



Memorandum

To: Rick Whetsel, SAWPA

*From: Richard Meyerhoff, CDM
Thomas Lo, CDM*

Date: July 26, 2011

Subject: Technical Memorandum - Box Springs Channel Follow-up Study, 2011 Dry Season

Purpose

The Box Springs Channel site was originally sampled as part of the Urban Source Evaluation Plan (USEP) Monitoring Program in 2007-2008. During that sample period, human source bacteria were regularly detected and high bacterial indicator concentrations were present. Following a local investigation in 2008, a sanitary/storm sewer cross connection was identified and corrected. During the 2011 dry season, Riverside County Flood Control & Watershed Conservation District (RCFCWCD) staff in coordination with CDM conducted a 5-week follow-up study to evaluate current bacterial indicator levels and verify that human source bacteria are no longer present. This technical memorandum reviews past USEP sample results and presents the results from recent sampling during the 2011 dry season.

Description of Box Springs Channel Site

Box Springs Channel drains a 31 square mile urbanized subwatershed in the City of Riverside. Dry weather flows measured in this channel are approximately 3.2 cfs (average of USEP field measurements in dry season 2007) and may consist of a combination of nuisance flow from urban drainages in the City of Riverside and de minimus water from Riverside Public Utilities (RPU). This channel may be divided into two segments:

- Upstream channel – Engineered section with 0.15 mile vertical-wall concrete-lined channel; 0.10 mile trapezoidal rock-lined slope with natural bottom
- Downstream Channel – 0.4 mile natural segment that confluences with the Middle Santa Ana River.

The Box Springs Channel USEP site was identified very early in the 2007-2008 USEP Monitoring period as having elevated fecal coliform and *E. coli* concentrations and strong indications of

possible contamination from human sources. RCFCWCD initiated an IC/ID investigation in January 2008 to attempt to identify the source of the bacteria.

Coincidentally, during the same time, the City of Riverside was also reviewing plans to replace a sewer line running near Box Springs Channel. While performing dye tests on lateral sewer lines, the City discovered a single restroom toilet, located in the Sam Evans Sports Complex on the Riverside Community College (RCC) Riverside Campus, was inadvertently connected to a storm drain pipe rather than a sewer line. To correct the problem, the cross-connected toilet was removed in May of 2008 and the sewer lateral was later capped to prevent any recurrence.

Subsequent sampling in February 2009 indicated that bacterial concentrations were lower than recorded the previous summer. In addition, two separate samples analyzed by the Orange County Water District were both negative for the presence of human source bacteria. However, in September of 2009, another sample collected from Box Springs Channel indicated the probable presence of low levels of human bacteria.

Previous USEP Monitoring Results

The 2007-2008 USEP results indicated elevated geometric bacterial indicator concentrations and the common presence of human source bacteria (Table 1). The observed concentrations exceeded existing Basin Plan fecal coliform objectives and proposed *E. coli* objectives.

Table 1. Bacterial Indicator Data Summary for Box Springs Channel, 2007 Dry Season

Parameter	Geometric Mean Dry Season 2007	
	Week of 7/14 to Week of 8/11	Week of 9/1 to Week of 9/29
Fecal coliform	12,990	23,077
<i>E. coli</i>	1,149	4,793
Human Source <i>Bacteroides</i>	Present 5 of 5 samples	Present 5 of 5 samples

Box Springs Channel Follow-up Study Results

From April 19 to June 24, 2011, RCFCWCD staff in coordination with CDM sampled Box Springs Channel, collecting data for field parameters, bacterial indicator concentrations, and presence/absence of human source bacteria (Tables 2, 3 and 4). Water quality parameters were collected five consecutive weeks. Flow data were gathered for five additional weeks¹.

¹ Additional flow data were gathered to support other ongoing source evaluation studies to improve dry weather flow estimates in the area.

Table 2. Water Quality Parameters and Flow Results

Sample Date	Temp (°C)	Turbidity (NTU)	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH	Flow (cfs)
04/19/2011	17.08	59.20 ¹	520	9.41	7.90	3.2
04/27/2011	17.92	1.10	569	9.06	7.75	0.5
05/03/2011	18.57	0.87	562	9.06	7.87	1.2
05/11/2011	17.7	0.9	680	9.45	8.02	1.5
05/19/2011	15.8	35.1 ¹	748	9.45	8.03	3.3
5/24/2011						1.17
6/2/2011						NR ²
6/9/2011						3.66
6/14/2011						2.70
6/24/2011						0.50
					Mean Flow	2.2

¹ Pipeline construction activity near Box Springs channel may be source of elevated turbidity readings.

² NR (no reading) due to flow meter equipment malfunction

Table 3. Box Springs Channel Bacterial indicator Results

Date	Fecal Coliform (cfu/100 mL)	<i>E. coli</i> (cfu/100 mL)
4/19/2011	540	780
4/27/2011	770	990
5/3/2011	3,900	2,100
5/11/2011	2,400	2,000
5/19/2011	900	1,400
Geomean	1,285	1,353

Table 4. Results of Analyses for Presence/Absence of *Bacteroides* at Box Springs Channel

Sample Date	Human Marker: (Presence/Absence of <i>Bacteroides</i>)
4/19/11	Absent
4/27/11	Absent
5/3/11	Absent
5/11/11	Absent
5/19/11	Absent

Study Findings

Sample results indicate significant reductions in the geometric mean of fecal coliform observed in summer 2007 as compared to what was observed in 2011. *E. coli* concentrations were similar when compared to one 2007 sample period (July-August 2007), but lower when compared to the other (September 2007) (see Table 1). Regardless, the observed geometric mean concentrations in 2011 are well above existing or proposed Basin Plan water quality objectives for bacterial indicators.

Results from *Bacteroides* analyses indicate that no human bacteria were present in the water samples collected in 2011. This finding further supports the presumption that the cross-connection discovered during the IC/ID investigation in January 2008 was the source of the human bacteria detected during 2007-2008 USEP monitoring.