

LIGHT TRANSPARENCY OF WAKULLA SPRINGS*

Wakulla County, Florida

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Wakulla Springs is one of the larger springs in Florida with a flow of approximately 283 cubic feet per second. It is roughly in the shape of an inverted cone with a head diameter of about 400 feet and a depth of 103 feet. The surface is about 25 feet above sea level and covers an area of approximately 5 acres. Data on the geology of the springs are provided by Ferguson *et al.* (1947).

The extreme clarity of the water, the precipitous sides of the walls of the spring, the fact that the bottom is visible at nearly all times of the day, and the natural beauty of the semi-tropical surroundings, all combine to make Wakulla Springs a favorite tourist attraction. A fleet of glass-bottomed boats carrying visitors over the springs is in almost constant operation during the daylight hours. For this reason, opportunity to make serious studies of this interesting region is severely restricted. On November 4, 1952, the Management of Wakulla Springs interrupted normal tourist activities long enough for the writers to make one series of light transparency measurements. For this assistance, and for providing a glass bottom boat and operator, grateful acknowledgment is made.

PROCEDURE AND RESULTS

All light measurements were made on November 4, 1952 between 11:30 and 12 noon EST. A slight northerly breeze produced small surface ripples on the water. The sun was bright and there were a few scattered clouds. No appreciable

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precipitation had taken place for two or three days before these observations.

Light readings were taken at intervals from the surface to the bottom by a Clark submarine photometer equipped with opal filter, 14-mm iris and a Weston 594 Photronic Cell. The extinction coefficient, k , was computed from

$$I/I_0 = e^{-kx},$$

where I is the light intensity a distance x below the surface. It was assumed that the photo-cell current was directly proportional to the light intensity.

A white Secchi disk, 20 cm in diameter, disappeared at 22 meters when observed from the deck of the boat, but was visible to the bottom at 30 meters when viewed through the glass bottom inside the boat.

The variation of light intensity with depth is shown in Figure 1. The line A - B was fitted by sight, ignoring extreme readings at top and bottom. From the slope of this line and the above equation an extinction coefficient $k = 0.10$ was determined.

Using the equation

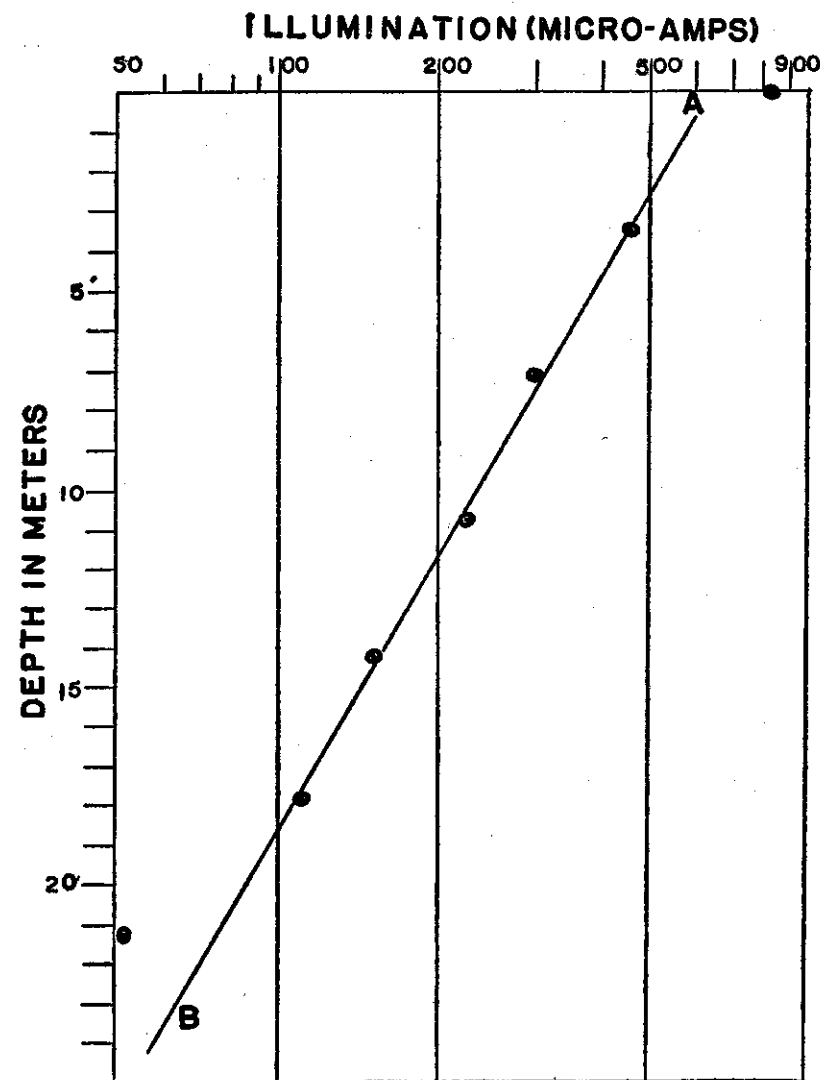
$$k = 1.7/d$$

where d = Secchi disk reading in meters, $k = 0.077$ for the observed value of 22 meters.

The large reduction of light which occurred between the surface and 3.5 meters is probably the result of scattering and loss of intensity. A similar reduction is noted between 18 and 21 meters. This appears to be due to the irregularity of the spring walls and the decreased diameter of the spring basin which, in the deeper parts of the spring, may have considerable influence on light penetration.

COMPARISONS WITH OTHER WATERS

Table 1 presents data on various bodies of water to aid in comparison. The extinction coefficient ($k = 0.10$) obtained for Wakulla Springs compares favorably with other non-



marine waters with relatively high light transmission qualities. Wakulla waters are decidedly more transparent than Crystal and Diamond Lakes ($k = 0.192$) in Wisconsin, measured by Whitney (1938). The extinction coefficient computed from the 22 meter Secchi disk reading ($k = 0.077$) is between

that computed from Secchi disk readings made by Hasler (1938) in Crater Lake ($k = 0.042$), Oregon, and by Strom (1931) in a Norwegian Lake ($k = 0.094$). In comparison to marine waters, the clarity of Wakulla waters approaches that found in the Woods Hole region (Clark, 1938a) but it is exceeded by the Sargasso Sea (Clark, 1933) and the Cayman Sea (Clark, 1938b).

TABLE 1
Selected Extinction Coefficients (k) and Secchi Disk Readings
from Various Localities and Wakulla Springs

LOCALITY	k	SECCHI DISK (meters)	k (computed)
Crystal and Diamond Lakes, Wisconsin ¹	0.192	—	—
Norwegian Lake ²	—	18	0.094
Crater Lake, Oregon ³	—	40	0.042
Sargasso Sea ⁴	0.031—0.192	—	—
Sargasso Sea ⁵	—	47	—
Cayman Sea ⁶	0.042	—	—
Woods Hole Region ⁷	0.090—0.36	—	—
Wakulla Springs ⁸	0.10	22	0.077

$k = 1.7/d = \text{Secchi Disk reading in meters}$

¹Whitney, L. V., 1938

⁵Clark, G. L., 1941

²Strom, K. M., 1931

⁶Clark, G. L., 1938b

³Hasler, A. D., 1938

⁷Clark, G. L., 1938a

⁴Clark, G. L., 1933

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