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August 23, 2012

Brad Crement  
HBH Consulting Engineers  
2316 Portland Rd, Ste H  
Newberg, OR 97132

**Re: Cannon Beach (00164) Tracer Study – Slow Sand Plant  
Final Approval – PR #221-2010**

Dear Mr. Crement,

On December 22, 2010, I received the memorandum for HBH Project #2001-025 entitled “Cannon Beach Contact Tracer Study Methodology” dated December 13, 2010, which outlined a methodology that would have been used to perform a contact tracer study for Cannon Beach’s slow sand plant and 1.0 MG reservoir. On June 1, 2012, I received a revised “Cannon Beach Contact Tracer Study Methodology” memorandum dated May 31, 2012. The May 31, 2012 revision reduced the test flow rate from 1,116 gpm to 700 gpm, however, the remaining methodology was left unchanged from the original December 2010 submittal. Since historical records demonstrated a peak hour demand flow of 725 gpm recorded by the City on August 13, 2010, a test flow of 800 gpm was subsequently proposed and approved on June 5, 2012.

**The tracer study, conducted on June 21, 2012 is granted Final Approval.** The study demonstrated a **contact time of 320 minutes under gravity flow conditions** through 6,340-ft of 12” pipe, then through a 1.0 MG reservoir, and then 1,735-ft of 12” pipe to the first user located near the intersection of Reservoir Rd and East Sunset Blvd. This contact time was determined at a reservoir influent flow rate of 370 gpm, reservoir effluent flow rate of 800 gpm, average reservoir level of 213 inches (933,114 gallons), and plug flow through a total pipe volume of 47,319 gallons yielding a reservoir baffling factor of 18%. **Contact time is reduced to 273 minutes under conditions in which water is pumped** to the reservoir at 700 gpm through the first 6,340-ft, 12” diameter reservoir influent pipe segment.

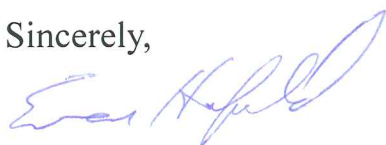
August 23, 2012

Conditions and results of the tracer study are tabulated as follows:

Plant (WTP-AE)	Slow Sand Plant for Elk Creek
Measured Contact Time	<b>320 min through reservoir inlet pipe, 1 MG reservoir, and reservoir outlet pipe.</b>
Flow rate	<b>800 gpm</b>
Storage facilities included in study	<ol style="list-style-type: none"> <li>1) 6,340-ft of 12" reservoir inlet piping (37,230 gallons)</li> <li>2) 1.0 MG tank (level dropped 29.5" from a starting level of 227.5" during the test for an average volume of 933,114 gallons)</li> <li>3) 1,735-ft of 12" reservoir outlet piping to the 1<sup>st</sup> customer (10,188 gallons)</li> </ol>
Initial & final 1.0 MG reservoir levels	Reservoir at max level at 228-inches (1 MG) 227.5-inches initial test level (997,807 gallons). 198-inches final test level (868,421 gallons) - a drop of 29.5 inches throughout the test 213-inches average level (933,114 gallons)
Initial (C <sub>0</sub> ) & final (C <sub>10</sub> ) chlorine residual measured at the 0.45 MG reservoir effluent	C <sub>0</sub> = 0.51 mg/l C <sub>10</sub> = 0.61 mg/l (based on 1.0 mg/l increase in plant dose)
Contact Times	<ol style="list-style-type: none"> <li>1) Inlet piping = 100.6 min (37,230 gallons, 100% baffling factor, 370 gpm gravity flow)</li> <li>2) 1.0 MG tank = 207 min (933,114 gal @ 213-in avg water level, 13% baffling factor, 800 gpm effluent flow)</li> <li>3) Outlet piping = 12.7 min (10,188 gallons, 100% baffling factor, 800 gpm gravity flow)</li> </ol> <p>Total contact time = 320 min = 100.6 min + 207 min + 12.7 min</p> <p>Under conditions in which water is pumped through the inlet piping at 700 gpm to the 1.0 MG tank, contact time through the inlet piping is reduced from 100.6 minutes to 53.2 minutes, which results in a total contact time of 272 minutes (53.2 min + 207 min + 12.7 min = 272.9 min).</p>
1 MG Tank Baffling Factor	<p><b>1 MG Tank Baffling Factor = 18%</b></p> <p>This baffling factor is determined by subtracting contact time contributed through the pipe segments from the total contact time, multiplying that number by the flow (800 gpm) and then dividing by the volume in the tank. The calculation is as follows:</p> <p>320 min – 100.6 min (inlet piping) – 12.7 min outlet piping) = 207 min.            Baffling Factor = Time x flow / volume            Baffling Factor = 207 min x 800 gpm / 933,114 gal = 0.18 (18%).</p>

Thank you for your patience in this process and if you have any questions, or would like this in an alternate format, please feel free to contact me at (971) 673-0419 or via e-mail at [evan.e.hofeld@state.or.us](mailto:evan.e.hofeld@state.or.us).

Sincerely,



Evan Hofeld, Regional Engineer  
 OHA - Drinking Water Program

cc: Daniel Willyard, City of Cannon Beach