

DATE: January 20, 2023 FILE REF:

TO: Heidi Schmitt Marquez & Nicole Krueger- WDNR Wastewater Program

FROM: Mary Gansberg, Water Resources Management Specialist; Kristi Minahan, Water Quality Standards; Diane Figiel, Limit Calculation Coordinator

SUBJECT: Geisel Creek and Dunes Lake

Water resources staff monitored both Geisel Creek (WBIC 97400) and Dunes Lake (WBIC 97300) in Door County in 2021 and 2022 (Map 1). This monitoring was conducted, in part, to support permit reissuance for Sevastopol Sanitary District No.1 Wastewater Treatment Facility (WWTF). Following 2021 surveys, additional monitoring was recommended in 2022 to confirm current conditions. This memo summarizes the additional baseline data collected. The 2021 data were summarized in a report and is included as Attachment A. All data are entered in the SWIMS, Fish & Habitat, or WATERS database.

Summary of recommendations

- **Segment 1: Geisel Creek-headwater**
 - *Description:* From the headwaters down to the confluence with Unnamed Tributary WBIC 5011385 (center of Sec. 19, T28N, R27E)
 - *Codified designated use:* Listed in ch. NR 104 as Limited Aquatic Life (LAL): “Maple Creek [aka Geisel Cr] from the Sevastopol S.D. STP to the center of Sec. 19, T28N, R27E”; and “From the center of Sec. 19 to Mud Lake” [aka, Dunes Lake] is listed as LAL-Wetland.
 - *Classification used for previous permit issuance:* LAL
 - *Previous stream class recommendations:* This was not included for recommended changes in the 2003 ch NR 104 proposed updates
 - *Modeled Natural Community:* Warm Transition Headwater
 - *New recommended Natural Community and Designated Use:* Update classifications to Designated Use: Warmwater; Natural Community: Warm Transition Headwater from the headwaters down to the confluence with Unnamed Tributary WBIC 5011385 (beyond that point the stream widens and becomes non-wadeable).

- **Segment 2: Geisel Cr-mainstem (downstream of confluence with unnamed tributary WBIC 5011385)**
 - *Description:* From the confluence of Geisel Cr with Unnamed Tributary WBIC 5011385 (center of Sec. 19, T28N, R27E) to Dunes Lake
 - *Codified designated use:* Listed in ch. NR 104 as Limited Aquatic Life (LAL)-Wetland: Maple Creek [aka Geisel Cr] “From the center of Sec. 19 to Mud Lake” [aka, Dunes Lake]
 - *Classification used for previous permit issuance:* LAL
 - *Previous stream class recommendations:* This was not included for recommended changes in the 2003 ch NR 104 proposed updates
 - *Modeled Natural Community:* Warm Headwater
 - *New recommended Natural Community and Designated Use:* Update classifications to Designated Use: Warmwater; Natural Community: Non-wadeable—likely Warm Headwater but no fish survey was done in this portion so a Natural Community is not verified

- **Segment 3: Dunes Lake**
 - *Description:* Shallow Drainage Lake
 - *Codified designated use:* Warmwater
 - *Classification used for previous permit issuance:* Warmwater
 - *Previous stream class recommendations:* NA
 - *Modeled Natural Community:* NA
 - *New recommended Natural Community & Designated Use:* No change--DU: Warmwater; NC: Shallow Drainage Lake

Map 1. Geisel Creek and Dunes Lake monitoring locations.



Geisel Creek

Electrofishing surveys were completed using a backpack stream shocker both upstream and downstream from the Sevastopol Sanitary District discharge on Geisel Creek in 2022. The upstream survey was upstream of Brauer Road (Station ID:10047028) and the downstream location was upstream of E. Dunn Road (Station ID:10047030). The four survey results are shown in Table 1.

Table 1. Species and abundance of fish captured from electroshocking in Geisel Creek at Brauer Rd and E. Dunn Rd on May 16, 2022 and June 15, 2022 along with stream flow measurements.

Species	Brauer Rd				E. Dunn Rd			
	5/16/2022	Flow 2.74 cfs	6/15/2022	Flow 2.27 cfs	5/16/2022	Flow 6.67 cfs	6/15/2022	Flow 1.63 cfs
Blacknose shiner*	1							
Brook stickleback	7		1				1	
Central mudminnow			2		1		1	
Creek chub					2			
Iowa darter*	2							
Johnny darter**	2							
Northern redbelly dace**			1					
White sucker					2			
Total	12		4		5		2	

* Intolerant species

** Intermediate tolerant species

Although a low number of fish were captured during the surveys, two intolerant species (Iowa darter and Blacknose shiner) and two intermediate tolerant species (Johnny darter and Northern redbelly dace) were captured at Brauer Road indicating the stream can support a diverse aquatic life community. All fish species captured at E. Dunn Road are considered tolerant transitional species indicating that the natural community verification completed in 2021 is correct and Geisel Creek should be considered a warm transition headwater from the headwaters down to the confluence with Unnamed Tributary WBIC 5011385. Unnamed Tributary 5011385 flows into Geisel Creek approximately 0.8 miles downstream of E. Dunn Rd. Downstream from that confluence, the stream widens and becomes non-wadeable. The modeled Natural Community is Warm Headwater and this seems appropriate; there is a well-established channel so the previous designation of LAL-wetland is not correct. Regardless, for designated use purposes, the entire stretch should be considered warmwater and removal of Geisel Creek's LAL designation for both segments in NR 104 is recommended.

Although stream flow was adequate during all four surveys, Geisel Creek did dry up at E. Dunn Rd in July (photo 1). Stream flow was measured at 2.27 cfs in June at Brauer Rd (photo 2).

Photo 1. Dry stream channel July 21, 2022 E Dunn Rd



Photo 2. Geisel Creek at Brauer Rd June 15, 2022



Dunes Lake

Water quality monitoring - Chlorophyll *a*, total phosphorus (TP), Secchi depth, and dissolved oxygen and temperature profile data were collected at the deep spot in Dunes Lake (Station ID: 10029267) in the summer of 2021 and 2022. Trophic status was calculated using chlorophyll data. Note Secchi disc hit bottom during each measurement. Photo 3 from Dunes Lake September 13, 2022 shows clear water and abundant native aquatic plant growth.

Photo 3. Clear water and abundant native aquatic plants on Dunes Lake.



Phosphorus – Table 2 contains TP results for 2022, 2021 and 2013. The TP criterion for Dunes Lake, classified as a shallow drainage lake, is 40 ug/L. The mean for 2022 was 14. The mean for 2021 is 41 ug/L, exceeding the criterion and much higher than the mean in 2013 at 19 ug/L. Values in 2021 were higher overall, with one particularly high value of 72.5 ug/L. (Sample values are shown by year in the water quality tables below.)

Table 2. Total phosphorus (TP, ug/L) assessment results for 2022, 2021, 2013, and combined. The TP threshold is 40 ug/L.

	TP (ug/L)			
	2022	2021	2013	2013, 2021, 2022
Upper CL	16	72	23	27
<i>Mean</i>	14	41	19	21
Lower CL	12	23	15	17
Attainment determination	Clearly Meets	May exceed	Clearly meets	Clearly Meets

Chlorophyll a - Table 3 shows chlorophyll a concentrations from 2022, 2021 and 2013. The chlorophyll a threshold to protect aquatic life is 27 ug/L. Dunes Lake is below 27 in all three years, though in 2021 the standard deviation is very wide because there are only 2 samples instead of 3. (Sample values are shown by year in the water quality tables below.)

Table 3. Chlorophyll a (ug/L) Aquatic Life assessment results for 2022, 2021, 2013, and combined. The chlorophyll a threshold for aquatic life is 27 ug/L.

	Chlorophyll a (ug/L)			
	2022	2021*	2013	2013, 2021, 2022
Upper CL	3	82	5	7
<i>Mean</i>	2	22	2	4
Lower CL	1	6	1	2
Attainment determination	Clearly meets	May meet	Clearly meets	Clearly meets

* 2021 had only 2 values instead of 3 so had a wide standard deviation.

Conclusions/Summary

- Combining the 2022, 2021 and 2013 water quality data indicate that Dunes Lake is clearly attaining water quality standards for Total phosphorus and Chlorophyll a.
- The aquatic plant community (assessed in 2021) in Dunes Lake is not considered impaired.
- Fish survey data suggests that Geisel Creek supports a higher aquatic life fish community than the current codified classification of limited aquatic life.
- Geisel Creek should be reclassified to warm transition headwater natural community from the headwaters down to the confluence with Unnamed Tributary 5011385. This Unnamed Tributary flows into Geisel Creek approximately 0.8 miles downstream of E. Dunn Rd.
- No additional surveys on Geisel Creek or Dunes Lake are planned at this time.

Attachment A. Geisel Creek and Dunes Lake 2021 summary report.



Geisel Creek and
Dunes Lake 2021 repc

Summaries of results are shown by year below. These were pulled from the lakes page at: [Lake Water Quality 2022 Annual Report \(wisconsin.gov\)](http://wisconsin.gov)

Lake Water Quality 2022 Annual Report

Dunes Lake
Door County
Waterbody Number: 97300

Lake Type: DRAINAGE
DNR Region: NE
GEO Region: SE

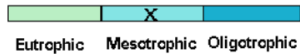
Site Name	Storet #
Dunes Lake - Center	10029267

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
07/21/2022	4	1.2	YES			57			NORMAL	CLEAR		
07/21/2022				2.03	16.3		40	50				
08/19/2022	4.5	1.4	YES			55			NORMAL	CLEAR		1-Beautiful, could not be nicer
08/19/2022				3.12	12		43	47				
09/13/2022	5.5	1.7	YES			53			NORMAL	CLEAR		1-Beautiful, could not be nicer
09/13/2022				1.28	13.4		37	48				

07/21/2022		
Depth FEET	Temp. DEGREES C	D.O. MG/L
1	25.2	8.7
3	24.5	9.5

08/19/2022		
Depth FEET	Temp. DEGREES C	D.O. MG/L
1	23.8	12.5
2	23.8	12.5
3	22	4.6

Dunes Lake - Center 2022 Results



Dunes Lake - Center was sampled 7 different days during the 2022 season. Parameters sampled included:

- water clarity
- temperature
- dissolved oxygen
- total phosphorus
- chlorophyll

The average summer (July-Aug) secchi disk reading for Dunes Lake - Center (Door County, WBIC: 97300) was 4.25 feet. The average for the Southeast Georegion was 6 feet. With this particular lake, it is important to note that the Secchi disc hit the bottom of the lake for 3 of the Secchi readings during the 2022 monitoring season. This indicates that the water clarity was actually greater than the Secchi readings imply.

Chemistry data was collected on Dunes Lake - Center. The average summer Chlorophyll was 2.6 µg/l (compared to a Southeast Georegion summer average of 24.5 µg/l). The summer Total Phosphorus average was 14.2 µg/l. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticeable algae blooms.

The overall Trophic State Index (based on chlorophyll) for Dunes Lake - Center was 42. The TSI suggests that Dunes Lake - Center was **mesotrophic**. Mesotrophic lakes are characterized by moderately clear water, but have a increasing chance of low dissolved oxygen in deep water during the summer.

Lake Water Quality 2021 Annual Report

Dunes Lake
 Door County
 Waterbody Number: 97300

Lake Type: DRAINAGE
 DNR Region: NE
 GEO Region: SE

Site Name	Storet #
Dunes Lake - Center	10029267

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
06/09/2021	4	1.2	YES		26	57		53				
07/08/2021	4	1.2	YES	14.7	35.3	57	55	56				
08/06/2021	4	1.2	YES			57						
08/06/2021				34.1	72.5		61	61				

06/09/2021		
Depth FEET	Temp. DEGREES C	D.O. MG/L
1	23.8	10.7
2	22.9	11.5
3	22.8	11.8

07/08/2021		
Depth FEET	Temp. DEGREES C	D.O. MG/L
1	18.6	6.8
2	18.7	7.3
3	18.9	7.5

08/06/2021		
Depth FEET	Temp. DEGREES C	D.O. MG/L
1	22.3	6.9
2	22.1	6.5
3	22	6
4	21.9	4.2

Lake Water Quality 2013 Annual Report

Dunes Lake
 Door County
 Waterbody Number: 97300

Lake Type: DRAINAGE
 DNR Region: NE
 GEO Region: SE

Site Name	Storet #
Dunes Lake - Center	10029267

Date	SD (ft)	SD (m)	Hit Bottom	CHL	TP	TSI (SD)	TSI (CHL)	TSI (TP)	Lake Level	Clarity	Color	Perception
05/15/2013	2.5	0.8	YES		15.1	64		49	HIGH	CLEAR	BROWN	4-Would not swim but boating OK (algae)
05/20/2013					18.1			51				
05/28/2013					19.1			51				
06/04/2013					22			52				
06/12/2013				1.27	17.6		37	50				
06/20/2013					19.3			51				
06/25/2013					23.5			53				
07/03/2013					21.3			52				
07/17/2013	2.75	0.8	YES			63			NORMAL	CLEAR	BROWN	4-Would not swim but boating OK (algae)
07/17/2013	2.75	0.8	Y	1.11	21.1	63	36	52				
08/20/2013	2.5	0.8	YES			64			LOW	CLEAR	BROWN	5-Enjoyment substantially impaired (algae)
08/20/2013	8.2	2.5	Y	0.946	14.8	47	34	49				
09/18/2013	3	0.9	Y	5.65	16.8	61	48	50	LOW	CLEAR	BROWN	4-Would not swim but boating OK (algae)
10/28/2013	2	0.6	YES		13.4	67		48	LOW	CLEAR	BROWN	4-Would not swim but boating OK (algae)

05/15/2013		
Depth FEET	Temp. DEGREES F	D.O. MG/L
2	52.6	8.4

07/17/2013		
Depth FEET	Temp. DEGREES F	D.O.
1	77.9	
	25.5	

08/20/2013		
Depth FEET	Temp. DEGREES F	D.O.
1	68	
	20	

09/18/2013		
Depth FEET	Temp. DEGREES F	D.O.
1	57.2	
	14.0	

10/28/2013		
Depth FEET	Temp. DEGREES F	D.O.
1	40.4	