e.g., Clark et al, 2004; 2005; Quast et al., 2006). The experimental design consists of introducing the tracers into the spreading pond over a period of a few days to a few weeks. The tagged pond water then infiltrates into the unsaturated zone and eventually recharges the groundwater system. To directly determine travel times tracer concentrations are measured in samples collected at selected wells screened down gradient (Figure 1).

The scale of deliberate tracer experiments is defined by the quantity of water that can be "tagged" and the signal to noise ratio of the tracer being used. The factors that often limit their size include (1) the cost of tracer, (2) the background concentration in both the recharge and local waters, and (3) the ability to introduce a sufficient amount of tracer without significantly changing the buoyancy or water quality of the tagged water. The cost of the tracer can be a particular problem when large volumes of water (>80 acre-feet) need to be tagged, as was the case for the Brooks Basin experiment. Gamlin et al. (2001), Clark et al. (2004, 2005), Avisar and Clark (2005), and Quast et al. (2006) have recently demonstrated that SF_6 and isotopically enriched boric acid can be used economically to tag large volumes of water. Furthermore, they demonstrated for SF_6 groundwater flow over spatial lengths greater than 4 km and temporal periods greater than 4 years can be evaluated using this tracer (Clark et al., 2004). The scale of B isotope experiments is generally smaller than SF_6 because the cost of enriched boric acid is significantly greater than SF_6 and the concentration of boron in reclaimed water is relatively high.

SF_6, a non-toxic and non-reactive gas, is an ideal tracer of groundwater flow. It has been shown in laboratory experiments and during a field experiment conducted near Phoenix, AZ, that, in the absence of non-aqueous phases, its movement is not retarded in porous media (Wilson and Mackay, 1993, 1996; Gamlin et al., 2001; Lee et al., 2008). It has been used as a tracer for mixing and gas exchange for decades in a number of settings including lakes, rivers, and the open ocean (e.g., Wanninkhof, 1985, 1987; Ledwell et al., 1986; Clark et al., 1996; Schmieder et al., 2008). More recently, SF_6 has been used successfully in groundwater studies in California (Orange, LA, and Ventura Counties) that traced the movement of artificially recharged water through groundwater systems (Gamlin et al., 2001; Fram et al., 2003; Clark et al., 2004, 2005; Avisar and Clark 2005; McDermott et al., 2008). In all cases, permission was requested and granted by the Department of Public Health to use SF_6 as a tracer in these potable supply aquifers.

There are a number of advantages of using SF_6 as a tracer of artificial recharge. First, SF_6 is more economical than most other tracers and, hence, more water can be tagged decreasing the probability that the tracers will pass wells undetected. Second, it does not change the density of the tagged water, thus buoyancy effects do not complicate the interpretation of the experimental results (e.g., Istok and Humphrey, 1995). Third, SF_6 does not degrade the quality of the water; it causes no known adverse health effects (Lester and Greenberg, 1950). Forth, because it is a gas, SF_6 can be removed from water easily by aeration.

The disadvantage of using SF_6 is it is a gas and is lost from solution via gas exchange at the air-water interface. Hence, the concentration in the spreading area will be variable and difficult to predict. Furthermore, at Brooks Basin, the recharged water flows for more than 300 ft through an unsaturated zone prior to reaching the water table. Gas loss can occur during infiltration. The depth to the water table below Brooks Basin is 5 to 10 times deeper than at any other site where gas tracers (SF_6, noble gas isotopes) have been used successfully. It is well known that gas transport can be slowed (retarded) by trapped air, the immobile air phase contained in the porous media (Fry et al., 1995; Vulava et al., 2002). However, once in the groundwater, laboratory and field experiments have shown that SF_6 (and other gases) is transported without retardation (Wilson and Mackay, 1993; Vulava et al., 2002).

In order to quantify the amount of retardation and gas loss within the vadose zone, a conservative ion tracer, isotopically enriched boric acid (96% ^{10}B), was added along with SF_6. Natural boron has two stable isotopes, ^{10}B and ^{11}B, with relative abundances of 19.8% and 80.2%, respectively. Boric acid enriched to 96% ^{10}B was purchased from Boron Products, LLC. Recently, Quast et al. (2006) demonstrated the potential of using ^{10}B enriched borate as a tracer at the Rio Hondo spreading basins in Los Angeles County. They showed that on the order of one kilogram of enriched boric acid is needed to sufficiently alter the B isotope ratio of recharge water, even if it contains a large percentage of boron-rich, reclaimed wastewater.

Phase I: Tracer Release and Basin Monitoring

The dual tracer experiment was initiated on Oct 15, 2008. For 70 days prior to adding tracers to Brooks Basin, recycled water was recharged to increase the moisture in the unsaturated zone beneath the basin with the intent of minimizing SF_6 loss during vertical percolation to the water table. Recharge at Brooks Basin was nearly continuous for the 9 months after tracer introduction and averaged 190 acre-feet per month from August 2008 through June 2009. The mean percolation rate was about 1 ft per day.

SF_6 and ^{10}B-enriched boric acid were first introduced to Brooks Basin about 10 m offshore of the access ramp (southern shore, approximately 500 feet from each of the east end of the 1,500 foot long basin). This initial release was followed by three additional releases at the water inlet structure for San Antonio Creek (southwestern corner), on Oct 21, Oct 26, and Nov 1 (day 6, 11, and 16). Each SF_6 injection consisted of 1-hour long release via bubbling the gas at an approximate depth of 1 m. Enriched boric acid was released by dissolving the powder in a small bucket and then pouring the solution into the pond. Approximately 2 kg of ^{10}B-enriched boric acid was released on Oct 15, and approximately 0.65 kg was released during each subsequent event.

To empirically define the tracer input function to the groundwater, surveys of pond water were conducted on days 1, 4, 6, 11, 14, 17, 20, 24, 29, 35, 41, 48, and 56 (Table 1). During each survey, near surface samples (~ 1-2 m deep) were collected from six fixed buoy stations. At each station a 3/4-inch garden hose was installed between the shore and the buoys. Three buoys were located at each end of the basin, more than 10 m from shore. Water was collected using a 12-volt submersible pump (connected at the hose end near the shore) after purging the hose of any prior water it contained. Samples were then shipped to UCSB for storage and analyses. The SF_6 and B isotope analytical procedures are described in Appendix 1. For all collection dates except Nov. 4, 2008, two vacutainers were collected and analyzed from each station. Data are presented (Table 1) by analysis order (top row first) rather than collection order. The agreement for the replicates is good with the exception of the Oct. 16, 2008 sampling for stations E1 and E2, for which the concentrations varied by an order of magnitude. This could have occurred if the first vacutainer was filled prior to completely flushing the hose and, if this were the case, the basin concentration for that day would be higher than the reported mean. The field procedure was changed following these analyses; the flushing time of the hose was increased.

Mean pond SF_6 concentrations determined for each survey ranged between about 4 pmol/L (day 56) and 262 pmol/L (day 1). With the exception of the measurements made on Day 1 and 8, the standard deviation of the 6 pond samples was always less than 25% and typically less than 10%. No station was systematically higher or lower than the mean suggesting the mixing within the pond was sufficiently fast to homogenize the tracer concentrations. The concentrations were the highest following the injections and decreased exponentially due to recharge and gas loss across the air-water interface (Figure 2). Mean concentrations for the pond immediately following each injection was estimated by extrapolating from the subsequent measurements back in time to the time of injection. The injection period is defined here as the period during which 94% of the total mass of SF_6 infiltrated from the pond. The average SF_6 concentration was determined by estimating the amount of SF_6 and water that infiltrated each day assuming a constant infiltration rate. During the first 35 days (between Oct 15 and Nov 19), the defined injection period, the mean concentration was 74 pmol/L.

Because of the analytical cost and limited machine time, equal portions of the six pond station samples were mixed together to form composite boron isotope samples, which were then analyzed. Prior to adding the enriched boric acid, the pond B concentration was 433 µg/L with a $\delta^{11}B$ value of +9‰, which is similar to values measured in the Brooks Basin lysimeters and wells (0‰ to +20‰) unaffected by the tracer release. Following the first addition of tracer, the mean B concentration was 410 µg/L (equivalent to the pretest measurement once the analytical uncertainty is considered) however the $\delta^{11}B$ value decreased to –89‰. This $\delta^{11}B$ decrease reflects the isotopic composition of the enriched boric acid, which was 96% ^{10}B and 4% ^{11}B (equivalent to a $\delta^{11}B$ value of about –990‰). During the 50-day monitoring period of the basin water, the B concentration decreased gradually to about 400 µg/L, then after day 42 dropped to 323 µg/L (Figure 3). The decrease in concentration is due to the addition of winter runoff in February 2009, which should have a lower B concentration than the reclaimed water. During the 50-day monitoring period the $\delta^{11}B$ value increased towards more typical values for the reclaimed water that was continuously added to replace the water that percolated into the ground (Figure 3). During the defined injection period (Oct 15 to Nov 19), the temporal average pond B concentration and $\delta^{11}B$ value were 417 µg/L and –41‰, respectively.

Subsurface Monitoring

Samples of unsaturated zone water and groundwater were collected from existing wells and lysimeters following protocols established by IEUA and UCSB. For each well, the monitoring period and frequency of sampling differed based on expected minimum arrival times. Table 2 contains the results from sampling of monitoring wells and production wells. In its southwestern corner, Brooks Basin has a cluster of lysimeters constructed at 5 foot increments that allow sampling of water from the unsaturated zone. Table 3 contains the results of lysimeter monitoring of the B tracer.

SF_6 was below the detection limit (<0.05 pmol/L) in all wells samples with the exception of the well MW-H sample collected on 5/19/09. No samples were collected from MW-H between early January and mid May 2008 so a breakthrough curve could not be constructed for it. The lysimeters were not sampled for SF_6 because unsaturated zone water was drawn into the cups using a vacuum, which would cause the water to degas.

The enriched boric acid was detected at one monitoring well, MW-A (screened about 80 ft below the pond bottom) and in one lysimeter, LYS-05. It was also observed in monitoring well MW-H in the 5/19/09 sample. While B tracer was observed at MW-A, SF_6 was not; this strongly suggests that SF_6 was lost during percolation through the unsaturated zone. The more surprising results are the lack of detection of B tracer at the deeper lysimeters, which were sampled for 2 months following the initial release of tracer. The data suggests that the lysimeters are located in a portion of the basin where the vertical flow is much slower than the mean water balance estimate of 1 ft/day. The conductivity data shows that these lysimeter depths are in hydraulic connection exists with the surface but on a longer time scale than the wells. In this part of the basin, localized clay lenses in the shallow subsurface (7.5 ft to 22.5 ft) appear to induce slower vertical flow, resulting in much longer water travel times. This is supported with the data from MW-H because this well is located near the lysimeters and no tracer detections were observed at MW-H until the final sampling event, about seven months after the initial release. Data from the deeper MW-A identifies an arrival within 5 days.

The breakthrough curve at LYS-05 shows very fast infiltration; the $\delta^{11}B$ value reached a peak value of –30.2‰ five days after the first release of tracer (Figure 4). This value is nearly identical to the pond mean value of –41‰, demonstrating that the upper unsaturated zone was almost completely flushed of untagged pond water. This is supported by the B concentration at LYS-05 (320-390 μg/L) that was slightly lower than the pond and significantly higher than at the deeper lysimeters (235±26 μg/L). A detail examination of the breakthrough shows that the first sample collected approximately one day after the release was –3‰, slightly less than the background range of 0‰ to +20‰. This suggests that the front of the tagged water may have arrived to LYS-05 after only one day of travel, although given the error of the B isotope analysis the low $\delta^{11}B$ value cannot be definitively attributed to the arrival of tracer. Therefore, the infiltration rate in upper 5 feet was greater than 1ft/day and possibly as fast as 5 ft/day.

The $\delta^{11}B$ breakthrough curve at MW-A shows the tracer first arrived about 1 week after the initial release and peaked about two weeks later. Maximum values persisted for about 20 days between day 13 and 35, reflecting the release period. As discussed above, the peak $\delta^{11}B$ value was more enriched than the mean release value, which is expected due to dispersion within the unsaturated zone. The mean infiltration rate to this well in the upper 100 ft of unsaturated zone is about 5 ft/day.

No $\delta^{11}B$ breakthrough was observed at P-02, P-10, or P-34, the three down gradient production wells. Their boron concentrations and $\delta^{11}B$ values averaged 20±2 µg/L and –4±4‰, respectively. These values are significantly different than in Brooks Basin and are more typical of natural waters not influenced with reclaimed water.

Simple two end member mixing calculations can be used to estimate the minimum detection at the productions wells. This calculation requires a number of assumptions, many of which are constrained with direct measurements. The calculation was conducted using the observed mean end member compositions of boron concentration and $\delta^{11}B$ value for Brooks Basin (411 µg/L and –41‰) and for the native groundwater (20 µg/L and –4‰). The mixing line shows that the $\delta^{11}B$ is very close to the high concentration end member (the injection water) until the fraction of tagged water drops below about 20% (Figure 5). It also shows that a 97% native groundwater and 3% tagged pond water mixture would have a $\delta^{11}B$ value equal to one standard error above the native groundwater value. Therefore, the deliberate tracer experiment showed that the travel time from Brooks Basin to the production wells was longer than the 7 month long experiment at the 3% level, and exceeds the minimum 6-month travel time to the nearest potable well for recycled water recharge.

Intrinsic Tracers

In addition to the added tracers, conductivity and boron can be used as intrinsic tracers near Brooks Basin. Times series analysis of intrinsic tracer has been use to determine travel time by estimating lag times between seasonal and other event variations (e.g., Lee et al., 1992; Vengosh and Keren, 1996). IEUA has laboratory conductivity measurements from July 2008 through the period of the deliberate tracer experiment. IEUA's conductivity measurements are from grab samples collected from the surface water adjacent the lysimeters. These records show that the conductivity of Brooks Basin is variable depending on the source of recharge water. The conductivity is the highest during the summer months and lowest following runoff events during the wet season. Additional conductivity data was collected during the tracer experiment from Brooks Basin and the sampled wells. A direct comparison of the two data sets, 1) field samples collected from buoyed pump/hose stations and 2) the grab samples adjacent the lysimeters, is difficult because only eight samples were analyzed on the same day and because it is unclear if any of these represent analysis on the same water mixture. However, the results do correlate well (R^2 = 0.93), although they do not follow a 1:1 line and their trend line has a non-zero intercept. Time series from both data sets are available for Brooks Basin and BRK-1/1. The two time series compare nicely, both capturing similar magnitude and timing of large seasonal changes in conductivity (Figure 6).

During the injection period, the conductivity in Brooks Basin ranged between 0.85 and 0.95 mS/cm. All subsurface waters were much lower, with the unsaturated zone wells MW-H, ranging between 0.51 and 0.83 mS/cm, and MW-A, ranging between 0.28 and 0.32 mS/cm. The conductivity of the local groundwater produced at the nearby production wells (P-2, P-10, and P-34) averaged 0.52±0.02 mS/cm, which is very similar to the average at BRK-1 (0.48±0.06 mS/cm). The lowest conductivity, 0.31 mS/cm, was observed at BRK-2/2.

Boron concentration-conductivity ratios are highly variable. Like conductivity, the boron concentrations are the highest in Brooks Basin during the monitoring period (average [B] = 404±33 µg/L and includes measurements outside of the injection period). All subsurface samples contained less boron, with concentrations at the deep wells, P-02, P-10, and P-34, BRK-1/2, BRK-2/1, and BRK-2/2 (~20 µg/L), about 20 times less than Brooks Basin. At the shallower monitoring wells adjacent to the basin, BRK-1/1, MW-A and MW-H the concentrations were intermediate.

The time series data of boron concentrations and conductivity only show a clear breakthrough of recharge water from Brooks Basin at well MW-A. Absence of breakthrough at the other wells may be due to the short record relative to the travel time of water at many of the wells. The conductivity time series at MW-A parallels the time series in Brooks Basin surface water but with an amplitude reduction of more than 50%. The discrete records show no time lags. This probably is the result of under sampling. The good correspondence between the two records indicates that the travel time is very rapid in basic agreement with the boron isotope results discussed above.

The IEUA conductivity record from Brooks Basin and BRK-1/1 is sufficiently long to look for lag times. The difficulty with this is that there is a 0.2 mS/cm-magnitude difference between the records and the amplitude of change is significantly larger in the recharge water (Figure 7). The magnitude difference and the attenuation of the change can be explained by mixing between the less conductive groundwater with the recharged recycled water. As such, it appears that the average lag time between changes in the recharge water and water at BRK-1/1 is about 4 months and indicates that the travel time through the ~300 ft thick unsaturated zone followed by ~20 ft of saturated aquifer is about 4 months.

Summary

The primary objective of this research was to determine travel times to the down gradient wells and evaluate whether the minimum 6-month travel time to the nearest potable use production well is met at Brooks Basin. The experiment was conducted over a period of seven months, which is longer than DHP's 6 month travel time regulation. During this time, recharge required 4 months to percolate to the regional water table and no tracer was observed beyond the immediate vicinity of the basin. Detailed evaluations of results from both the deliberate tracer experiment and the time-series intrinsic tracer data indicate that the travel time to the production wells is greater than 6 months.

Acknowledgements

I would like to thank Sheila Morrissey, Mike Davis, and Daniel Petersen of UCSB for assisting with both the field and laboratory work. The boron isotope samples were analyzed at the Analytical Laboratory of the Marine Science Institue at UCSB with the help of Kate Shears and George Paradis. Stavro Pilafas and Joe Liles of URS, Inc assisted with the collection of field samples. Andy Campbell of IEUA provided oversight of the project and a careful review of the final report. Funding for the project was provided by the Inland Empire Utility Agency.

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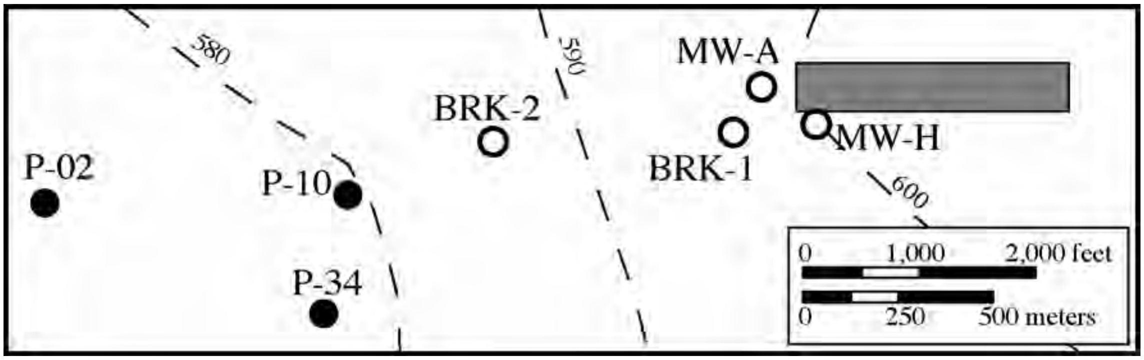


Figure 1: Map of the study area showing Brooks Basin (grey box), the regional groundwater elevation (dashed lines with elevations in feet above sea level), the sampled wells (monitoring = open circle; production = filled circle).

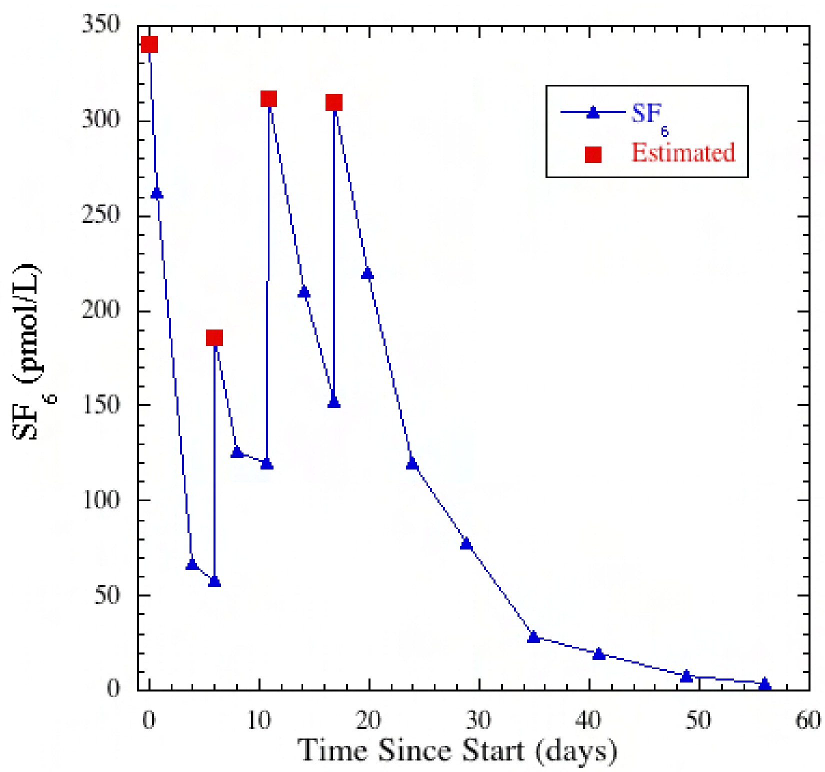


Figure 2: SF_6 concentrations in Brooks Basin during the release (Day 0-35) and subsequent monitoring period. The mean SF_6 concentration during the release period was 74 pmol/L.

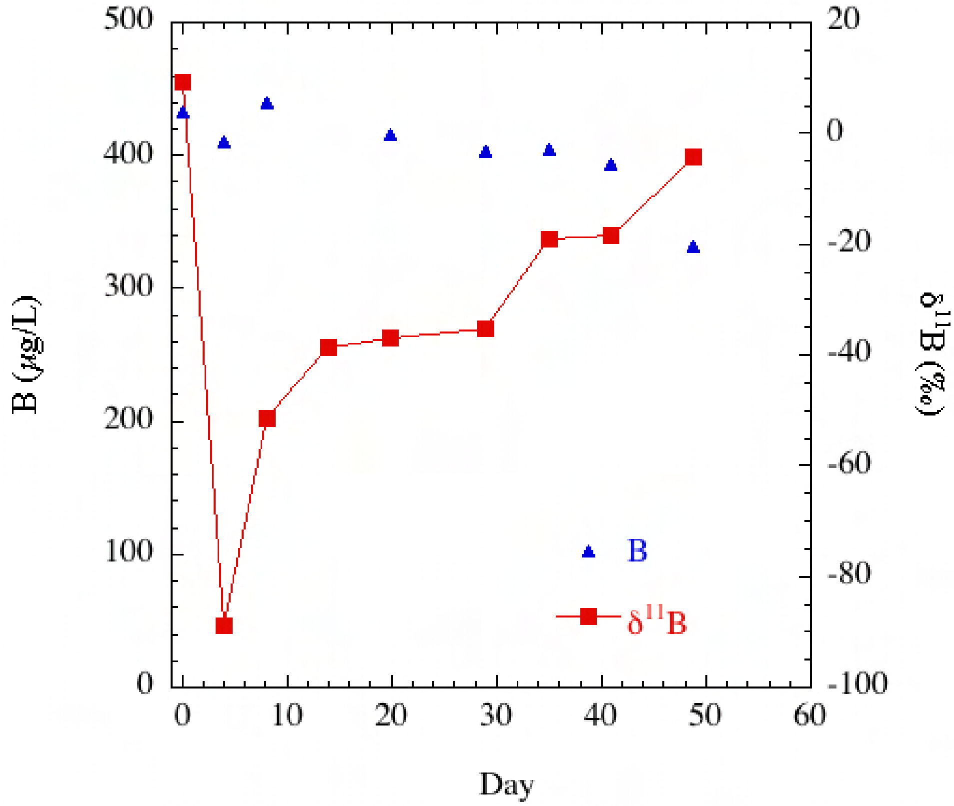


Figure 3: B concentrations and $\delta^{11}B$ in Brooks Basin during the release (Day 0-35) and subsequent monitoring period. The mean $\delta^{11}B$ value during the release period was –41‰.

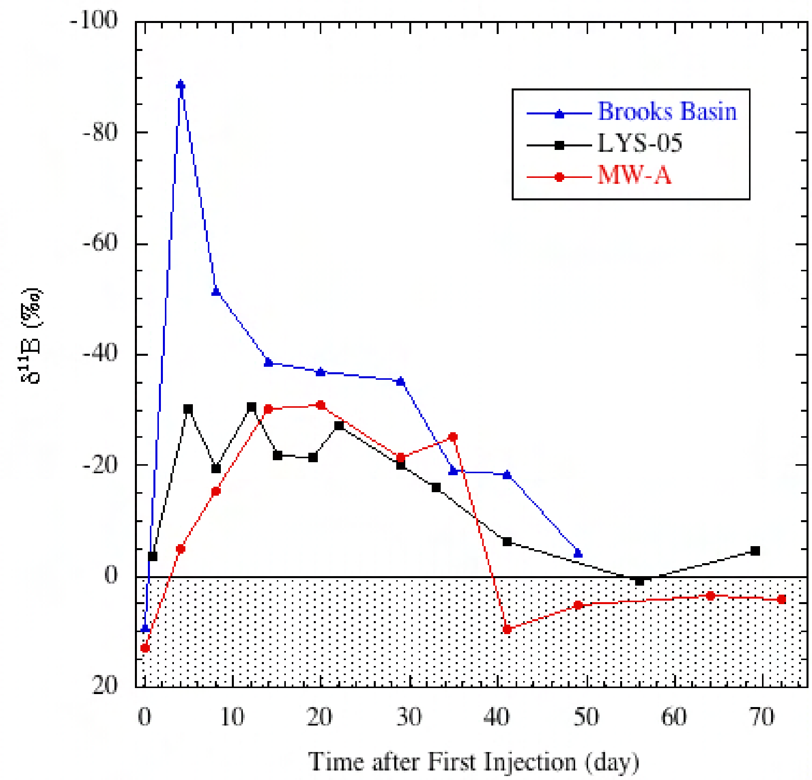


Figure 4: Breakthrough curves of δ^{11}B at LYS-05 and MW-A. The δ^{11}B values in Brooks Basin are shown for reference. Background δ^{11}B values are indicated with the gray box. The δ^{11}B has been plotted with negative values increasing towards the top.

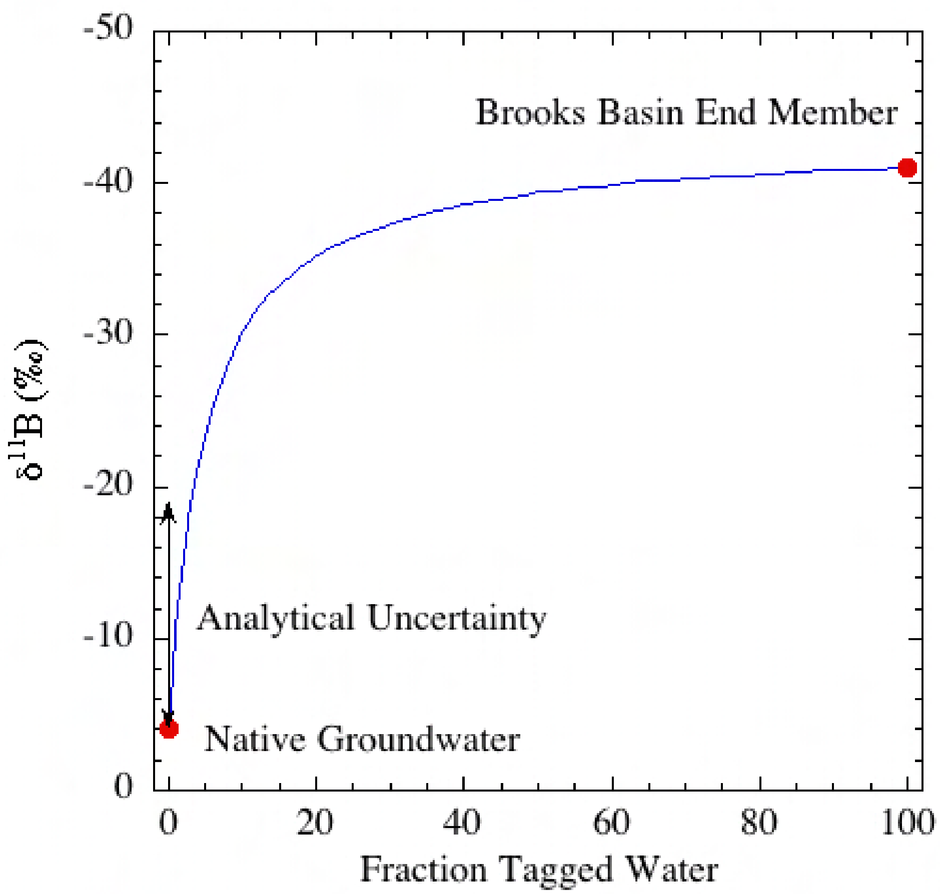


Figure 5: Mixing relationship between the tagged basin water and native groundwater found at the production wells using mean values. The arrow represents the analytical uncertainty and therefore a positive detection of the tagged basin water would be observed by a decrease in the $\delta^{11}B$ values to less than –19‰. The $\delta^{11}B$ has been plotted with negative values increasing towards the top.

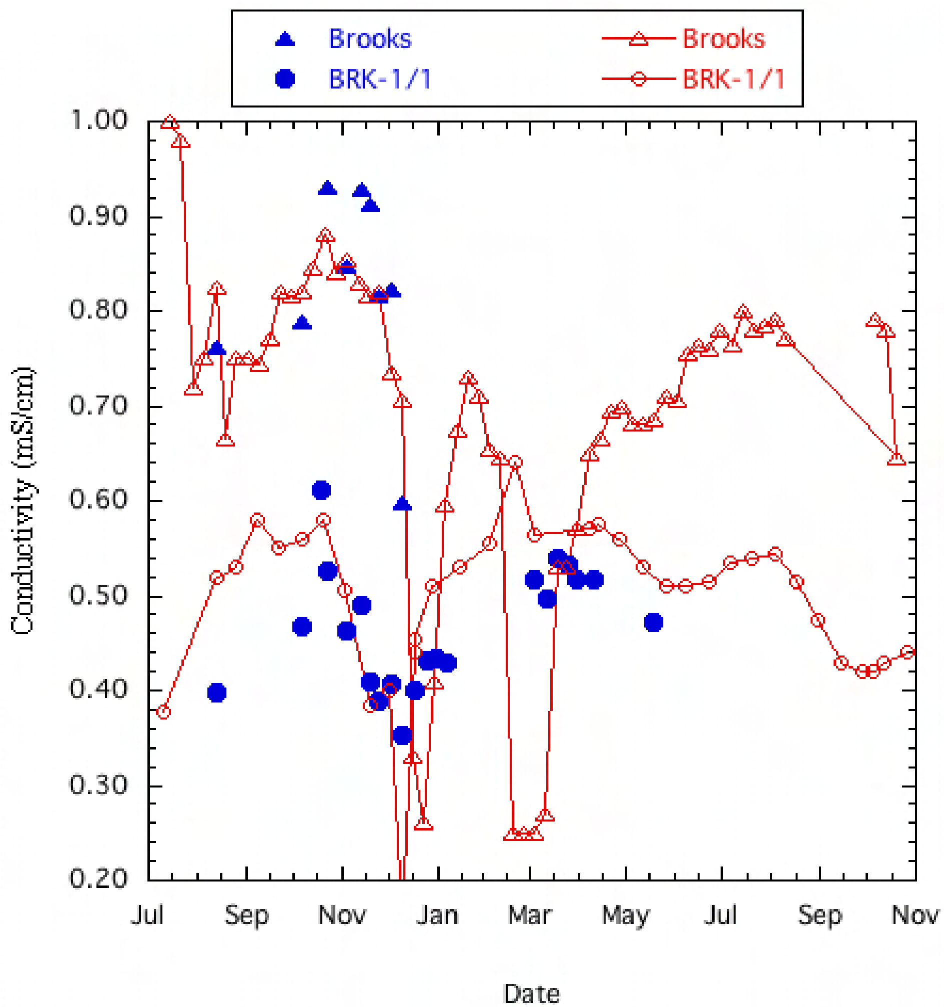


Figure 6: Comparison of IEUA (red points) and URS (blue points) conductivity time series.

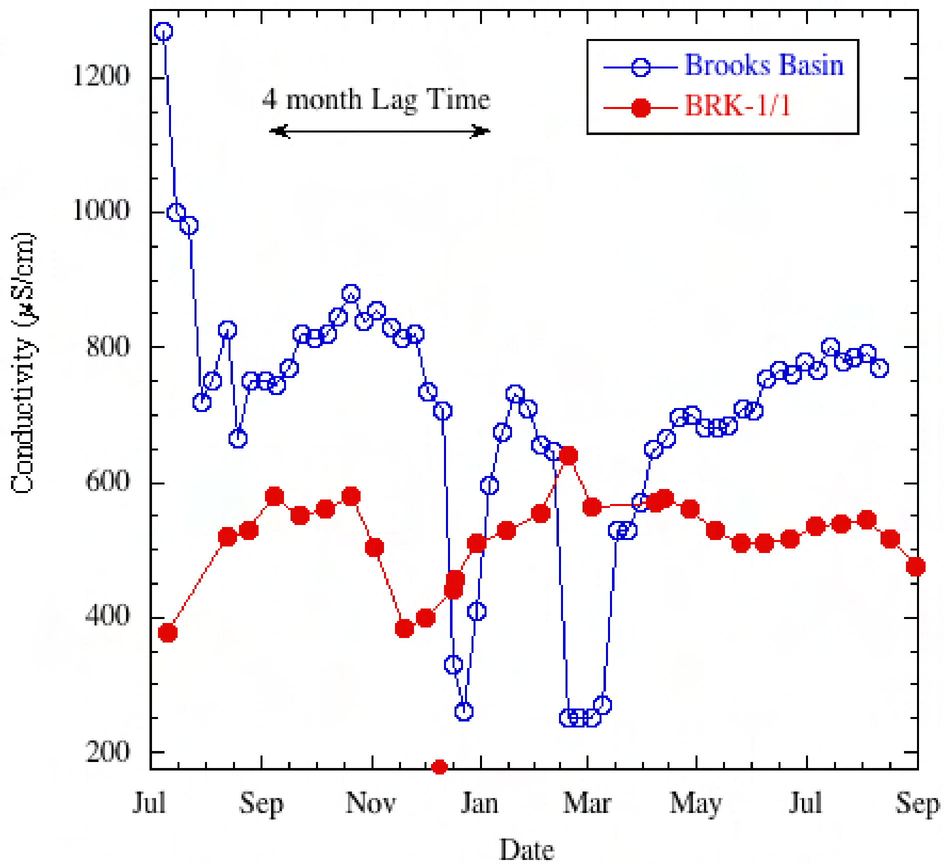


Figure 7: Time series of the IEUA conductivity measurements in Brooks Basin and BRK-1/1 showing the 4-month lag time.

APPENDIX 1: ANALYTICAL PROCEEDURES

The methodology used during the Oct-08 Brooks Basin tracer study is very simple and was developed by Dr. Jordan Clark at UCSB. It was earlier during tracer experiments conducted in Orange County, LA County, and Ventura County (Gamlin et al., 2001; Clark et al., 2004, 2005; Avisar and Clark, 2005; McDermott et al., 2006). However this experiment differed because ^{10}B-enriched boric acid was also added to the recharge water. During the initial phase, the tracers were released into Brooks Basin. During the second phase, water samples were collected at selected wells by URS and IEUA staff and sent to UCSB for analysis so that travel times could be determined.

All SF_6 samples will be analyzed using a head space method similar to that described by Clark et al. (2004). In the field, a pre-weighed 10 ml Vacutainer™ was partially filled (about 5 ml of water). These containers were sent to UCSB where they were weighed (to determine the sample size) and carefully filled with ultra-high purity nitrogen gas (so that the final pressure is equal to about 1 atmosphere). After a brief shaking to equilibrate the nitrogen gas with the water sample, the head space gas was injected through a column of $Mg(ClO_4)_2$ (to remove water vapor) into a small sample loop of known volume (about 1 ml). Subsequently, the gas in the sample loop was flushed into a gas chromatograph equipped with an electron capture detector with ultra-high purity nitrogen carrier gas. SF_6 was separated from other gases with a molecular sieve 5a column held at room temperature. The detector response was determined by running gas standards purchased from Scott-Marrin, Inc. The detection limit of this method is about 0.05 pmol/L. However, because these very low concentrations can also result from sampling errors (see below), we used 0.2 pmol/L as the reportable detection limit (RPL) to ensure no false positives. This is 330 times smaller than the mean pond concentration. Error on duplicate measurements was typically better than ±10%. Laboratory experiments have shown that SF_6 samples can be stored for at least 6 months without appreciable lost of SF_6 in Vacutainer™.

All boron isotope samples were collected in plastic bottles. Concentrations and $\delta^{11}B$ values were analyzed on a Finnigan Element2 high-resolution, double focusing, sector ICP-MS in the Marine Science Institute Analytical Laboratory at UCSB using standard ICP procedures. Samples were first diluted so that the sample B concentrations were similar to the standard concentration. The measured $^{11}B/^{10}B$ mass ratios were corrected for mass bias. The uncertainty of the concentration and $\delta^{11}B$ are better than ± 20 μg/L and ±15‰.

TABLE 1

BROOKS BASIN SURFACE WATER - SF_6 AND B DATA

Brooks Basin Tracer Experiment

Date	SF_6 (pmol/L)								Boron	$\delta^{11}B$	Conductivity
	East 1	East 2	East 3	West 1	West 2	West 3	Mean	±	µg/L	‰	mS/cm
10/15/2008									433	9.3	
10/16/2008	33	303	21	371	449	415					
10/16/2008	278	22	25	275	464	491	262	188			
10/19/2008	70	59	65	72	60	73					
10/19/2008	61	77	62	71	61	71	67	6	410	-88.7	
10/21/2008	56	59	54	57	64	55					
10/21/2008	55	55	57	66	58	55	58	4			
10/23/2008	134	46	40	200	176	179					
10/23/2008	131	44	50	189	157	165	126	63	439	-51.4	0.930
10/26/2008	123	128	122	102	112	103					
10/26/2008	117	124	126	109	108	98	114	10			
10/29/2008	229	213	207	166	230	248					
10/29/2008	225	186	199	155	235	229	210	29	--	-38.5	
11/01/2008	lost	120	126	172	166	169					
11/01/2008	111	110	130	168	169	166	146	26			
11/04/2008	236	210	218	187	246	224	220	21	416	-37.0	0.848
11/08/2008	103	100	110	122	136	129					
11/08/2008	114	119	98	131	131	143	120	15			
11/13/2008	79	79	77	70	76	76					
11/13/2008	85	82	81	75	74	75	77	4.0	403	-35.4	0.929
11/19/2008	27	29	26	30	30	31	29	2.0	405	-19.0	0.912
11/25/2008	20	20	20	20	21	20					
11/25/2008	20	20	21	19	21	19	20	0.6	394	-18.3	0.816
12/03/2008	7.3	7.0	6.3	7.2	7.7	7.4					
12/03/2008	8.2	8.2	6.3	8.4	7.7	7.7	7.5	0.7	332	-4.2	0.822
12/10/2008				4.0	3.9						
12/10/2008				3.7	3.9		3.9	0.1			

TABLE 2A
BROOKS BASIN ON-SITE MONITORING WELLS - CONDUCTIVITY AND B DATA
Brooks Basin Tracer Experiment

Date	Day 10/15/2008	MW-H			MW-A		
		Conductivity mS/Cm	Boron (µg/L)	$\delta^{11}B$ (‰)	Conductivity mS/Cm	Boron (µg/L)	$\delta^{11}B$ (‰)
08/13/2008	-63	0.346					
10/07/2008	-8	0.557			0.274		
10/16/2008	0	0.585			0.251		
10/19/2008	4	0.823			0.345		
10/23/2008	8	0.741	199	12.5	0.298	65	13.1
10/29/2008	14		252	5.9		85	-4.9
11/04/2008	20	0.770	277	6.8	0.288	87	-15.4
11/13/2008	29	0.829	273	7.0	0.350	81	-30.3
11/20/2008	35	0.812	290	5.8	0.347	83	-31.0
11/25/2008	41	0.821	293	12.2	0.294	78	-21.3
12/03/2008	49	0.835	299	1.5	0.304	82	-25.3
12/10/2008	56	0.695	235	11.2	0.261		9.6
12/18/2008	64	0.695	214	12.7	0.285	50	5.1
12/26/2008	72	0.602			--		
12/31/2008	77	0.591	219	12.4	0.301	47	3.4
01/07/2009	84	0.511	204	7.6	0.320	50	4.2
05/19/2009	216		269	-10.2			

TABLE 2B
BROOKS BASIN DEEP MONITORING WELLS - CONDUCTIVITY AND B DATA
Brooks Basin Tracer Experiment

Date	Day 10/15/2008	BRK-1/1			BRK-1/2			BRK-2/1			BRK-2/2		
		Conductivity mS/Cm	Boron (μg/L)	$\delta^{11}B$ (‰)	Conductivity mS/Cm	Boron (μg/L)	$\delta^{11}B$ (‰)	Conductivity mS/Cm	Boron (μg/L)	$\delta^{11}B$ (‰)	Conductivity mS/Cm	Boron (μg/L)	$\delta^{11}B$ (‰)
08/13/2008	-63	0.398			0.393								
10/07/2008	-8	0.467			0.435								
10/16/2008	0												
10/19/2008	4	0.612			0.572								
10/23/2008	8	0.526	38	8.9	0.494	21	-1.6						
10/29/2008	14		53	11.9		20	1.5						
11/04/2008	20	0.463	61	9.7	0.498	22	3.0						
11/13/2008	29	0.491	75	12.2	0.602	21	3.6						
11/19/2008	35	0.409	73	10.5	0.523	21	3.7						
11/25/2008	41	0.389	80	12.4	0.527	20	-0.1						
12/03/2008	49	0.407	77	8.3	0.538	20	9.3						
12/10/2008	56	0.353	82	7.6	0.457	22	0.4						
12/18/2008	64	0.400	109	-1.7	0.489	14	-10.6						
12/26/2008	72	0.431			0.457								
12/31/2008	77	0.434	62	10.7	0.460	10	4.2						
01/07/2009	84	0.429	78	-0.7	0.453	8	6.5						
01/15/2009	92		66	7.6		14	17.7		24	-0.3		12	13.9
02/25/2009	133												
03/03/2009	139	0.517	157	3.2		18	-2.9	0.531	23	-0.2	0.302	14	-5.5
03/11/2009	147	0.497			0.470								
03/19/2009	155	0.539			0.474								
03/25/2009	161	0.533	119	10.6	0.473	26	0.5					21	-3.7
03/31/2009	167	0.518			0.470								
04/08/2009	175	0.516	145	10.3	0.468	24	-2.4						
04/15/2009	182								31	4.9		19	-10.5
05/11/2009	208											20	-3.6
05/19/2009	216	0.471	113	0.6	0.484	24	-1.6	0.568			0.315	19	-5.6

TABLE 2C
BROOKS BASIN OFF SITE PRODUCTION WELL - CONDUCTIVITY AND B DATA
Brooks Basin Tracer Experiment

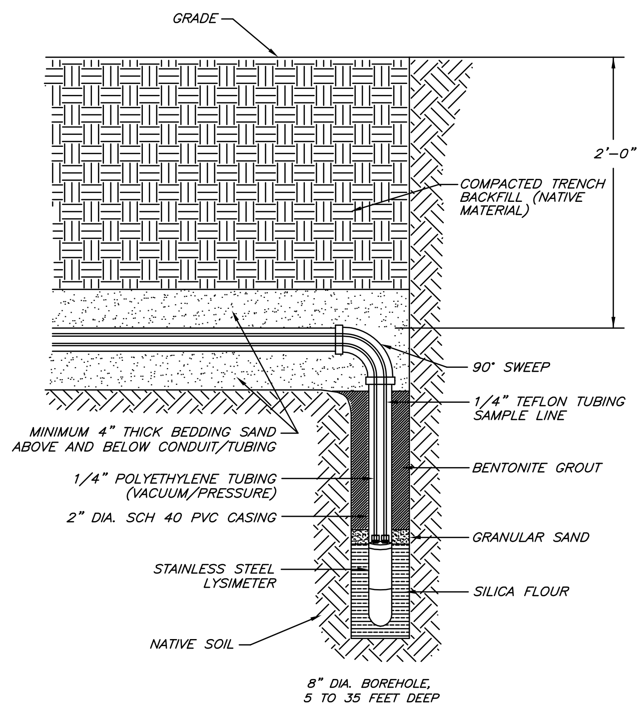
Date	Day 10/15/2008	P-02			P-10			P-34		
		Conductivity mS/Cm	Boron (µg/L)	$\delta^{11}B$ (‰)	Conductivity mS/Cm	Boron (µg/L)	$\delta^{11}B$ (‰)	Conductivity mS/Cm	Boron (µg/L)	$\delta^{11}B$ (‰)
01/07/2009	84									
01/15/2009	92	0.588	19	-5.2	0.498	17	1.0	0.527	18	-3.6
02/25/2009	133	0.533	19	-0.6	0.498	20	-10.0	0.517	21	-3.0
03/03/2009	139									
03/11/2009	147	0.535	21	-8.2	0.479	19	-10.4	0.516	21	-9.5
03/19/2009	155									
03/25/2009	161	0.561	24	-4.2	0.500	29	2.8	0.529	25	-3.0
03/31/2009	167									
04/08/2009	175	0.537	25	-0.4	0.500	24	-3.0	0.521	26	-1.6
05/11/2009	208									
05/19/2009	216	0.554	23	-4.5	0.485			0.520	24	-4.2

TABLE 3
BROOKS BASIN LYSIMETERS - B DATA
Brooks Basin Tracer Experiment

Date	Day 10/15/2008	LYS-05		LYS-10		LYS-25A		LYS-25B		LYS-35	
		$\delta^{11}B$ ‰	B µg/L	$\delta^{11}B$ ‰	B µg/L	$\delta^{11}B$ ‰	B µg/L	$\delta^{11}B$ ‰	B µg/L	$\delta^{11}B$ ‰	B µg/L
10/16/2008	1	-3.6	321	13.7	229	11.8	252	11.8	240	14.4	176
10/20/2008	5	-30.2	350	15.7	280	9.9	263	12.4	262	15.0	241
10/23/2008	8	-19.4	379	16.7	222	13.5	233	10.4	244	17.5	209
10/27/2008	12	-30.4	319	10.6	240	13.0	233	15.5	272	14.3	205
10/30/2008	15	-21.7	391	6.9	249	14.4	245	10.0	196	20.2	220
11/03/2008	19	-21.4	321	6.7	212	6.9	197	12.4	196	15.7	203
11/06/2008	22	-27.3	307	-1.2	206	4.6	210	9.8	207	11.5	217
11/13/2008	29	-20.2	333	-5.5	198	3.4	200	5.6	198	12.5	265
11/17/2008	33	-16.2	316	3.6	243	9.3	237	10.8	248	10.6	259
11/25/2008	41	-6.3	312	-1.4	247	3.8	231	13	248	13.5	258
12/10/2008	56	0.8	261	-1.4	249	2.6	240	16.1	247	7.6	258
12/23/2008	69	-4.6	106	1	263	0.6	233	17.1	275	7.4	276

APPENDIX B

LYSIMETER AND MONITORING WELL CONSTRUCTION DRAWINGS

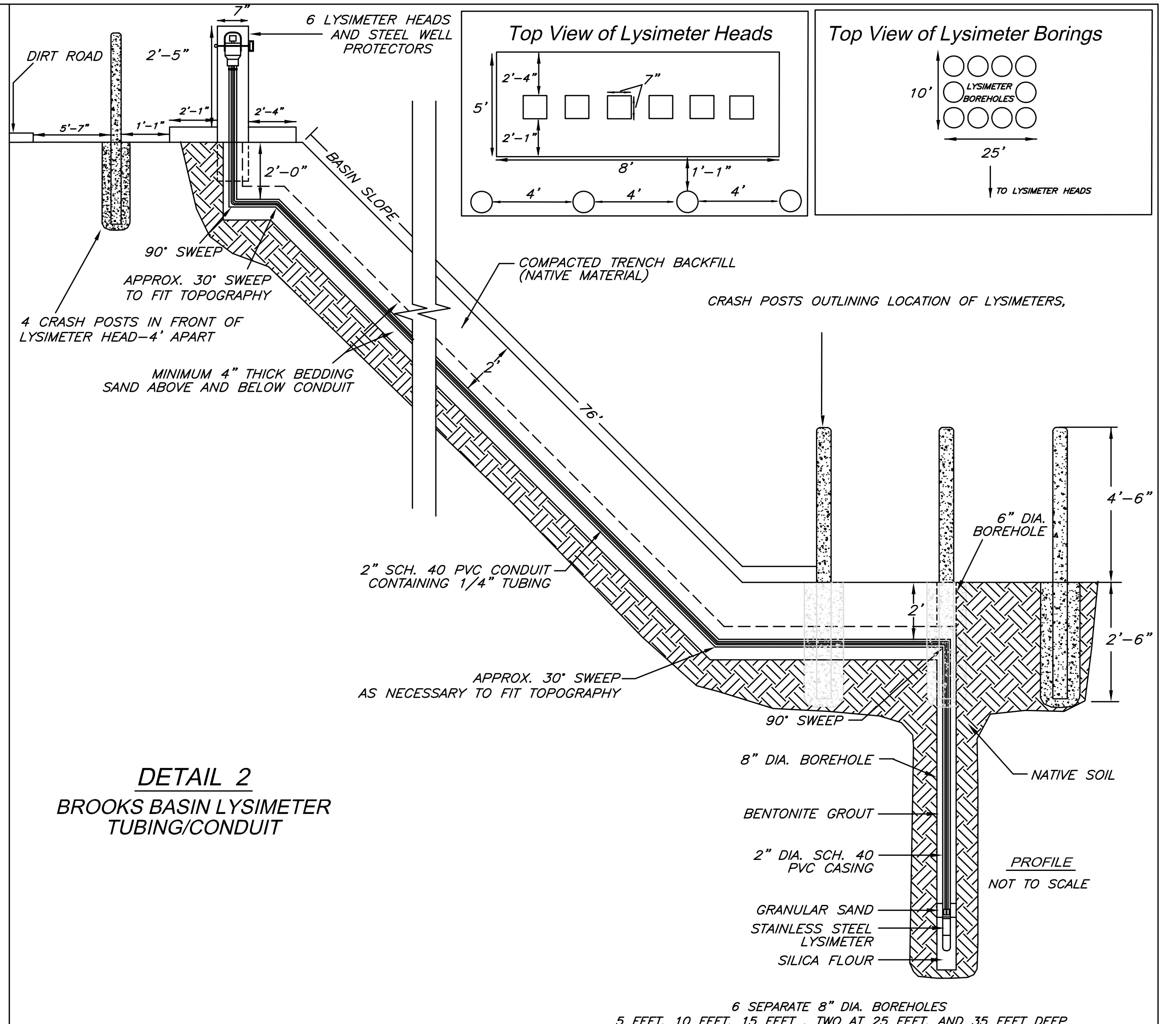


DETAIL 1

TYPICAL LYSIMETER

PROFILE

NOT TO SCALE



DETAIL 2

BROOKS BASIN LYSIMETER TUBING/CONDUIT

DIGALERT 811

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION:	APPROVED/DATE
1	04/30/07	TCR	UPDATED FOR 2007 CONTRACT	WEL
2	12/17/07	STJ	UPDATED FOR 2007 AS BUILT	TCR

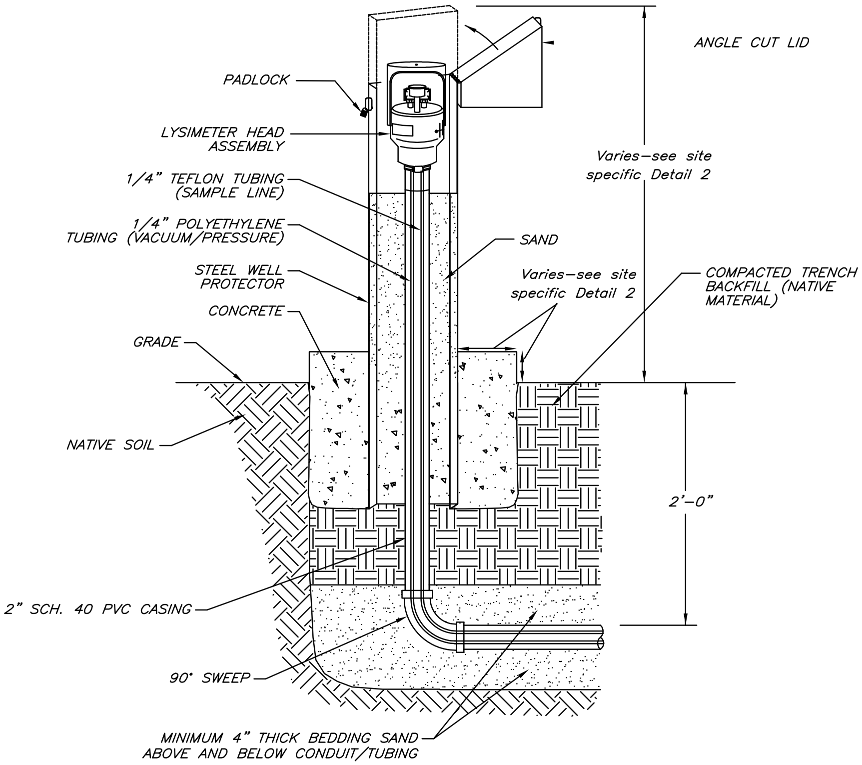
WILDERMUTH ENVIRONMENTAL INC.

Inland Empire Utilities Agency

REVIEWED BY:	DRAWN BY:	DATE:	DRAWING NO.
WEL	STJ	01/22/2008	7

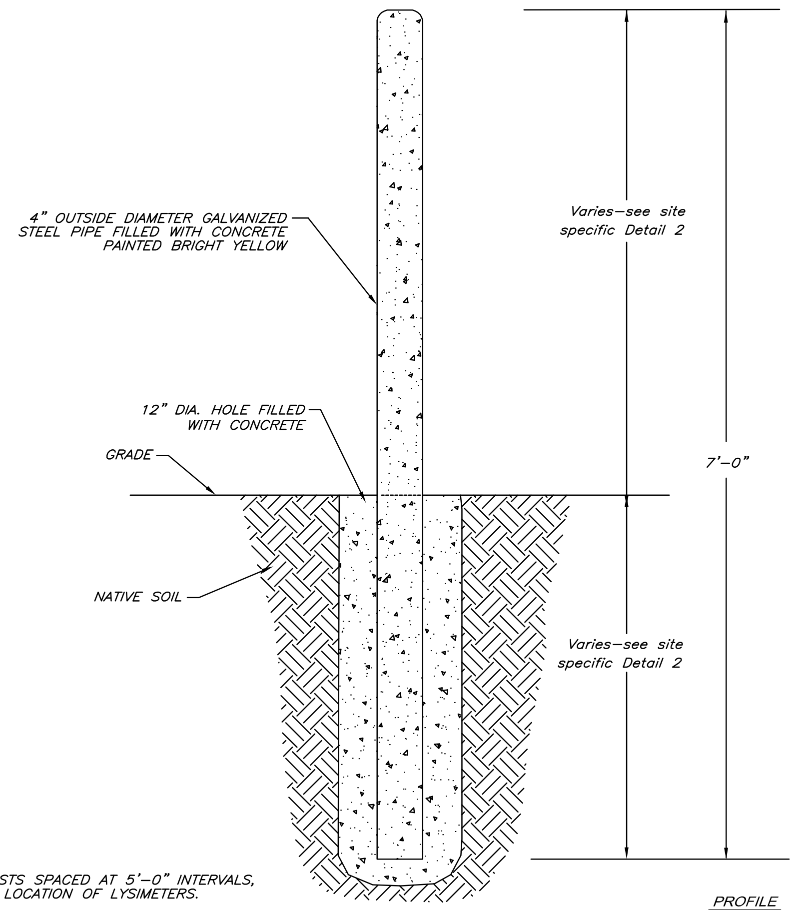
AS-BUILT DETAILS 1 AND 2
BROOKS LYSIMETER
INSTALLATION SCHEMATIC

SHEET NO.
7 OF 15



PROFILE
NOT TO SCALE

DETAIL 3
TYPICAL STEEL WELL PROTECTOR AND LYSIMETER HEAD ASSEMBLY



NOTES:
CRASH POSTS SPACED AT 5'–0" INTERVALS, OUTLINING LOCATION OF LYSIMETERS.

PROFILE
NOT TO SCALE

DETAIL 4
TYPICAL CRASH POST

DIGALERT 811

REVISIONS

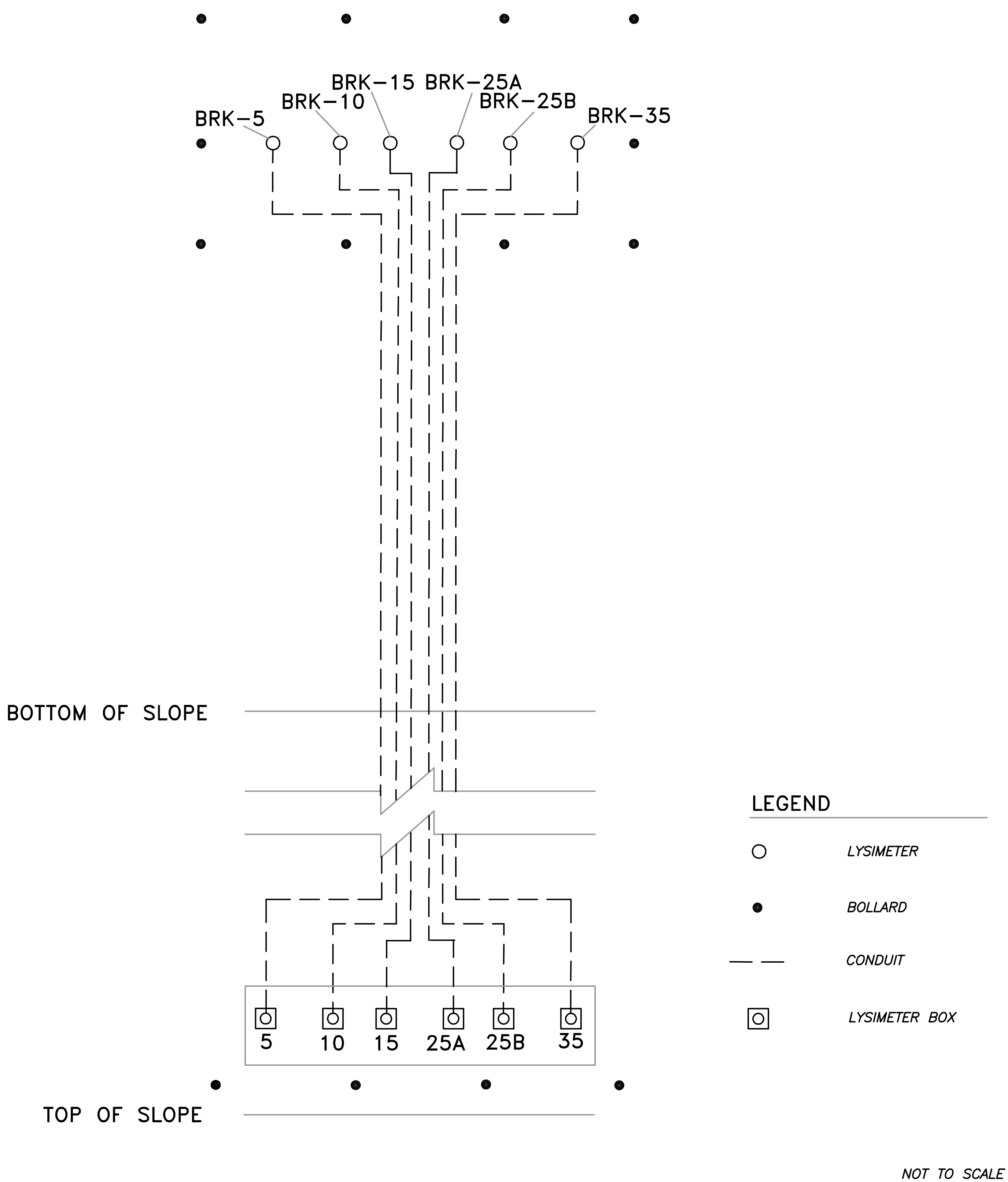
NO.	DATE	INITIAL	DESCRIPTION:	APPROVED/DATE
1	04/30/2007	TCR	UPDATED FOR 2007	WEL
2	12/21/2007	STJ	UPDATED FOR 2007	WEL 1/25/2008

WILDERMUTH ENVIRONMENTAL INC.
Inland Empire UTILITIES AGENCY

REVIEWED BY:	DRAWN BY:	START DATE:	DRAWING NO.
WEL	TCR	01/22/08	10

AS-BUILT DETAILS 3 AND 4
LYSIMETER HEAD
SCHEMATIC

SHEET NO.
10 OF 15



Wildermuth Environmental, Inc. 01/22/2008 3:00 PM 20080122_detail_Brooks.dwg

DRAWING 13
BROOKS LYSIMETER AS-BUILT
CHINO BASIN OPTIMUM BASIN MANAGEMENT PLAN
Recycled Water Groundwater Recharge Program

Project Name:	**Phase II RWR**
Project Location:	**Chino Basin, CA**
Project Number:	**007-004-066**
Client:	**IEUA**

LYSIMETER: BRK-5

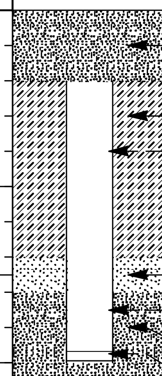
Date Started	**8/20/07**	Date Finished	**8/20/07**	Borehole Depth	**5.5 feet**	Drilling Contractor	**Layne Environmental**
Lat.	**34° 3' 38.04"**	Long.	**117° 42' 43.95"**	Drill Bit Size/Type	**8" Hollow Stem Auger**	Driller	**Alvaro Gutierrez**
Ground Surface Elevation	**870.0 feet**			Porous Interval	**4.5'-5' bgs**	Drill Rig Type	**CME**
Top of Casing Elevation	**NA**			Depth to Groundwater	**Not Encountered**	Drilling Method	**Hollow Stem Auger**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**	Sampling Method	**Split Spoon**

Elev., feet-msl	Depth, feet-bgs	Sample	Graphic	MATERIAL DESCRIPTION	LYSIMETER SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
870	0			Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), sand is medium to fine, trace of pebbles, some silt and clay.		
	5					
860	10					
	15					
850	20					
	25					
840	30					
	35					

Project Name:	**Phase II RWR**	**LYSIMETER: BRK-10**
Project Location:	**Chino Basin, CA**	
Project Number:	**007-004-066**	Sheet 1 of 1
Client:	**IEUA**	

Date Started	**8/20/07**	Date Finished	**8/20/07**	Borehole Depth	**10.5 feet**	Drilling Contractor	**Layne Environmental**
Lat.	**34° 3' 38.04"**	Long.	**117° 42' 43.95"**	Drill Bit Size/Type	**8" Hollow Stem Auger**	Driller	**Alvaro Gutierrez**
Ground Surface Elevation	**870.0 feet**			Porous Interval	**9.5'-10' bgs**	Drill Rig Type	**CME**
Top of Casing Elevation	**NA**			Depth to Groundwater	**Not Encountered**	Drilling Method	**Hollow Stem Auger**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**	Sampling Method	**Split Spoon**

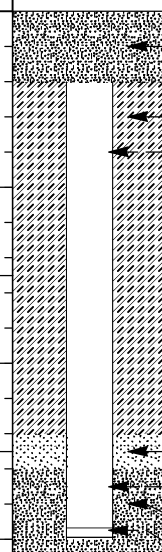
Elev., feet-msl	Depth, feet-bgs	Sample	Graphic	MATERIAL DESCRIPTION	LYSIMETER SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
870	0			Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), sand is medium to fine, trace of pebbles, some silt and clay.	Native Fill; Bentonite Grout; Sch. 40 PVC Conduit (1.9")	
	5					
				SILT (ML): yellowish brown (10YR, 5/6), moist, silt with trace amounts of clay.	No. 60 Transition Sand; Lysimeter Body (1500 mL); Silica Flour; Lysimeter Porous Tip	
860	10					
	15					
850	20					
	25					
840	30					
	35					



Project Name:	**Phase II RWR**	**LYSIMETER: BRK-15**
Project Location:	**Chino Basin, CA**	
Project Number:	**007-004-066**	Sheet 1 of 1
Client:	**IEUA**	

Date Started	**8/20/07**	Date Finished	**8/20/07**	Borehole Depth	**15.5 feet**	Drilling Contractor	**Layne Environmental**
Lat.	**34° 3' 38.04"**	Long.	**117° 42' 43.95"**	Drill Bit Size/Type	**8" Hollow Stem Auger**	Driller	**Alvaro Gutierrez**
Ground Surface Elevation	**870.0 feet**			Porous Interval	**14.5'-15' bgs**	Drill Rig Type	**CME**
Top of Casing Elevation	**NA**			Depth to Groundwater	**Not Encountered**	Drilling Method	**Hollow Stem Auger**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**	Sampling Method	**Split Spoon**

Elev., feet-msl	Depth, feet-bgs	Sample	Graphic	MATERIAL DESCRIPTION	LYSIMETER SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
870	0			Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), sand is medium to fine, trace of pebbles, some silt and clay.		
	5					
				SILT (ML): yellowish brown (10YR, 5/6), moist, silt with trace amounts of clay.		
860	10					
				Lean CLAY (CL): yellowish brown (10YR, 5/6), moist, lean clay that grades to silt.		
	15					
850	20					
	25					
840	30					
	35					



Report: LYSIMETER LOG; File: LYSIMETERS2007.GPJ; 1/25/2008

Project Name:	**Phase II RWR**
Project Location:	**Chino Basin, CA**
Project Number:	**007-004-066**
Client:	**IEUA**

LYSIMETER: BRK-25A

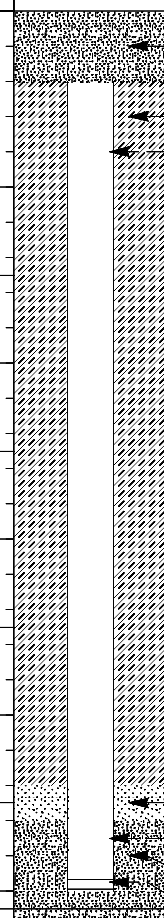
Date Started	**8/20/07**	Date Finished	**8/20/07**	Borehole Depth	**25.5 feet**	Drilling Contractor	**Layne Environmental**
Lat.	**34° 3' 38.04"**	Long.	**117° 42' 43.95"**	Drill Bit Size/Type	**8" Hollow Stem Auger**	Driller	**Alvaro Gutierrez**
Ground Surface Elevation	**870.0 feet**			Porous Interval	**24.5'-25' bgs**	Drill Rig Type	**CME**
Top of Casing Elevation	**NA**			Depth to Groundwater	**Not Encountered**	Drilling Method	**Hollow Stem Auger**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**	Sampling Method	**Split Spoon**

Elev., feet-msl	Depth, feet-bgs	Sample	Graphic	MATERIAL DESCRIPTION	LYSIMETER SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
870	0			Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), sand is medium to fine, trace of pebbles, some silt and clay.	Native Fill; Bentonite Grout; Sch. 40 PVC Conduit (1.9")	
	5					
				SILT (ML): yellowish brown (10YR, 5/6), moist, silt with trace amounts of clay.		
860	10					
				Lean CLAY (CL): yellowish brown (10YR, 5/6), moist, lean clay that grades to silt.		
	15					
				Poorly Graded SAND with Clay (SP-SC): yellowish brown (10YR, 5/6), moist, fine sand with clay lenses.		
850	20					
				Well-Graded SAND with Clay (SW-SC): (10YR, 5/6), sand is medium to fine, trace amount of silt and clay.	No. 60 Transition Sand; Lysimeter Body (1500 mL); Silica Flour; Lysimeter Porous Tip	
	25					
840	30					
	35					

Project Name:	**Phase II RWR**		**LYSIMETER: BRK-25B**
Project Location:	**Chino Basin, CA**		
Project Number:	**007-004-066**		Sheet 1 of 1
Client:	**IEUA**		

Date Started	**8/20/07**	Date Finished	**8/20/07**	Borehole Depth	**25.5 feet**	Drilling Contractor	**Layne Environmental**
Lat.	**34° 3' 38.04"**	Long.	**117° 42' 43.95"**	Drill Bit Size/Type	**8" Hollow Stem Auger**	Driller	**Alvaro Gutierrez**
Ground Surface Elevation	**870.0 feet**			Porous Interval	**24.5'-25' bgs**	Drill Rig Type	**CME**
Top of Casing Elevation	**NA**			Depth to Groundwater	**Not Encountered**	Drilling Method	**Hollow Stem Auger**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**	Sampling Method	**Split Spoon**

Elev., feet-msl	Depth, feet-bgs	Sample	Graphic	MATERIAL DESCRIPTION	LYSIMETER SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
870	0			Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), sand is medium to fine, trace of pebbles, some silt and clay.		
	5					
				SILT (ML): yellowish brown (10YR, 5/6), moist, silt with trace amounts of clay.		
860	10					
				Lean CLAY (CL): yellowish brown (10YR, 5/6), moist, lean clay that grades to silt.		
	15					
				Poorly Graded SAND with Clay (SP-SC): yellowish brown (10YR, 5/6), moist, fine sand with clay lenses.		
850	20					
				Well-Graded SAND with Clay (SW-SC): (10YR, 5/6), sand is medium to fine, trace amount of silt and clay.		
	25					
840	30					
	35					

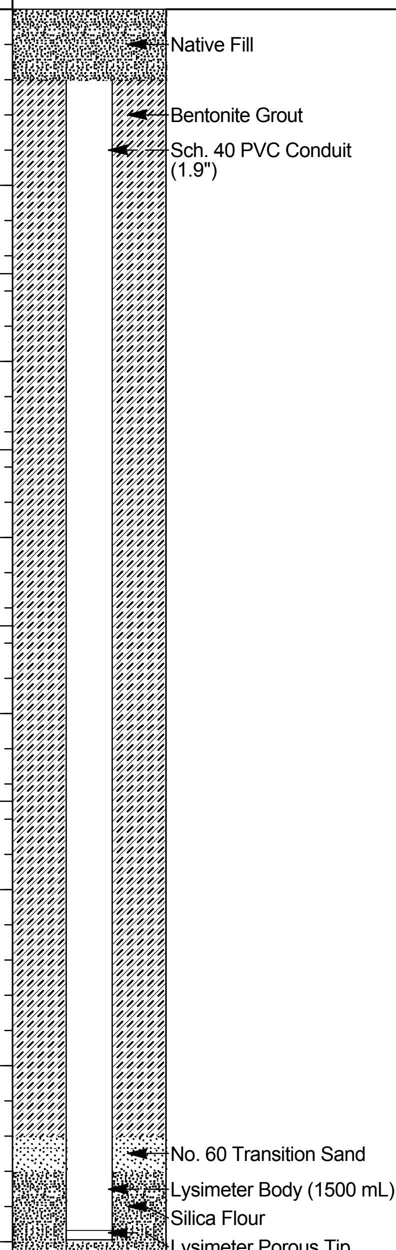


Project Name:	**Phase II RWR**		**LYSIMETER: BRK-35**
Project Location:	**Chino Basin, CA**		
Project Number:	**007-004-066**		Sheet 1 of 1
Client:	**IEUA**		

Date Started	**8/20/07**	Date Finished	**8/20/07**	Borehole Depth	**35.5 feet**	Drilling Contractor	**Layne Environmental**
Lat.	**34° 3' 38.04"**	Long.	**117° 42' 43.95"**	Drill Bit Size/Type	**8" Hollow Stem Auger**	Driller	**Alvaro Gutierrez**
Ground Surface Elevation	**870.0 feet**			Porous Interval	**34.5'-35' bgs**	Drill Rig Type	**CME**
Top of Casing Elevation	**NA**			Depth to Groundwater	**Not Encountered**	Drilling Method	**Hollow Stem Auger**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**	Sampling Method	**Split Spoon**

Elev., feet-msl	Depth, feet-bgs	Sample	Graphic	MATERIAL DESCRIPTION	FIELD NOTES
870	0			Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), sand is medium to fine, trace of pebbles, some silt and clay.	
	5				
				SILT (ML): yellowish brown (10YR, 5/6), moist, silt with trace amounts of clay.	
860	10				
				Lean CLAY (CL): yellowish brown (10YR, 5/6), moist, lean clay that grades to silt.	
	15				
				Poorly Graded SAND with Clay (SP-SC): yellowish brown (10YR, 5/6), moist, fine sand with clay lenses.	
850	20				
				Well-Graded SAND with Clay (SW-SC): (10YR, 5/6), sand is medium to fine, trace amount of silt and clay.	
	25				
840	30				
	35				

LYSIMETER SCHEMATIC AND CONSTRUCTION DETAILS



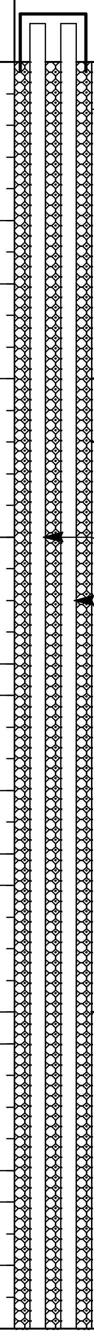
Project Name:	**Recycled Water Recharge Monitoring Program**	**Boring Log / BRK-1**
Project Location:	**Brooks Basin, Montclair Ca**	
Project Number:	**007-004-067**	Sheet 1 of 14
Client:	**IEUA**	

Date Started	**2/8/07**	Date Finished	**3/15/07**	Borehole Depth	**620.0 feet**
Lat.	**117° 42' 49"**	Long.	**34° 3' 37"**	Drill Bit Size/Type	**17.5" Tri-cone**
Ground Surface Elevation	**921.0 feet**			Screened Interval(s)	**310-350 ft-bgs; 520-560 ft-bgs**
Top of Casing Elevation	**924.0 feet**			Depth to Groundwater	**1/1 - 287 feet, 1/2 - 311 feet**
Logged By	**A. Ligutom**			Reviewed By	**B. Leever, PG**

Drilling Contractor	**Best Drilling and Pump, Inc.**
Driller	**Chris Gomez**
Drill Rig Type	**Wagner Morehouse**
Drilling Method	**Flooded Reverse**
Sampling Method	**Interval collection by spitter box**

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION
920	0		Top Soil (OL): dark brown (7.5YR, 3/2).
	5		
910	10		Organic (OL): dark brown (7.5YR, 3/2), few pebbles/gravel 2 mm-3 cm.
	15	08:26	Well Graded SAND (SW): light olive brown (2.5Y, 5/3), Medium gravel, few pebbles, sub-angular to angular 1x8 cm cobble present, 10% gravel 90% sand.
900	20		Poorly Graded SAND with Gravel (SP): light olive brown (2.5Y, 5/3), Medium-coarse sand some cobbles up to 4 cm, angular to subangular-dry. 30% gravel, 70% sand.
	25		Well Graded SAND with Gravel (SW): olive brown (2.5Y, 4/3), Subangular medium-coarse cobbles, subrounded to subangular granitic and metamorphic cobbles and gravel, 40% gravel, 60% sand.
			Well Graded GRAVEL with Sand (GP): dark grayish brown (2.5Y, 4/2), Coarse sub-rounded to rounded, elongate to rounded gravel, well rounded, gravel 1 cm-12 cm, 70% gravel, 30% sand.
890	30	08:33	
		08:53	Poorly Graded GRAVEL with Sand (GP): very dark grayish brown (2.5YR, 3/2), gravel has granitic and metamorphic clasts, 3 cm-30 cm, 60% gravel, 40% sand, moist.
	35	09:17	Well Graded SAND with Gravel (SW): very dark grayish brown (2.5YR, 3/2), 50% gravel, 50% sand.
	40	09:20	Silty CLAY with Sand (CL): dark reddish brown (5YR, 3/4), Reddish some gravel interbedded sand, 5% gravel, 10% sand, 45% silt, 40% clay.

WELL SCHEMATIC AND CONSTRUCTION DETAILS



FIELD NOTES

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	40						
			09:28		Silt with SAND (ML): dark reddish brown (5YR, 3/4), sand is medium to coarse, silt is red and unconsolidated, 40% sand, 60% silt, low moisture.		
870	45					Cement inside conductor casing (0-50 ft-bgs)	
			09:45		Silty SAND (SM): dark reddish brown (5YR, 3/4), sand is medium to fine with silt, trace gravel, moist.		
	50						
860	55						
	60						
			12:55		Well Graded SAND (SW): brown (7.5YR, 5/2), 60% coarse sand, 40% fine sand.		
850	65		13:11		Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), 9% angular gravel, 90% fine-coarse sand, 1% silt.	50% Benseal Grout/50%Sand (No.3) (50-294 ft bgs)	
			13:14		Well Graded SAND (SW): dark yellowish brown (10YR, 4/4), 100% fine sand.		
					Poorly Graded SAND (SP): dark yellowish brown (10YR, 3/6), 5% angular gravel, 90% coarse sand, 5% medium sand.		
	70		13:17		Poorly Graded SAND (SP): dark yellowish brown (10YR, 3/6), 5% angular gravel, 90% fine sand, 5% silt.		
			13:24		Poorly Graded SAND (SP): dark yellowish brown (10YR, 4/4), 10% angular gravel, 40% medium sand, 50% fine sand.		
840	75		13:27		Poorly Graded SAND with Gravel (SP): dark yellowish brown (10YR, 3/4), 20% angular gravel, 4-5 cm diameter, 20% medium sand, 60% fine sand.		
			13:30		Poorly Graded SAND (SP): dark yellowish brown (10YR, 4/6), 1% gravel, 18% medium sand, 80% fine sand, 1% clay.		
			13:34		Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), 10% sub-angular gravel, 80% medium sand, 10% fine sand.		
	80		13:37		Lean CLAY (CL): dark brown (7.5YR, 3/3), trace of sand.		
			13:39				
830	85		13:42		Lean CLAY (CL): dark yellowish brown (7.5YR, 4/6), 5% medium sand, 95% lean clay.		
			13:44		Poorly Graded SAND with Gravel (SP): dark brown (7.5YR, 3/3),		

WILDERMUTH ENVIRONMENTAL INC.

Project Name:	**Recycled Water Recharge Monitoring Program**
Project Location:	**Brooks Basin, Montclair Ca**
Project Number:	**007-004-067**
Client:	**IEUA**

Boring Log / BRK-1

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			15% angular gravel, 85% medium sand, trace of clay. Gravel is 3-5 cm diameter.		
		13:44	Poorly Graded GRAVEL with Sand (GP): reddish brown (10YR, 5/3), 80% gravel, 10% coarse sand, 10% medium sand. gravel is 5-7 cm diameter.		
	90	13:47	Poorly Graded SAND with Gravel (SP): dark reddish brown (2.5YR, 3/3), 20% angular to sub-angular gravel, 80% medium sand. Gravel is 5-7 cm diameter.		
820		13:50	Poorly Graded SAND (SP): dark reddish brown (2.5YR, 3/3), 5% gravel, 45% coarse sand, 50% medium sand. Gravel is <1 cm diameter.		
	95	13:51	Well Graded GRAVEL with Sand (GW): very dark grayish brown (2.5Y, 3/2), 40% coarse sand, 60% fine to coarse gravel.		
		14:47	Poorly Graded SAND with Gravel (SP): reddish brown (2.5Y, 5/4), 80% coarse sand, 20% fine gravel.		
	100	14:56	Well Graded GRAVEL with Sand (GW): strong brown (7.5YR, 4/6), 75% gravel, 25% coarse sand, trace of medium sand. Gravel is 1-3 cm, metamorphic.		
		15:00	Well Graded SAND with Gravel (SW): very dark grayish brown (10YR, 3/2), 50% sub-angular gravel, 50% sand. Gravel is 1-7 cm diameter.		
810		15:02	Well Graded SAND (SW): olive brown (2.5Y, 4/3), 10% gravel, 45% medium sand, 35% fine sand, 10% fat clay.		
	105	15:08	Well Graded GRAVEL with Sand (GW): olive brown (2.5, 4/3), 70% sub-rounded to rounded gravel, 30% sand. Gravel is 1-5 cm diameter.		
		15:12	Well Graded GRAVEL with Sand (GW): dark olive gray (5Y, 3/2), 80% gravel, 20% coarse to medium sand. Gravel is 1-8 cm diameter.		
	110	15:13 15:15	Well Graded SAND with Gravel (SW): very dark grayish brown (10YR, 3/2), 20% fine gravel, 20% coarse sand, 60% medium sand.	50% Benseal Grout/50%Sand (No.3) (50-294 ft bgs)	
800		15:18	Lean CLAY (CL): brown (7.5YR, 5/4), 5% coarse sand, 95% lean clay.		
	115	15:20 15:22	Lean CLAY with Sand (CL): brown (7.5YR, 5/3), 75% medium sand, 10% fine sand, 15% clay, trace of gravel.		
	120	15:25	Poorly Graded SAND (SP): strong brown (7.5YR, 5/6), 70% medium sand, 30% fine sand.		
790	125	15:27 15:31	Well Graded GRAVEL with Sand (GW): light olive brown (2.5Y, 5/4), 60% coarse to fine gravel, 40% coarse to fine sand, grades to clay. Gravel is 4-5 cm diameter.		
		15:58	Lean CLAY (CL): brown (7.5YR, 4/4), 10% coarse sand, 90% clay.		
	130	16:02 16:04	Clayey SAND (SC): brown (7.5YR, 4/3), 60% coarse sand, 40% clay.		

WILDERMUTH ENVIRONMENTAL INC.

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
780	135		16:06 16:10		Well Graded GRAVEL with Sand (GW): very dark grayish brown (2.5 Y, 3/2), 20% coarse gravel, 50% fine gravel, 30% coarse sand.		
	140		16:14 16:17 16:22 16:33		Poorly Graded GRAVEL with Sand (GP): olive (5Y, 4/4), 85% angular to sub-angular gravel, 10% coarse sand, 5% fine sand, 143-144 feet hard drilling, probably a boulder.		
770	145		16:43 16:51		Poorly Graded SAND with Gravel (SP): olive (5Y, 4/4), 25% sub-rounded gravel, 75% coarse sand.		
760	150 155		16:57 16:58 17:00 17:04		Well Graded SAND with Gravel (SW): olive (5Y, 4/4), 30% fine to coarse gravel, 30% medium sand, 40% fine sand. Gravel is 1-2 cm diameter.		
			17:07 09:50		Well Graded SAND with Clay (SW): yellowish red (5YR, 4/6), 5% fine gravel, 40% coarse sand, 40% medium sand, 15% clay. Clay is fat.		2/15/2007
750	160		09:51		Poorly Graded SAND (SP): dark reddish brown (2.5YR, 3/3), 5% gravel, 80% sand, 10% silt, 5% clay.	50% Benseal Grout/50%Sand (No.3) (50-294 ft bgs)	
	165		10:00		Well Graded SAND (SW): very dark grayish brown (10YR, 3/2), 10% gravel, 85% coarse to medium sand, 5% silt.		
					Poorly Graded SAND (SP): dark grayish brown (10YR, 3/2), 15% gravel, 85% coarse to medium sand, trace of silt. Metamorphic clasts present.		
			10:05		Poorly Graded SAND (SP): dark Grayish Brown (10YR, 4/2), 30% gravel, 70% coarse to medium sand, mineralogy is quartz, and feldspar. Metamorphic clasts present.		
	170		10:08		Poorly Graded SAND with Gravel (SP): very dark grayish brown (10YR, 3/2), 45% gravel, 55% coarse sand.		
740	175		10:10		Poorly Graded GRAVEL with Sand (GP): very dark grayish brown (10YR, 3/2), gravel and sand are subangular, 50% coarse gravel, 50% coarse to fine sand.		
	180		10:16 10:20		Poorly Graded SAND with Gravel (SP): very dark grayish brown (10YR, 3/2), 30% coarse to fine gravel, 70% coarse sand, angular to sub-angular.		

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	180				
		10:26	Poorly graded SAND with Gravel (SP): very dark gray brown (10YR, 3/2), coarse sand, pebbles and gravel, angular to sub-angular.		
730	185	10:30			
		10:33			
		10:36			
	190	11:08	Poorly graded SAND with Gravel (SP): brown (10YR, 4/3), 40% coarse gravel, 20% coarse sand, 40% medium sand, gravel is 1-7 cm angular to sub-angular.		
		11:11	Clayey SAND (SC): brown (10YR, 5/3), coarse sand, fat clay.		
720	195	11:14	Clayey SAND (SC): brown (10YR, 5/3), 70% coarse sand, 30% clay, trace of silt.		
		11:17	Sandy Fat CLAY (CH): brown (7.5YR, 4/3), 40% coarse to medium sand, 10% silt, 50% clay.		
		11:20	Clayey SAND (SC): brown (10YR, 4/3), 5% gravel, 5% silt, 60% medium to coarse sand, 30% clay.		
	200	11:26	Silty SAND (SC): dark brown (7.5YR, 3/3), fine to medium sand with some silt and clay.		
		11:31	Silty SAND (SM): brown (10YR, 4/3), fine to coarse sand with silt and clay.		
710	205	11:34	Clayey Silty SAND (SM): brown (10YR, 4/3), 60% coarse sand, 10% silt, and 30% clay.		
		11:38	Poorly graded SAND with Gravel (SP): brown (10YR, 5/3), 70% medium to coarse sand, 5% silt, 25% gravel, trace amounts of clay.		
		11:40	Fat CLAY (CH): dark brown (7.5YR, 3/3), 5% gravel, 20% silt, 75% clay.		
	210	11:44		50% Benseal Grout/50%Sand (No.3) (50-294 ft bgs)	
		11:46			
700	215	11:50	Clayey SAND with Silt and Gravel (SC): brown (10YR, 5/3), 5% gravel, 60% medium to coarse grain sand, sub-angular, 5% silt, and 30% clay.		
		11:55	Sandy Lean CLAY (CL): dark brown (7.5YR, 3/3), 5% gravel, 5% sand, 90% clay.		
		11:57	Clayey SAND (SC): brown (7.5YR, 5/3), 60% medium sand, 40% clay.		
	220	11:59			
		12:20	Clayey SAND (SC): strong brown (7.5YR, 4/6), 45% coarse sand, 50% medium sand, 5% fat clay, bits of metal from drill bit.		
690	225	12:26	Gravelly SAND (GP): very dark green (10YR, 3/1), 20% fine quartz gravel, 10% medium sand, 70% very coarse sand.		
		12:30			

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			12:33		Poorly graded SAND (SP): brown (10YR, 4/3), 80% medium sand to gravel, 20% fine sand.		
	230		12:36		CLAY (CL): yellowish brown (10YR, 5/8), 10% sand, 90% clay.		
			12:37		Lean CLAY (CL): light yellowish brown (10YR, 6/4), 5% angular to subrounded gravel, 25% medium sand, 70% clay, trace amount of silt.		
680	235		12:41		Clayey SAND (SC): dark yellow brown (10YR, 3/6), 70% coarse sand, 10% medium sand, 20% clay, trace amount of gravel.		
			12:45		Poorly graded SAND (SP): dark yellow brown (10YR, 3/4), 5% angular gravel, 30% medium sand, 60% fine sand, 5% clay.		
			12:47		Clayey SAND (SC): dark yellow brown (10YR, 4/4), 80% coarse sand, 10% fine sand, 10% clay, clay forms about 1-4 cm in diameter.		
	240		12:52		Clayey SAND with Gravel (SC): dark brown (10YR, 3/3), 10% gravel, 60% coarse sand, 15% medium sand, 15% clay, 1-7 cm angular to subangular gravel.		
			12:56				
670	245		12:59		Well Graded SAND (SW): dark grayish brown (2.5Y, 4/2), 20% coarse sand, 40% medium sand, 40% fine sand.		
			13:01				
			13:05		Fat CLAY (CH): reddish brown (5YR, 4/3), 10% medium to coarse sand, 90% fat clay.		
	250		13:07		Fat CLAY (CH): reddish brown (5YR, 4/3), 5% coarse to medium sand, 95% clay.	50% Benseal Grout/50%Sand (No.3) (50-294 ft bgs)	
			14:27				
660	255		14:31				
			14:36		Fat CLAY (CH): brown (7.5YR, 4/4), 100% clay.		
	260		14:41		Fat CLAY (CH): yellowish brown (10YR, 6/4), 5% fine sand and 95% clay.		
			14:44		Sandy Gravelly CLAY (CH): yellowish brown (10YR, 5/4), 10% 1 cm to 2 cm angular gravel, 20% coarse sand, 10% fine sand, 60% clay.		
650	265		14:56				
			14:58		Sandy CLAY (SC): dark yellowish brown (10YR, 4/6), 30% coarse sand, 20% medium sand, 50% clay.		
			14:59				
	270		15:03		Clayey SAND (SC): dark yellowish brown (10YR, 3/4), 20% coarse sand, 40% medium sand, 40% clay.		
			15:05				

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
640	275		15:08		Clayey SAND (SC): dark yellowish brown (10YR, 4/4), 5% gravel, 60% medium sand, 20% fine sand, 15% clay.		
			15:12		Gravelly SAND (GP): very dark gray (10YR, 3/1), 20% 1 cm to 4 cm coarse gravel, 70% coarse sand, 10% medium sand.		
	280		15:17 15:22 15:26 15:54		Poorly Graded SAND (SP): very dark gray (10YR, 3/1), 20% coarse sand, 75% medium sand, 5% fine gravel.		
630	285		15:59 16:07				
	290		16:11			50% Benseal Grout/50%Sand (No.3) (50-294 ft bgs)	
620	295		16:16		Clayey SAND (SC): dark brown (10YR, 3/3), 5% gravel, 70% sand, 25% clay.		
			16:22		Gravelly SAND (GP): dark brown (10YR, 3/3), 35% gravel, 65% sand with trace of fat clays.	Medium sized coated bentonite pellets	
	300		16:24 16:28 16:32		Sandy GRAVEL (GP): dark yellowish brown (10YR, 4/4), 60% gravel, 40% medium to coarse sand.	Filter Sand (299-304 ft bgs)	
610	305		16:43 16:49				Rig Chatter
	310						
600	315		16:57 16:59 17:00		Poorly Graded GRAVEL with Sand (GP): brown (10YR, 4/3), 80% gravel, and 20% sand, trace gravels.	0.02" wire wrapped screen (310-350 ft bgs)	
	320		09:20 09:23		Poorly Graded SAND with Gravel (GP): dark yellowish brown (10YR, 3/4), 20% gravel, 80% coarse sand.		

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	320						
			09:29		Poorly graded SAND (SP): 10% gravel, 90% very coarse sand.		
590			09:31		Clayey SAND (SC): dark yellowish brown (10YR, 3/6), 10% gravel, 30% clay, and 60% sand.		
	325		09:33				
			09:36		Lean CLAY (CL): dark reddish brown (5YR, 3/3), 5% sand, 95% clay.		
	330		09:38		Sandy Lean CLAY (SC): dark reddish brown (5YR, 3/4), 30%sand, 70% clay.	Filter Sand (299-304 ft bgs)	
			09:41		CLAY (CL): dark reddish brown (5YR, 3/3), 5% sand, 95% clay.		
580			09:44		Sandy Lean CLAY (SC): Sand is 30%, 70% clay.		
	335		09:49		Poorly Graded SAND (SP): brown (10YR, 4/3), 90% sand, 10% clay.		
			09:52				
	340		09:56		Well Graded SAND (SW): brown (7.5YR, 4/3), 90% coarse to fine sand, 10% clay.	0.02" wire wrapped screen (520-560 ft bgs)	
			10:00		Clayey SAND (SC): brown (10YR, 5/3), 10% gravel, 60% sand 30% clay.		
570			10:04		Poorly Graded SAND with Gravel (SP): brown (10YR, 4/3), 20% gravel, and 80% sand.		
	345		10:09				
			10:13		Poorly Graded SAND with Gravel (SP): brown (10YR, 4/3), 35% gravel, and 65% sand.		
	350		10:35		Poorly Grade SAND (SP): brown (10YR, 4/3), 60% coarse sand, 40% medium sand, trace of silt.		
			10:43		Well Graded SAND (SW): yellowish brown (10YR, 5/6), 10% coarse sand, 80% medium sand, 10% fine sand, trace of gravel .	Silt Trap (350-355 ft-bgs)	
560			10:47		Clayey SAND (SC): yellowish brown (10YR, 5/8), 60% coarse sand, 20% fine sand, 20% fat clay.		
	355		10:50				
	360		10:59		Sandy CLAY (SC): brownish yellow (10YR, 6/6), 30% fine to medium sand, 70% clay.		
			11:02			Medium sized coated bentonite pellets	
550			11:07				
	365		11:12				

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
		11:15	Clayey SAND (SC): brown (10YR, 4/3), 20% medium sand, 40% fine sand, 40% clay.		
	370	11:22			
		11:25			
540	375	11:31			
		11:34	SAND (SW): yellowish Brown (10YR, 5/8), 40% fine sand, 50% coarse sand, 10% clay.		
	380	12:40			
		12:42			
		12:43			
530	385	12:44			
		12:45	Fat CLAY with Sand (SC): yellowish brown (10YR, 5/6), 20%sand, 80% clay.		
	390	12:47			
		12:51			
		12:52			
520	395	12:53			
		12:55			
	400	12:58		50% Benseal Grout/50%Sand (No.3) (362-503 ft bgs)	
		13:01			
		13:06			
510	405	13:10			
		13:14			
	410	13:17	Clayey SAND (SC): yellowish brown (10YR, 5/6), 80% sand, 20% clay.		
		13:25	Poorly Graded SAND (SW): grayish brown (10YR, 5/2), 29% coarse sand, 80% medium sand, 1% clay.		

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			13:54				
500	415		13:58				
			14:05				
	420		14:10				
			14:16				
			14:23				
490	425		14:25		Clayey SAND (SC): brownish yellow (10YR, 6/8), 60% coarse sand, 20 medium sand, 20% clay.		
			14:30				
	430		14:39				
			14:31				
			14:57		Poorly Graded SAND (SP): brown (10YR, 5/3), 55% coarse sand, 40% medium sand, 5% fine gravel.		
480	435		15:08		Poorly Graded SAND (SP): dark yellowish brown (10YR, 4/4), trace gravel, 80% coarse sand, 15% medium sand, 5% clay.		
			15:09		Lean CLAY with Sand (CL): yellowish brown (10YR, 6/8), 25% medium sand, 75% clay.		
	440		15:17		Clayey SAND (SC): brownish yellow (10YR, 6/8), 30% medium sand, 30% fine sand, 40% clay.	50% Benseal Grout/50%Sand (No.3) (362-503 ft bgs)	
			15:23				
470			15:48		SAND (SP): brownish yellow (10YR, 6/8), 75% medium sand, 20% fine sand, 5% clay.		
	445		15:52				
			15:57		Clayey SAND (SC): brownish yellow (10YR, 6/6), 85% sand, 15% clay, trace of gravel.		
	450		16:02		CLAY (CL): strong brown (7.5YR, 5/8), 10% sand, 90% clay.		
			16:06				
460			16:09				
	455		16:10				
			16:13		Fat CLAY with Sand (CH): strong brown (7.5YR, 5/8), 20% coarse sand, 80% clay.		
			16:15				
	460						

Project Name:	**Recycled Water Recharge Monitoring Program**	**Boring Log / BRK-1**
Project Location:	**Brooks Basin, Montclair Ca**	Sheet 11 of 14
Project Number:	**007-004-067**	
Client:	**IEUA**	

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			16:17				
			16:19				
450	465		16:24		Poorly Graded SAND (SP): yellowish brown (7.5YR, 4/6), 30% coarse sand, 70% medium sand, 10% clay.		
			16:29		Clayey SAND (SP): strong brown (7.5YR, 5/6), 40% course sand, 35% medium to fine sand, 25% clay		
	470		16:31				
			16:34				
			16:36		Poorly Graded SAND with Gravel (SP): dark yellowish brown (10YR, 4/6), 30% gravel, 65% sand, 5% clay.		
440	475		09:45		Lean CLAY (CL): light brown (7.5YR, 6/4), 100% clay.		
			09:53		Poorly Graded SAND (SP): brownish yellow (10YR, 6/6), 20% medium sand, 60% coarse sand, and trace amount of clay.		
	480		09:58			50% Benseal Grout/50%Sand (No.3) (362-503 ft bgs)	
			10:03		Fat CLAY with Sand (SC): dark yellowish brown (10YR, 4/4), 20% medium sand, 80% fat clay.		
			10:08		Clayey SAND (SC): light yellowish brown (10YR, 6/4), 60% medium sand, 10% fine sand, 30% clay.		
430	485		10:11				
			10:15		SAND (SP): yellowish brown (10YR, 5/4), 50% medium sand, 40% fine sand, 50%, 10% clay.		
	490		10:17				
			10:21		Well Graded SAND (SW): brown (10YR, 5/3), 60% coarse sand, and 40% medium sand.		
			10:25				
420	495		10:29				
			10:32				
	500		10:34		Well Graded SAND with Gravel (SW): grayish brown (10YR, 5/2), 20% gravel, 60% coarse sand, 20% medium sand; 1-3 cm sub-rounded.		
			10:37				
			10:41				
410	505		10:44				
			10:58				

WILDERMUTH ENVIRONMENTAL INC.

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS
				Medium sized coated bentonite pellets
		11:14	Poorly Graded SAND (SP): grayish brown (10YR, 5/2), 10% gravel, 80% coarse sand, 10% fine sand.	
	510	11:17		Filter Sand (509-514 ft-bgs)
		11:22		
400	515	11:27	Fat CLAY (CH): yellowish red (5YR, 4/6), 5% sand, 95% fat clay.	
		11:30	Fat CLAY with Sand (CH): dark yellowish brown (10YR, 4/4), 10% coarse sand, 10% fine sand, 80% clay.	
		11:31	Well Graded SAND (SW): brown (10YR, 5/3), 10% gravel, 20% medium sand, 60% fine sand, 10% clay.	
	520	11:35	Well Graded SAND (SP): yellowish brown (10YR, 5/4), 35% coarse sand, 60% medium sand, 5% clay.	0.02" wire wrapped screen (520-560 ft bgs)
		11:36	Poorly Graded SAND (SP): yellowish brown (10YR, 5/4), 5% fine gravel, 50% coarse sand, 35% medium sand.	
390	525	11:41		
		11:45	Poorly Graded SAND (SP): brown (10YR, 5/4), 50% coarse sand, 45% medium sand, and 5% clay, trace of gravel.	
		11:47		
	530	11:51		
		11:53	Well Graded SAND (SW): light gray (10YR, 7/2), 20% coarse sand, 20% medium sand, 50% fine sand, 10% clay, trace of gravel.	
380	535	11:54		
		11:56	Well Graded SAND with Clay (SW): yellowish brown (10YR, 5/4), 40% coarse sand, 20% medium sand, 40% clay.	
		11:59	Sandy CLAY (SC): light yellowish brown (10YR, 6/4), 15% medium sand, 15% coarse sand, 70% clay.	
	540	12:25	Fat CLAY (CH): brown (7.5YR, 4/4), 5% sand, 95% clay.	
		12:30		
370	545	12:33	Clayey SAND (SC): brown (7.5YR, 4/3), 60% medium sand, 40% clay, trace of gravel.	
		12:35	Sandy CLAY (SC): brown (7.5YR, 4/2), 30% sand, 70% clay.	
		12:37		
	550	12:41		
		12:46	Fat CLAY with Sand (CH): grayish brown (10YR, 5/2), 20% sand, 80% clay, trace of gravel.	

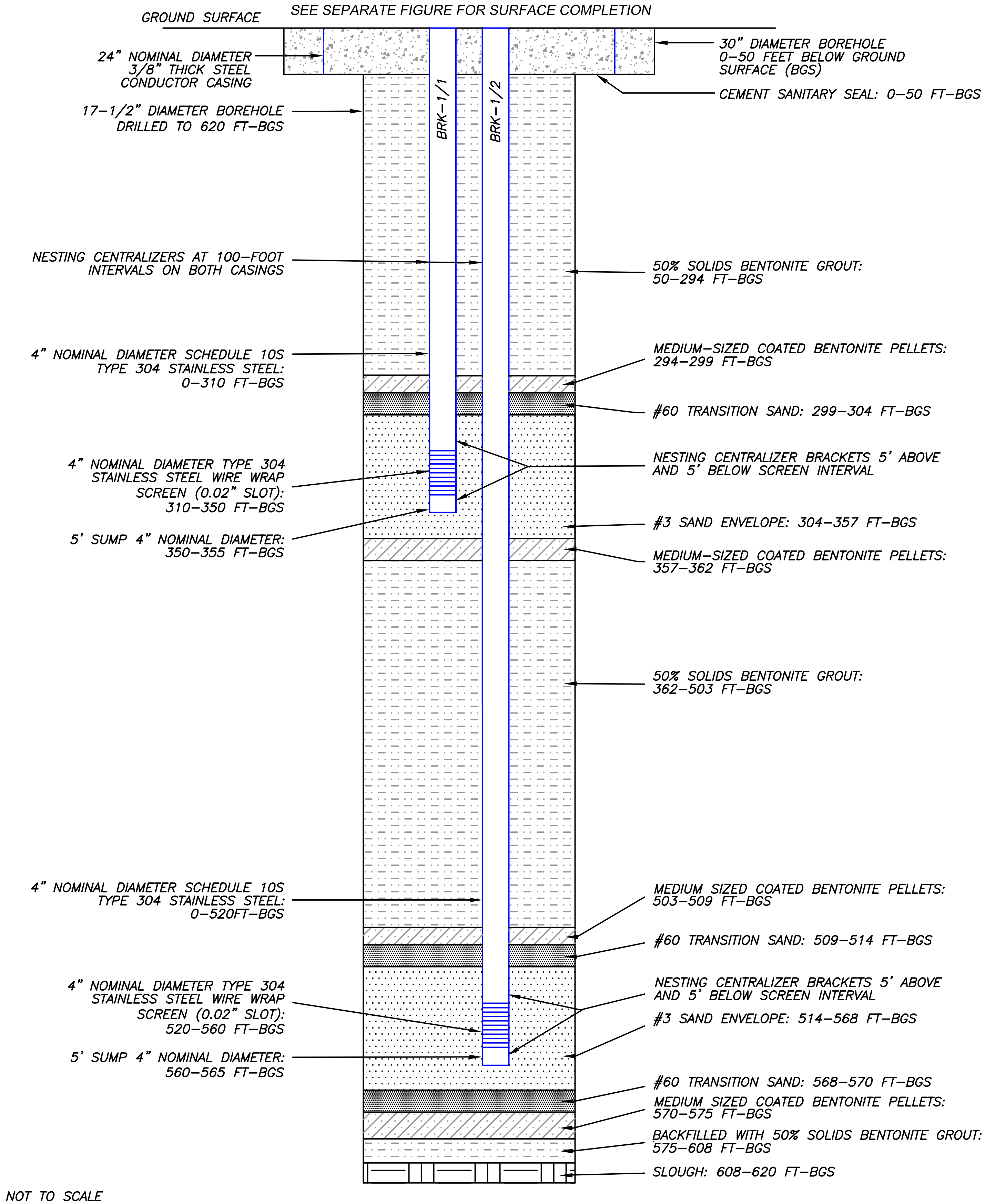
FIELD NOTES

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
360	555		12:49		Clayey SAND (SC): dark grayish brown (10YR, 4/2), 60% coarse sand, 20% medium sand, 20% clay.	Filter Sand (514-568 ft-bgs)	
			12:54		Clayey SAND (SC): dark grayish brown (10YR, 4/2), 70% coarse sand, 10% medium sand, 20% clay.		
			12:58				
	560		13:00		Well Graded SAND (SW): gray (10YR, 6/1), 45% coarse sand, 45% coarse sand, 10% clay.		
			13:03			Silt Trap (560-565 ft-bgs)	
350	565		13:05				
			13:07				
			13:10				
	570		14:00				
			14:48		Fat CLAY (CH): brown (7.5YR, 4/4), 10% coarse sand, 90% clay.	Medium sized coated bentonite pellets (570-575 ft-bgs)	
340	575		14:51		Sandy Fat CLAY (CH): brown (7.5YR, 4/4), 20% coarse sand, 20% medium sand, 60% clay.		
			14:53				
			14:58				
	580		15:00		Fat CLAY (CH): reddish yellow (7.5YR, 7/6), 100% clay.		
			15:03		Fat CLAY (CH): strong brown (7.5YR, 4/6), 10% medium sand, 90% clay.		
330	585		15:08			50% Benseal Grout/50%Sand (No.3) (575-608 ft bgs)	
			15:09		Sandy Fat CLAY (CH): brown (7.5YR, 5/4), 20% coarse sand, 20% medium sand, 60% clay.		
			15:12				
	590		15:16				
			15:19				
320	595		15:21				
			15:22		Fat CLAY (CH): stong brown (7.5YR, 4/6), 10% sand, 90% clay.		
			15:25				
	600						

Project Name:	Recycled Water Recharge Monitoring Program
Project Location:	Brooks Basin, Montclair Ca
Project Number:	007-004-067
Client:	IEUA

Boring Log / BRK-1

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	600				
		16:03	Fat CLAY (CH): dark yellowish brown (10YR, 4/6), 100% clay.		
310	605	16:11	Clayey SAND (SC): dark yellowish brown (10YR, 3/6), 30% coarse sand, 20% medium sand, 10% fine sand, 40% clay.		
		16:12	Fat CLAY (CH): brown (10YR, 5/3), 100% clay, trace of sand.		
	610	16:14		Slough (608-620 ft-bgs)	
		16:16			
300	615	16:18	Sandy Fat CLAY (CH): dark yellowish brown (10YR, 4/4), 30% medium sand, 70% clay.		
		16:21	Sandy CLAY (CH): brown (10YR, 4/3), 10% coarse sand, 10% medium sand and 80% clay, trace gravel.		
		16:25	Fat CLAY (CH): brownish yellow (10YR, 6/6), 10% fine sand, and 90% clay, trace amount of gravel.		
	620	16:25			
290	625				
	630				
280	635				
	640				
270	645				



8/17/07

WELL COMPLETION AS BUILT
BRK-1 WELL

OPTIMUM BASIN MANAGEMENT PROGRAM

FN:20070817_ BRK–1_AsBuilt.dwg

Project Name: Recycled Water Recharge Monitoring Program
Project Location: Brooks Basin, Montclair Ca
Project Number: 007-004-067
Client: IEUA

Boring Log / BRK-2

Date Started	6/13/07	Date Finished	7/20/07	Borehole Depth	635.0 feet	Drilling Contractor	Best Drilling and Pump, Inc.
Lat.	117° 43' 87"	Long.	34° 3' 26"	Drill Bit Size/Type	17.5" Tri-cone	Driller	Chris Gomez
Ground Surface Elevation	910.0 feet			Screened Interval(s)	350-390 ft-bgs; 568-588 ft-bgs	Drill Rig Type	Wagner Morehouse
Top of Casing Elevation	907.0 feet			Depth to Groundwater	2/1 - 290 feet, 2/2 - 325 feet	Drilling Method	Flooded Reverse
Logged By	A. Ligutom			Reviewed By	B. Leever, PG	Sampling Method	Interval collection by spitter box

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION
910	0		Asphalt
			Topsoil: Brown silty soil
		07:17	
	5		
900	10		
		07:22	Fine silty soil, 1 cm rounded pebbles
	15		
890	20		
		07:30	Poorly Graded SAND (SP): 100% fine sand.
			Sandy SILT (SM): sandy silt with cobbles.
		07:36	Poorly Graded SAND (SP): fine sand with angular fine gravel 1-2 cm.
	25		
880	30		
		07:49	Poorly Graded SAND (SP): fine to medium red sand.
	35	07:55	Poorly Graded SAND (SP): fine to medium red sand, some gravel.
870	40	08:04	Poorly Graded SAND (SP): fine to medium red sand.

WELL SCHEMATIC AND CONSTRUCTION DETAILS

- Flush mounted concrete vault (4' x 4' x 4') with hinged double doors
- 17.5" nominal dia. borehole (50-620 ft-bgs)
- 30" nominal dia. borehole with 3/8" steel conductor casing and cement sanitary seal (0-50 feet-below ground surface)
- **BRK-2/1** 4" dia. Sch 10 Type 304 SS casing (with stainless steel wire wrap screen from 350-390 ft-bgs)
- **BRK-2/2** 4" dia. Sch 10 Type 304 SS casing (with stainless steel wire wrap screen from (568-588 ft-bgs)
- Cement inside conductor casing (0-50 ft-bgs)

FIELD NOTES

WILDERMUTH ENVIRONMENTAL INC.

Project Name:	Recycled Water Recharge Monitoring Program
Project Location:	Brooks Basin, Montclair Ca
Project Number:	007-004-067
Client:	IEUA

Boring Log / BRK-2

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	40						
860							
	45		08:14		Silty SAND (SM): silty soil.	Cement inside conductor casing (0-50 ft-bgs)	
			08:14		Poorly Graded SAND (SP): medium sand.		
	50						
			07:12		Poorly Graded SAND (SP): dark yellowish brown (10YR, 4/4), 40% coarse sand, 55% medium sand, 5% gravel.		
850							
	55		07:21		Well Graded SAND (SW): dark yellowish brown (10YR, 4/6), 55% coarse sand, 20% medium sand, 20% fine sand.		
	60					50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
			07:23		Well Graded SAND (SW): yellowish brown (10YR, 5/8), 70% medium sand, 30% fine sand.		
840							
	65		07:25				
			07:27				
			07:29				
	70		07:58				
			08:11		Poorly Graded SAND (SP): yellowish brown (10YR, 5/8), 70% medium sand, 30% fine sand.		
830							
	75		08:20				
			08:23		Fat CLAY (CH): strong brown (7.5YR, 5/8), 40% fine sand, 60% clay.		
			08:26		Fat CLAY (CH): brown (7.5YR, 4/3), 30% fine sand, 70% clay.		
	80		08:31				
			08:35		SAND (SW): dark yellowish brown (10YR, 3/6), 10% gravel, 20% coarse sand, 30% medium sand, 30% fine sand, 10% clay.		
820							
	85						
			09:23				

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			09:27		Poorly Graded SAND with Gravel (SP): dark yellowish brown (10YR, 4/4), 15% gravel, 40% medium sand, 45% fine sand. Gravel is 1-2cm, angular, with quartz and epidote.		
	90		09:29		Fat CLAY (CH): strong brown (7.5YR, 5/6), 10% gravel, 10% fine sand, 80% clay. Gravel is 1-2 cm, angular.		
810			09:33		Poorly Graded SAND (SP): yellowish brown (10YR, 5/6), 15% medium sand, 80% fine sand, 5% clay.		
	95		09:36				
			09:44				
			09:47				
	100		09:53				
800			10:00		Well Graded SAND (SW): brown (10YR, 5/3), 10% gravel, 60% medium sand, 30% fine sand. Gravel is 1-2 cm, angular, with quartz, epidote, shale.		
	105		10:13				
			10:15				
			10:37		Poorly Graded SAND with Gravel (SP): yellowish brown (10YR, 5/8), 20% gravel, 80% fine sand. Gravel is 1-4 cm, angular, with quartz, epidote, and shale.		
	110		10:39		Clayey SAND (SC): yellowish brown (10YR, 5/4), 10% gravel, 75% sand, 15% clay.	50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
790							
	115		10:45		Clayey SAND (SC): yellowish brown (10YR, 5/8), 50% medium sand, 35% fine sand, 15% clay.		
			10:50				
			10:56				
	120		11:03				
			11:07				
780							
	125						
			12:00		Clayey SAND (SC): strong brown (7.5YR, 5/6), 30% medium sand, 50% fine sand, and 20% clay. Trace amount of gravel.		
			12:01				
	130		12:05		Clayey SAND with Gravel (SC): dark gray (10YR, 4/1), 20% gravel, 20% coarse sand, 30% medium sand, 15% fine sand, 15% clay. Gravel is 1-4 cm, angular, with quartz and epidote.		
			12:15		Poorly Graded SAND (SP): brownish yellow (10YR, 6/8), 5% gravel, 30% medium sand, 65% fine sand. Gravel is 1-5 cm, angular to		
770							

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
770			sub-angular, quartz, with epidote, granite, and shale.		
	135	12:41	Poorly Graded SAND (SP): dark yellow brown (10YR, 4/4), 10% gravel, 30% medium sand, 60% fine sand. Gravel is 1-5cm, angular to sub-angular, with quartz, epidote, granite, and shale.		
		12:48	Well Graded SAND (SW): yellowish brown (10YR, 5/8), 5% gravel, 10% coarse sand, 55% medium sand, 10% fine sand. angular and stained quartz.		
		13:00	Poorly Graded SAND (SP): yellowish brown (10YR, 5/8), 10% medium sand, 90% fine sand. Trace amount of gravel and clay.		
	140	13:06	Poorly Graded SAND (SP): grayish brown (10YR, 5/2), 40% coarse sand, 40% medium sand, 20% fine sand.		
760		13:12	Well Graded SAND with Gravel (SW): dark gray (10YR, 4/1), 20% gravel, 80% fine to medium sand. Gravel is 1-4 cm, angular to sub-angular, quartz, shale, and metamorphic rocks.		
	145	13:32			
		14:09	Well Graded SAND with Clay (SW-SC): yellowish brown (10YR, 5/6), 20% coarse sand, 40% medium sand, 30% fine sand, and 10% clay. Trace amount to gravel, 1-2 cm and angular.		
		14:21			
	150	13:30	Well Graded SAND with Gravel (SW): yellowish brown (10YR, 5/6), 20% gravel, 80% fine sand. Gravel is 1-4 cm, stained quartz, granite, and shale.		
		14:00			
750	155	14:50			
		15:09			
		15:20	Well Graded SAND with Gravel (SW): light brownish gray (10YR, 6/2), 15% gravel, 50% coarse sand, 35% medium sand. Gravel is 1-2cm, angular to sub-angular, quartz, feldspar, epidote, and granite.		
	160	15:30	Poorly Graded SAND (SP): yellowish brown (10YR, 5/8), 20% medium sand, 60% fine sand.	50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
		15:35			
740	165	15:41			
		16:39			
		16:47			
	170	16:53	Sandy Lean CLAY (CL): brown (7.5YR, 4/4), 20% fine sand, 80% clay.		
730		16:57			
	175	17:03	Sandy Lean CLAY (CL): dark brown (7.5YR, 4/4), 10% fine sand, 90% clay.		
		17:07			
		17:13			
	180				

WILDERMUTH ENVIRONMENTAL INC.

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	180	17:20	Poorly Graded SAND (SP): dark yellowish brown (10YR, 4/6), 5% medium sand, 85% fine sand, 10% clay.		
720		17:25, 17:30	Clayey SAND (SC): yellowish brown (10YR, 5/6), 30% medium sand, 50% fine sand, 20% clay.		
	185	17:59, 18:05	Sandy Lean CLAY (CL): brown (10YR, 5/3), 40% medium to coarse sand, and 60% clay, soft and firm.		
	190	18:17	Poorly Graded GRAVEL with Clay and Sand (GP-GC): 50% gravel, 40% sand, 10% clay, multicolored.		
710		18:21	Lean CLAY with Sand (CL): brown (10YR, 5/3), 10% sand, and 90% clay, soft and firm.		
	195	18:23, 18:28	Clayey SAND (SC): 70% sand, and 30% clay, multicolored, micaceous, iron stained.		
	200	18:31, 18:33, 18:40	Clayey SAND (SC): 80% sand, and 20% clay, trace amount of gravel.		
		18:55	Well Graded SAND with Clay and Gravel (SP-SC): 40% gravel, 50% sand, 10% clay.		
700		19:01, 19:18	Clayey SAND with Gravel (SC): 30% gravel, 40% sand, 30% clay, gravel is multicolored, quartz,		
	205	19:25	Clayey SAND (SC): 50% sand, 50% clay.		
		19:52	Poorly Graded SAND with Clay and Gravel (SP-SC): 30% gravel, 60% sand, 10% clay, fine to medium granitic gravel, rounded to sub-rounded.		
		20:05	Clayey SAND (SC): 80% sand, 20% clay, sand is very fine to coarse, white quartz, has a brown silty matrix.		
	210	20:16	Clayey SAND (SC): 60% sand, 40% clay.	50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
690		20:21	Clayey SAND (SC): brown (10YR, 5/3), 50% sand, 50% clay, soft and firm, silty matrix.		
	215	20:24	Clayey SAND (SC): brown (10YR, 5/3), 50% sand, 50% clay, sand is fine to coarse and has a silty matrix.		
		20:27	Sandy Lean CLAY (CL): brown (10YR, 5/3), 40% sand, 60% clay.		
		20:29	Clayey SAND (SC): 10% gravel, 50% sand, 40% clay, fine to coarse quartz and granitic sand with fine granitic.		
	220	20:33	Poorly Graded SAND with Clay and Gravel (SP-SC): 30% gravel, 60% sand, 10% clay, angular lithic fragments, quartz cobbles.		
680		20:40	Poorly Graded SAND with Gravel (SP): 30% gravel, 70% sand.		
	225	20:47, 20:50, 22:31	Clayey SAND with Gravel (SC): 20% gravel, 60% sand, 20% clay, angular, clay matrix, unconsolidated, micaceous.		

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			22:43		Poorly Graded SAND with Gravel (SP): 50% gravel, 50% sand.		
	230		22:58		Poorly Graded SAND with Clay (SP-SC): 10% gravel, 80% sand, 10% clay, sand is fine to coarse, unconsolidated, white to clear quartz, angular to sub-angular.		
670			23:05		Sandy Lean CLAY (SC): brown (10YR, 5/3), 20% sand, 80% clay, soft and firm, silty and sandy inclusions.		
	235		23:12		Sandy Lean CLAY (SC): 40% sand, 60% clay.		
			23:18		Clayey SAND (SC): 10% gravel, 70% sand, 20% clay, multicolored to clear quartz with granitic fragments, fine to medium granitic granule, iron stained.		
	240		23:29 23:40 23:50		Poorly Graded SAND with Gravel (SP): 20% gravel, 80% sand.		
660	245		00:02 00:08 00:37		Poorly Graded SAND with Clay and Gravel (SP-SC): 20% gravel, 70% sand, 10% clay, increase in coarse to fine sand and gravel, angular.		
			00:47		Poorly Graded SAND with Clay (SP-SC): 10% gravel, 80% sand, 10% clay, sand is coarse to fine, angular to sub-rounded, silty matrix.		
	250		00:55		Sandy Lean CLAY (CL): Brown (10YR, 5/3), 10% sand, 90% clay, firm, sticky, trace amount of gravel.	50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
650	255		01:07 01:11		Sandy Lean CLAY (CL): 10% sand, 90% clay.		
	260		01:14 01:24 01:29		Sandy Lean CLAY (CL): 30% sand, 70% clay, increase in coarse sand.		
					Poorly Graded SAND with Gravel (SP): 20% gravel, 80% sand, sand and gravel are very fine to coarse, multicolored.		
640			01:47		Poorly Graded SAND with Gravel (SP): 30% gravel, and 70% sand, trace amount of clay.		
	265		02:09 02:18 02:53		Poorly Graded SAND with Clay and Gravel (SP-SC): 30% gravel, 60% sand, 10% clay, increase in gravel.		
	270		02:59 03:06		Clayey SAND (SC): 10% gravel, 40% sand, 50% clay, increase in brown (10YR, 5/3) clay.		
630			03:14		Sandy Lean CLAY (CL): 40% sand, 60% clay, clay is brown with sand lenses.		

Project Name:	**Recycled Water Recharge Monitoring Program**
Project Location:	**Brooks Basin, Montclair Ca**
Project Number:	**007-004-067**
Client:	**IEUA**

Boring Log / BRK-2

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
630			03:25				
	275						
			03:47		Poorly Graded SAND with Gravel (SP): 20% gravel, 80% sand, clear to white quartz, angular to sub-rounded.		
			04:05				
	280		04:26				
			04:43				
620					Poorly Graded SAND with Clay (SP-SC): 10% gravel, 80% sand, 10% clay, and trace amount of silt, multicolored, very fine to coarse with granule to 1", brown silty matrix, weathered granitics and mafics.		
	285		05:15				
			06:43		Poorly Graded SAND with Gravel (SP): 15% gravel, 85% fine to coarse sand, and trace amount of silt and clay.		
			07:25				
	290		14:39		Well Graded SAND (SW): dark yellowish brown (10YR, 4/4), 10% gravel, 30% medium sand, 60% fine sand, quartz, feldspar, granite clasts, angular to sub-angular, .5 cm, some shale.		
			15:03				
610							
	295		15:21				
			16:53				
			17:25		Fat CLAY with SAND (CH): strong brown (7.5YR, 5/8), 30% fine to medium sand, 70% clay.		
	300		17:50		Well Graded SAND (SW): dark yellowish brown (10YR, 4/4), 10% gravel, 35% coarse sand, 35% medium sand, 15% fine sand, 5% clay, some stained quartz, and granite clasts.	50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
			18:16				
600							
			18:36		Poorly Graded SAND with Gravel and Clay (SP-SC): 20% gravel, 70% sand, 10% clay.		
	305		18:49				
			19:26		Sandy Lean CLAY (CL): 10% gravel, 40% sand, 50% clay, clay is brown and sticky.		
			19:35				
	310		19:47				
			19:59		Sandy Lean CLAY (CL): brown (10YR, 5/3), 30% sand, 70% clay.		
590							
			20:15		Sandy Lean CLAY (CL): brown (10YR, 5/3), 30% sand, 70% clay, micaceous.		
	315						
			20:28				
			20:37				
	320						

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Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	320		20:47 20:57		Clayey SAND (SC): brown (10YR, 5/3), 60% sand, 40% clay, increase in fine to medium and coarse quartz sand, angular to sub-angular, weathered granitics.		
580	325		21:03 21:05		Sandy Lean CLAY (CL): brown (10YR, 5/3), 20% sand, 80% clay, soft.		
			22:38		Sandy Lean CLAY (CL): dark reddish brown (2.5YR, 2.5/3), 40% sand, 60% clay.		
			22:48		Sandy Lean CLAY (CL): light brown (10YR, 6/3), 50% sand, 50% clay.		
	330		23:06		Clayey SAND (SC): 60% sand, 40% clay.	50% Benseal Grout/50%Sand (No.3) (50-340 ft bgs)	
570	335		23:29 23:53		Poorly Graded SAND with Gravel (SP): 20% gravel, 80% sand.		
			00:19		Poorly Graded SAND with Gravel (SP): 40% gravel, 60% sand. Sand and gravel are multicolored and quartz is clear to white, sub-rounded to angular.		
	340		00:50 01:32		Poorly Graded SAND with Gravel (SP): 30% gravel, 70% sand.		
560	345		01:36 02:00 02:05		Sandy Lean CLAY (CL): dark brown (10YR, 3/3), 30% sand, 70% clay, sticky.	Medium sized coated bentonite pellets	
			02:33		Clayey SAND (SC): 60% sand, and 40% clay, fine to coarse quartz sand with trace granite gravels.		
			02:48		Clayey SAND (SC): 10% gravel, 60% sand, 30% clay.		
	350		03:05		Clayey SAND (SC): brown (10YR, 5/3), 10% gravel, 70% sand, 20% clay.		
550	355		03:32 04:15		Poorly Graded SAND with Clay (SP-SC): 10% gravel, 80% sand, 10% clay, angular quartz sand, very fine to coarse.	0.02" wire wrapped screen (350-390 ft bgs)	
	360		05:05 05:44 06:38		Poorly Graded SAND with Gravel (SP): 30% gravel, 70% sand, hard packed sand and gravels.		
540	365		09:59 10:50		Well Graded SAND (SW): yellow brown (10YR, 5/4), 55% coarse sand, 15% medium sand, 15% fine sand, 10% gravel, 5% clay, some orange stained quartz, epidote and granite.	Filter Sand (345-400 ft bgs)	
			12:06		Well Graded SAND (SW): yellow brown (10YR, 5/4), 20% coarse		

Project Name:	Recycled Water Recharge Monitoring Program
Project Location:	Brooks Basin, Montclair Ca
Project Number:	007-004-067
Client:	IEUA

Boring Log / BRK-2

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
					sand, 50% medium sand, 20% fine sand, angular, quartz, feldspar, and granite fragments.		
			12:46		Well Graded SAND with Gravel (SW): grayish brown (10YR, 5/2), 15% gravel, 30% coarse sand, 50% medium sand, 5% clay. Gravel is 1-4 cm, angular to sub-rounded, granitic quartz, epidote.		
	370		12:53		Clayey SAND (SC): yellowish brown (10YR, 5/6), 25% medium sand, 45% coarse sand, 30% clay, some quartz fragments, 1-2 cm, angular to sub-angular.	Filter Sand (345-400 ft bgs)	
530			13:05		Well Graded SAND (SW): brownish yellowish (10YR, 6/6), 20% coarse sand, 40% medium sand, 35% fine sand, 5% clay, some granitic fragments, 1-2cm, angular, sand is very angular.		
	375		13:18		Fat CLAY with Sand (CH): strong brown (7.5YR, 5/6), 40% fine to medium sand, 60% clay, clay is fat, some quartz fragments, angular to sub-angular.		
			13:23		Fat CLAY (CH): brown (7.5YR, 5/4), 10% fine sand, 90% clay.		
			13:27				
	380		13:29			0.02" wire wrapped screen (350-390 ft bgs)	
			13:33		Clayey SAND (SC): dark reddish brown (5YR, 3/4), 60% fine sand, 40% clay.		
520							
	385		13:37				
			13:55				
			14:18		Well Graded SAND (SW): dark yellowish brown (10YR, 3/4), 60% coarse, 35% medium sand, 5% clay, some clay balls, and orange stained quartz.		
	390		14:45		Sandy Lean CLAY (CL): brown (7.5YR, 4/3), 30% fine to medium sand, 70% clay.		
			14:52		Clayey SAND (SC): yellowish brown (10YR, 5/6), 40% medium sand, 20% fine sand, 40% clay.	Silt Trap (350-355 ft-bgs)	
510							
	395		14:55				
			15:07				
			15:16		Fat CLAY (CH): brown (7.5YR, 5/4), 10% fine sand, 90% clay, clay is hard.		
	400		15:23		Sandy Lean CLAY (CL): strong brown (7.5YR, 5/6), 40% fine sand, 60% clay.		
			15:35			Medium sized coated bentonite pellets	
500							
	405		15:42				
			16:27		Clayey SAND (SC): brown (10YR, 5/3), 10% coarse sand, 40% medium sand, 30% fine sand, 30% clay.		
			16:51				
	410		17:32			50% Benseal Grout/50%Sand (No.3) (405-556 ft bgs)	
			18:10		Poorly Graded SAND with Gravel (SP): 30% gravel, 70% sand.		
490							

WILDERMUTH ENVIRONMENTAL INC.

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	415	18:58			
		19:48, 20:24	Poorly Graded SAND with Clay and Gravel (SP-SC): 20% gravel, 70% sand, 10% clay. Gravel is multicolored, lithic fragments, quartz, rounded to sub-angular, sharp quartz sand matrix.		
480	420	20:35, 20:48	Sandy Lean CLAY (CL): 20% sand, 80% clay.		
	425	21:34	Poorly Graded SAND with Clay and Gravel (SP-SC): 20% gravel, 70% sand, 10% clay.		
470	430	21:42, 23:35, 00:14, 01:00, 01:47, 02:14	Poorly graded SAND with Gravel (SP): 30% gravel, 70% sand.		
	435	02:27, 02:34	Sandy Lean CLAY (CL): light brown (10YR, 6/3), 10% sand, 90% clay, firm, sticky.		
460	440	02:46, 03:00	Sandy Lean CLAY (CL): brown (10YR, 5/3), 40% sand, 60% clay, increase in fine to coarse quartz sand.	50% Benseal Grout/50%Sand (No.3) (405-556 ft bgs)	
	445	03:18, 03:22	Sandy Lean CLAY (CL): brown (10YR, 5/3), 30% sand, 70% clay.		
		03:50, 04:04	Clayey SAND (SC): brown (10YR, 5/3), 60% sand, 40% clay, and trace amount of gravel, increase in quartz sand, fine to coarse.		
450	450, 455	04:30, 04:37, 04:48, 05:19	Sandy Lean CLAY (CL): brown (10YR, 5/3), 30% sand, 70% clay.		
	460	05:50	Clayey SAND (SC): 80% sand, 20% clay, and trace amount of gravel, sand is fine to coarse, angular, soft clay matrix.		

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
			06:25		Clayey SAND (SC): yellowish brown (10YR, 5/6), 30% coarse sand, 40% medium sand, 10% fine sand, 20% clay.		
440							
			10:53		Clayey SAND (SC): yellowish brown (10YR, 5/6), 10% coarse sand, 30% medium sand, 30% fine sand, 30% clay.		
	465		10:57		Clayey SAND (SC): yellowish brown (10YR, 5/6), 10% gravel, 50% coarse sand, 10% medium sand, 10% fine sand, 20% clay, rounded to sub-rounded quartz and feldspar fragments.		
			11:19		Sandy Lean CLAY (CL): brown (7.5YR, 5/3), 10% fine sand, 90% clay.		
			11:23				
	470				Fat CLAY (CH): dark brown (7.5YR, 3/4), 5% sand, 95% clay, hard clay.		
			11:29				
430							
	475		11:31		Sandy Lean CLAY (CL): strong brown (7.5YR, 5/8), 40% fine to medium sand, 60% clay.		
			11:34				
			11:36				
	480		11:41		Clayey SAND (SC): yellowish brown (10YR, 5/8), 40% coarse sand, 30% medium sand, 30% clay, rounded sand.		
			11:45		Poorly graded SAND with Clay (SP-SC): yellowish brown (10YR, 5/4), 10% coarse sand, 70% medium sand, 10% fine sand, 10% clay.		
420							
	485						
			12:05		Clayey SAND (SC): yellowish brown (10YR, 5.8), 50% coarse sand, 30% medium sand, 20% clay.		
			12:07		Sandy Lean CLAY (CL): strong brown (7.5YR, 5/6), 40% medium sand, 60% clay.		
	490		12:08			50% Benseal Grout/50%Sand (No.3) (405-556 ft bgs)	
			12:10				
410							
			12:13				
	495						
			12:15				
			12:19		Well Graded SAND with Clay (SW-SC): dark yellowish brown (10YR, 4/6), 40% coarse sand, 30% medium sand, 20% fine sand, 10% clay.		
	500		12:26		Well Graded SAND with Gravel (SW): dark grayish brown (10YR, 4/2), 15% gravel, 60% coarse sand, 10% medium sand, 10% fine sand, 5% clay, 1-3 cm, angular to sub-angular, shale, quartz, and feldspar.		
			12:29		Sandy Lean CLAY (CL): strong brown (7.5YR, 5/8), 20% fine sand, 80% clay.		
400							
			12:30				
	505						
			12:47				

Project Name:	**Recycled Water Recharge Monitoring Program**	**Boring Log / BRK-2**
Project Location:	**Brooks Basin, Montclair Ca**	
Project Number:	**007-004-067**	Sheet 12 of 14
Client:	**IEUA**	

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
		12:49	Fat CLAY (CH): strong brown (7.5YR, 4/6), 5% fine to medium sand, 95% clay.		
	510	12:51			
		12:53			
390					
		12:55	Fat CLAY (CH): strong brown (7.5YR, 4/6), 10% fine sand, 90% clay.		
	515				
		12:57	Sandy Lean CLAY (CL): strong brown (7.5YR, 4/6), 30% fine sand, 70% clay.		
		12:58	Fat CLAY (CH): brownish yellow (10YR, 6/8), 5% very fine sand, 95% clay.		
	520	13:01	Clayey SAND (SC): yellowish brown (10YR, 5/8), 30% coarse sand, 30% medium sand, 10% fine sand, 30% clay.		
		13:05	Well Graded SAND with Gravel (SW): dark yellowish brown (10YR, 4/6), 15% gravel, 55% coarse, 15% medium sand, 15% fine sand, quartz and feldspar, 1-2 cm, angular to sub-rounded.		
380					
		13:06	Clayey SAND (SC): strong brown (7.5YR, 5/8), 85% fine to medium sand, 15% clay, hard clay balls.		
	525				
		14:09	Sandy Lean CLAY (CL): yellowish brown (10YR, 5/8), 20% fine to medium sand, 80% clay.		
		14:15			
	530	14:19		50% Benseal Grout/50%Sand (No.3) (405-556 ft bgs)	
		14:27			
370			Clayey SAND (SC): yellowish brown (10YR, 5/8), 30% coarse sand, 50% medium sand, 20% clay.		
		14:32			
	535				
		14:37			
		14:41	Sandy Lean CLAY (CL): yellowish brown (10YR, 5/6), 15% medium sand, 15% fine sand, 70% clay.		
	540	14:50	Clayey SAND (SC): brown (10YR, 5/6), 70% fine sand, 30% clay.		
		14:53			
360					
		14:55	Well Graded SAND (SW): brown (10YR, 5/3), 55% coarse sand, 40% medium sand, 5% clay, orange quartz.		
	545				
		15:24	Clayey SAND (SC): yellowish brown (10YR, 5/6), 45% coarse sand, 30% medium sand, 25% clay.		
		15:29			
	550	15:32			
		15:37	Sandy Lean CLAY (CL): brown (7.5YR, 5/4), 20% fine to medium sand, 80% clay, hard clay balls.		
350					

Project Name:	Recycled Water Recharge Monitoring Program
Project Location:	Brooks Basin, Montclair Ca
Project Number:	007-004-067
Client:	IEUA

Boring Log / BRK-2

Elevation, feet-msl	Depth, feet-bgs	Sample Interval	Sample Time	Graphic Log	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	555		15:42, 15:49			50% Benseal Grout/50%Sand (No.3) (405-556 ft bgs)	
			15:57		Clayey SAND (SC): yellowish brown (10YR, 5/6), 55% coarse sand, 30% medium sand, 15% clay, angular to sub-rounded sand, some orange stained quartz.		
	560		16:03		Gravelly Lean CLAY with Sand (CL): yellowish brown (10YR, 5/8), 15% gravel, 85% clay, gravel is 1-3 cm, angular to sub-angular quartz, shale, epidote, feldspar.	Medium sized coated bentonite pellets	
340	565		16:07, 16:14		Sandy Lean CLAY (CL): yellowish brown (10YR, 5/6), 30% fine sand, 70% clay.		
			16:50		Fat CLAY (CH): strong brown (7.5YR, 5/6), 10% fine sand, 90% clay.		
	570		16:55, 17:04		Sandy Lean CLAY (SC): strong brown (10YR, 4/6), 30% medium sand, 70% clay.	0.02" wire wrapped screen (350-390 ft bgs)	
330			17:17		Fat CLAY (CH): brown (7.5YR, 5/6), 5% fine sand, 95% clay.		
	575		17:23		Clayey SAND (SC): yellowish brown (10YR, 5/8), 70% medium sand, 15% fine sand, 15% clay.		
			17:33		Poorly graded SAND with Gravel (SP): yellowish brown (10YR, 5/4), 20% gravel, 60% coarse sand, 30% medium sand, Trace amount of clay, gravel is 1-5 cm, angular to sub-angular, granite, quartz, shale.		
	580		17:47, 17:54		Clayey SAND (SC): brownish yellow (10YR, 6/5), 30% coarse sand, 30% medium sand, 20% fine sand, 20% clay, and trace amount of gravel, angular, shale fragments.		
320			18:04		Poorly Graded SAND with Clay (SP-SC): 10% gravel, 10% clay, 80% sand.		
	585		18:10, 18:12, 19:03		Fat CLAY (CH): brown (10YR, 5/3), 100% clay, sticky clay balls.	No. 3 Sand (562-603 ft bgs)	
	590		19:09, 19:18		Fat CLAY (CH): brown (10YR, 5/3), 100% clay, sticky clay balls.	Filter Sand (350-355 ft-bgs)	
310			19:25		Fat CLAY (CH): 100% clay.		
	595		19:37, 19:47		Sandy Lean CLAY (CL): 10% sand, 90% clay, 1' sand streak at 594.5'-595.5'.		
	600		19:56		Sandy Lean CLAY (CL): brown (10YR, 5/3), 20% coarse sand, 10% fine gravel, 70% clay.		

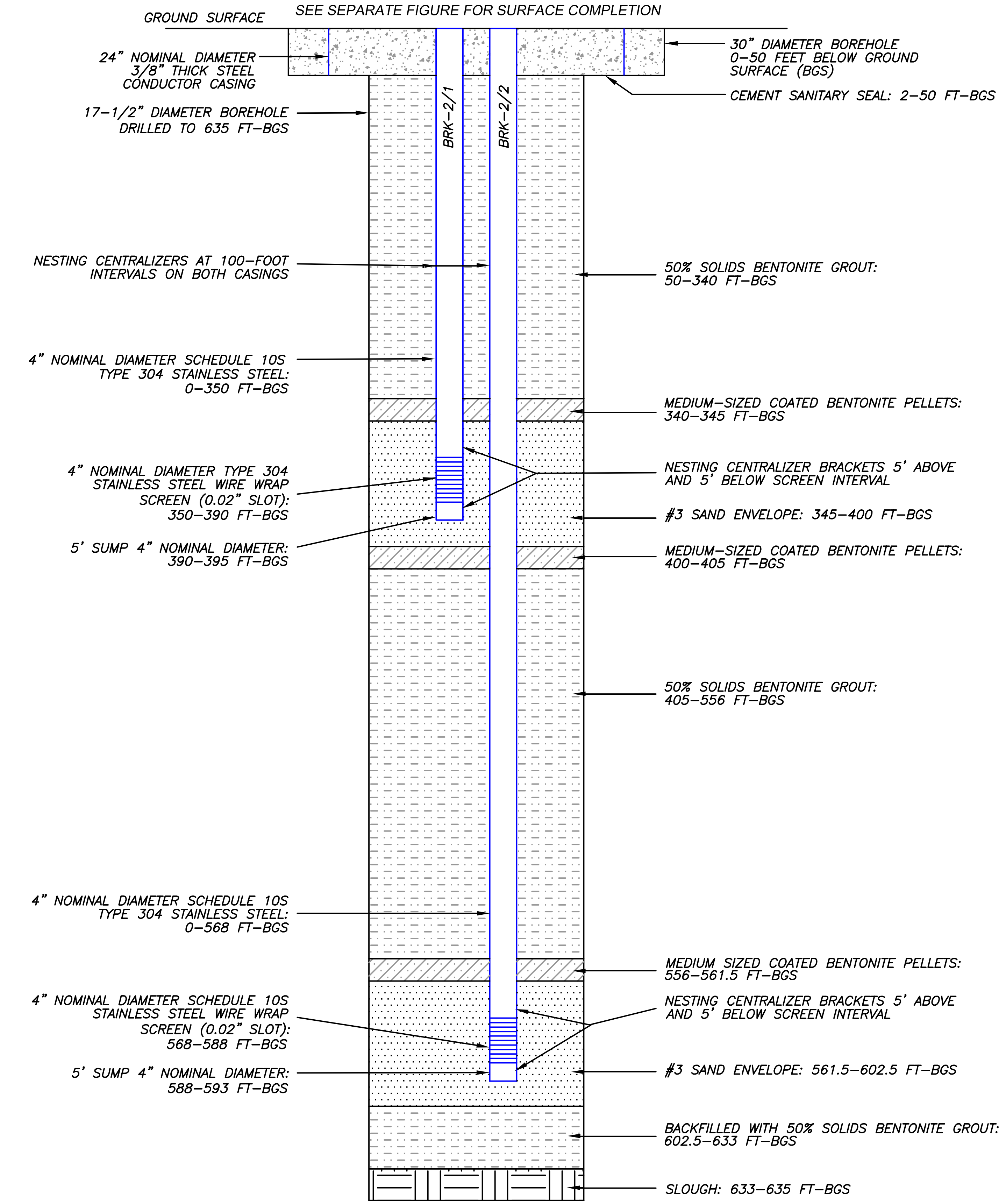
WILDERMUTH ENVIRONMENTAL INC.

Project Name:	**Recycled Water Recharge Monitoring Program**
Project Location:	**Brooks Basin, Montclair Ca**
Project Number:	**007-004-067**
Client:	**IEUA**

Boring Log / BRK-2

Elevation, feet-msl	Depth, feet-bgs	Sample Time	MATERIAL DESCRIPTION	WELL SCHEMATIC AND CONSTRUCTION DETAILS	FIELD NOTES
	600	20:02		No. 3 Sand (562-603 ft bgs)	
300		20:10	Sandy Lean CLAY (CL): 10% fine gravel, 30% sand, 60% clay.		
	605	20:18			
		20:19			
		20:23			
		20:50	Clayey SAND with Gravel (SC): brown (10YR, 5/3), 20% gravel, 50% sand, 30% clay, granitic and quartz gravel, rounded and sub-angular.		
	610	21:02			
290		21:08	Clayey SAND (SC): light brown (10YR, 6/3), 10% gravel, 40% sand, 50% clay.		
	615	21:13	Sandy Lean CLAY (SC): 10% sand, 90% clay.	50% Benseal Grout/50%Sand (No.3) (603-633 ft bgs)	
		21:24	Fat CLAY (CH): 100% clay.		
		21:31			
	620	21:39	Sandy Lean CLAY (CL): brown (10YR, 5/3), 10% gravel, 20% sand, 70% clay.		
280		21:44	Sandy Lean CLAY (CL): brown (10YR, 5/3), 10% sand, 90% clay, soft, sticky.		
		21:50			
	625	21:51			
		22:23	Sandy Lean CLAY (CL): 20% sand, 80% clay, increase in sand.		
		22:29			
	630	22:36			
		22:42			
270		22:48	Sandy Lean CLAY (CL): 10% sand, 90% clay.	Slough	
	635	22:54			
	640				
260					
	645				

WILDERMUTH ENVIRONMENTAL INC.



NOT TO SCALE

Inland Empire UTILITIES AGENCY

WELL COMPLETION AS BUILT
BRK-2 WELL

OPTIMUM BASIN MANAGEMENT PROGRAM

8/17/07

FN:20070817_ BRK–2_AsBuilt.dwg