Oneida Nation
Final Water Quality Assessment Report

Grant I- 00E73903
April 1, 2015 – March 31, 2017

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The Oneida Nation adopted Water Quality Standards in 1996. A priority of the water resources team is to effectively implement Oneida Nation's Water Quality Standards and Water Resource Ordinance, and achieve 'fishable and swimmable' waters of the Reservation. This report is a final summary of water quality data collected in the Oneida Nation Reservation and an assessment of water quality for the Clean Water Act Section 106 grant cycle April 1, 2015 through March 31, 2017.

Table 1. Atlas of Tribal Waters

Factor/Resource	Value
Surface area of Tribal lands (acres)	65,280
Surface area of Tribal lands (mi^2)	102
Reservation population (total residents)[1]	24,131
Reservation population (enrolled Oneida members)[2]	4,460
Total miles of rivers and streams[3]	294.95
Number of monitoring points on streams	11
Acres of lakes/ponds[3]	248.75
Number of monitoring points on lakes	3
Total acres of wetlands[3]	7,015.6

[1] 2015 American Community Survey 5-Year Estimates; [2] Oneida Tribal Enrollment Department (6/2/2017); [3] Oneida Geographic Land Information Systems (GLIS)

Oneida Surface Water Quality Monitoring and Assessment Program

Physical, chemical, and biological information are collected regularly at designated stations throughout the Reservation. This level of monitoring determines water quality trends in each sub-watershed based on ecologically-based indicators, and identifies potential problem areas. Table 2 lists parameters of interest and monitoring frequency. Parameters marked with * indicate those for which numeric criteria exist in the Oneida WQ Standards.

Table 2. Oneida Nation Water Quality Monitoring Program – schedule of parameters and frequency.

Parameter	# Sites	Frequency	Parameter	# Sites	Frequency
Chemical (Lab analysis)			**Physical**		
*Alkalinity	14	Quarterly	Conductivity	14	Monthly
*Chloride	14	Quarterly	*Dissolved Oxygen	14	Monthly
*Nitrogen, Ammonia	14	Quarterly	*pH	14	Monthly
Nitrogen, Nitrate + Nitrite	14	Quarterly	Salinity	14	Monthly
*Total Phosphorus	14	Quarterly	*Temperature	14	Monthly
*Total Dissolved Solids	14	Quarterly	*Turbidity	14	Monthly
Total Suspended Solids	14	Quarterly			
*Sulfate	14	Quarterly			

Oneida Water Quality Standards and Designated Uses

The primary designated uses of Oneida surface waters are *Aquatic Life – Cold Water and Warm Water Ecosystems* and *Recreation – Primary and Secondary Contact*. These uses are expressed in Article IX of the Oneida Water Quality Standards and are outlined in Table 4. The Standards designate Trout Creek, Lancaster Brook and associated tributaries as cold water ecosystems; all other waters are warm water ecosystems.

Oneida Lake is the only water body that is used for Primary Contact Recreational purposes; as a new lake (reclamation of former sand quarry), Oneida did not exist at the time the Standards were written and so this designation is not named in the document. All other waterbodies are listed for Secondary Contact Recreational. Weekly sampling for *E. coli* is conducted at Oneida Lake by the Public Health Sanitarian during the swimming season; the ONWQ standard for *E. coli* is the minimum standard in use. Sampling results are shared with the Oneida Water Resources Program.

Table 3. Oneida Water Quality Standards for selected parameters

Parameter of Concern	Criterion
Alkalinity	≥20 mg/L as $CaCO_3$
Dissolved Oxygen	≥6 mg/L except in hypolimnion of stratified lakes
Dissolved Solids	≤250 mg/L for chlorides and sulfates
pH	6.0-9.0; with no fluctuations greater than 0.5 units within a 24-hour period, other than by natural causes
Total Phosphorus - lakes	≤0.025mg/L
Total Phosphorus – streams which flow directly into a lake or reservoir (Duck Creek only)	≤0.05 mg/L
Total Phosphorus – streams which do not flow directly into a lake or reservoir (all streams except Duck Creek)	≤0.1 mg/L
Temperature	No temperature changes that would adversely affect fish and aquatic life
Turbidity	≤5 NTU when background turbidity is ≤50 NTU; or no more than a 10% increase when background turbidity is >50 NTU

2015 – 2017 Water Quality Monitoring Results

Between April 1, 2015 and March 31, 2017, fourteen monitoring stations were sampled on a monthly basis from March through December for pH, temperature, dissolved oxygen, specific conductance, and turbidity. Quarterly grab samples were collected in June, July and October 2015; March, June, September and December 2016; and March 2017. Grab samples were sent to Northern Lakes Services and analyzed for alkalinity, chloride, ammonia nitrogen, nitrate + nitrite nitrogen, total phosphorus, total dissolved solids, total suspended solids, and sulfate. Selected sites were additionally sampled for nutrients following a rain event on March 27, 2017. Quarterly samples were not collected at certain sites in March and December because of ice cover.

Attainment of Designated Uses

The Oneida Water Resources Program had previously determined that total phosphorus (TP) would be used as the primary representative water quality indicator, as it is the pollutant of greatest concern in Oneida surface waters as well as in downstream waters (the Lower Fox River and the bay of Green Bay). Phosphorus is routinely sampled and analyzed on a quarterly basis, as more frequent sampling is cost prohibitive. However, quarterly data for a single parameter is not truly representative of water conditions throughout the year, thereby introducing error into the process of determining Designated Use attainment. To allow for this uncertainty, the Program has established that streams for which 90% of samples meet the Oneida Water Quality standard for TP within a calendar year will be considered as *fully supporting* the designated aquatic life use. Streams for which 75%-89% of samples meet the TP standard will be considered as *fully supporting but threatened*.

Based on these criteria, within this grant cycle, three sites fully supported designated uses (Table 4): Oneida Lake (the new lake), Lancaster Brook, and Thornberry Creek. As a newly-reclaimed lake, Oneida Lake is oligotrophic. Lancaster Brook and Thornberry Creek are cold-water trout streams dependent on baseflow.

Two sites supported designated uses, but were threatened: Quarry Lake and Oneida Creek (measured at Bodart Court - OCBC). However, the attainment at OCBC is not truly representative of Oneida Creek. Only 5 samples were collected at OCBC, compared to the downstream site, Oneida Creek at Van Boxtel (OCVB), because OCBC tends to dry up more frequently. On the three occasions that OCBC was not sampled, the OCVB samples exceeded the TP standard.

Table 4. Attainment of designated use, 2015-17. Total number of samples varies; certain sites were not sampled (due to ice cover or no flow) and additional event sampling was conducted at selected sites.

Use Attainment 2015-2017				
	Site	Total # of Samples	% of Samples Meeting Standard	Use Attainment?
Lakes ≤0.025 mg/L	OL	7	57	NO
	ONL	7	100	FULLY
	QL	6	83	FULLY BUT THREATENED
Tributaries ≤0.1 mg/L	DCCL	8	0	NO
	FCLR	7	29	NO
	LBN	8	100	FULLY
	OCBC	5	80	FULLY BUT THREATENED
	OCVB	8	38	NO
	SLV	7	29	NO
	TCBW	9	67	NO
	TCFF	8	63	NO
	THCC	8	100	FULLY
Duck Creek ≤0.05 mg/L	DCPP	9	11	NO
	DCSM	8	0	NO

Fully supporting = 90-100% of samples meet WQS

Fully supporting but threatened = 75-89% of samples meet WQS

Quarterly Monitoring – Analysis of Grab Samples

Table 5 summarizes maximum values for each parameter analyzed in quarterly grab samples. Of the eight parameters measured, the five highest were samples from Dutchman Creek at Cyrus Lane (highlighted fields). Phosphorus data are presented at the end of this section.

- The table of maximum values also presents minimum alkalinity value (110 mg/L), as low alkalinity would be of greater concern than high alkalinity. This value is well above the minimum standard of 20 mg/L.

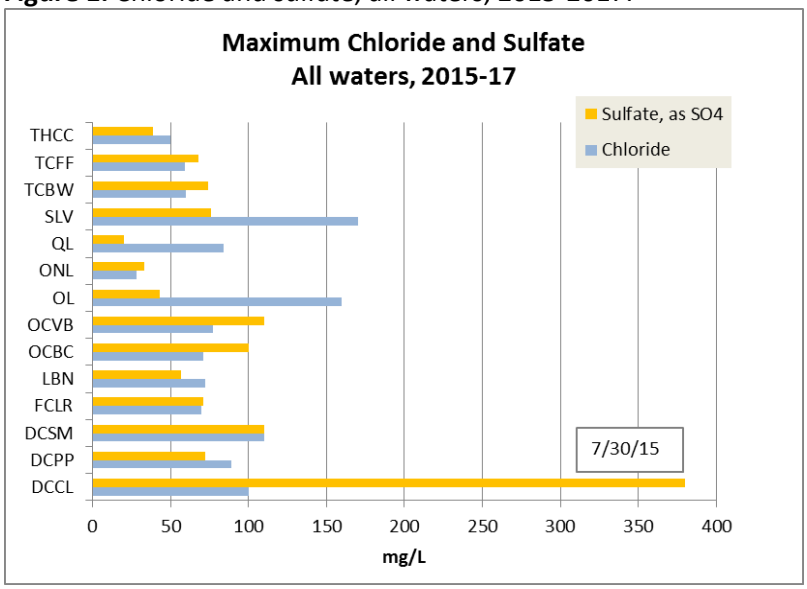
- The Oneida Water Quality Standard for "Dissolved Solids" specifies numeric criteria "not to exceed 250 mg/L for chlorides and sulfates." There is no separate criterion for "Total Dissolved Solids." Based on this standard, chloride is within specified limits, despite elevated levels at Silver Creek and Osnuhsa Lake (Figure 1). Chloride measurements at Osnuhsa Lake were the highest for any single site; all seven samples from Osnuhsa were among the nine highest measurements. Median chloride value for all sites during this period is 59.5 mg/L.

Table 5. Maximum values and dates of occurrence for each parameter measured in quarterly grab samples from April 1, 2015 to March 31, 2017.

Characteristic	Count	Maximum (mg/L)		Date	Location
Alkalinity, Total	103	330 max	110 min	6/30/15, 7/30/15	DCSM / ONL
Chloride	102	170.0		9/14/16	SLV
Nitrogen, NO_2+NO_3	105	13.0		12/6/16	OCBC
Nitrogen, ammonia as N	105	0.21		6/30/15, 10/29/15	DCCL
Total Phosphorus	105	1.8		7/30/15	DCCL
Total Dissolved Solids	102	990.0		7/30/15	DCCL
Total Suspended Solids	102	59.0		7/30/15	DCCL
Sulfur, sulfate (SO4) as SO4	102	380.0		7/30/15	DCCL

- The maximum sulfate value (380 mg/L, at DCCL on 7/30/15) is the only exceedance from the standard (Figure 1); however, it is exactly double the next highest value of 190 mg/L, also at DCCL on 9/14/16. The median sulfate value for all sites is 44 mg/L. The only significant rain event preceding 7/30/15 sampling was 1.33 inches on July 13, with an additional 0.15 inches in the five days following that rain event, and no precipitation was measured again until 0.01 on July 30. Thus, runoff would not appear to be the cause of this input. The six highest sulfate values of this period were at DCCL; this merits further investigation.

Figure 1. Chloride and sulfate, all waters, 2015-2017.



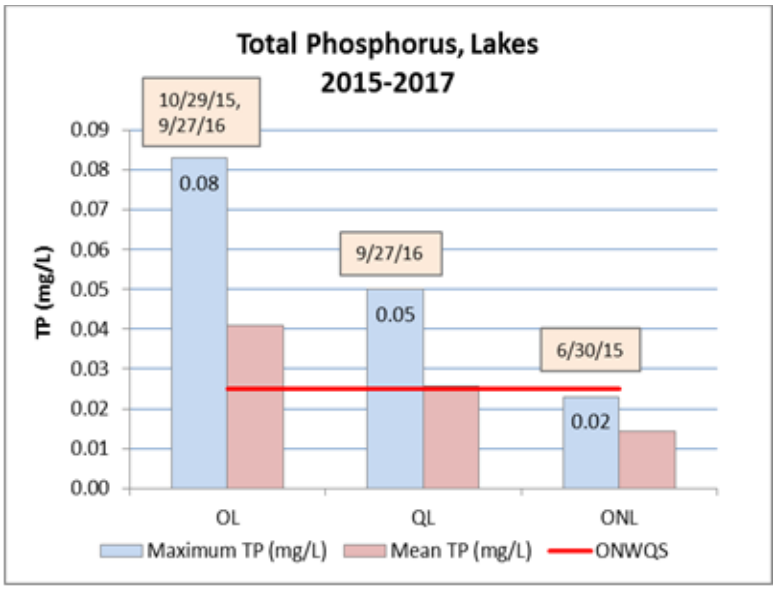
- Oneida Water Quality Standards do not specify numeric criteria for nitrites and nitrates, nor is there an aquatic life use criterion for this parameter within the State of Wisconsin water quality standards. However, the maximum value of 13.0 (OCBC, 12/6/16) would exceed the Wisconsin drinking water standard for nitrates (10 mg/L) (Table 5). Although Oneida Creek is not a source for drinking water, this elevated value may be of concern. Precipitation, snow and temperature data indicate a .32 inch rain event, along with up to 3 inches of snowmelt in the three days preceding that sampling event. The next highest value for this parameter was 7.5 mg/L, from a sample at Dutchman Creek – Cyrus Lane (DCCL), collected on the same date.

- The maximum ammonia value of 0.21 mg/L at DCCL, taken on June 30, 2015 (Table 5), is potentially concerning due to the increasing toxicity of ammonia at higher temperature and pH. Because I have been unable to locate the monthly monitoring data for 2015 (an issue noted in the previous WQAR), I do not know the pH and temperature of the stream on those days. Based upon average pH and temperature values in other years, there is a possibility that ammonia level in the stream on that date may have exceeded the ONWQ criterion ["Maximum Allowable Four-Day Average Concentration for Total Ammonia (accounting for Salmonids and other Sensitive Coldwater Species)"]. Dutchman Creek is a warm water stream.

Total Phosphorus – Lakes

Oneida Lake (ONL, the new lake) is oligotrophic and consistently meets the TP standard established for lakes (≤0.025 mg/L). Maximum values for Osnuhsa and Quarry Lakes were in fall (Figure 2). On 9/27/16, Osnuhsa and Quarry Lakes were fully mixed, so high phosphorus levels likely were due to re-suspension of sediments. At Osnuhsa Lake, decomposition of curly leaf pondweed could be fueling the phosphorus release; at Quarry Lake, it is possible that an algae die-off was taking place. These questions merit further investigation of algae and nutrient dynamics. For this reason, in 2017, we added summer cholorphyll-a analysis to our monitoring, but only for June and September. More frequent analysis in summer months may shed some light on this situation. It is encouraging that mean values for Quarry Lake meet the standard.

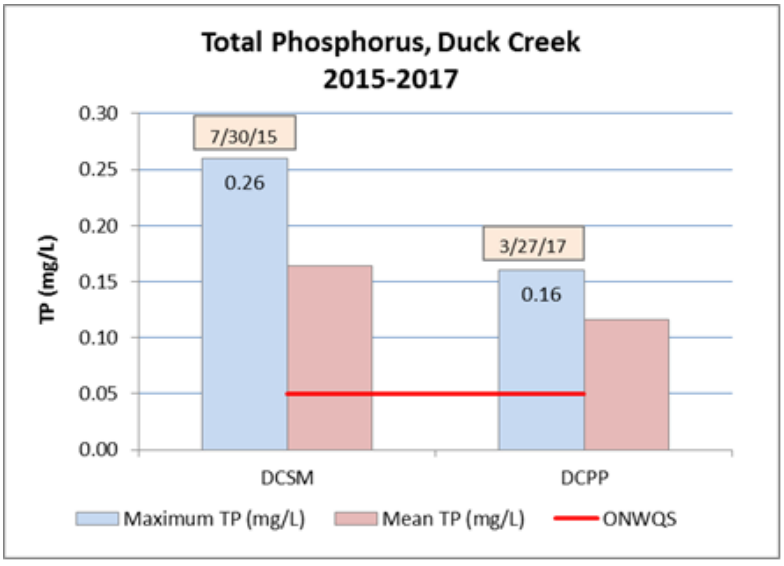
Figure 2. Total phosphorus, lakes, maximum and mean values.



Total Phosphorus – Duck Creek

Both monitoring sites on Duck Creek demonstrate exceedance of the phosphorus criterion established for streams that empty into lakes or reservoirs (≤0.05 mg/L) (Figure 3). Maximum and mean values at the upstream site (at Seminary Road, DCSM) are higher than at the downstream site (at Pamperin Park, DCPP). The maximum value at DCSM (0.26 mg/L) is five times greater than the criterion and in neither instance was associated with a rain event immediately preceding sampling.

Figure 3. Total phosphorus, Duck Creek, maximum and mean values.

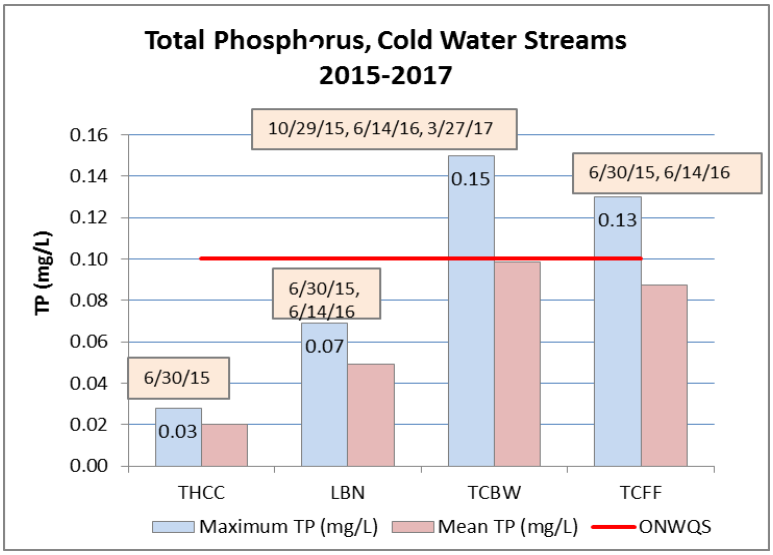


Greater discharge at the downstream site allows for a dilution effect. However, land use between the two sites, including substantial riparian buffers, may also be a factor. A closer analysis of the riparian corridor and adjacent land use might enhance our understanding of what is happening between upstream and downstream sites.

Total Phosphorus – Cold Water Streams

The streams which have typically been least-impaired – Lancaster Brook and its tributary, Thornberry Creek – continue to maintain water quality within the criterion established for tributaries (≤0.1 mg/L) (Figure 4). Mean TP values at Trout Creek also meet the standard; but several values in excess of the standard suggest that on the basis of this measure alone, Trout Creek is not attaining designated uses. Maximum and mean TP levels were slightly higher upstream (TC-Brookwood) than downstream (TC-County Road FF). All of the maximum values for cold water streams were from samples collected within one day of a rain event.

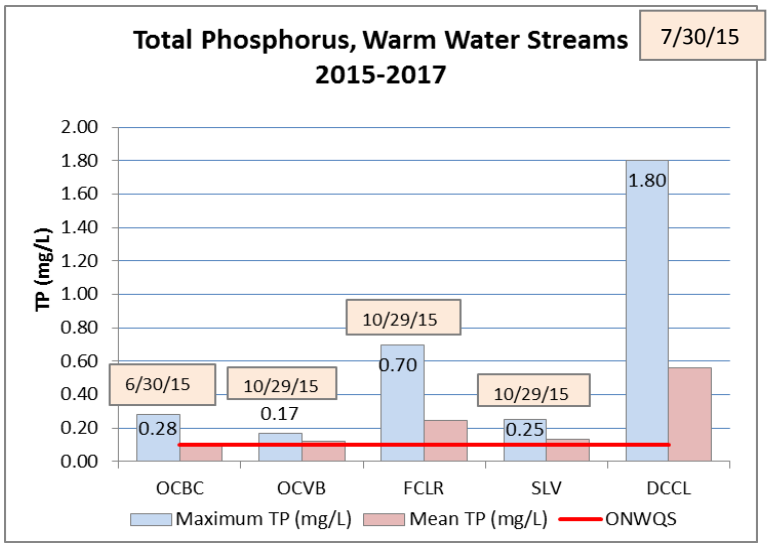
Figure 4. Total phosphorus, cold water streams, maximum and mean values.



Total Phosphorus – Warm Water Streams

Maximum values at all four warm water streams exceed the Oneida TP standard for tributaries, though with varying degrees of impairment (Figure 5). As with Duck Creek and Trout Creek, the upstream site on Oneida Creek (OC-Bodart Court) shows higher maximum and mean TP values than downstream (OC-Van Boxtel); again, dilution effect may be a factor. OCBC is a tributary located in a residential area surrounded by agricultural fields and is minimally buffered. OCVB is on the main stem of Oneida Creek, near its mouth at Duck Creek, and flows well-buffered by a wooded riparian corridor through most of this lower reach.

Figure 5. Total phosphorus, warm water streams, maximum and mean values.



It is encouraging that mean values of Oneida Creek and Silver Creek are close to the standard. We expect to see improvements in water quality of Silver Creek with the 2017 implementation of several non-point source projects through the Silver Creek Pilot Project with NEW Water (the Green Bay

Metropolitan Sewerage District). Dutchman Creek continues to be the most impaired waterbody on the Reservation, as shown by the TP data and other water quality data in this report. Every sample from Dutchman Creek exceeded the water quality standard for TP.

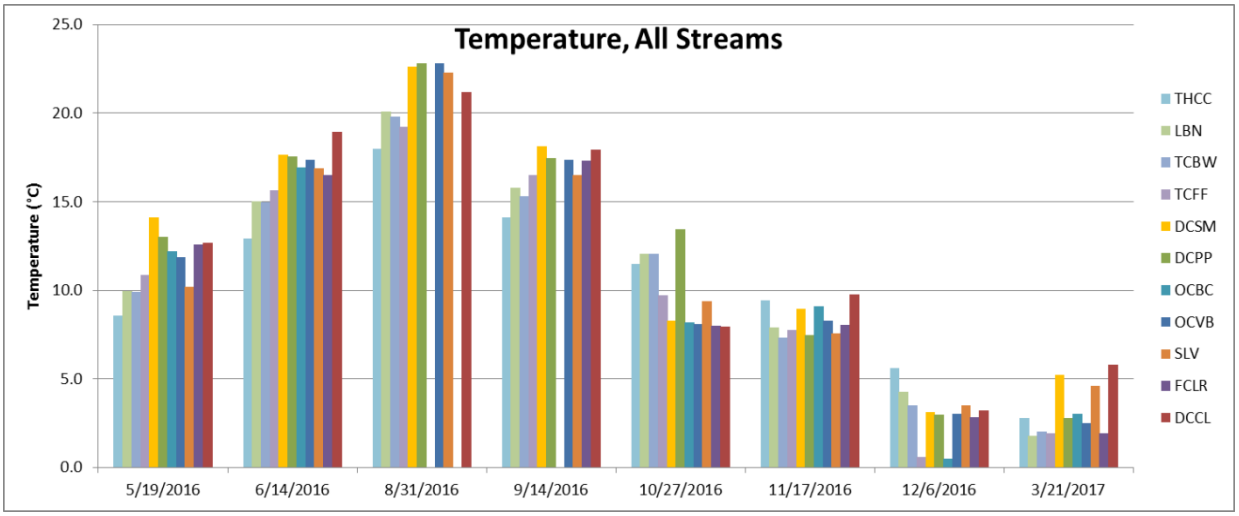
2017

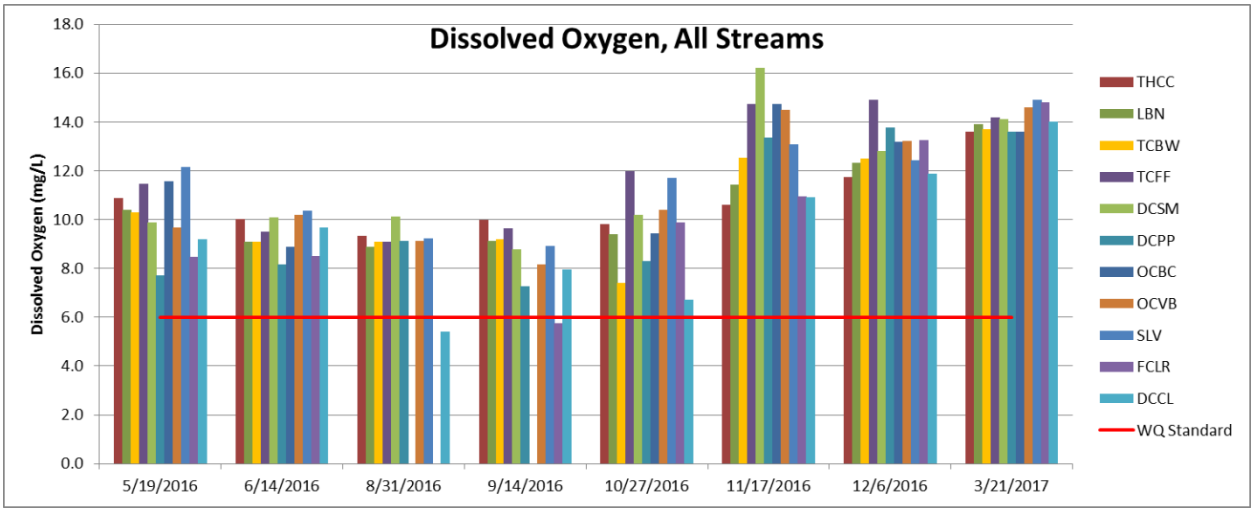
Monthly Monitoring – Analysis of Temperature and Dissolved Oxygen

Streams

Stream temperatures in 2016 reflect normal weather patterns and may be considered stable (Figure 6). Dissolved oxygen was consistently higher than the minimum standard of 6 mg/L, with only two exceptions. 2015 temperature and dissolved oxygen data are not available.

Figure 6. Temperature and dissolved oxygen, all streams, 2016. 2015 data not available.



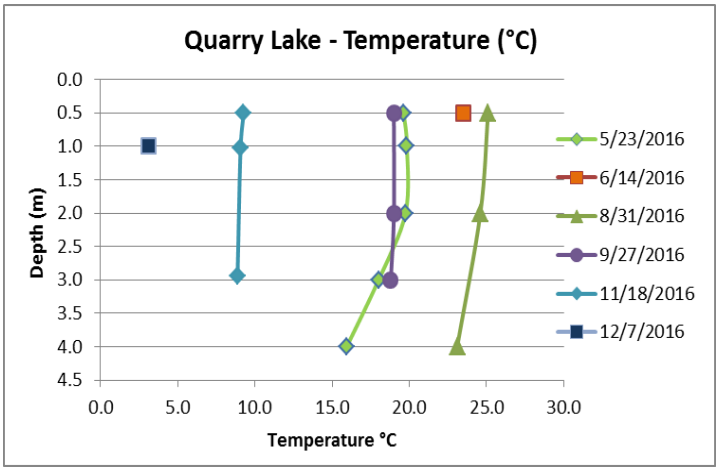


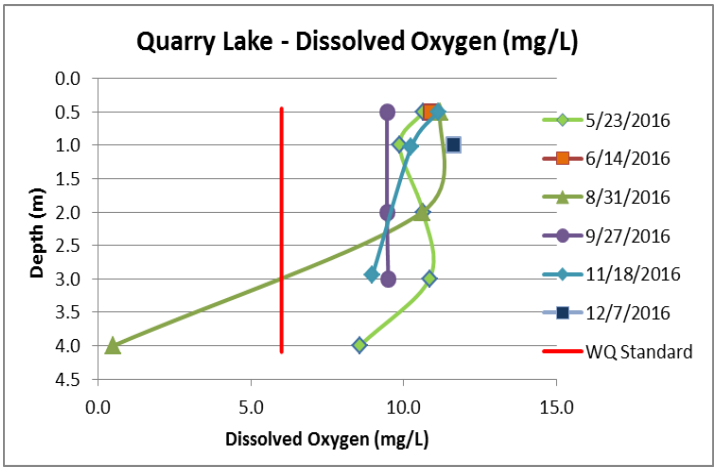
Lakes

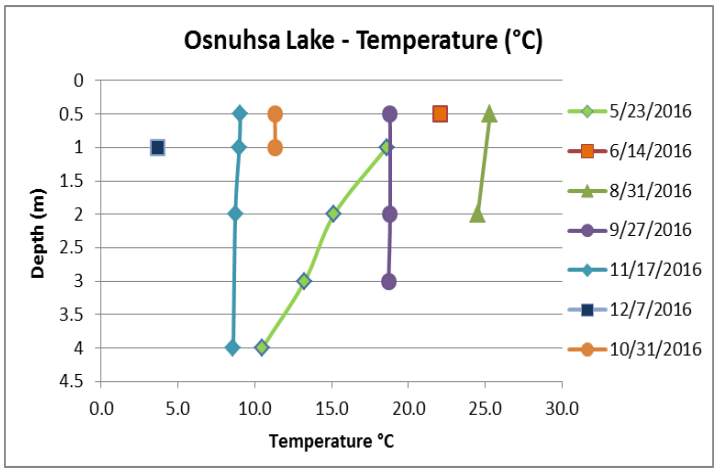
The lakes included in the monitoring program are the primary fishery and recreational lake resources on the Oneida Reservation. Quarry Lake (5 acres) was a former limestone quarry and has the longest history of use. It is a seepage lake. Osnuhsa Lake (5 acres) is an impoundment that was initially created for stormwater treatment. Quarry and Osnuhsa Lakes are eutrophic, and both have significant issues with AIS. Osnuhsa received an herbicide treatment for curly leaf pondweed in April 2017. Treatment protocol requires herbicide application for a minimum of three consecutive years. Eurasian water milfoil is significantly impacting habitat and water quality at Quarry Lake; the Water Resources Specialist is investigating management options. Oneida Lake(20 acres) is the newest and largest lake resource; the lake was formed as a reclamation of a former sand quarry and is classified as an oligotrophic seepage lake. Phase I construction of the lake was completed in 2015.

All three lakes are shallow and remain mixed throughout most of the year (Figure 7 and Figure 8). There is evidence the lakes may stratify under certain conditions, such as on May 23, 2016; maximum air temperature in the three days prior to and including this sampling date was >80^{o} F. In 2016, dissolved oxygen at all depths was higher than the minimum standard of 6 mg/L, except at Osnuhsa Lake in June and September.

Figure 7. Temperature and dissolved oxygen, Quarry and Osnuhsa Lakes, 2016. 2015 data not available.







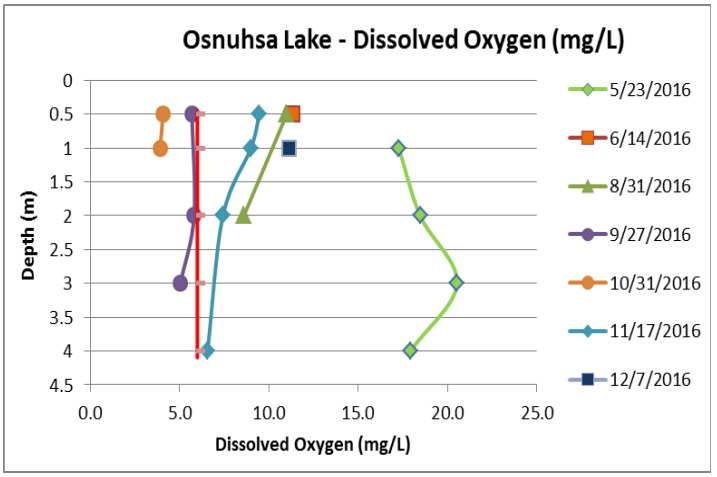
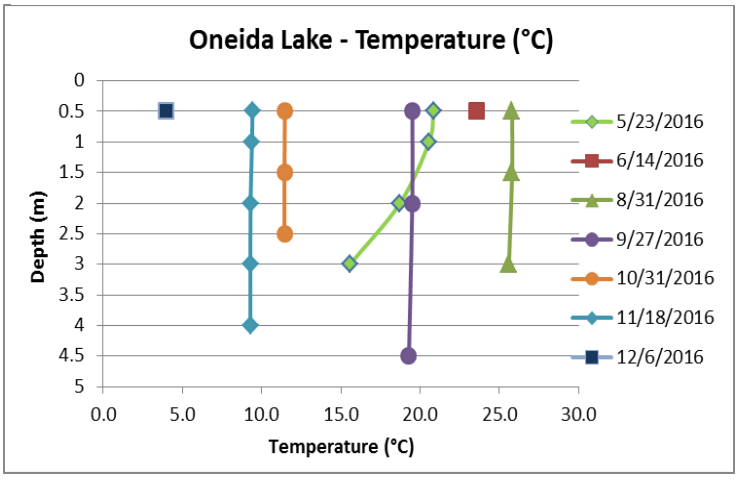
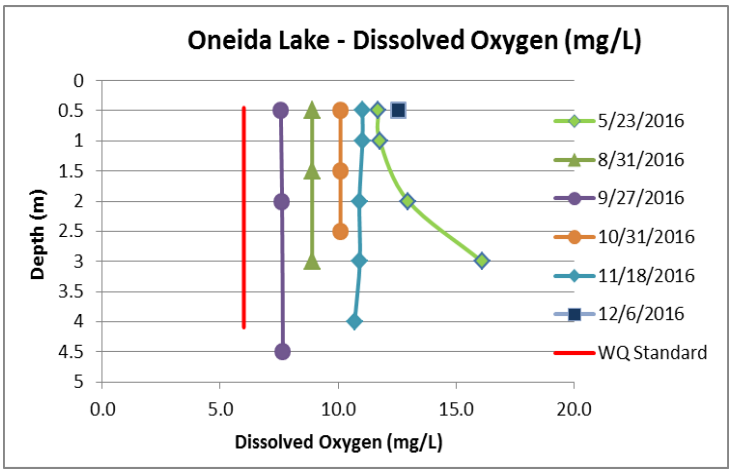


Figure 8. Temperature and dissolved oxygen, Oneida Lake, 2016. 2015 data not available.

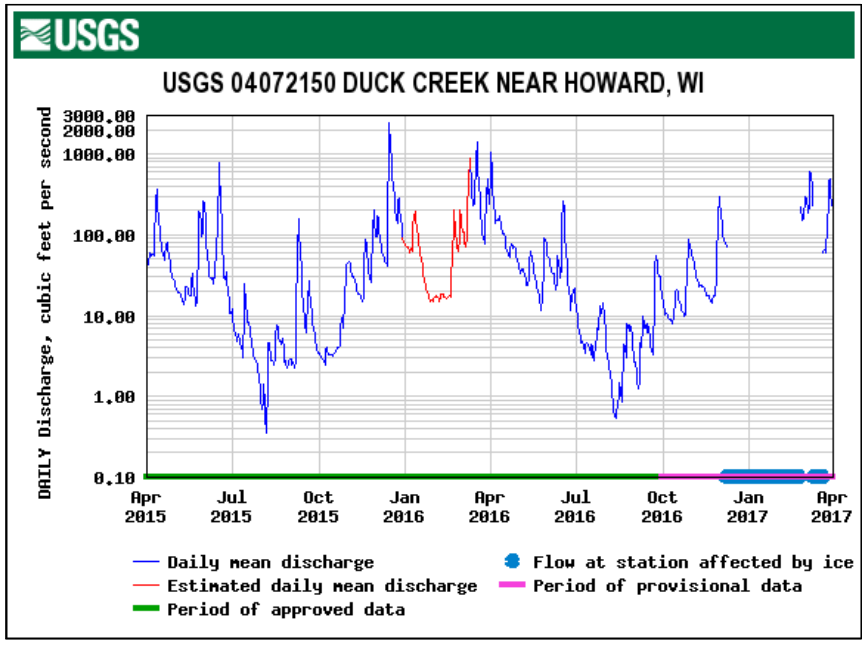




USGS Gaging station on Duck Creek (USGS 04072150)

The USGS operates gaging station on Duck Creek in a cooperative agreement with the Tribe. Discharge and gage height are continuously monitored and available to view and download at: http://waterdata.usgs.gov.

Figure 9 Daily mean discharge at USGS monitoring station on Duck Creek, April 1, 2015 – March 31, 2017.



Report Summary and Conclusions

During the period of April 1, 2015 through March 31, 2017, the majority of Oneida water bodies were not attaining designated uses. Using an assessment strategy based upon meeting the Oneida Water Quality Standards for total phosphorus, two of the three lakes and two of seven streams were in attainment. Duck Creek did not attain designated uses. However, many of these water bodies do support aquatic life, which calls into question the suitability of relying on this criterion as a primary measure of water quality. Notably, Quarry Lake contains a robust population of panfish and largemouth bass; Trout Creek has supported brook trout and redside dace in recent years, even during years of "non-attainment;" and Oneida anglers regularly report catching northern pike, walleye, perch, and even lake trout in Duck Creek.

The main sources of stream impairment in Oneida surface waters continue to be sedimentation from agriculture and residential construction and excessive nutrients from agriculture, suburban lawns and golf courses. This holds true for downstream waters as well (the lower Fox River and the bay of Green Bay). Additionally, a loss of hydrologic function from tiling and ditching has resulted in increased flashiness following precipitation events and reduced flows during dry periods in Reservation streams. Addressing these issues remains a high priority for Oneida environmental programs.

In 2017, 500 acres in the Trout Creek watershed were fenced for grazing, along with an additional 258 acres divided between the Fish Creek, Silver Creek and Duck Creek watersheds. The majority of these new pastures had been in row crops. Planning also is in place to shift an additional 650 acres from row crops into grazing in the Oneida Creek watershed, as part of a demonstration farm to be funded through the Great Lakes Restoration Initiative. In 2016-17, the Silver Creek Project installed 5 grassed waterways, 3 buffers, 3 WASCOBs, 97 acres of grazing, 740 acres of cover crops, 180 acres of restored wetlands, and many other structural and operational best management practices (BMPs). These changes on the landscape will certainly have measureable positive impacts on water quality.

The Oneida Water Resources Program staff is committed to implementing a monitoring strategy that is realistic but also robust enough to capture the effects of these changes on the landscape. A critical gap in the Monitoring Strategy is the lack of an assessment methodology for determining use attainment that combines physical, chemical and biological and habitat data. Developing such an integrated assessment methodology that is aligned with the large-scale implementation of BMPs is a top priority for the April 1, 2017 – March 31, 2019 CWA 106/PPG grant cycle.

To this end, the Water Resources Specialist is currently engaged in two major initiatives. The first initiative is completion of a baseline analysis and assessment of water quality data from 2003 to the present. The baseline assessment will determine trends in water quality (if possible); identify new priorities for the monitoring program; and initiate action toward revising the Oneida Water Quality Standards. The second initiative is to bring Oneida into the Consortium of Region 5 tribes that have adopted Gold Systems' Ambient Water Quality Monitoring System (AWQMS). AWQMS will not only enhance accuracy of data management and efficiency of data analysis capabilities, but also will readily accept benthos and other biological data. Taken together, these initiatives will create a strong platform for developing an integrated approach to water quality assessment that is truly reflective of the health of Oneida waters.