Technical Memorandum

VISUAL AESTHETIC CHARACTERIZATION OF LOW TURBIDITY WATERS

Prepared by:

ROBERTSON - BRYAN, INC.
Specializing in Water and Power Resources

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The information contained in this appendix was developed to assess the visual aesthetic characteristics of water at low turbidity levels (i.e., < 2 NTUs). The methodology employed had two components, which were: 1) documentation of visual observations using a standardized "index" of water clarity (see data sheet); and 2) photography of a secchi disk at various depths in the chlorine contact basins of municipal wastewater treatment plants, at multiple turbidity levels below 2 NTUs. A secchi disk was used because it provided a suitable object for assessing relative water clarity from an observer's perspective; however, it should be noted that the secchi disk was not used to determine a "secchi depth," for which this instrument is typically used. The recording of visual observations using the standardized index was the primary method for documenting the aesthetic effects of turbidity between 0 and 2 NTUs. The photography was performed in an attempt to capture, in photos, what the observer actually saw at various turbidity levels and water depths. This information is presented here to provide the reader with evidence pertaining to the visual effect of turbidity changes when both starting and ending turbidity levels remain below 2 NTUs.

Two assessments were made using the above methodology. Data sheets characterizing the visual observations for both events are provided below. Due to lighting conditions and conditions within the chlorine contact basin, the photographs for the first event were deemed by the observers to have accurately captured what they saw with the naked eye and recorded on the data sheet. Conversely, the lighting conditions, presence of filamentous algae, and presence of scattered clumps of algae suspended in the basins assessed in the second event resulted in photographs that the observers determined were not representative of the actual visual esthetic quality of the effluent itself, which is accurately reflected by the "turbidity aesthetic categories" checked in the data sheet presented herein. Therefore, the photographs for the second event are not included in this appendix, but the visual observation data sheet is included.

Turbidity Levels
Visual Observations Data Sheet

Personnel: Georgia Bryan, Mary Sue Ki, kim Spear
WWTP Name: Roseville
Date: 1 Nov. 2002
Time: 11:20 am
Approx. Ambient Air Temp. (°F) 65°
Winds: None Light Breezy Windy
(Circle one)
Approx. % Cloud Cover: 50%
Meter Turbidity: 0.562
Sample Turbidity: 0.83

Secchi Disk Observations within Chlorine Contact Basins at WWTP

Secchi Depth (ft) Below Effluent Surface	Turbidity Aesthetics Category*				
1	☐1.	☐2.	☐3.	☐4.	☐5.
2	☐1.	☑2.	☐3.	☐4.	☐5.
3	☐1.	☑2.	☐3.	☐4.	☐5.
4	☐1.	☑2.	☐3.	☐4.	☐5.

*Category Definitions

☐1. Turbidity has no affect on visual characteristics of secchi disk (looks the same as holding disk at arm's length out of water).

☐2. Turbidity results in slight "graying effect" of white portions of disk, but not black portions. Overall visual image of disk still very distinct and clear.

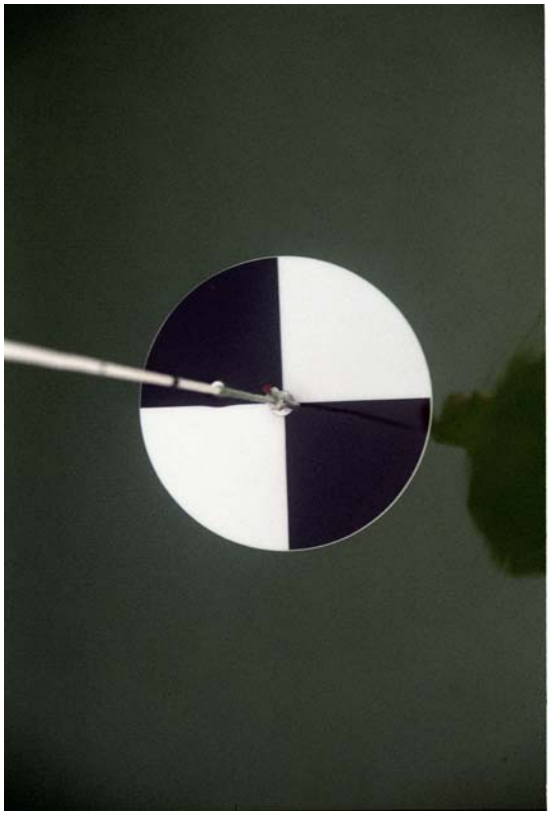
☐3. Turbidity has notable affect on brightness of both white and black portions of disk. Overall visual image of disk remains distinct.

☐4. Black and white delineations are no longer finite and stark, but rather appear as indistinct areas of color transition.

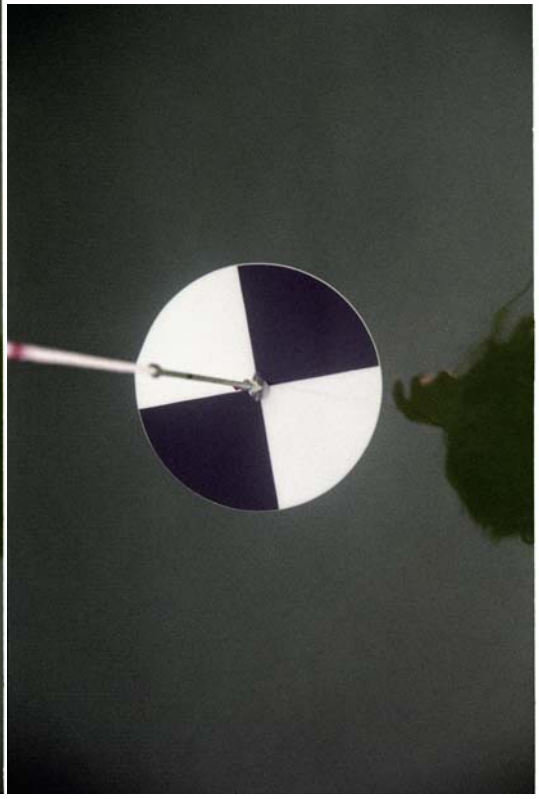
☐5. Turbidity substantially impedes ability to discern distinct differences between the black and white portions of the disk. Only poorly defined light and dark patches discernable.

Notes: graying effect at 2, 3, and 4 ft. may be merely a result of shadowing rather than turbidity.

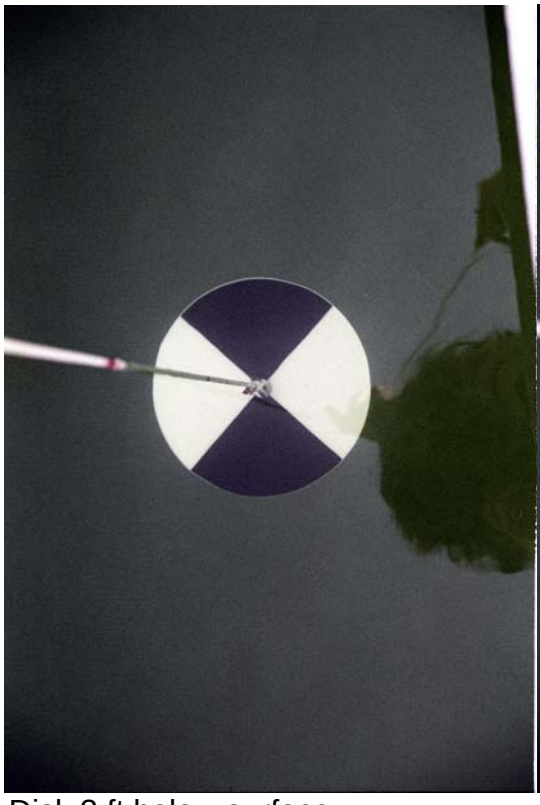
PHOTO CHARACTERIZATION OF WATER CLARITY
EFFLUENT TURBIDITY LEVEL: 0.83 NTU



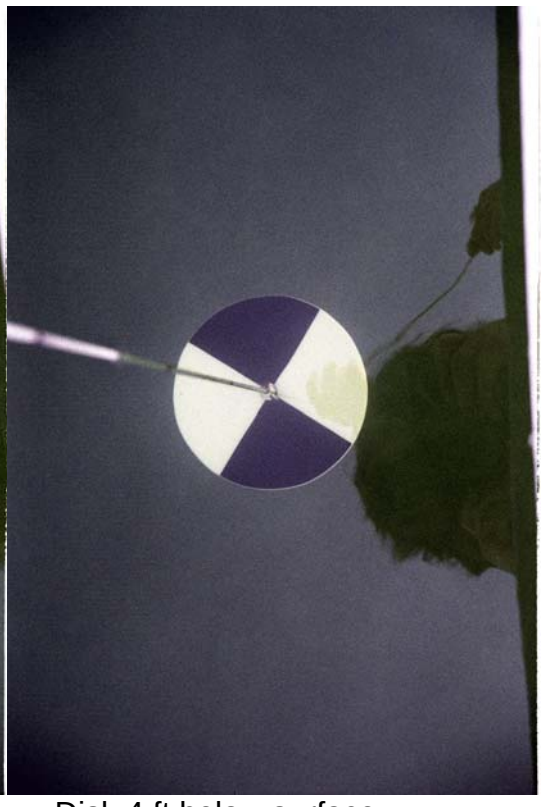
Disk 1 ft below surface



Disk 2 ft below surface



Disk 3 ft below surface



Disk 4 ft below surface

Turbidity Levels
Visual Observations Data Sheet

Personnel: Georgia Bryan, Mary Sue Francis WWTP Name: Auburn
Date: 28 March 2003 Time: 10:45
Approx. Ambient Air Temp. (°F) 75° Winds: None Light Breezy Windy (Circle one)
Approx. % Cloud Cover: 10%
Meter Turbidity: no meter available Sample Turbidity: ~~1.5~~ G.B. 1.7 effluent

Secchi Disk Observations within Chlorine Contact Basins at WWTP

Secchi Depth (ft) Below Effluent Surface	Turbidity Aesthetics Category*				
1	☑1.	☐2.	☐3.	☐4.	☐5.
2	☑1.	☐2.	☐3.	☐4.	☐5.
3	☐1.	☑2.	☐3.	☐4.	☐5.
4	☐1.	☑2.	☐3.	☐4.	☐5.

*Category Definitions

☐1. Turbidity has no affect on visual characteristics of secchi disk (looks the same as holding disk at arm's length out of water).

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☐3. Turbidity has notable affect on brightness of both white and black portions of disk. Overall visual image of disk remains distinct.

☐4. Black and white delineations are no longer finite and stark, but rather appear as indistinct areas of color transition.

☐5. Turbidity substantially impedes ability to discern distinct differences between the black and white portions of the disk. Only poorly defined light and dark patches discernable.

Notes: slight graying effect at 3 & 4' was actually "greening" due to algae build up on walls casting a greenish light on to lower depths of basin.