

**2013 Summary of Tracing for Four Points in and near the Balcones Canyonlands
Sam Hamilton and Bull Creek Preserves**
October 25, 2013

David A. Johns, P.G.
Senior Environmental Scientist
City of Austin, Watershed Protection Department
Office 512-974-2781
FAX 542-974-2846
david.johns@austintexas.gov

Abstract

Follow up monitoring was conducted to determine the direction of groundwater migration, approximate flow velocities, and what springs are downgradient of the proposed Four Points Jollyville Transmission Main shaft in the vicinity of Four Points Drive and Riverplace Blvd.. The last samples were pulled from sites in April. Results show the dye injected in 2011 emerging from only Gaas Spring, just upstream of the Sam Hamilton Preserve, and being detected at two close downstream sites on the main stem of Bull Creek. Results from the 2012 injection show dye detection in two nearby downgradient monitoring wells, similar to 2011, as well as in Gaas Spring. These results document that the groundwater flowpaths in the Edwards in the area of the 4 Points shaft are the same as prior to excavation of the shaft.

Background

Infrastructure related to Water Treatment Plant 4 is proposed near and below the Balcones Canyonlands Sam Hamilton west and Bull Creek Preserves. Greater understanding of groundwater in these areas has provided data to protect significant resources within the preserve, particularly springs and the aquatic species associated with the springs. Groundwater tracing is a commonly used technique to achieve reliable understanding of groundwater movement in karst systems (Hauwert et al, 2004, Quinlan, 1990, Aley, 1999)

A previous tracing study using multiple dyes injected into boreholes located on uplands on the original Bull Creek plant site detected dyes in springs to the north, northwest and east of the site, essentially radiating from the topographic higher uplands. Results also indicate movement of water from the Edwards into the underlying Walnut formation as indicated by tracer detections in spring discharging from the Walnut (CoA-1, in preparation). Another trace was conducted in 2011 in a borehole in the center of the proposed 4 Points shaft which was detected some monitoring wells northeast of the site and in Gaas Springs immediately upstream of the Sam Hamilton Preserve. A second injection at 4 Points was conducted in 2012 in the standpipe leading to a permeable ring around the shaft at the base of the Edwards.

Methods

Methods for these traces are described in reports submitted to BSP staff in 2011 and 2012 and these methods have not changed.

Results

Four Points Trace

Dye injected in the Four Points well in 2011 was detected in multiple wells generally northeast of the injection point and in Gaas Spring (Photo 1). Dye was also detected in the main stem of Bull at two sites downstream of the spring. The 2012 trace has been detected in JT112 and JT128 wells as well as Gaas Spring (Photo 2).

Dye was first detected in JT112 about 140 ft away within one-to-two days after injection for a velocity between 55 and 115 ft/day. It was not detected in any of the three wells along Riverplace Blvd. First arrival of dye at Gaas Spring was between 53 and 78 days after injection for a travel velocity of between 48 and 70 ft/day. These velocities are similar to the original WTP4 traces in 2007 (COA-1, in preparation). In comparison to other traces in the northern Edwards, these travel times are slow. Traces at Buttercup Cr, Stillhouse Hollow, and Wheless all demonstrated travel times of 100's to 1000's of feet per day. These faster travel times are likely attributed to injection into existing karst features, which are likely integrated into the conduit systems feeding springs. The Old WTP4 and Four Points traces were not injected into existing karst features, and likely migrated through formation porosity initially before possibly entering conduits leading to the springs.

Results of this trace will be report in an inhouse Watershed Protection Department report (COA-2, in preparation).

Conclusions

Tracers injected at the Four Points shaft site prior to shaft excavation and following excavation have been detected in most of the same monitoring sites. These results indicated that the shaft has not appreciably altered the direction or rate of groundwater movement at the base of the Edwards formation in this area. The 2012 trace demonstrates that the permeable ring constructed at the base of the Edwards is functioning as intended to allow groundwater to move around the shaft and continue along pre-construction pathways.

References

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COA-2, in preparation, *Results of Tracing for Pit Springs and Four Points in and near the Balcones Canyonlands Sam Hamilton and Bull Creek Preserves*.

Hauwert, Nico, David Johns, Thomas Aley, and James Sansom, 2004, *Groundwater Tracing Study of the Barton Springs Segment of the Edwards Aquifer, Southern Travis and Northern Hays Counties, Texas*: Report by the Barton Springs/Edwards Aquifer

BCP 2013 Annual Report
October 25, 2013

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Terranes: Ground Water and Vadose Zone Monitoring, ASTM STP 1053*, D. M. Nielsen
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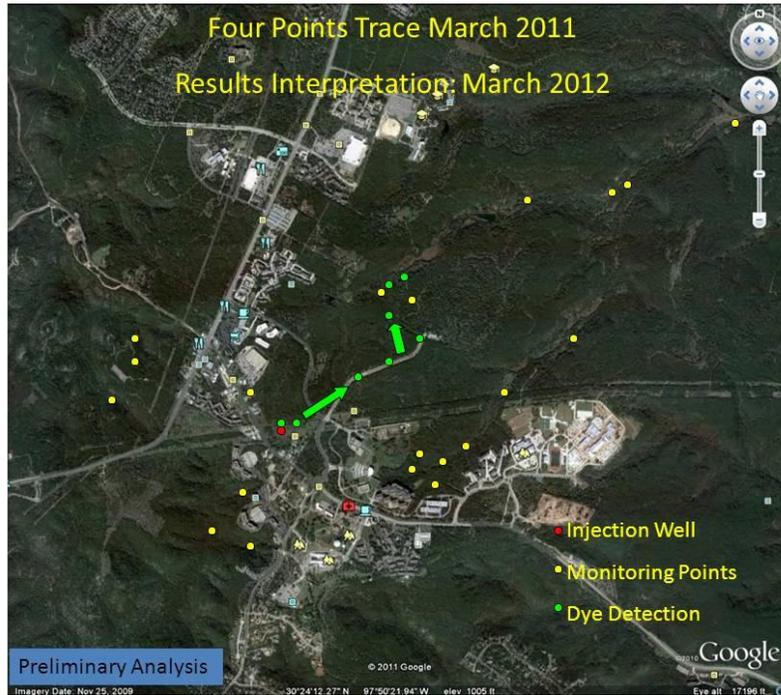


Photo 1. Aerial image of the Four Points area showing location of March 2011 injection point, monitoring sites and preliminary interpretation of results.

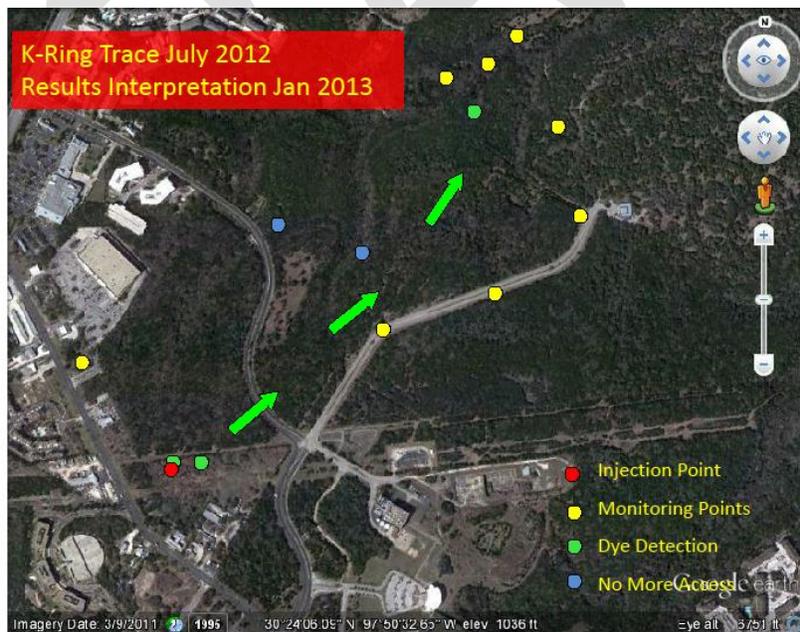


Photo 2. Aerial image of Four Points area showing injection point at current 4 Points shaft and confirmed detections in monitoring wells and Gaas Spring. The two blue points are springs where only temporary monitoring was possible.