

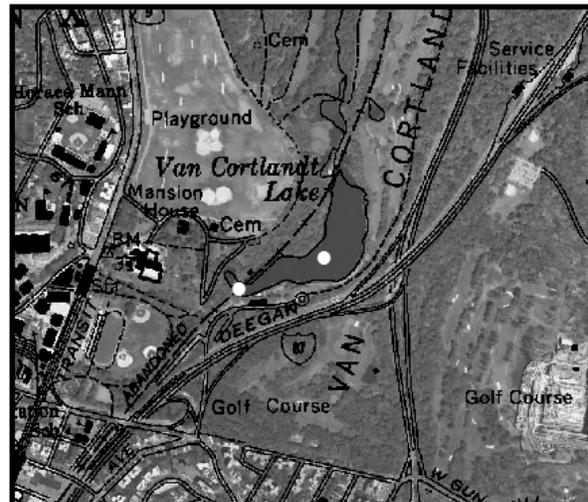
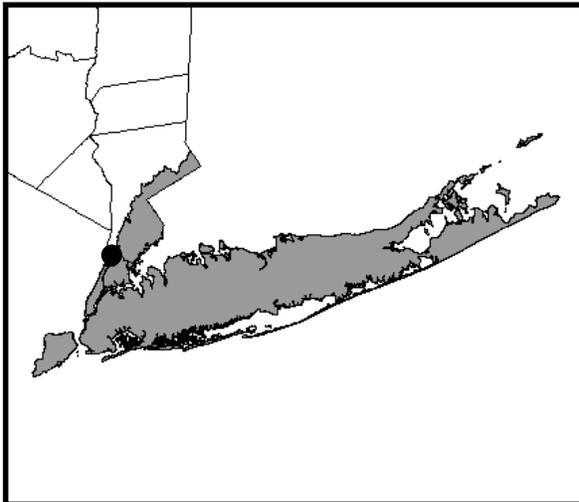
LCI Lake Water Quality Summary

General Lake Information

Lake Name:	Van Cortlandt Lake
Location:	Van Cortlandt Park, Bronx, New York
Basin:	Atlantic Ocean/ Long Island Sound
Size:	5.2 hectares (= 13 acres)
Lake Origins:	man-made in 1690s
Major Tributaries:	Tibbets Brook
Lake Tributary to?:	Harlem River via underground drainage
Water Quality Classification:	B (best intended use: primary contact recreation)
Sounding Depth:	2.0 meters (= 5.5 feet)
Sampling Coordinates:	Latitude: 40.8902, Longitude: -73.89054 (June and July) Latitude: 40.8894, Longitude: -73.8931(August and Sept.)
Sampling Access Point:	Van Cortlandt Park Golf Course Parking Area
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Dates:	6/23, 7/20, 8/19 & 9/23/2009
Samplers:	David Newman, NYSDEC Division of Water, Albany Scott Kishbaugh, NYSDEC Division of Water, Albany Steven Finnemore, NYSDEC Division of Water, Albany
Contact Information:	Scott Kishbaugh, NYSDEC Division of Water sakishba@gw.dec.state.ny.us ; 518-402-8282

Lake Map

(sampling location marked with a circle)



Background and Lake Assessment

Van Cortlandt Lake is the largest freshwater lake in the Bronx. It is situated in Van Cortlandt Park near the golf course's club house. The lake is used by local area residents for shoreline fishing and the park has a public golf course, hiking trails, and athletic fields. The lake is at the northern edge of the Bronx with the area surrounding the park being highly urbanized, although portions of the park itself are forested.

Van Cortlandt Lake was sampled through the NYSDEC Division of Water's intensive (summer monthly) Lake Classification and Inventory Survey (LCI) program in 2009. The lake was selected for inclusion for 2009 due to historic water quality issues at the lake. The lake was listed in the 2000 Atlantic Ocean/ Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List as an *Impacted Segment* due to nutrients enrichment, algal blooms, silt and sedimentation problems and dense stands of rooted aquatic vegetation. Starting in the fall of 2001 a restoration project was initiated at the lake to remove sediment from the lake bottom as well limiting sediment flowing into the lake via storm water inlets. The lake was sampled in August 1981 as part of an EPA and NYC study of the lake.

Van Cortlandt Lake can be characterized as a *eutrophic*, or a highly productive lake. The phosphorus readings (TSI = 70, typical of *eutrophic* lakes) are higher than expected given the water clarity readings (TSI = 59, typical of *eutrophic* lakes) and the chlorophyll *a* readings (TSI= 56, typical of *eutrophic* lakes). These data suggest that phosphorus readings would have to be reduced by at least 50% before seeing a discernible effect on water clarity and chlorophyll *a* (algae). This also indicates that phosphorus might not be limiting algae growth in the lake. The 1981 study found data similar (total phosphorus = 0.13 mg/l, NO_x = 0.1 mg/l, total nitrogen = 1.4 mg/l) to that measured in 2009.

These data indicate that algal blooms were not consistently occurring during the 2009 sampling season, but that baseline nutrient levels may support persistent blooms.

The water appeared to be brown, rather than green, due to high turbidity in the lake. Secchi disk readings were less than one meter in June and August and less than 2 meters in July. Rooted aquatic plants were visible near the shore of several sections of the lake. The low water clarity precludes the growth of many submergent plants. The composition of the plant community is typical of those in the region, comprised of floating leaf plants (spatterdock, and yellow water lily) and submergent plants (western waterweed). No exotic aquatic plants were observed.

Like most shallow lakes, Van Cortlandt Lake does not exhibit thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are established. Temperature and dissolved oxygen readings are comparable through the water column. pH readings indicate slightly alkaline water which is typical of lakes with high algae levels. Conductivity readings indicate hard water (high ionic strength) and are typical for lakes in urbanized watersheds.

The lake appears to be typical of shallow hardwater lakes in urbanized watersheds. Other lakes with similar water quality characteristics often support warmwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program. Due to a lack of deep cold oxygen rich water, coldwater fisheries would not be supported.

Nitrogen and phosphorus levels were highly elevated, making it difficult to determine which nutrient is limiting. It is likely that phosphorus limits algae growth when phosphorus readings are below 50 parts per billion, but other factors, including nitrogen, may limit algae growth at higher nutrient levels. Chloride, sodium, and iron were also highly elevated indicating significant impacts from stormwater runoff through developed areas. It is not known if this results in any ecological impacts.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Van Cortlandt Lake is not classified for use as a potable water supply. Although the LCI data are not sufficient to evaluate potable water use, these data suggest that the lake water would require substantial treatment to serve as potable water supply, due to the high levels of algae and ions in the water column.

Contact Recreation (Swimming)

Van Cortlandt Lake is classified for contact recreation- swimming and bathing- although it is not believed that these uses are presently supported. Bacteria data are needed to evaluate the human health safety of the lake for swimming- these are not collected through the LCI. The data collected through the LCI indicate that swimming may be impaired by excessive algae, and poor water clarity. Water clarity readings are regularly below the state DOH guidance (= 1.2) to protect the safety of swimmers. Any future use of the lake for contact recreation would probably require management of nutrient source and reduction of algae levels and sediment inputs to provide safe and aesthetically acceptable swimming conditions.

Non-Contact Recreation (Boating and Fishing)

The lake currently does not support any boating at this time. Access to the lake for boats is precluded, although the lake may support non-power boating. The lake does currently support shore-line fishing, although angling may be affected by shoreline surface rooted plant growth (mostly lilies). However, this cannot be evaluated through the program.

Aquatic Life

High nutrient, chloride, and metal levels observed in the lake during the summer may affect some aquatic organisms (floating and benthic). Additional biological studies would need to be conducted to evaluate aquatic life impacts from these stressors.

Aesthetics

These data indicate that aesthetics may be threatened by low water clarity, although it is unlikely that these conditions affect the existing uses of the lake and surrounding park.

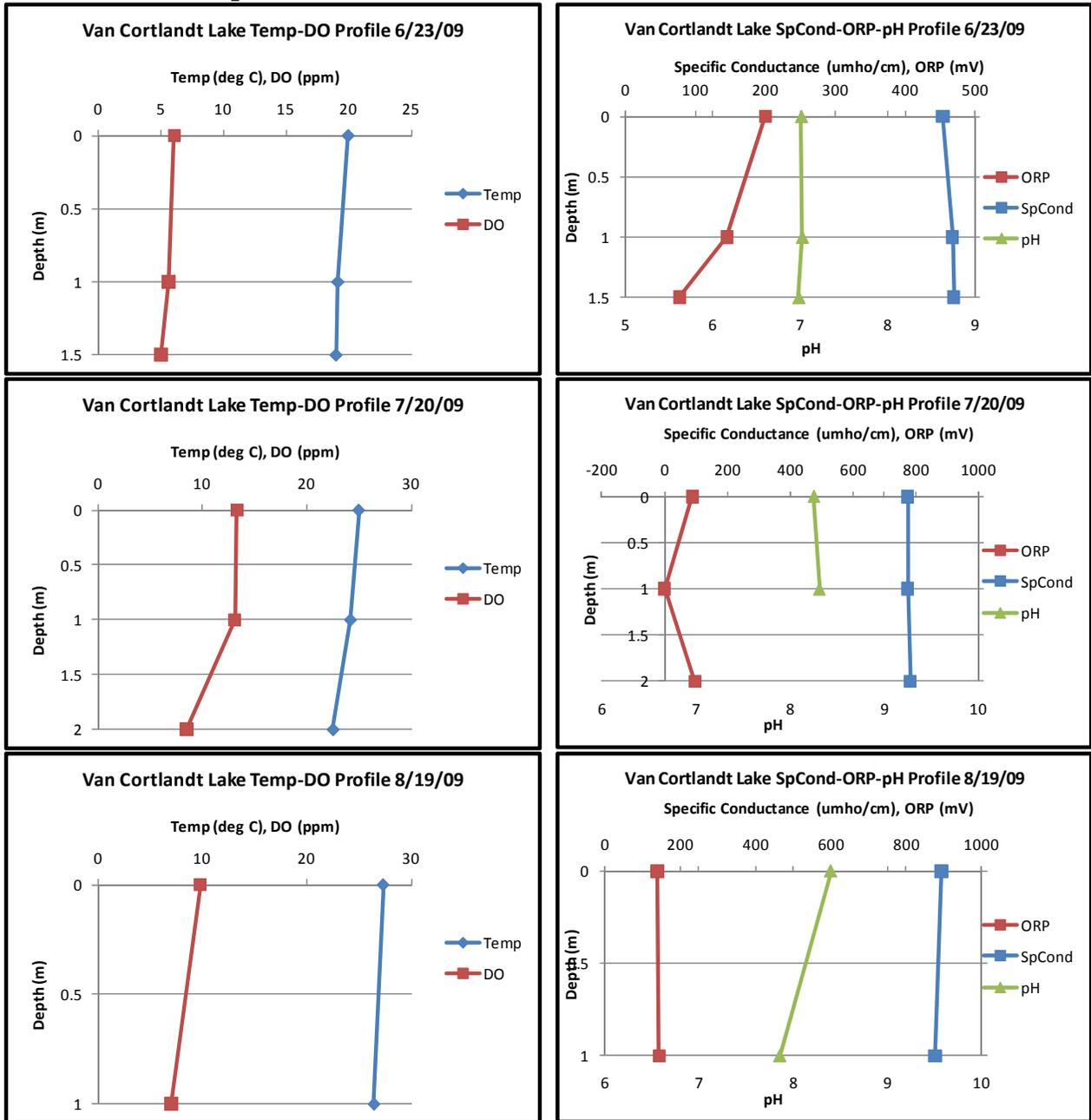
Additional Comments

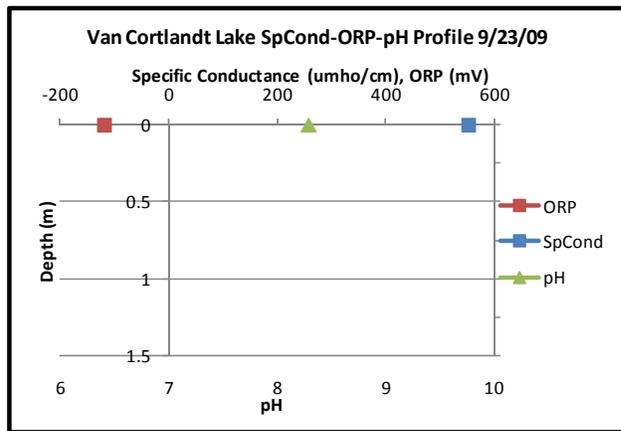
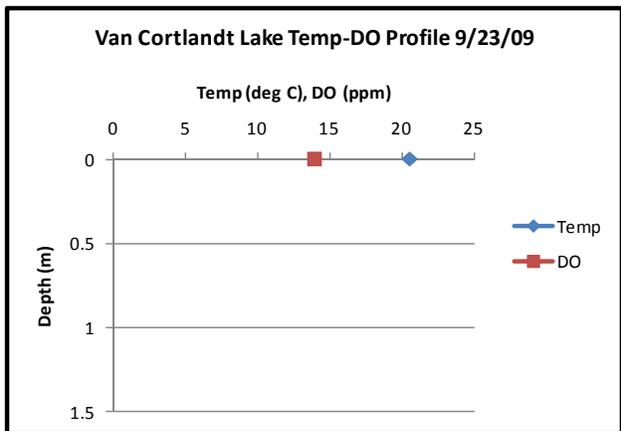
1. The 2009 LCI and the 1981 data show similar water quality conditions, indicating that these data represent normal conditions in Van Cortlandt Lake.
2. Any master planning for the Van Cortlandt Park should evaluate whether existing or future water quality conditions can support contact recreation or more active use of the lake. Any plans for using the lake for contact recreation should include bacteria monitoring to determine the relative safety of the lake for these uses. For logistic reasons, this sampling is not conducted through the LCI, but regular bacteria monitoring could be conducted by park staff at a local certified laboratory.
3. Algae identification would determine if the lake may suffer from harmful algal blooms (HABs) and/or the production of algal toxins. An algae sample was collected for this purpose at the Lake in August, but the results have not been provided to the NYSDEC.
4. Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.

Aquatic Plant IDs

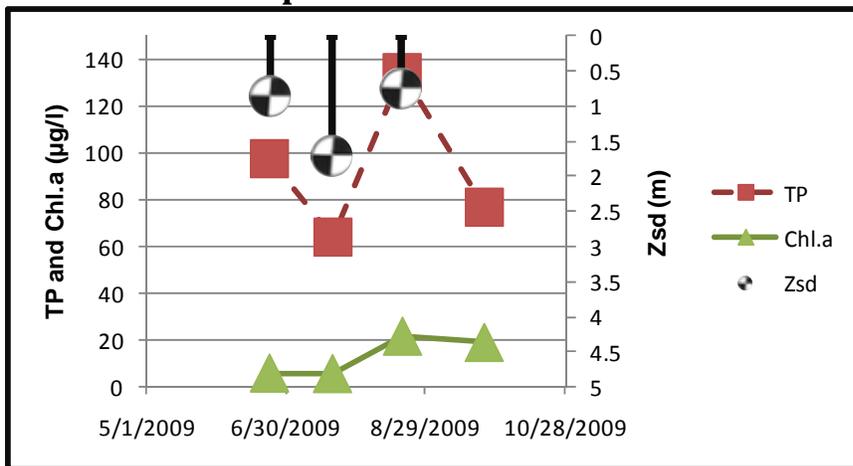
Exotic Plants: None observed
 Native Plants: *Nuphar sp.* (yellow water lily)
Nymphaea sp (spatterdock)
Elodea nuttali (western waterweed)

Time Series: Depth Profiles





Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	3	0.75	1.1	1.7	Eutrophic	67% of readings violate DOH guidelines
TSI-Secchi			64.1	58.6	52.4	Eutrophic	No pertinent water quality standards
TP	mg/l	4	0.0641	0.0931	0.134	Eutrophic	100% of readings violate DOH guidelines
TSI-TP			64.1	69.5	74.7	Eutrophic	No pertinent water quality standards
TSP	mg/l	4	0.0231	0.0307	0.0391	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	4	0.0137	0.2351	0.67	Elevated nitrate	No readings violate DOH guidance value
NH4	mg/l	4	0.042	0.126	0.252	Potentially high ammonia	No readings violate DOH guidance value
TKN	mg/l	4	0.52	0.86	1.16	Elevated organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	4	20.58	26.07	34.87	Nutrient Limitation Unclear	No pertinent water quality standards
CHLA	ug/l	4	5.9	13.28	21.9	Eutrophic	No pertinent water quality standards
TSI-CHLA			48.0	56.0	60.9	Eutrophic	No pertinent water quality standards
Alkalinity	mg/l	4	84	100.3	110	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	4	10	22.5	35	Weakly Colored	No pertinent water quality standards
TOC	mg/l	4	4.7	5.6	6.5		No pertinent water quality standards
Ca	mg/l	4	31.3	37.7	41.7	Strongly Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	4	0.512	1.065	1.8	Taste or odor likely	100% of readings violate DOH guidelines
Mn	mg/l	4	0.0655	0.119	0.179		No readings violate DOH guidance value
Mg	mg/l	4	9.73	13.38	14.9		No readings violate DOH guidance value
K	mg/l	4	3.61	4.47	5.59		No pertinent water quality standards
Na	mg/l	4	68.6	84.73	91.9		100% of readings violate DOH guidelines
Cl	mg/l	4	127	156.5	171	Significant road salt runoff	No readings violate DOH guidance value
SO4	mg/l	4	14.7	18.23	21.5		No readings violate DOH guidance value

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
WQ Assessment	1-5, 1 best	4	3	3.75	4	High Algae Levels	No pertinent water quality standards
Weed Assessment	1-5, 1 best	4	2	2.75	3	Plants Grow to Lake Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	4	3	3.75	4	Substantially Impaired	No pertinent water quality standards

Legend Information

General Legend Information

Surface Samples	= integrated sample collected in the first 2 meters of surface water
N	= number of samples
SECCHI	= Secchi disk water transparency or clarity - measured in meters (m)
TSI-SECCHI	= Trophic State Index calculated from Secchi, = $60 - 14.41 * \ln(\text{Secchi})$

Laboratory Parameters

ND	= Non-Detect, the level of the analyte in question is at or below the laboratory's detection limit
TP	= total phosphorus- milligrams per liter (mg/l) Detection limit = 0.003 mg/l; NYS Guidance Value = 0.020 mg/l
TSI-TP	= Trophic State Index calculated from TP, = $14.42 * \ln(\text{TP} * 1000) + 4.15$
TSP	= total soluble phosphorus, mg/l Detection limit = 0.003 mg/l; no NYS standard or guidance value
NOx	= nitrate + nitrite nitrogen, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 10 mg/l
NH4	= total ammonia, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 2 mg/l
TKN	= total Kjeldahl nitrogen (= organic nitrogen + ammonia), mg/l Detection limit = 0.01 mg/l; no NYS standard or guidance value
TN/TP	= Nitrogen to Phosphorus ratio (molar ratio), = $(\text{TKN} + \text{NOx}) * 2.2 / \text{TP}$ > 30 suggests phosphorus limitation, < 10 suggests nitrogen limitation
CHLA	= chlorophyll <i>a</i> , micrograms per liter ($\mu\text{g/l}$) or parts per billion (ppb) Detection limit = 2 $\mu\text{g/l}$; no NYS standard or guidance value
TSI-CHLA	= Trophic State Index calculated from CHLA, = $9.81 * \ln(\text{CHLA}) + 30.6$
ALKALINITY	= total alkalinity in mg/l as calcium carbonate Detection limit = 10 mg/l; no NYS standard or guidance value
TCOLOR	= true (filtered or centrifuged) color, platinum color units (ptu) Detection limit = 5 ptu; no NYS standard or guidance value
TOC	= total organic carbon, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value
Ca	= calcium, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value
Fe	= iron, mg/l Detection limit = 0.1 mg/l; NYS standard = 0.3 mg/l
Mn	= manganese, mg/l Detection limit = 0.01 mg/l; NYS standard = 0.3 mg/l
Mg	= magnesium, mg/l Detection limit = 2 mg/l; NYS standard = 35 mg/l
K	= potassium, mg/l Detection limit = 2 mg/l; no NYS standard or guidance value
Na	= sodium, mg/l Detection limit = 2 mg/l; NYS standard = 20 mg/l
Cl	= chloride, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l
SO4	= sulfate, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l

Field Parameters

Depth	= water depth, meters
Temp	= water temperature, degrees Celsius
D.O.	= dissolved oxygen, in milligrams per liter (mg/l) or parts per million (ppm) NYS standard = 4 mg/l; 5 mg/l for salmonids
pH	= powers of hydrogen, standard pH units (S.U.)

