Pride Lake Water Quality Investigation

Scott County Park, Scott County Iowa

Fall 2019 to Fall 2021

INTRODUCTION:

Partners of Scott County Watersheds (PSCW) in conjunction with the Scott County Conservation Department initiated a study in 2019 to determine the water quality coming into and within Pride Lake. Pride Lake is located in Scott County Park in central Scott County, and is part of the Scott County Conservation Department park system (see Figure 1 for Pride Lake location). The purpose of the study was to determine issues which may be impacting Pride Lake, as to best manage the lake and prolong its lifespan.

Figure 1: Pride Lake Site Location

Image Courtesy USGS 2018 Eldridge Quadrangle 7.5 Minute Series Topographic Map

The methodology chosen for investigation was to duplicate the field sampling efforts utilized by PSCW in the annual county-wide water quality snapshots. This methodology includes using kits, test strips and equipment to determine concentrations of phosphorus (as orthophosphate), chloride, nitrate, nitrite, dissolved oxygen, pH, water temperature and transparency. This methodology allows for affordable repeatable analysis, and while not as accurate as laboratory or meter derived analysis, offers a fairly reasonable sense of trends and concentrations. PSCW staff trained Scott County Conservation Department staff on how to collect samples and analyze the samples utilizing the field methodology.

Initially nine sample sites were chosen for monthly collection. It was determined that samples would be collected from April to October each year for a period of 2 years. Figure 2 on the following page indicates the locations of the sample sites. The following is a descriptive list of the sample sites:

- 982092: a historic PSCW snapshot site located on Glynns Creek and 220th Avenue, upstream of the lake.
- SPC -PL1: Glynns Creek inflow into lake, downstream of 982092
- SPC-PL2: a sediment trap located on the southwest corner of lake, fed by an unnamed stream that comes in from Parkview
- SPC-PL3: lake outflow structure
- SPC-PL4: mid section of lake, discontinued after 2020 due to sampling logistics
- SPC-PL5: upstream of sediment pond on unnamed stream from Parkview, within park boundary
- SPC-PL6: inflow from small unnamed tributary flowing from east
- SPC-S1: Glynns Creek downstream of lake, discontinued after 2020 due to sampling logistics
- SPC-S2: unnamed Parkview stream at 220th Avenue

Figure 2: Pride Lake Sampling Locations

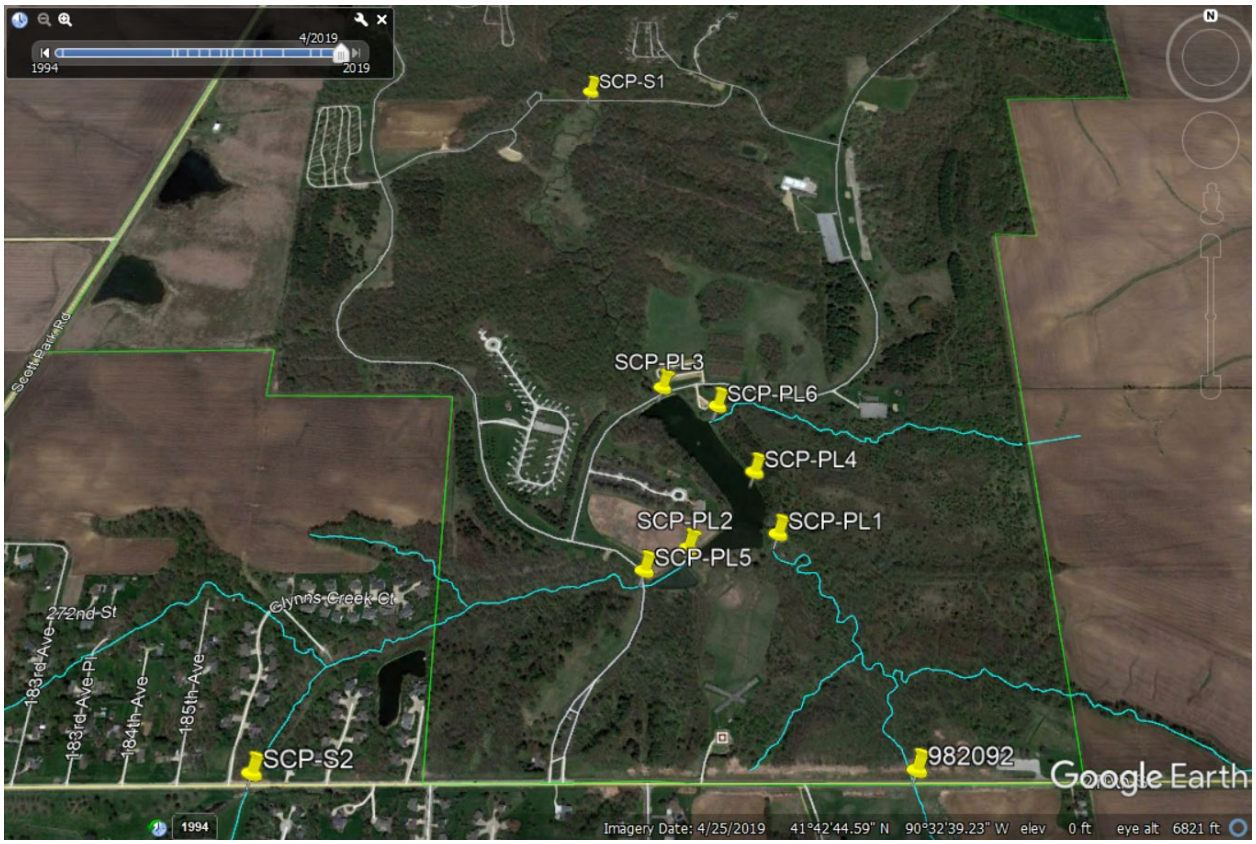


Image courtesy of Google Earth

RESULTS:

Site 982092 – The mean transparency is 19 cm, with lows of below 10 cm encountered initially. The transparency trend appears somewhat stable, but the mean is less than the desired 30 cm. The nitrate mean is 4 mg/L (milligrams per Liter or parts per million), with a range of 0 to 5 mg/L. There is no maximum contaminant level (MCL) for nitrate for protection of aquatic wildlife or prevention of excess vegetation, but the drinking water standard in Iowa is 10 mg/L. The concentration of nitrate in a water body that would lead to excess vegetation and eutrophication is very site specific, so in general, the goal is for low concentrations with a declining or stable trend. The nitrite mean is 0 mg/L. Phosphorus averaged 0.45 mg/L, above the generally accepted rule of thumb of 0.1 mg/L for prevention of excess vegetation. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. Dissolved oxygen (DO) averaged 6 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat. Although the trend is stable; there were a few instances of DO at the 5 mg/L concentration. No anomalous temperatures were observed, and chloride was essentially at the non detection concretion.

Site SPC-PL1 - The mean transparency is 27 cm, with lows of below 10 cm encountered initially. The transparency trend appears downward, and the mean is less than the desired 30 cm. The nitrate mean is 3.5 mg/L, with a range of 0 to 5 mg/L. The nitrite mean was 0.04 mg/L, there is no MCL for nitrate for prevention of excess vegetation or aquatic habitat, but the drinking water MCL is 1 mg/L. Phosphorus averaged 0.27 mg/L, above the generally accepted rule of thumb of 0.1 mg/L for prevention of excess vegetation. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. DO averaged 7 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat. Although the trend is stable; there was one instance of a reading of 4 mg/L. No anomalous temperatures were observed, and chloride was essentially at the non detection concentration.

Site SPC-PL2 - The mean transparency is 31 cm, with lows of below 10 cm encountered initially. The transparency trend appears upward, and the mean just above the desired 30 cm. The nitrate mean is 0.3 mg/L, with most readings at 0 mg/L. The nitrite mean is 0 mg/L. Phosphorus averaged 0.18 mg/L, but most readings were 0 mg/L. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. DO averaged 7 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat, although the trend is stable; there were a few instances of DO at the 5 mg/L concentration. No anomalous temperatures were observed. The mean chloride concentration is 55 mg/L with an upward trend. The acute MCL for chloride is 629 mg/L, and the chronic MCL is 389 mg/L, while the drinking water MCL is 250 mg/L.

Site SPC-PL3 - The mean transparency is 46 cm, with an apparent upward trend. The nitrate mean is 1.2 mg/L, with most readings at 0 mg/L. The nitrite mean is 0.05 mg/L. Phosphorus averaged 0.09 mg/L, below the generally accepted rule of thumb of 0.1 mg/L for prevention of excess vegetation, but most readings were 0 mg/L. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. The mean DO was 8 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat. There were two instances of DO at 3 mg/L. No anomalous temperatures were observed. The mean chloride concentration is 36 mg/L, with a few actual detections, although there appears to be a stable trend.

Site SPC-PL5 - The mean transparency is 32 cm, with an apparent stable trend. The nitrate mean is 0.7 mg/L, with most readings at 0 mg/L. The nitrite mean is 0.1 mg/L, with most readings at zero. Phosphorus averaged 0.3 mg/L, but most readings were 0 mg/L. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. DO averaged 6 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat, although there were two instances of DO below 5 mg/L. No anomalous temperatures were observed. The mean chloride concentration is 78 mg/L with an upward trend.

Site SPC-PL6 - The mean transparency is 39 cm, with an apparent stable trend. The nitrate mean is 1 mg/L, with most readings at 0 mg/L. The nitrite mean is 0.03 mg/L, with most readings at zero. Phosphorus averaged 0.01 mg/L, with most readings at 0 mg/L. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. DO averaged 6 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat, although there were three instances of DO below 5 mg/L. No anomalous temperatures were observed, and chloride was essentially at the non detection concentration.

Site SPC-S2 - The mean transparency is 43 cm, with an apparent stable trend. The nitrate mean is 0.4 mg/L, with most readings at 0 mg/L. The nitrite mean is 0 mg/L. Phosphorus averaged 0.2 mg/L, with

most readings at 0 mg/L. The pH mean is 8, within the range of 6-9 suitable for aquatic habitat. DO averaged 6 mg/L, within the 5 to 12 mg/L range suitable for aquatic habitat, although there were three instances of DO below 5 mg/L. No anomalous temperatures were observed. The mean chloride concentration is 132 mg/L with an upward trend.

The data summary table for the sites and associated parameters is included as Attachment A. Photos of each sample site are included in Attachment B.

DISCUSSION:

There were some limitations to the investigation. Sampling in the middle of the lake was not feasible given time constraints, so parameter concentrations in that area and in the subsurface near the lake bottom are a missing component.

Regarding nutrients such as nitrate and phosphorus, it appears the Glynns Creek is the dominant source coming into the lake. The unnamed tributary from Parkview does not seem to be a significant source of nitrate/nitrite, and the sediment basin on that stream appears to be having some effect on phosphorus concentrations, although the mean still exceeds the 0.1 mg/L target. While nutrients may be flowing in from the east tributary (Site PL6) the small wetland/pond that has formed in the sample area may be acting as a nutrient sink, as excess vegetation has been noted frequently at this location, indicating the nutrients are being utilized prior to entering the lake. Of note are the lower mean concentrations of nutrients at the lake outflow, likely either from dilution or these nutrients being used by the lake ecosystem or deposition.

Dissolved oxygen levels in the streams and lake appear within acceptable ranges, with occasional concentrations below 5 mg/L. Currently there is not a trend from the inflow streams that is of concern, but DO levels within the lake still need to be determined, which was outside the scope of this study. It is likely that the lake experiences thermal stratification and layered DO levels like similar water bodies across Iowa.

Temperature and pH levels are within optimal ranges and do not indicate a concern at this time.

Transparency is a way to indicate how “dirty” the water is, how much material is suspended, either organic or inorganic. The lower the number, the more turbid the water is. Glynns Creek appears to be the dominant source for water that has greater suspended materials, which is general indication of how much the water is likely to be transporting sediments. The unnamed Parkview tributary does not appear to be a significant source of sediments, although it is difficult to determine the effectiveness of the sediment pond at this time. Pride Lake outflow transparency readings are generally higher than inflow readings, likely indicating that sediments from the inflow streams are dropping out in the lake. This is to be expected in such a hydrologic setting. In early 2021 the Iowa DNR conducted a bathymetric survey of Pride Lake, which is provided in Attachment C.

Chloride was essentially non detect in the Glynns Creek and east tributary. Chloride is generally indicative of road salt application, and during non winter months is not detected due to the mobility of the chloride ion in water. However, the Pride Lake outflow location had four low level detections. The unnamed Parkview tributary appears to be the source for chloride entering the lake. All three sample points on this stream had detectable concentrations and increasing trends. The highest concentrations were observed at sample point S2, adjacent to 220th Ave. In addition, one sample was collected in August 2021, further upstream of S2, and yielded a concentration of 211 mg/L. These chloride concentrations are not typical of non winter concentrations in rural/suburban streams around the county. The only comparable streams with similar concentrations are in the central urbanized parts of Bettendorf and Davenport. It does not appear that these high concentrations from Parkview are from historic road salt use, but further investigation would be conducted to know for sure. Also of concern are the summer 2021 samples still indicating high concentrations, even though a drought was occurring. This means that baseflow concentrations (groundwater inputs into the stream) have high chloride concentrations, as no surface runoff was occurring. Possible sources could be unknown buried trash/refuse in the stream watershed, sanitary sewer exfiltration near the stream, a large dissolved phase chloride plume in the groundwater from historic road salt use, human/animal wastes, or chlorine discharges from residents. Currently there is not enough data to determine why chloride concentrations are atypically high in such a small suburban stream.

RECOMMENDATIONS:

The purpose of the study was to determine issues which may be impacting Pride Lake, as to best manage the lake and prolong its lifespan. As such the following recommendations are proposed:

1) Further investigation into the chloride concentrations in the unnamed Parkview tributary is warranted. While nutrient concentrations and sediment from this stream are not a current concern, the unknowns regarding the chloride issue may be impacting the lake ecosystem.

2) Glynns Creek is the dominant source of nutrients and sediment into the lake. While the SPC-PL1 location appears to be acting as a small sediment basin/water control structure, nutrients and turbid water ware making their way into the lake. Additional best management practices in the SPC-PL1 location or on the portion of Glynns Creek within Scott County Park could be implemented, including but not limited to expansion of constructed wetlands, floating treatment islands, and/or erosion control.

3) Dissolved oxygen levels within the lake, as mentioned above, likely follow similar stratification patterns as other Iowa lakes. With the influx of phosphorus and sediment into the system, the internal phosphorus loading will likely be an issue in the future for the lake, if not already. When stratification occurs, DO levels drop near the lake bottom, and release of phosphorus trapped in sediments occurs, leading to an excess of this important nutrient, and hence a large increase in emergent and floating aquatic vegetation. It is recommended to consider a system to circulate/add DO to the lake to help prevent this occurrence, as well as lower the risk of fish kills due to low DO conditions.

4) The bathymetric survey conducted by the Iowa DNR will be useful in determining sediment movement and deposition. It is recommended that further surveys are conducted to compare to the 2021 survey, and if available, to compare to lake as-built conditions.

PSCW is happy to discuss the study results further if required, and will participate in assisting Scott County with any of the recommendations listed above.

Steve Gustafson, PG, ICGP
Vice Chair
Partners of Scott County Watersheds

Acknowledgments:

Thank you to Scott County Conservation Staff Roger Kean, Marc Miller, Erik Johnson, Brad Taylor, Tanner Rickertsen, David Ong, Jim Graham, former PSCW coordinator Cassie Druhl and current PSCW Coordinate Kelsi Denoyer. Without their assistance and wiliness to conduct the sample collection this study would have not been possible.

ATTACHMENT A

Site Number	Description	Sample Date	Transparency (cm)	Temperature (F)	pH	Nitrite (mg/L)	Nitrate (mg/L)	Dissolved Oxygen (mg/L)	Orthophosphate (mg/L)	Chloride (mg/L)	Previous 48 hr Precip (in)	Comments	Longitude	Latitude
982092	Glynns Creek at 220th	10/21/2019	5	56	8	0	2	10	2	28	0.57		41.698491°	-90.523504°
982092	Glynns Creek at 220th	6/3/2020	3	62	8	0	5	8	1	28	0.77	taken after heavy rain		
982092	Glynns Creek at 220th	7/24/2020	5	77	9	0	5	5	0	28	0			
982092	Glynns Creek at 220th	8/20/2020	17	78	8	0	5	6	1	28	0			
982092	Glynns Creek at 220th	9/29/2020	23	59	8	0	2	8	1	28	0.73			
982092	Glynns Creek at 220th	10/19/2020	13	43	8	0	5	5	0	28	0.16			
982092	Glynns Creek at 220th	4/27/2021	44	66	8	0	5	6	0	33	0.02			
982092	Glynns Creek at 220th	6/2/2021	31	75	9	0	5	8	0	33	0			
982092	Glynns Creek at 220th	7/6/2021	25	68	9	0	5	5	0	33	0			
982092	Glynns Creek at 220th	8/3/2021	22	68	9	0	5	5	0	33	0			
982092	Glynns Creek at 220th	9/9/2021	28	82	9	0	0	6	0	33	0			
SCP-PL1	Glynns Creek inflow into Lake	10/21/2019	3	54	7	0	5	10	2	28	0.57		41.702729°	-90.526364°
SCP-PL1	Glynns Creek inflow into Lake	6/3/2020	4	80	8	0	5	8	1	28	0.77	taken after heavy rain		
SCP-PL1	Glynns Creek inflow into Lake	7/24/2020	32	66	9	0.15	5	6	0	29	0			
SCP-PL1	Glynns Creek inflow into Lake	8/20/2020	56	86	9	0.3	2	10	0	28	0			
SCP-PL1	Glynns Creek inflow into Lake	9/29/2020	30	57	8	0	5	10	0	28	0.73			
SCP-PL1	Glynns Creek inflow into Lake	10/19/2020	29	43	6	0	2	6	0	28	0.16			
SCP-PL1	Glynns Creek inflow into Lake	4/27/2021	42	72	9	0	5	6	0	28	0.02			
SCP-PL1	Glynns Creek inflow into Lake	6/2/2021	36	72	8	0	5	4	0	33	0			
SCP-PL1	Glynns Creek inflow into Lake	7/6/2021	35	70	9	0	5	8	0	33	0			
SCP-PL1	Glynns Creek inflow into Lake	8/3/2021	12	66	9	0	0	6	0	33	0			
SCP-PL1	Glynns Creek inflow into Lake	9/9/2021	20	68	9	0	0	8	0	33	0			
SCP-PL2	Sed Pond outflow into Lake	10/21/2019	2	53	7	0	2	6	1	28	0.57		41.702462°	-90.528537°
SCP-PL2	Sed Pond outflow into Lake	6/3/2020	4	79	8	0	1	5	1	28	0.77	taken after heavy rain		
SCP-PL2	Sed Pond outflow into Lake	7/24/2020	60	68	NT	NT	NT	5	0	NT	0			
SCP-PL2	Sed Pond outflow into Lake	8/20/2020	18	81	8	0	0	5	0	58	0	drying up, dead fish		
SCP-PL2	Sed Pond outflow into Lake	9/29/2020	22	59	8	0	0	10	0	58	0.73			
SCP-PL2	Sed Pond outflow into Lake	10/19/2020	29	43	7	0	0	6	0	41	0.16			
SCP-PL2	Sed Pond outflow into Lake	4/27/2021	33	77	9	0	0	8	0	94	0.02			
SCP-PL2	Sed Pond outflow into Lake	6/2/2021	34	86	9	0	0	8	0	85	0			
SCP-PL2	Sed Pond outflow into Lake	7/6/2021	60	79	9	0	0	6	0	30	0			
SCP-PL2	Sed Pond outflow into Lake	8/3/2021	60	79	9	0	0	8	0	85	0			
SCP-PL2	Sed Pond outflow into Lake	9/9/2021	22	79	9	0	0	8	0	46	0	water very low		
SCP-PL3	Lake outflow	10/21/2019	28	50	9	0	0	12	0	34	0.57		41.705706°	-90.529103°
SCP-PL3	Lake outflow	6/2/2020	59	28	9	0	5	10	0	28	0.77			
SCP-PL3	Lake outflow	7/24/2020	33	31	7	0.15	2	8	1	28	0			
SCP-PL3	Lake outflow	8/20/2020	40	82	7	0	0	6	0	34	0			
SCP-PL3	Lake outflow	9/29/2020	60	57	8	0.3	0	10	0	28	0.73			
SCP-PL3	Lake outflow	10/19/2020	60	48	7	0.15	0	8	0	28	0.16			
SCP-PL3	Lake outflow	4/27/2021	44	77	9	0	5	8	0	53	0.02			
SCP-PL3	Lake outflow	6/2/2021	60	77	8	0	1	3	0	46	0			
SCP-PL3	Lake outflow	7/6/2021	55	84	9	0	0	10	0	46	0			
SCP-PL3	Lake outflow	8/3/2021	45	77	9	0	0	3	0	33	0			
SCP-PL3	Lake outflow	9/9/2021	30	77	9	0	0	8	0	46	0			
SCP-PL4	Middle of Lake	10/21/2019	22	50	8	0	0	10	0	30	0.57		41.703943°	-90.526851°
SCP-PL4	Middle of Lake	6/2/2020	55	82	9	0.15	5	10	0	28	0.77			
SCP-PL4	Middle of Lake	7/24/2020	49	88	9	0.15	2	8	0	28	0			
SCP-PL4	Middle of Lake	8/20/2020	42	82	8	0	0	10	0	54	0			
SPC-PL5	Upstream of Sed Pond	10/21/2019	10	53	7	0	0	10	2	40	0.57		41.702041°	-90.529598°
SCP-PL5	Upstream of Sed Pond	6/3/2020	11	70	8	0	5	5	1	41	0.77	taken after heavy rain		
SCP-PL5	Upstream of Sed Pond	7/24/2020	55	72	9	NT	NT	4	0	NT	0			
SCP-PL5	Upstream of Sed Pond	8/20/2020	17	72	8	0	0	3	0	99	0			
SCP-PL5	Upstream of Sed Pond	9/29/2020	60	57	9	0	0	8	0	78	0.73			
SCP-PL5	Upstream of Sed Pond	10/19/2020	44	41	8	0	0	5	0	41	0.16			
SCP-PL5	Upstream of Sed Pond	4/27/2021	45	72	9	0	0	6	0	94	0.02			
SCP-PL5	Upstream of Sed Pond	6/2/2021	48	73	8	0	2	6	0	94	0			
SCP-PL5	Upstream of Sed Pond	7/6/2021	13	77	9	1	0	8	0	114	0			
SCP-PL5	Upstream of Sed Pond	8/3/2021	19	66	9	0	0	5	0	104	0			
SCP-PL5	Upstream of Sed Pond	9/9/2021										no water		
SCP-PL6	East trib pre Lake inflow	10/21/2019	19	55	7	0	0	8	1	28	0.57		41.705310°	-90.527704°
SCP-PL6	East trib pre Lake inflow	6/2/2020	58	82	9	0.15	5	10	0	28	0.77			
SCP-PL6	East trib pre Lake inflow	7/24/2020	45	77	9	0.15	2	8	0	28	0			
SCP-PL6	East trib pre Lake inflow	8/20/2020	30	82	7	0	0	8	0	28	0			
SCP-PL6	East trib pre Lake inflow	9/29/2020	46	52	7	0	0	8	1	28	0.73			
SCP-PL6	East trib pre Lake inflow	10/19/2020	44	32	6	0	0	4	0	28	0.16			
SCP-PL6	East trib pre Lake inflow	4/27/2021	49	75	9	0	2	10	0	28	0.02			
SCP-PL6	East trib pre Lake inflow	6/2/2021	42	77	9	0	1	3	0	33	0			
SCP-PL6	East trib pre Lake inflow	7/6/2021	60	81	9	0	1	6	0	33	0			
SCP-PL6	East trib pre Lake inflow	8/3/2021	33	73	9	0	0	5	0	33	0			
SCP-PL6	East trib pre Lake inflow	9/9/2021	2	70	8	0	0	3	0	39	0	algea covered		
SCP-S1	Downstream of Lake (Cody)	10/21/2019	38	50	8	0	0	10	0	34	0.57		41.713119°	-90.531110°
SCP-S1	Downstream of Lake (Cody)	6/2/2020	60	77	9	0.15	5	5	0	28	0.77	is now Cody Lake		
SCP-S1	Downstream of Lake (Cody)	7/24/2020	45	84	9	0	0	8	0	28	0			
SCP-S1	Downstream of Lake (Cody)	8/20/2020	60	79	8	0	0	5	0	28	0			
SCP-S2	Parkview trib on 220th	10/21/2019	29	58	7	0	0	10	1	61	0.57		41.698593°	-90.538219°
SCP-S2	Parkview trib on 220th	6/2/2020	50	77	8	0	2	8	0	148	0.77			
SCP-S2	Parkview trib on 220th	7/25/2020	15	70	7	0	0	4	0	NT	0			
SCP-S2	Parkview trib on 220th	8/20/2020	NT	75	8	0	0	3	1	123	0	little water		
SCP-S2	Parkview trib on 220th	9/29/2020	52	61	9	0	0	6	NT	123	0.73			
SCP-S2	Parkview trib on 220th	10/19/2020	54	46	7	0	0	5	NT	67	0.16			
SCP-S2	Parkview trib on 220th	4/27/2021	60	68	8	0	1	8	0	136	0.02			
SCP-S2	Parkview trib on 220th	6/2/2021	33	68	7	0	0	6	0	306	0			
SCP-S2	Parkview trib on 220th	7/6/2021	22	72	9	0	1	5	0	147	0			
SCP-S2	Parkview trib on 220th	8/3/2021	60	68	9	0	0	5	0	114	0			
SCP-S2	Parkview trib on 220th	9/9/2021	60	73	9	0	0	4	0	94	0			
RW-1	Parkview trib on Shawnee Cir	8/5/2021	60	75	8	0.3	2	4	0.3	211	0	low flow	41°41'47.21"N	-90°32'18.86"W

ATTACHMENT B

982092

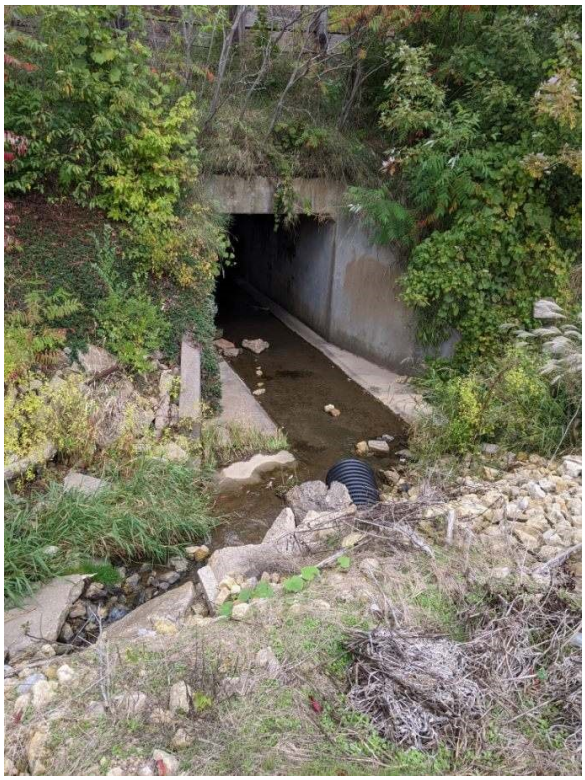
SPC-PL1

SPC-PL2

SPC-PL3

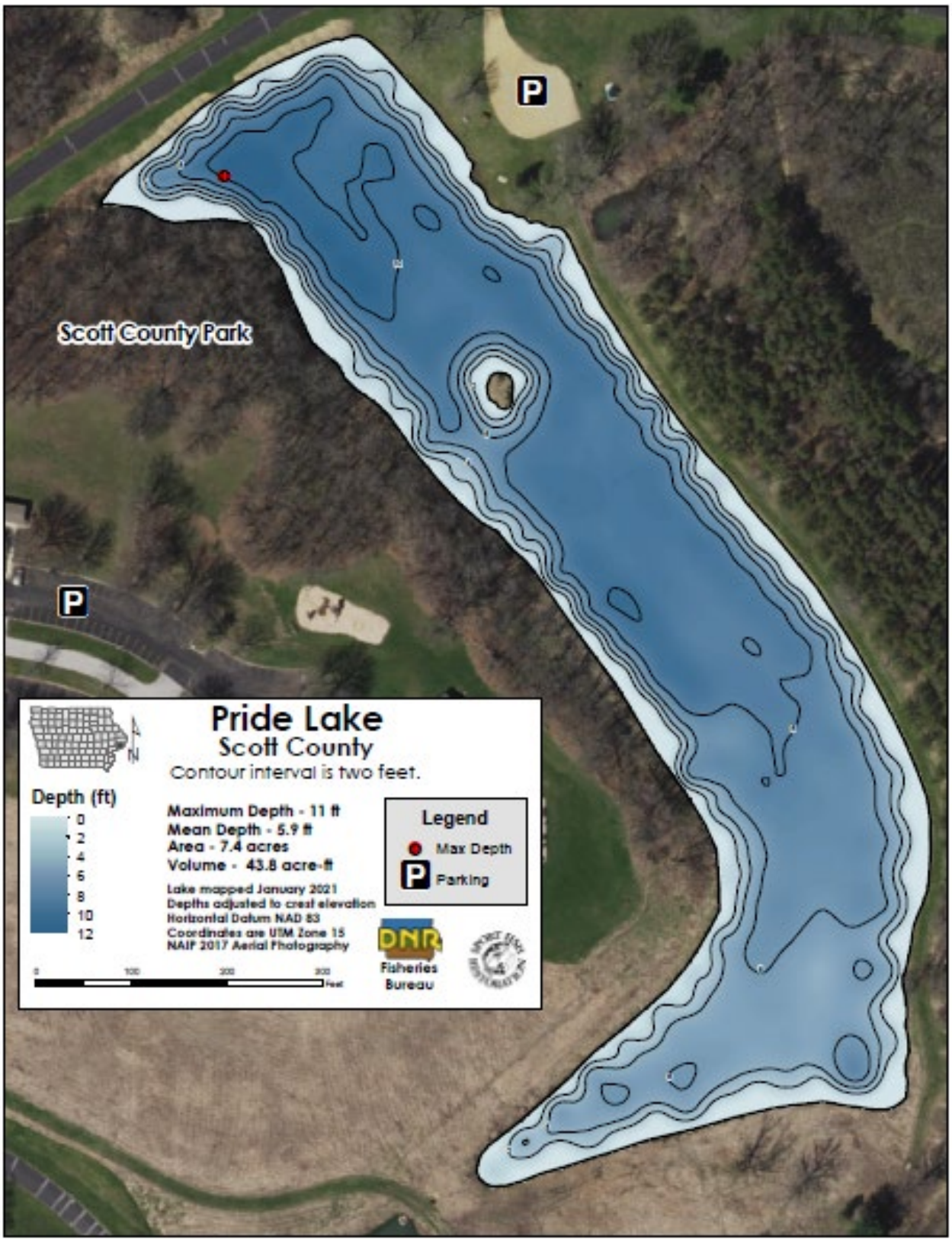
SPC-PL5

SPC-PL6



SPC-S2

ATTACHMENT C


P
Scott County Park
P
Pride Lake
Scott County
Contour interval is two feet.
Depth (ft)
0
2
4
6
8
10
12
Maximum Depth - 11 ft
Mean Depth - 5.9 ft
Area - 7.4 acres
Volume - 43.8 acre-ft
Lake mapped January 2021
Depths adjusted to crest elevation
Horizontal Datum NAD 83
Coordinates are UTM Zone 15
NAIP 2017 Aerial Photography
Legend
Max Depth
Parking
DNR
Fisheries
Bureau