Middle Lake Hamilton

LAKE VEGETATION INDEX ASSESSMENT

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Methods

STUDY AREA ANALYISIS

The watershed containing Middle Lake Hamilton was analyzed using ESRI ArcGIS 10.2. Using this software with 2020 Polk County aerial, 2017 FDEP Land Use/ Landscape Support Index (LU), Landscape Development Intensity (LDI) Index values were calculated for the 100 meter buffer surrounding the lake following the procedures of Reiss & Brown 2012(Reiss & Brown. 2012. Landscape Development Intensity (LDI) Index User's Manual. H.T. Odum Center for Wetlands, University of Florida. March 2012). According to Reiss and Brown "The LDI represents a human disturbance gradient for wetland systems. The LDI is an integrated measure of human activity, combining the effects from air and water pollutants, physical damage, changes in the suite of environmental conditions … on the structure and processes of landscapes and ecosystems… Natural, undeveloped LU/LC classes have a LDI index value of one. In the Florida framework, the maximum LDI index score is approximately 42."

The LDI is calculated by multiplying each land use coefficient by the percentage of the area of interest occupied by that land use, and then summing the results. The Florida Department of Environmental Protection (DEP) uses the LDI as a tool to estimate potential land use impacts on streams, lakes, and wetlands. LDI values less than two (≤ 2) can be considered minimally disturbed."

LAKE VEGETATION INDEX ASSESSMENT

Polk County requested the implementation of the Florida Department of Environmental Protection methods for Lake Vegetation Index (LVI 1000) (http://www.dep.state.fl.us/water/sas/sop/sops.htm) using forms FD 9000-27 (LVI Field Sheet) and FD 9000-31 (Lake Observation Field Sheet).

The Lake Vegetation Index (LVI) is a rapid assessment protocol in which selected sections of a lake are assessed for the presence or absence of vegetation through visual observation and through the use of a submerged vegetation sampling tool called a Frodus. The assessment results provide a list of species presents and the dominant and where appropriate co-dominant species that are found in each segment. These results are then entered into a scoring table and a final LVI score is determined. LVI scores provide an estimate of the vegetative health of a lake. Our assessment team was trained and qualified by FDEP to conduct these assessment as an independent team and must prequalify each year prior to conducting additional assessments. The LVI method consists of dividing the lake into twelve pie-shaped segments (see diagram below) and selecting a set of four segments from the twelve to include in the LVI. The assessment team then travels across the segment and identifies all unique species of aquatic plant present in the segment. Additionally, a Frodus is thrown at several points on a single five-meter belt transect that is established in the center of the segment from a point along the shore to a point beyond the submerged vegetation zone. For scoring, the threshold score for impairment is 43.

Four metrics are utilized in the Lake Vegetation Index Survey; Dominant Coefficient of Conservatism (CoC), Percent Florida Exotic Pest Plant Council Type 1 (% FLEPPC), Percent Native Taxa, Percent Sensitive Taxa.

The Dominant Coefficient of Conservatism (CoC) metric for the dominant or co-dominate species in each section. The CoC applies a score of 0-10 to each species based on its ecological tolerances and fidelity to pre-settlement conditions. Species with higher scores show a high fidelity to native, undisturbed habitats and are typically sensitive to alterations. Available CoC scores can be obtained from LT 7000 from the Florida Department of Environmental Protection at: http://www.dep.state.fl.us/water/sas/sop/sops.htm.

The percent FLEPPC (Florida Exotic Pest Plant Council) Category 1 invasive exotic taxa in a single sampling unit (pie slice) by dividing the number of FLEPPC Category I taxa by the total number of taxa in that sampling unit. Multiply result times 100. Refer to Appendix LVI 1000-1 to determine which plants are on the FLEPPC Category 1 list. Note that not all exotic taxa should be included in this metric, only those listed in Appendix LVI 1000-1 as Category 1 FLEPPC. If the FLEPPC updates their list of Category 1 exotics, those updates shall not be reflected in this calculation until they are included in Appendix LVI 1000-1.

The percent native taxa in a single sampling unit (pie slice) is calculated by dividing the number of native taxa by the total number of taxa in that sampling unit. Multiply result times 100. Nativity status is determined by the Plant Atlas from the Institute for Systematic Botany, and is listed in Appendix LVI 1000-1. For informational purposes, visit the website http://www.florida.plantatlas.usf.edu/. Taxa that are native according to the Plant Atlas from the Institute for Systematic Botany but are not on the list in Appendix LVI 1000-1 may be included in this metric calculation, but inclusion of these additional taxa is not required.

The percent sensitive taxa in a single sampling unit by summing the number of taxa with a C of C (Coefficient of Conservatism) score >= 7 and then dividing by the total number of taxa in that sampling unit. Multiply result times 100. Refer to Appendix LVI 1000-1 for a list of C of C scores.

WATER QUALITY ASSESSMENT

Physical water quality samples were taken using a Eureka Manta Sub-2 multiprobe pre and post calibrated on the day of the assessment. Measurements taken with this device include: depth, conductivity, pH, Dissolved Oxygen (mg/l and % Saturation) and salinity.

Study Area

Middle Lake Hamilton is located in the Peace River – Peace Creek Canal Watershed in Polk County, Florida. The Landscape Development Intensity Index of the 100 meter buffer around Middle lake Hamilton is dominated by Residential (79.8%), Natural (16.9%) and Transportation (2.9%) land uses. The resulting LDI value for the 100 meter buffer around Middle Lake Hamilton is 6.98.

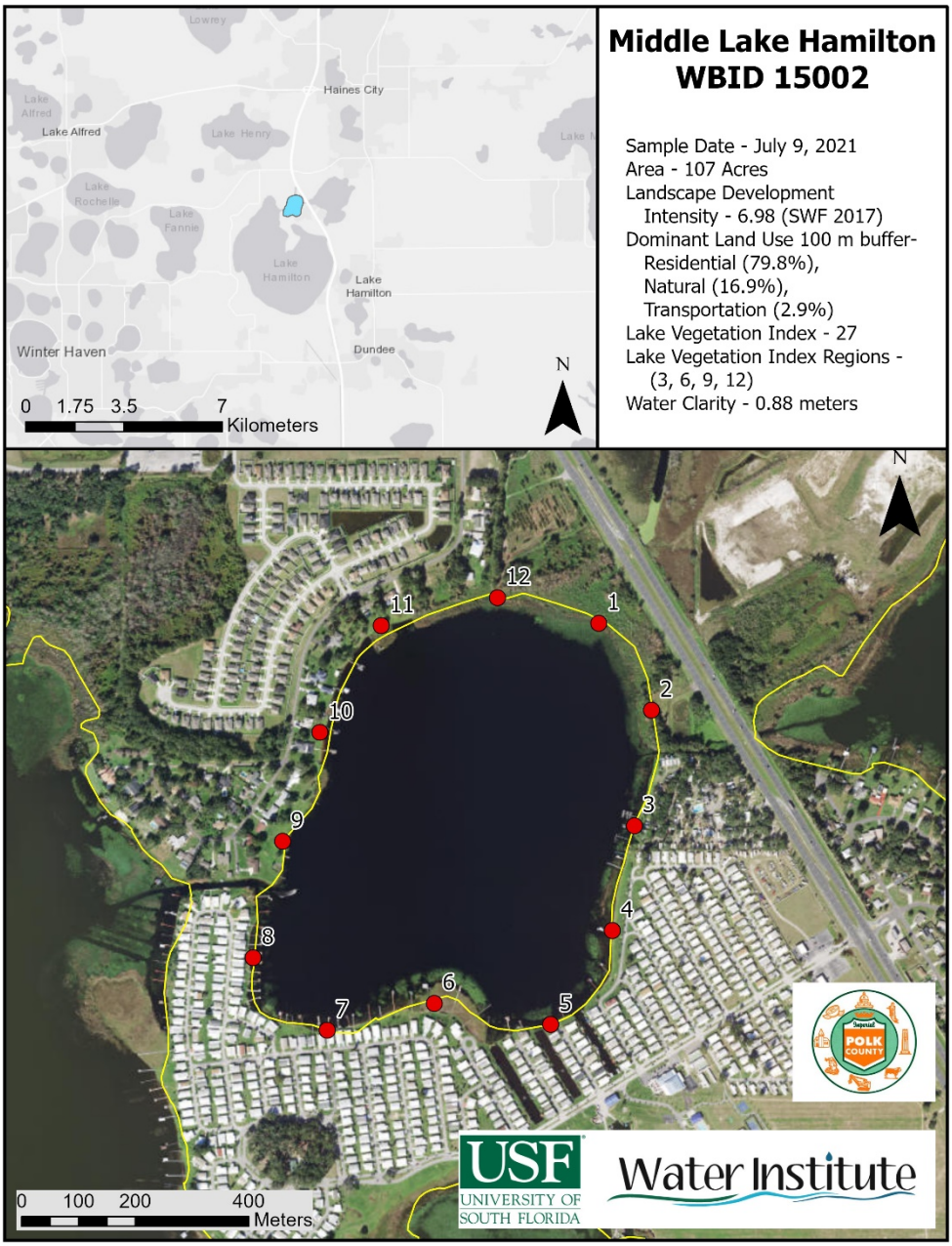

FIGURE 1: 2021 MIDDLE LAKE HAMILTON ASSESSMENT STUDY AREA MAP

Lake Habitat and Lake Vegetation Index Assessment

Figure 2 Overview photograph of the Middle Lake Hamilton showing typical shoreline vegetation.

The lake assessment for the Middle Lake Hamilton was conducted on July 9, 2021. The water in Middle Lake Hamilton was characterized as turbid and green. The secchi disk depth was 0.88 meters (2.89 feet). The vegetation quality of the plants in Middle Lake Hamilton are predominantly native species (76.1%) with moderate growths of non-native nuisance species such as *Urochloa mutica, Panicum repens and Eichhornia crassipes*. Some direct inputs of stormwater were noted through pipes to the lake but the majority of stormwater reaches the lake through sheet flow. The bottom substrate quality was dominated by sand/silt with some accumulation of coarse particulate organic matter.

Figure 3 Pontederia cordata on Middle Lake Hamilton

The Lake Vegetation Index identified 46 species of wetland vegetation growing in the four selected sections along Middle Lake Hamilton. The majority of these species (35) are native species. The remaining 11 species (*indicated in bold in Table 1*) are non-native and invasive to this region. The emergent vegetation community along Middle Lake Hamilton is dominated by a variety of emergent species including *Typha* and *Pontederia cordata.* The floating leaved vegetation community in Middle Lake Hamilton was dominated by *Nuphar* and *Nymphoides aquatica*. Submerged aquatic vegetation was present in Middle Lake Hamilton with growth consisting of four species. The most common species of submerged vegetation were *Hydrilla verticillata* and *Vallisneria americana*.

The calculated LVI score for Middle Lake Hamilton was 27, below the impairment threshold of 43 classifying the result as "Impaired". The main issues with the vegetation community is the presence of several invasive species and few sensitive species. Figure 4 shows the map of Middle Lake Hamilton detailing the LVI regions used for the assessment (Regions 3, 6, 9, 12). Table 1 details the species list results of the Lake Vegetation Index. Table 2 details the scoring result for the Lake Vegetation Index.

Table 1: Lake Vegetation Index results for Middle Lake Hamilton 7/9/21. "C" and "D" values indicate the species was dominant or co-dominant in the region. Species in bold indicate non-native invasives.

SPECIES	CofC	3	6	9	12
Alternanthera philoxeroides	0.00	1	1	1	1
Eichhornia crassipes	0.00	1	1	1	1
Ludwigia leptocarpa	3.00	1	1	1	1
Nuphar	3.50	C	C	1	C
Panicum repens	0.00	1	1	1	1
Sagittaria lancifolia	3.00	1	1	1	1
Hydrocotyle	2.00	1	1	1	
Mikania scandens	1.95	1		1	1
Nymphaea odorata	5.00	1	1		1
Pontederia cordata	5.38	C	1	1	
Typha	1.00		1	D	C
Urochloa mutica	0.00	1	1	1	
Bacopa monnieri	3.50		1		1
Cyperus odoratus	3.00	1			1
Cyperus polystachyos	1.56	1	1		
Hydrilla verticillata	0.00	1	1		
Ludwigia peruviana	0.00			1	1
Nymphoides aquatica	6.09	1	C		
Oxycaryum cubense	0.50	1			1
Salvinia minima	0.00		1		1
Vallisneria americana	7.00	1	1		
Acer rubrum	4.65				1
Aeschynomene indica	0.49		1		
Azolla caroliniana	1.81	1			
Baccharis glomeruliflora	3.00			1	
Bidens laevis	5.50			1	
Eleocharis cellulosa	7.80		1		
Eleocharis interstincta	7.80	1			
Eupatorium capillifolium	0.83				1
Fuirena scirpoidea	5.50	1			
Hibiscus grandiflorus	6.00				1
Ludwigia arcuata	3.50		1		
Ludwigia octovalvis	2.00	1			
Melaleuca quinquenervia	0.00			1	
Micranthemum glomeratum	5.85				1
Myrica cerifera	2.00				1
Najas guadalupensis	5.07		1		
Panicum hemitomon	5.82	1			
Persicaria glabra	4.50			1	
Potamogeton illinoensis	6.64		1		
Ptilimnium capillaceum	2.73		1		
Sacciolepis striata	5.35		1		
Salix caroliniana	2.95				1
Sapium sebiferum	0.00				1
Sesbania herbacea	1.00			1	
Taxodium	7.00			1	

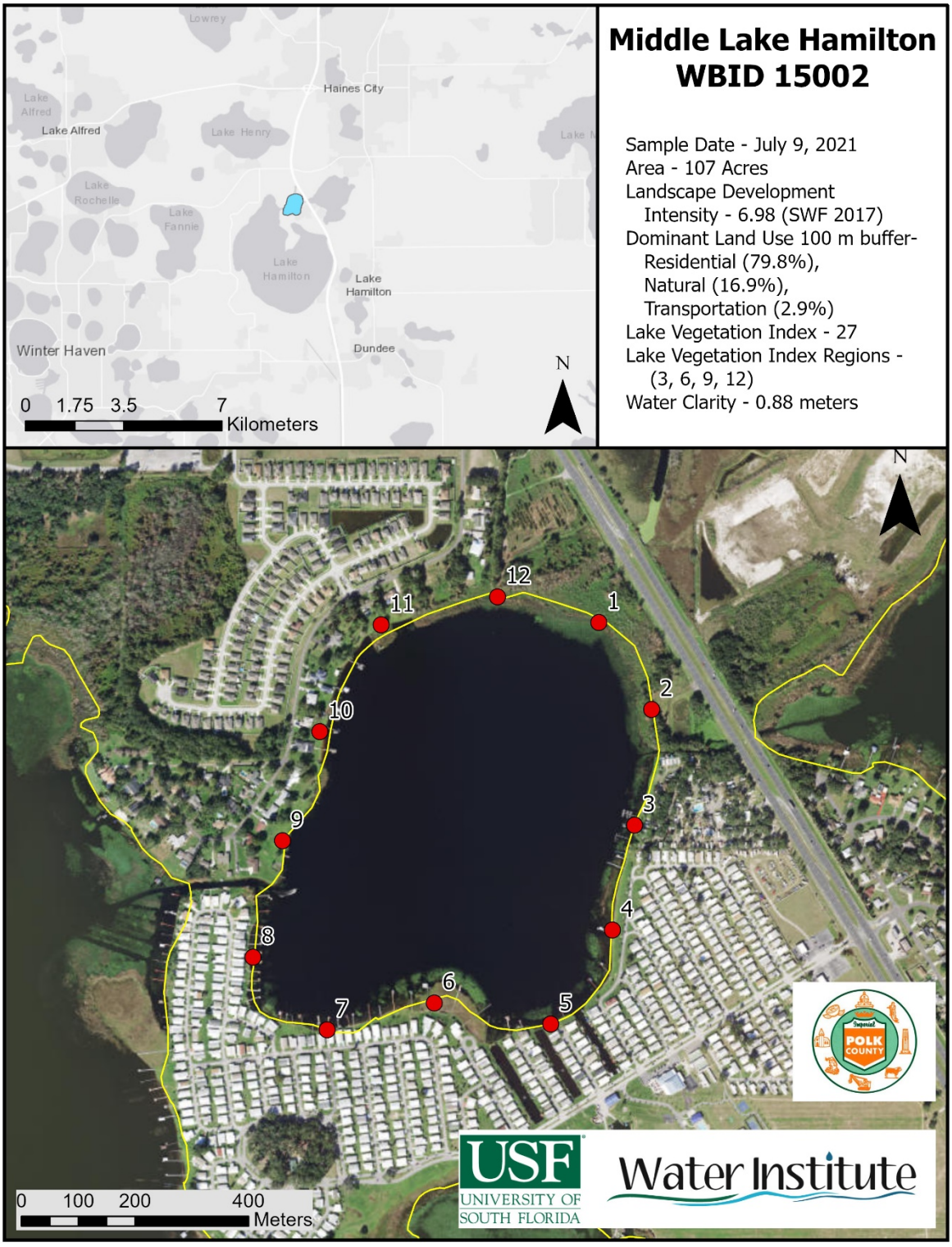

Figure 4: Lake Vegetation Index region map for Middle Lake Hamilton

Table 2: Scoring Summary for the Lake Vegetation Index

LVI Score Summary	3	6	9	12
Total # of taxa in sampling unit	22	24	18	21
% Native taxa in sampling unit	72.72727	70.83333	66.66667	66.66667
% FLEPPC CAT 1 taxa in sampling unit	18.18182	20.83333	27.77778	23.80952
% Sensitive taxa in sample unit	9.090909	8.333333	5.555556	0
Dominant CoC in sample unit	4.44	4.795	1	2.25
Native Score ((x-62.5)/37.5) or ((x-66.67)/25.89)=	0.233962	0.160809	0	0
Invasive FLEPPC 1 Score (1 - (x/30))=	0.393939	0.305556	0.074074	0.206349
Sensitive Score (x/(27.78 or 20)) =	0.454545	0.416667	0.277778	0
Dominant CoC Score (x/(7.91 or 7)) =	0.634286	0.685	0.142857	0.321429
Raw Score Total = N+I+S+D =	1.716732	1.568031	0.494709	0.527778
Division Factor = (3 D=0 or 4) =	4	4	4	4
Average LVI dividend = Raw /DF	0.429183	0.392008	0.123677	0.131944
South				
LVI Score for sampling unit =	42.91831	39.20077	12.36772	13.19444

Total LVI SCORE =	27

Water Quality Assessment

During the assessment of Middle Lake Hamilton, a Measurement specialties Manta sub-2 water quality probe was used in the central portion of the lake to capture physical water quality parameters. Table 3 provides a summary of the Physical/Chemical conditions recorded at the middle of the Middle Lake Hamilton.

Table 3: Middle Lake Hamilton Water Quality (Field)

Depth (m)	Temp °C	pH	DO (mg/L)	DO (%sat)	Cond (unho/cm)	Salinity (ppt)	Secchi Depth (m)
0.32	28.88	8.55	9.12	117.1	171.0	0.08	0.88
1.19	28.1	8.16	7.74	98.1	172.0	0.08	
2.16	27.96	7.49	0	0	311.0	0.14	

At the time of the assessment, the water in Middle Lake Hamilton was turbid and green with a secchi disk depth of 0.88 meters (2.89 feet). This value is near the mean value of secchi disk readings for the past ten years according to the Polk County Water Atlas (https://polk.wateratlas.usf.edu/lake/waterquality.asp?wbodyid=160496&wbodyatlas=lake).

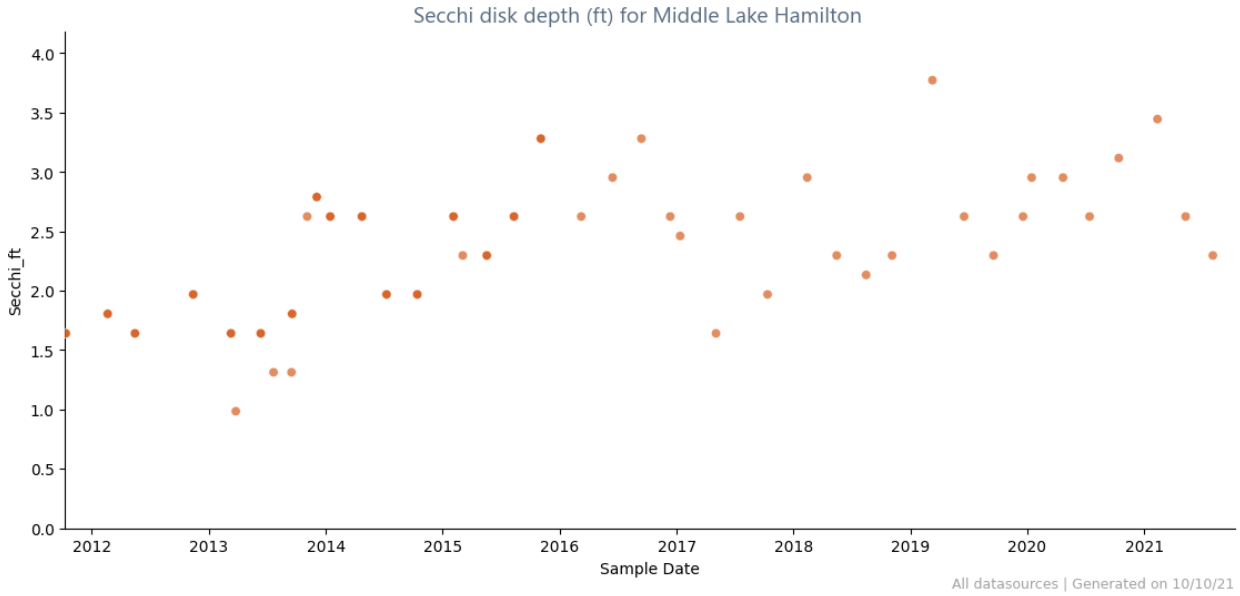

Figure 5 Secchi Disk Depth values for the previous ten years for Middle Lake Hamilton

Conclusion

The results of the assessment of Middle Lake Hamilton shows an impaired lake based on the results of the Lake Vegetation Index with a score of 27, below the impairment threshold of 43 set by the Florida Department of Environmental Protection. Residential (79.8%), Natural (16.9%) and Transportation (2.9%) land uses dominated the 100 meter buffer around the lake. The shoreline vegetation was dominated by *Typha* and *Pontederia cordata* and included several Non-native FLEPPC Category I plants. The floating leaved vegetation community was dominated by *Nuphar* and *Nymphoides aquatica.* The submerged aquatic vegetation community contained *Hydrilla verticillata* and *Vallisneria americana*. Middle Lake Hamilton had a low Secchi Disk value at the time of the assessment with a value of 0.88 meters (2.89 feet).