SURVEY OF LAKES IN CONOCOPHILLIPS ALASKA INC. ACTIVITY AREAS – 2017

Final Report

December 2017

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1. INTRODUCTION

Between July 15 and August 21, 2017, a total of 33 lakes were sampled for fish, water depth, and water chemistry to support potential use by ConocoPhillips Alaska, Inc. as water sources for winter exploration (Figure 1). The lakes were located in the National Petroleum Reserve-Alaska (NPR-A) in the Fish/Judy Creek and Colville River drainages. For purposes of this report, lakes are grouped into 3 geographic areas:

1. Willow West (NPR-A) – 20 lakes (Figure 2 and Table 1)
2. Willow East (NPR-A) – 11 lakes (Figure 3 and Table 1)
3. Stony Hill (Colville River) – 2 lakes (Figure 4 and Table 1)

The purpose of this study was to estimate the volume of water available for winter industrial use and to document fish presence and habitat use in lakes that may be used to support operations and exploration activities.

Objectives of the study were to:

- obtain lake bathymetry and estimate water volumes for selected lakes;
- identify fish species present in selected lakes within the project areas of interest; and
- measure water chemistry parameters to assess suitability of water for potential uses.

The selected lakes may be used as sources of freshwater during exploration and development activities such as ice road and ice pad construction, potable water supply, and drilling support. Permitting decisions on water withdrawal consider potential impacts to fish that depend on an adequate water supply for surviving winter. The inventory of fish and fish habitat provides information for assisting permitting decisions regarding water use and ice road routing.

Lakes in which fish were verified as present were divided into two categories: 1) lakes containing species sensitive to habitat changes likely to be associated with water withdrawal; and 2) lakes containing species more resistant to such changes. Species sensitive to impacts of water withdrawal (such as reduced dissolved oxygen and increased dissolved solids) include lake trout, broad whitefish, least cisco and Arctic grayling; while the more resistant species are Alaska blackfish and ninespine stickleback. Alaska blackfish are particularly resistant to low dissolved oxygen and are able to use atmospheric oxygen (Armstrong 1994). Residents of the Yukon Delta have reported observing Alaska blackfish oriented along cracks in the ice during winter to use oxygen in ponds that have gone anoxic. Ninespine stickleback can also withstand low dissolved oxygen (Lewis et al. 1972), although not to the same extent as Alaska blackfish. However, ninespine stickleback can withstand higher levels of dissolved solids, and often frequent brackish nearshore waters during summer.

Regulatory agencies managing the withdrawal of surface waters on the North Slope generally adhere to similar criteria to govern maximum volumes of water and ice that may be withdrawn from fish bearing and non-fishing bearing lakes. Withdrawal of unfrozen water from lakes and the removal of ice aggregate from grounded areas ≤ 4 ft. deep may be authorized on a site-specific basis depending on water volume and depth and the waterbody's fish community. The Alaska Department of Fish and Game (ADF&G), Alaska Department of Natural Resources (ADNR) and Bureau of Land Management (BLM) (per 2013 Record of Decision (ROD) in Best Management Practice B-2) restrict water withdrawal as follows:

Water withdrawal and ice aggregate removal criteria by agency

	ADF&G (Alaska Department of Fish and Game)	ADNR (Alaska Department of Natural Resources)	BLM (Bureau of Land Management)
No fish present	No authority	Water withdrawal: up to 20% of the total lake volume Ice aggregate: Combined ice and unfrozen water shall not exceed 20% of the total lake volume	Water withdrawal: up to 35% of the total lake volume Ice aggregate: Combined ice and unfrozen water shall not exceed 35% of the total lake volume
Resistant fish species present	Water withdrawal: up to 30% of lake volume under 5 ft. of ice Ice aggregate: Combined ice and unfrozen water shall not exceed 30% of the total lake volume under 5 ft. of ice	Water withdrawal: up to 30% of lake volume under 5 ft. of ice Ice aggregate: Combined ice and unfrozen water shall not exceed 30% of the total lake volume under 5 ft. of ice	Water withdrawal: up to 30% of lake volume under 5 ft. of ice Ice aggregate: Only ice aggregate may be removed from lakes that are ≤ 5 ft. deep, Combined ice and unfrozen water shall not exceed 30% of the total lake volume under 5 ft. of ice
Sensitive fish species present	Water withdrawal: up to 15% of lake volume under 7 ft. of ice Ice aggregate: Combined ice and unfrozen water shall not exceed 15% of the total lake volume under 7 ft. of ice	Water withdrawal: up to 15% of lake volume under 7 ft. of ice Ice aggregate: Combined ice and unfrozen water shall not exceed 15% of the total lake volume under 7 ft. of ice	Water withdrawal: up to 15% of lake volume under 7 ft. of ice Ice aggregate: Only ice aggregate may be removed from lakes that are ≤ 7 ft. deep, Combined ice and unfrozen water shall not exceed 15% of the total lake volume under 7 ft. of ice

Withdrawal requests outside of the established criteria can be evaluated by regulators on a site by site basis and usually require written justification. These exceptions to the criteria can lead to additional monitoring at the requested water source.

2. METHODS

2.1. Biological Survey

The biological survey consisted of sampling with:

- gill nets for sensitive species
- minnow traps
- seines
- visual survey (with dip net sampling) for resistant species

Lakes were sampled with short-duration gill net sets (up to 9 hour total sampling effort; usually 3 nets per lake for up to 3 hours of total soak time each, unless fish were captured sooner). The gill nets were multimesh, 120-feet (ft) long, with six panels of variable mesh. Mesh size ranged from 1 to 3.5 inches stretched. These net designs have been previously used to collect inventory-level data from lakes throughout the North Slope for similar surveys. Sets were kept to a short duration to minimize the chance for entangling water birds and to minimize fish mortality. Nets were placed in habitats expected to be used by fish for feeding or for movement between feeding areas, and were removed after fish were detected. Fish captured were enumerated, measured in fork length (FL) to the nearest millimeter (mm), and released. Duration of each set was recorded to allow calculation of catch rates.

Visual surveys supplemented with dip-net sampling and/or beach seining were conducted to identify additional fish species not susceptible to gill nets. Ninespine stickleback are often observed in shallow water along the lake shore and because of their affinity for nearshore vegetation, they are vulnerable to hand-held dip nets. During the visual survey, frequent sweeps through vegetated areas were made with a small mesh dip net. The length of the visual/dip net survey was measured with a handheld GPS. If stickleback were observed, minnow traps and seines were not used.

Minnow traps were used to identify small fish species that may not have been detected by gill nets, visual surveys, or seining. Minnow traps baited with preserved salmon eggs were set at the edge of surveyed lakes in areas expected to provide cover or feeding areas for species such as Alaska blackfish, ninespine stickleback, and slimy sculpin. The traps were set and retrieved in concert with other sampling.

Sensitive fish species were found in Lake M9901 in 1999, therefore, the lake was not resampled for fish in 2017.

2.2. Water Chemistry

Water chemistry parameters were measured to assess fish habitat conditions and provide information on the suitability of lake water for industrial uses. Water chemistry measurements included surface measures of water temperature, specific conductance, pH, and turbidity. Temperature and specific conductance were *in situ* surface measurements recorded from approximately the middle of each lake with a calibrated YSI ProPlus water quality meter. A sample was returned to the field office to measure pH and turbidity. Potential hydrogen (pH) was measured with an Oakton Acorn Series 5 pH meter. Turbidity was measured with a Lamotte 2020 or equivalent turbidity meter. A water sample was sent to Pollen Environmental, LLC in Fairbanks, AK for laboratory determination of chloride, sodium, calcium, magnesium, and hardness (as $CaCO_3$).

2.3. Bathymetric Survey and Volume Calculations

Bathymetric data obtained during the survey allowed lake volume to be estimated. Location and depth were recorded at approximately 1 to 2-second intervals on a Lowrance Model HDS-7 Gen 2 integrated GPS/depth sounder. The study design was to record at least eight depth transects on each lake. Lake volume was estimated by contour mapping of depth intervals. Contour maps were prepared by plotting the position and depth data obtained by GPS on GIS base maps and plotting the contours on maps of the surveyed lakes. 1-ft depth contour intervals were plotted for lakes where the maximum depth was 10-ft or less, and 2-ft intervals were used for deeper lakes. The surface area of each contour was obtained, then volume was estimated using the formula for truncated cones:

$V = h/3*(A1+A2+(A1*A2) (1/2))$

Where h = vertical depth of the stratum; A1 = area of the upper surface; and A2 = area of the lower surface of the stratum whose volume is to be determined. The volumes of individual strata are summed to obtain the volume of the desired depth intervals.

The area of a lake potentially available for ice aggregate was estimated by calculating the area of each lake that is 4 ft or less in depth, assuming ice will attain thickness of at least 4 ft prior to the need for aggregate and thus will be grounded. If the ice is thinner than 4 ft at the time of ice removal, then the available area for ice removal will be less.

The procedure for estimating the gallons available as ice aggregate is as follows:

1. The area of the 4-ft depth contour is subtracted from the lake outline (0-ft contour) to provide the area (in acres) less than 4 ft deep.
2. The upper one foot of the acreage less than 4 ft deep is converted to cubic yards.
3. The cubic yards are reduced by 9% to account for ice expansion as the water freezes.
4. The remaining volume is multiplied by 202 gallons per cubic yard to arrive at the final estimate of gallons available for use.

2.4. Lake Summaries

The lake numbering protocol used for the survey is based on the researcher and year code combination. The lake number contains several pieces of information, including the code of the sampler and the initial year of sampling as noted below.

Sampler Code:

MC = McElderry and Craig (1981); fish sampling 1979

B = Bendock fish sampling 1977-1986

L = Lobdell; water chemistry sampling 1991-1999

M = Moulton; fish sampling 1995-2014

M = Moulton and Morris, fish sampling 2015

MM = Morris and Moulton, fish and bathymetric sampling 2017

MB = Michael Baker Jr., Inc. water chemistry and bathymetry sampling 2002-2012

N = Netsch et al. (1977) NPRA fish sampling 1977

R = Reanier depth sampling 2000-2007

First Two Numerals:

Year of Initial Sampling (if Moulton sampled a lake previously sampled by McElderry and Craig, then the McElderry and Craig lake number is used).

Last Two Numerals:

Numbers 01 through 99 are used to identify the individual lake sampled within a given year.

For each lake in the survey, the following information is accounted for and provided as applicable:

1. A diagram of the lake bathymetry
2. Other names used for the same lake
3. Lake location – latitude and longitude
4. The U.S. Geological Survey (USGS) quadrangle sheet and the township and range in which the lake is situated
5. Surface area in acres
6. Maximum depth in feet
7. Presence or absence of an outlet
8. Calculated total lake volume at the time of survey
9. Water volume under 4 ft of ice
10. Water volume under 5 ft of ice
11. Water volume under 7 ft of ice
12. Acres of potential ice aggregate for ice road construction
13. Gallons of water represented by the upper 1 ft of ice available for ice aggregate
14. Maximum recommended under-ice water withdrawal
15. Water chemistry measurements
16. Catch record, including gear used, date sampled, species caught and size range
17. Where appropriate data exist, the length frequency of dominant species is plotted
18. Map depicting potential ice aggregate removal areas
19. Map depicting measured depth transects

Data packets for each lake are presented in Section 6 of this report.

3. RESULTS

3.1. Biological Observations

All lakes selected for evaluation during 2017 that could be used as freshwater sources for ice road construction, drilling support, and/or potable water during winter are depicted in Figure 1. Water use may be in the form of either direct withdrawal of water from below the ice or by collecting ice aggregate.

3.1.1. Willow West Lakes

Surveys within the Willow West survey area include 20 lakes in the NPR-A (Figure 2 and Table 1). Surveyed lakes varied in depth, with maximum depths exceeding 7 ft in 16 lakes. Sensitive fish species were captured in 8 of the 20 lakes and included broad whitefish, least cisco, and Arctic grayling (Table 2). Resistant fish species, including ninespine stickleback and Alaska blackfish, were captured in 14 of the 20 lakes. Fish were not captured in 2 of the 20 lakes (Table 2).

3.1.2. Willow East Lakes

Surveys within the Willow East Survey area include 11 lakes in the NPR-A (Figure 3 and Table 1). Maximum lake depths were similar to Willow West area lakes, with 10 lakes exceeding 7 ft. Arctic grayling were the only sensitive species captured or previously identified in 2 of the 11 lakes (Table 2). Resistant fish species, including ninespine stickleback and Alaska blackfish, were captured in all lakes except Lake M9901. Although not sampled for fish in 2017, Lake M9901 was previously sampled in 1999 and has documented use by sensitive fish species (Arctic grayling) (Table 2).

3.1.3. Stony Hill Lakes

The two lakes surveyed in the Stony Hill area had maximum depths exceeding 24 ft. These lakes are also located within the NPR-A, and are within the floodplain of the Colville River and are subject to frequent flooding by the river. Sensitive fish species, including broad whitefish, least cisco, and northern pike, were captured (Figure 4 and Table 2). Resistant fish species, including ninespine stickleback, were only captured in Lake MM1731 (Table 2). Comparisons of satellite imagery from the Bureau of Land Management (BLM) from 2002, more recent imagery, and field observations in 2017 show that the banks of Lake MM1732 have breached and that the lake is now connected to an adjacent water body. As a result of the breaching, water surface elevation appears to have lowered substantially between 2002 and 2017 (See Section 8, Lake MM1732 Data Packet).

3.2. Water Chemistry Measurements

3.2.1. Willow West Lakes

Water chemistry parameters measured in the 20 surveyed lakes are listed in Table 3. Surface water temperature measurements between July 17 to July 30 averaged 13.7 degrees Celsius (°C). Temperatures varied over the sampling period and ranged from 17.7 °C on July 19 to 11.5 °C on July 23, 25, and 26 (Table 3). Specific conductance also varied throughout the survey area, ranging from 60 to 250 µSiemens/centimeter (µS/cm). Turbidity was generally highest in shallow lakes and lowest in deep lakes, averaging 1.39 nephelometric

turbidity units (NTU), ranging from 0.63 to 3.91 NTU. Potential hydrogen (pH) averaged 8.01 units ranging from 7.20 to 8.80 units.

3.2.2. Willow East Lakes

Water chemistry parameters measured in the 11 surveyed lakes are listed in Table 3. Water chemistry parameters in 10 of the 11 lakes were also measured prior to 2017 surveys and are presented in Table 3. Surface water temperature measurements in the 2017 period between July 15 to August 21 averaged 11.6 ° C. Temperatures cooled over the sampling period and ranged from 16.6 ºC on July 21 to 8.1 ºC on August 20 and 21 (Table 3). Specific conductance in 2017 varied throughout the survey area, ranging from 69 to 517 µS/cm. Turbidity in 2017 varied across lakes and averaged 1.12 NTU ranging from 0.59 to 1.54 NTU. Potential hydrogen (pH) in 2017 averaged 7.97 units ranging from 7.52 to 8.34 units. Nearly all water chemistry parameters measured in both years sampled were lowest in Lake M0106 and by far the highest in Lake M0111.

3.2.3. Stony Hill Lakes

Water chemistry parameters measured in Lake MM1731 and MM1732 are listed in Table 3. Surface water temperature measurements on July 18 averaged 17.0 ° C and were slightly warmer in Lake MM1732 than in Lake MM1731. All water chemistry parameters, aside from chloride, were slightly higher in Lake MM1732 than in Lake MM1731.

4. DISCUSSION

4.1. Evaluation of Fish Concerns

Fish sampling and depth measurements were used to evaluate each lake regarding its potential to support fish. If fish were captured during sampling, the lake was classified as fish-bearing. Gill net set duration was relatively short at all lakes where sensitive fish species were present, because fish were captured almost immediately after net deployment. The absence of catch does not necessarily mean a lake does not support fish. Lakes deeper than 7 ft. are likely to retain unfrozen water during winter, thus have potential to overwinter fish.

Maximum volumes of water and ice that may be withdrawn from fish bearing and non-fishing bearing lakes per agency requirements previously outlined in Section 1 are described below.

4.2. Available Water and Ice Chips

4.2.1. Willow West Lakes

In the Willow West study area, the 20 surveyed waterbodies contained 256.79 million gallons of available under-ice water (Table 4). The quantity of available under-ice water was mostly dispersed between 10 of the 20 lakes (Table 4). An additional 1.03 billion gallons is potentially harvestable as ice aggregate, mostly from lakes N77101A, N77101C, M1703, and MM1707 (Table 5).

4.2.2. Willow East Lakes

In the Willow East study area, the 11 surveyed waterbodies contained 104.02 million gallons of available under-ice water, mostly from lakes M0007, M0112, and M0006 (Table 4). An additional 133.29 million gallons is potentially harvestable as ice aggregate, mostly from lakes M0104, M0007, MM1701, and M0008 (Table 5).

4.2.3. Stony Hill Lakes

In the Stony Hill study area, the 2 surveyed waterbodies contained 18.98 million gallons of available under-ice water, mostly from Lake MM1731 (Table 4). An additional 22.69 million gallons is potentially harvestable as ice aggregate, mostly from Lake MM1732 (Table 5).

5. REFERENCES

Armstrong, R.H. 1994. Alaska blackfish. ADF&G's Wildlife Notebook Series. Alaska Department of Fish and Game. Juneau, AK.

Lewis, D.B., M. Walkey, and H.J.G. Dartnall. 1972. Some effects of low oxygen tensions on the distribution of the three-spined stickleback *Gasterosteus aculeatus* L. and the nine-spined stickleback *Pungitius* (L). J. Fish. Biol. 4: 103-108.

Moulton, L.L. 1998. Lakes sampled for fish within and near the Colville River delta, Alaska 1979-1998. Report by MJM Research to ARCO Alaska Inc. Bainbridge Island, WA. 513p

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FIGURES

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Figure 1. Overview of lakes surveyed during 2017 as potential water sources to support exploration activities.

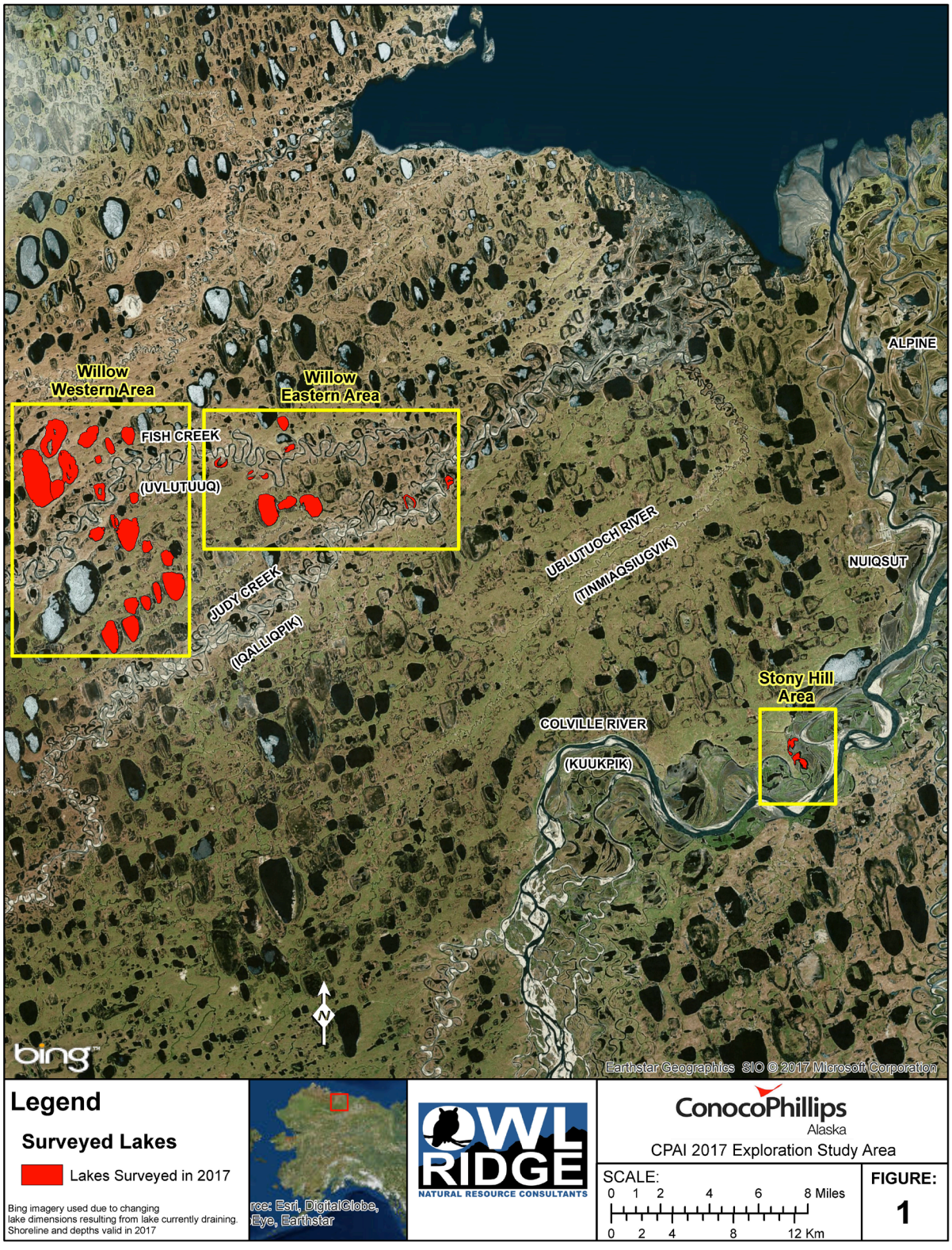

Figure 2. Lakes surveyed during 2017 in the Willow West area as potential water sources to support exploration activities.

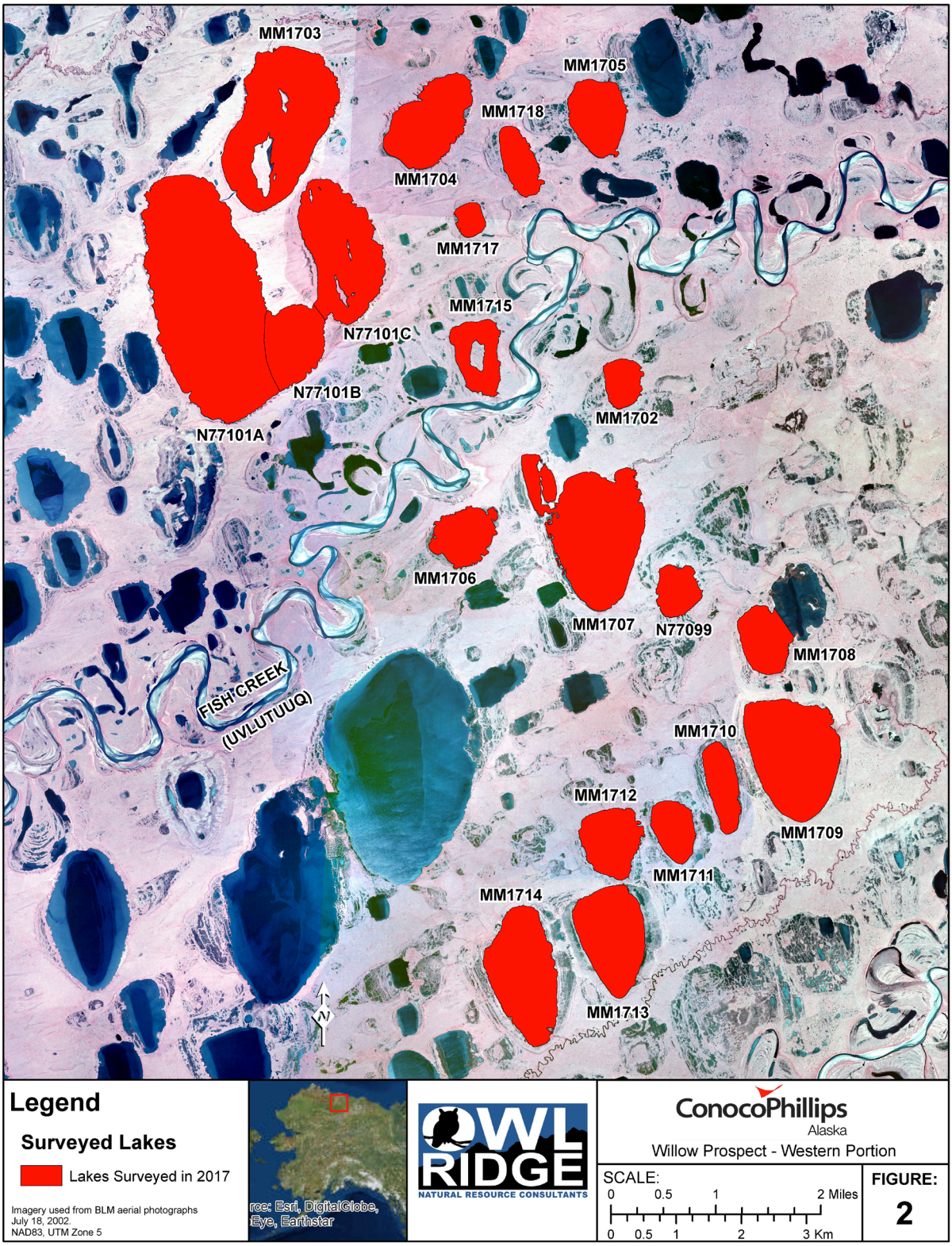

Figure 3. Lakes surveyed during 2017 in the Willow East area as potential water sources to support exploration activities.

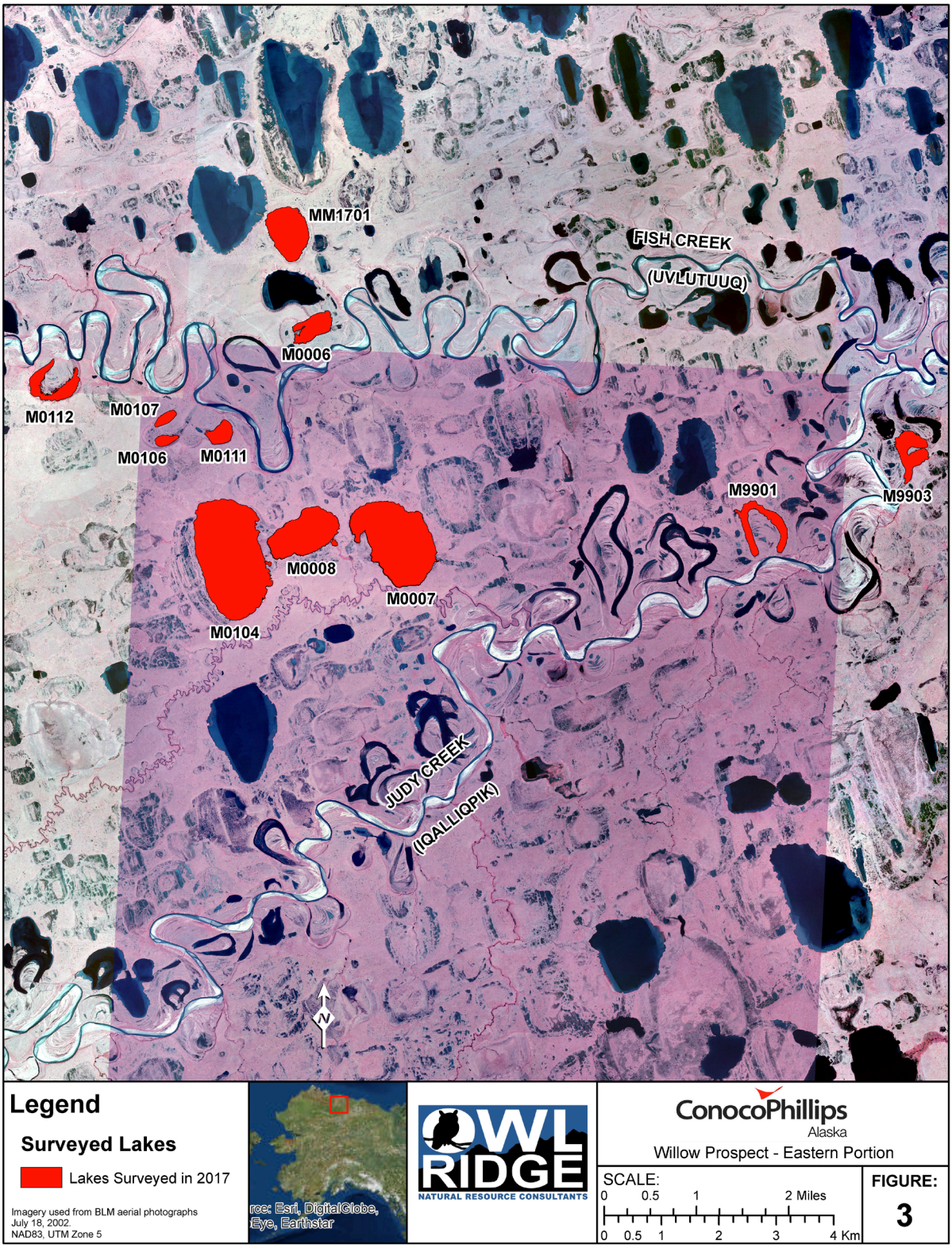

Figure 4. Lakes surveyed during 2017 in the Stony Hill area as potential water sources to support exploration activities.

TABLES

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Table 1. Summary of lakes sampled in 2017 for winter water use in ConocoPhillips, Alaska Inc. exploration areas.

Region	Lake Name	Latitude (NAD83)	Longitude (NAD83)	Town	Range	Section	Surface Area (acres)	Maximum Depth (feet)	Lake Volume (mill. gals)
Willow West Area									
	MM1702	70.22551	152.30070	10N	1W/2W	13/14/31/36	89.4	7.4	113.1
	MM1703	70.26214	152.43966	10N/11N	2W	4/5/32/33	682.9	7.8	169.6
	MM1704	70.25898	152.38707	10N/11N	2W	3/4/33/34	315.6	11.1	364.5
	MM1705	70.26069	152.31546	10N	2W	2/35	204.9	7.0	274.7
	MM1706	70.20335	152.36404	10N	2W	22/27	170.8	12.9	191.0
	MM1707	70.20165	152.30995	10N	2W	14/23/24/25/26	656.6	6.7	622.6
	MM1708	70.19194	152.23439	10N	1W	19/29/30	161.8	8.4	175.2
	MM1709	70.17585	152.22278	9N/10N	1W	5/6/31/32	517.1	5.9	687.2
	MM1710	70.17117	152.25340	9N/10N	1W/2W	6/1/31/36	135.5	10.0	308.1
	MM1711	70.16356	152.27127	9N	2W	1	121.5	10.4	241.7
	MM1712	70.16202	152.29772	9N	2W	1/2	196.6	10.8	324.0
	MM1713	70.14892	152.29318	9N	2W	1/11/12	332.6	7.0	517.2
	MM1714	70.14300	152.33094	9N	2W	10/11/14/15	411.3	7.9	697.6
	MM1715	70.22889	152.35432	10N	2W	10/15	150.2	11.7	269.3
	MM1717	70.24660	152.36598	10N	2W	3	47.0	15.9	119.5
	MM1718	70.25495	152.34653	10N/11N	2W	2/3/34/35	114.2	7.8	138.2
	N77099	70.19806	152.27242	10N	2W	24/25	106.5	6.9	121.4
	N77101A	70.23561	152.45667	10N	2W	4-9/16-18	1328.6	25.1	1546.0
	N77101B	70.22831	152.43343	10N	2W	4-9/16-18	233.6	6.6	164.6
	N77101C	70.24185	152.41704	10N	2W	4-9/16-18	482.6	18.2	415.8
Willow East Area									
	M9901	70.23006	151.81838	10N	1E	11/14	68.1	17.6	150.8
	M9903	70.23982	151.75726	10N	1E	12	71.3	18.8	134.0
	M0006	70.25718	152.03257	10N/11N	1W	1/36	58.2	12.3	125.6
	M0007	70.22240	151.99085	10N	1E/1W	7/18/12/13	369.6	9.3	576.2
	M0008	70.22501	152.03423	10N	1W	12/13/14	181.5	7.6	279.7
	M0104	70.22100	152.06825	10N	1W	11/14/23	513.7	5.5	618.3
	M0106	70.23899	152.09887	10N	1W	10	14.1	11.3	34.7
	M0107	70.24229	152.09922	10N	1W	3/10	14.7	10.1	34.5
	M0111	70.24011	152.07377	10N	1W	2/11	32.0	12.6	72.5
	M0112	70.24521	152.15701	10N	1W	4	62.3	16.1	164.2
	MM1701	70.27257	152.04693	11N	1W	25/26/35/36	125.8	8.1	151.8
Stony Hill Area									
	MM1731	70.09167	152.15456	9N	4E	33	81.9	21.9	272.4
	MM1732	70.08250	152.13647	8N	4E	3/4/33	109.0	26.7	142.2

Table 2. Summary of fish sampling for lakes surveyed in 2017 at ConocoPhillips, Alaska Inc. exploration areas.

			Gill Nets		Minnow Traps		Seine		Visual Survey	
Region	Lake Name	Sample Date	Set Duration (hours)	Fish Species[1]	Set Duration (hours)	Fish Species[1]	Effort	Fish Species[1]	Distance (yards)	Fish Species[1]
Willow West Area										
	MM1702	7/17/2017	9.4	none	16.3	none	3 hauls	none	205	none
	MM1703	7/19/2017	4.6	LSCS	12.4	none	--	--	--	--
	MM1704	7/19/2017	9.1	none	10.4	NSSB	--	--	--	--
	MM1705	7/22/2017	10.0	none	14.4	NSSB	--	--	--	--
	MM1706	7/23/2017	9.3	none	17.1	NSSB	1 haul	none	100	none
	MM1707	7/25/2017	7.7	BDWF, GRAY	8.3	none	--	--	--	--
	MM1708	7/26/2017	7.7	none	8.3	BKFH	--	--	--	--
	MM1709	7/25/2017	2.6	LSCS	--	--	--	--	--	--
	MM1710	7/24/2017	7.9	none	0.3	NSSB	--	--	5	NSSB
	MM1711	7/24/2017	8.8	none	1.3	none	--	--	20	NSSB
	MM1712	7/27/2017	9.4	none	12.6	NSSB	--	--	--	--
	MM1713	7/27/2017	9.0	GRAY	12.0	NSSB	--	--	--	--
	MM1714	7/26/2017	1.4	GRAY	12.5	NSSB	--	--	--	--
	MM1715	7/30/2017	9.1	none	13.7	none	1 haul	NSSB	25	BKFH
	MM1717	7/29/2017	7.2	none	3.9	NSSB	--	--	--	--
	MM1718	7/29/2017	9.2	none	12.2	none	1 haul	NSSB	150	none
	N77099	7/22/2017	8.8	none	15.2	none	3 hauls	none	200	none
	N77101A	7/28/2017	2.5	LSCS, BDWF, GRAY, LKTR, BURB*	--	--	4 hauls	NSSB	0	NSSB
	N77101B	7/28/2017	--	LSCS, BDWF, GRAY, LKTR, BURB*	--	--	--	--	--	--
	N77101C	7/28/2017	--	LSCS, BDWF, GRAY, LKTR, BURB**	--	--	--	--	--	NSSB
Willow East Area										
	M9901	8/20/2017	--	GRAY***	--	--	--	--	--	--
	M9903	8/21/2017	6.2	none	--	--	--	--	1	NSSB
	M0006	7/16/2017	6.2	none	9.0	NSSB, BKFH	--	--	1	NSSB
	M0007	7/15/2017	6.2	none	16.0	NSSB	--	--	1	NSSB
	M0008	7/15/2017	5.3	GRAY	10.7	NSSB	--	--	--	--
	M0104	7/16/2017	9.1	none	10.3	NSSB	--	--	--	--
	M0106	8/19/2017	6.2	none	--	--	--	--	5	NSSB
	M0107	8/19/2017	6.2	none	0.5	NSSB	--	--	20	NSSB
	M0111	8/20/2017	6.2	none	--	--	--	--	10	NSSB
	M0112	8/18/2017	8.1	none	0.5	none	--	--	20	NSSB
	MM1701	7/17/2017	9.1	none	9.7	NSSB	--	--	--	--
Stony Hill Area										
	MM1731	7/18/2017	9.4	LSCS, PIKE, BDWF	12.6	NSSB	--	--	--	--
	MM1732	7/18/2017	9.4	PIKE, BDWF	12.6	none	--	--	--	--

[1] GRAY = Arctic grayling, LSCS= least cisco, BDWF = broad whitefish, PIKE = northern pike, BKFH = Alaska blackfish, NSSB = ninespine stickleback, LKTR = lake trout, BURB = burbot

-- = not measured
*Lake sampled for fish in 1977
**Not sampled for fish because of direct connection to Lake N77101A
***Sampled for fish 1999

Table 3. Water chemistry parameters measured in conjunction with 2017 lake sampling at ConocoPhillips, Alaska Inc. exploration areas.

Region	Lake	Date	Water Temp. (ºC)	Specific Conductance (µS/cm)	Turbidity (NTU)	pH	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)
Willow West Area											
	MM1702	7/17/2017	15.5	247	0.89	8.25	31.0	5.1	12.0	30.0	97
	MM1703	7/19/2017	17.2	218	0.75	8.36	34.0	3.9	6.6	12.0	100
	MM1704	7/19/2017	17.7	166	0.67	8.42	25.0	2.9	4.9	10.0	75
	MM1705	7/22/2017	12.8	239	3.91	8.21	34.0	4.0	10.0	25.0	100
	MM1706	7/23/2017	11.5	249	0.93	8.30	31.0	5.2	12.0	29.0	97
	MM1707	7/25/2017	11.5	196	1.28	8.05	24.0	4.1	9.5	24.0	77
	MM1708	7/26/2017	11.5	60	1.51	7.29	6.2	1.4	3.3	7.6	21
	MM1709	7/25/2017	12.6	124	3.76	7.72	13.0	2.4	7.7	18.0	43
	MM1710	7/24/2017	13.2	74	0.83	7.20	6.4	1.5	5.4	14.0	22
	MM1711	7/24/2017	13.0	103	0.72	7.52	8.4	2.1	7.7	18.0	30
	MM1712	7/27/2017	12.2	127	1.56	7.64	11.0	2.9	8.0	22.0	41
	MM1713	7/27/2017	11.6	120	1.11	7.67	11.0	2.5	7.8	19.0	38
	MM1714	7/26/2017	12.1	90	1.53	7.62	8.8	1.9	5.5	12.0	30
	MM1715	7/30/2017	15.4	246	0.81	8.34	31.0	5.5	11.0	25.0	100
	MM1717	7/29/2017	15.5	250	1.14	8.28	33.0	4.9	11.0	23.0	100
	MM1718	7/29/2017	15.3	114	1.15	7.98	14.0	2.2	5.3	11.0	44
	N77099	8/11/1977	8.0	197	--	7.70	--	--	--	--	--
		7/22/2017	12.5	176	2.54	8.23	25.0	3.3	6.7	17.0	75
	N77101A	8/14/1977	11.0	218	--	8.80	--	--	--	--	--
		7/28/2017	12.6	192	0.63	8.29	28.0	3.5	5.9	13.0	85
	N77101B*	--	--	--	--	--	--	--	--	--	--
	N77101C	7/28/2017	16.3	192	0.63	8.29	28.0	3.5	5.9	13.0	85
Willow East Area											
	M9901	7/10/1999	14.7	180	--	7.66	24.7	3.7	4.6	23.8	79.8
		8/20/2017	8.1	188	0.80	8.15	25.0	4.4	6.2	25.0	81
	M9903	7/10/1999	15.3	87	--	8.11	9.7	1.9	2.8	7.9	33
		8/21/2017	8.1	188	0.80	8.15	12.0	2.2	3.6	9.1	38
	M0006	7/15/2000	9.9	223	--	7.97	27.4	5.1	9.7	21.2	89
		7/16/2017	15.1	241	0.78	8.21	28.0	5.8	11.0	25.0	95
	M0007	7/16/2000	11.4	295	--	8.15	35.5	5.5	11.9	32.0	111
		7/15/2017	16.3	334	1.06	8.27	40.0	7.6	17.0	43.0	130
	M0008	7/16/2000	12.6	125	--	7.83	14.1	2.7	5.9	13.5	46
		7/15/2017	16.6	107	1.26	7.74	12.0	2.1	5.4	20.0	40
	M0104	7/16/2001	11.6	81	2.00	7.91	10.0	1.7	3.9	8.1	33
		7/16/2017	15.8	85	1.54	7.78	9.7	1.6	4.2	13.0	31
	M0106	7/17/2001	12.6	69	1.10	7.54	7.0	1.8	4.6	8.4	25
		8/19/2017	8.5	69	1.46	7.52	6.8	1.6	4.0	8.6	24
	M0107	7/17/2001	13.1	114	1.20	7.85	12.0	2.6	7.8	14.0	40
		8/19/2017	8.4	85	1.54	7.78	9.7	1.6	4.2	13.0	31
	M0111	7/19/2001	14.0	540	1.30	8.40	52.0	15.0	37.0	99.0	190
		8/20/2017	8.1	517	1.48	8.34	47.0	14.0	34.0	79.0	180
	M0112	7/20/2001	14.3	162	0.80	8.00	15.0	3.3	8.9	19.0	51
		8/18/2017	8.7	145	1.02	7.77	15.0	3.4	8.4	19.0	52
	MM1701	7/17/2017	14.0	157	0.59	7.98	20.0	3.5	6.6	17.0	63
Stony Hill Area											
	MM1731	7/18/2017	16.4	81	0.94	7.71	9.6	2.9	2.3	8.7	36
	MM1732	7/18/2017	17.5	134	1.43	8.62	16.0	5.6	3.1	2.8	64

--= not measured
*Water chemistry parameters not measured because of direct connection to Lake N77101A

Table 4. Recommended maximum water volumes available for under-ice water withdrawal from lakes surveyed in 2017 for ConocoPhillips, Alaska Inc. exploration needs (does not include volume related to ice aggregate).

Region	Lake	Surface Area (acres)	Max. Depth (ft.)	Total Calculated Volume (mill. gals)	20% of Total Lake Volume (mill. gals)	30% of Water Under 5 ft of Ice (mill. gals)	15% of Water Under 7 ft of Ice (mill. gals)	Sensitive Fish Present[1]	Resistant Fish Present[2]	Recommended Maximum Under-Ice Withdrawal (mill. gals)
Willow West Area										
	MM1702	89.4	7.4	113.1	22.62	1.20	0.00	none	none	22.623
	MM1703	682.9	7.8	169.6	33.92	2.97	0.01	LSCS	none	0.012
	MM1704	315.6	11.1	364.5	72.90	13.26	0.45	none	NSSB	13.257
	MM1705	204.9	7.0	274.7	54.95	4.15	0.00	none	NSSB	4.146
	MM1706	170.8	12.9	191.0	38.20	17.28	2.98	none	NSSB	17.276
	MM1707	656.6	6.7	622.6	124.51	11.78	0.00	BDWF, GRAY	none	0.000
	MM1708	161.8	8.4	175.2	35.03	3.61	0.00	none	BKFH	3.613
	MM1709	517.1	5.9	687.2	137.45	2.66	0.00	LSCS	--	0.000
	MM1710	135.5	10.0	308.1	61.63	31.17	5.44	none	NSSB	31.167
	MM1711	121.5	10.4	241.7	48.34	20.44	2.21	none	NSSB	20.445
	MM1712	196.6	10.8	324.0	64.79	17.67	0.44	none	NSSB	17.668
	MM1713	332.6	7.0	517.2	103.43	9.33	0.04	GRAY	NSSB	0.039
	MM1714	411.3	7.9	697.6	139.52	33.46	0.25	GRAY	NSSB	0.252
	MM1715	150.2	11.7	269.3	53.85	24.29	5.42	none	BKFH, NSSB	24.291
	MM1717	47.0	15.9	119.5	23.90	16.98	6.01	none	NSSB	16.984
	MM1718	114.2	7.8	138.2	27.64	2.05	0.01	none	NSSB	2.050
	N77099	106.5	6.9	121.4	24.28	0.79	0.00	none	NSSB	24.280
	N77101A	1328.6	25.1	1546.0	309.21	142.34	36.67	LKTR, LSCS, GRAY, BDWF, BURB	NSSB	36.669
	N77101B	233.6	6.6	164.6	32.92	3.23	0.00	LKTR, LSCS, GRAY, BDWF, BURB	NSSB	0.000
	N77101C	482.6	18.2	415.8	83.15	52.04	22.03	LKTR, LSCS, GRAY, BDWF, BURB	NSSB	22.026
Willow East Area										
	M9901	68.1	17.6	150.8	30.17	17.00	4.60	GRAY	--	4.599
	M9903	71.3	18.8	134.0	26.80	9.88	0.99	none	NSSB	9.878
	M0006	58.2	12.3	125.6	25.11	12.32	2.53	none	BKFH, NSSB	12.318
	M0007	369.6	9.3	576.2	115.25	35.38	2.09	none	NSSB	35.381
	M0008	181.5	7.6	279.7	55.94	11.56	0.14	GRAY	NSSB	0.136
	M0104	513.7	5.5	618.3	123.66	0.32	0.00	none	NSSB	0.316
	M0106	14.1	11.3	34.7	6.94	3.97	0.83	none	NSSB	3.966
	M0107	14.7	10.1	34.5	6.90	3.58	0.67	none	NSSB	3.579
	M0111	32.0	12.6	72.5	14.51	7.94	1.76	none	NSSB	7.945
	M0112	62.3	16.1	164.2	32.84	22.66	7.06	none	NSSB	22.660
	MM1701	125.8	8.1	151.8	30.35	3.24	0.01	none	NSSB	3.245
Stony Hill Area										
	MM1731	81.9	21.9	272.4	54.48	44.20	15.23	LSCS, PIKE, BDWF	NSSB	15.226
	MM1732	109.0	26.7	142.2	28.44	10.35	3.76	PIKE, BDWF	none	3.758

[1] Sensitive species include grayling, whitefishes, char, burbot, slimy sculpin, etc.

[2] Resistant species are ninespine stickleback (NSSB) and Alaska blackfish (BKFH)

GRAY = Arctic grayling, LSCS= least cisco, BDWF = broad whitefish, PIKE = northern pike, LKTR = lake trout, BURB = burbot

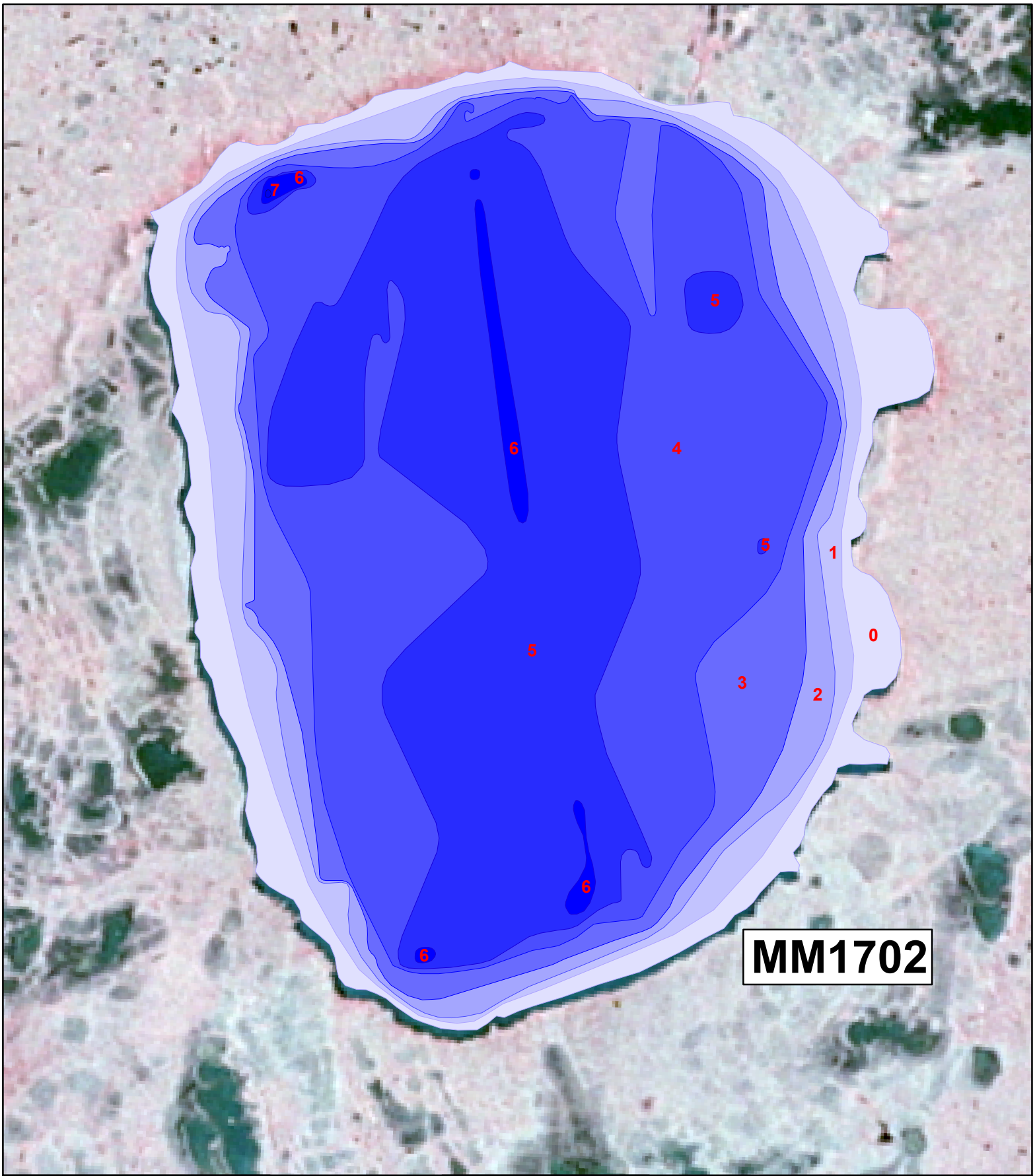
Table 5. Estimated area available for removing ice aggregate, based on the area covered by water shallower than 4 feet, surveyed in 2017 for ConocoPhillips, Alaska Inc. exploration areas.

Region	Lake	Surface Area (acres)	Max. Depth in 2017 (feet)	Acres covered by Water shallower than 4 feet	Gallons of Water As Chips (mill. gals)
Willow West Area					
	MM1702	89.4	7.4	31.9	9.458
	MM1703	682.9	7.8	647.2	191.938
	MM1704	315.6	11.1	172.9	51.286
	MM1705	204.9	7.0	63.5	18.822
	MM1706	170.8	12.9	105.6	31.318
	MM1707	656.6	6.7	416.1	123.404
	MM1708	161.8	8.4	82.7	24.522
	MM1709	517.1	5.9	131.1	38.877
	MM1710	135.5	10.0	16.1	4.788
	MM1711	121.5	10.4	24.7	7.327
	MM1712	196.6	10.8	50.1	14.848
	MM1713	332.6	7.0	49.0	14.544
	MM1714	411.3	7.9	76.4	22.654
	MM1715	150.2	11.7	52.2	15.477
	MM1717	47.0	15.9	12.0	3.564
	MM1718	114.2	7.8	53.6	15.895
	N77099	106.5	6.9	52.5	15.559
	N77101A	1328.6	25.1	856.5	254.001
	N77101B	233.6	6.6	169.7	50.314
	N77101C	482.6	18.2	418.9	124.227
Willow East Area					
	M9901	68.1	17.6	16.4	4.850
	M9903	71.3	18.8	15.2	4.503
	M0006	58.2	12.3	11.1	3.294
	M0007	369.6	9.3	134.1	39.759
	M0008	181.5	7.6	51.7	15.318
	M0104	513.7	5.5	142.8	42.337
	M0106	14.1	11.3	1.4	0.428
	M0107	14.7	10.1	1.4	0.424
	M0111	32.0	12.6	5.4	1.610
	M0112	62.3	16.1	11.5	3.406
	MM1701	125.8	8.1	58.5	17.359
Stony Hill Area					
	MM1731	81.9	21.9	7.7	2.284
	MM1732	109.0	26.7	68.8	20.407

(gallons of water available as chips is the water content of the top 1 ft. of ice)

6. LAKE SUMMARIES

6.1. Lake Summaries for Lakes Sampled in the Willow West Area, 2017.



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1702

based on transects surveyed on July 17, 2017

SCALE:

250 125 0 250
Feet

N

Lake MM1702

Other Names: None known
Location: 70.22551°N 152.30070°W
USGS Quad Sheet: Harrison Bay A-4: T10N R2W Sec. 13,14
T10N R1W Sec. 31; T10N R2W Sec. 36
Habitat: Tundra lake
Area: 89 acres
Maximum Depth: 7.4 feet
Active Outlet: No
Total Lake Volume: 113.12 million gallons (July 17, 2017 data)
Water Volume Under 4 ft of ice: 17.83 million gallons
Water Volume Under 5 ft of ice: 4.01 million gallons
Water Volume Under 7 ft of ice: 0.00 million gallons

Potential Ice Aggregate: 31.90 acres (water depth 4 ft or less)
9.46 million gallons

Maximum Recommended Winter Removal: **22.62 million gallons**
(No fish present, 20% of total water volume)

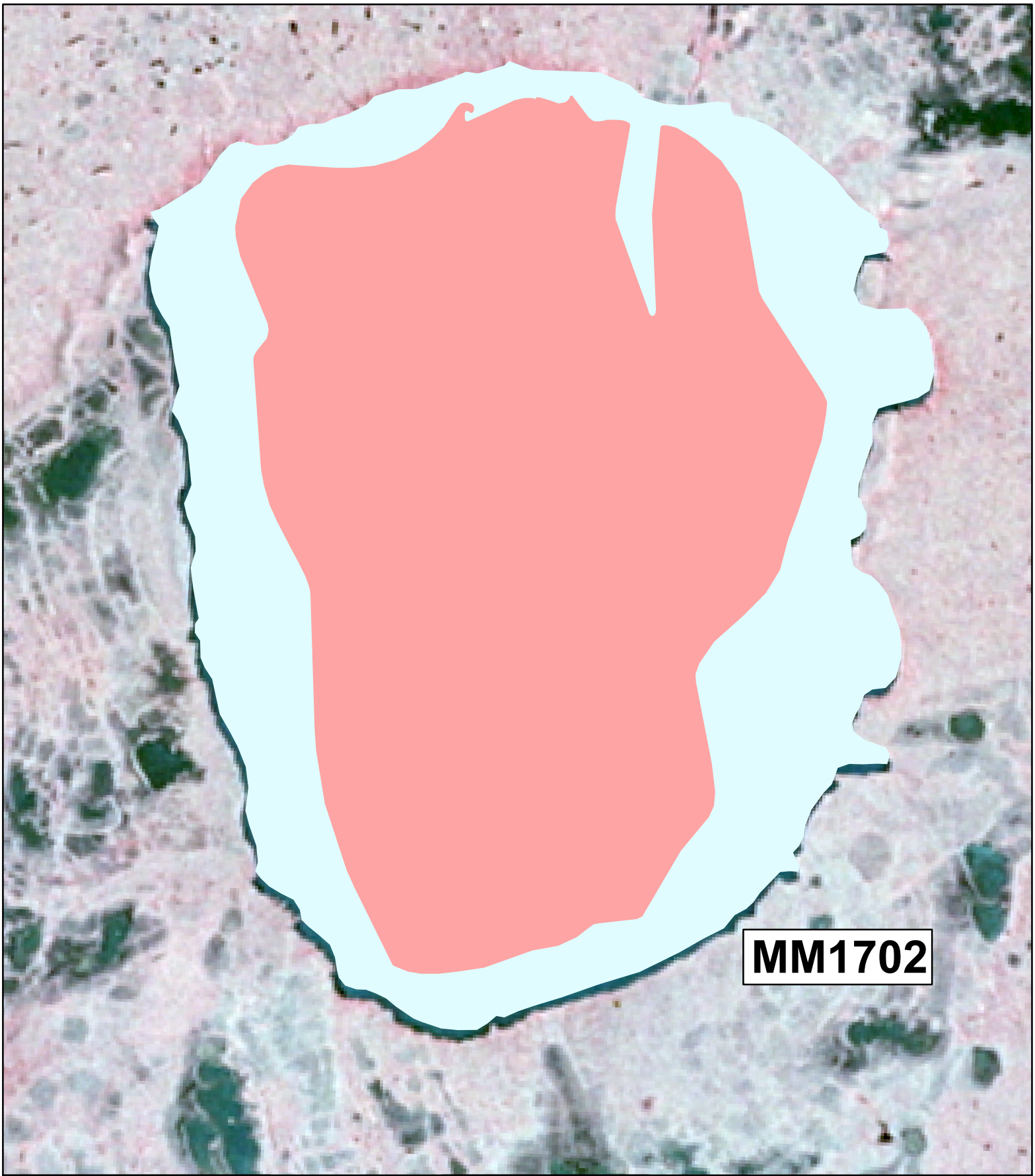
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	31.0	5.1	12.0	30.0	97.0	247.2	0.9	8.25	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 2017	9.4	None	0
Minnow Trap	Jul 17 2017	16.3	None	0
Seine Net	Jul 17 2017	3 hauls	None	0
Visual+Dipnet	Jul 17 2017	205 yds	None	0

Data Last Revised: September 14, 2017



Ice Chip Areas

- 4 feet or shallower - available for ice chips
- Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

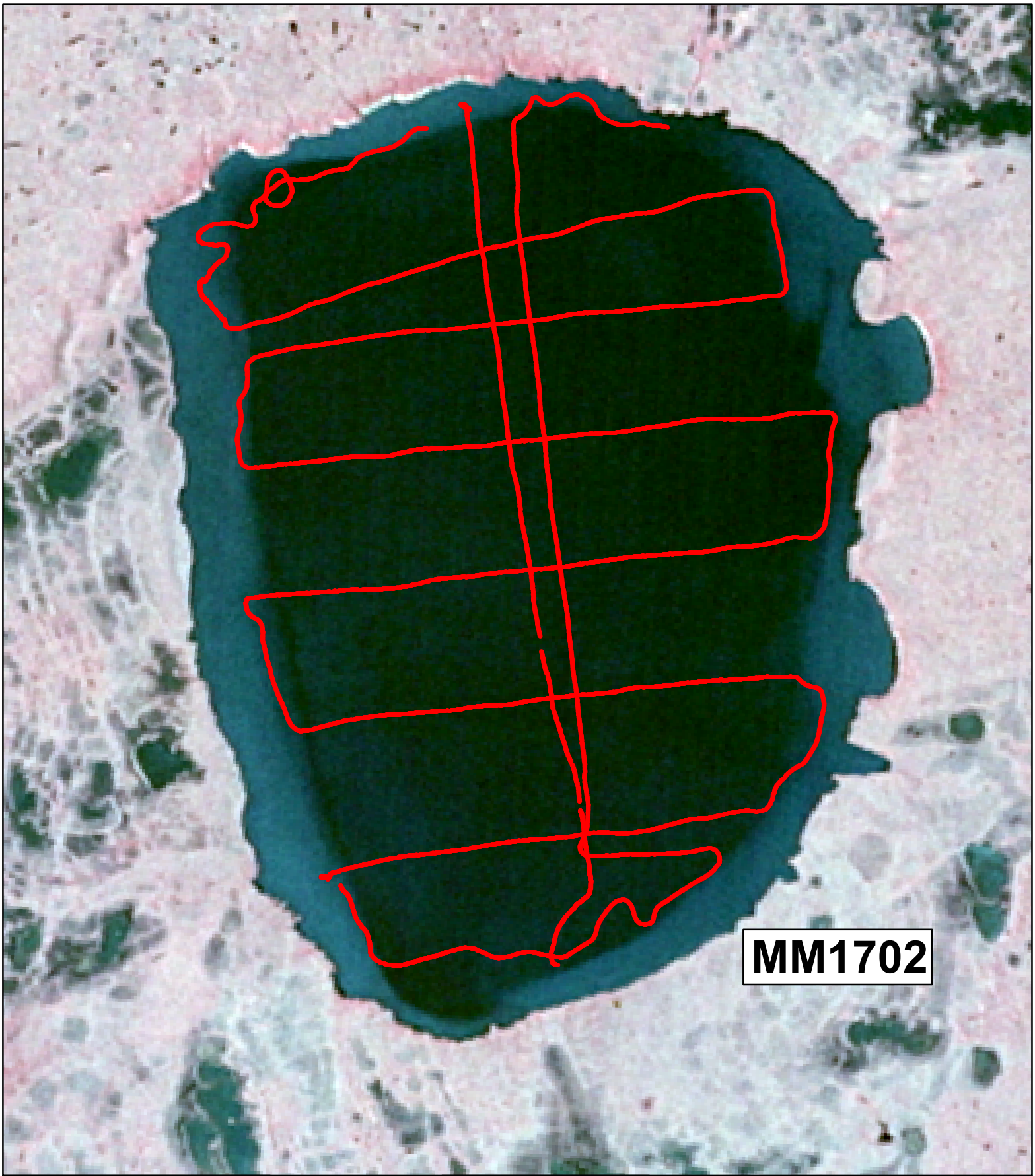
Area Available for Ice Chip Collection at Lake MM1702

based on transects surveyed on July 17, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

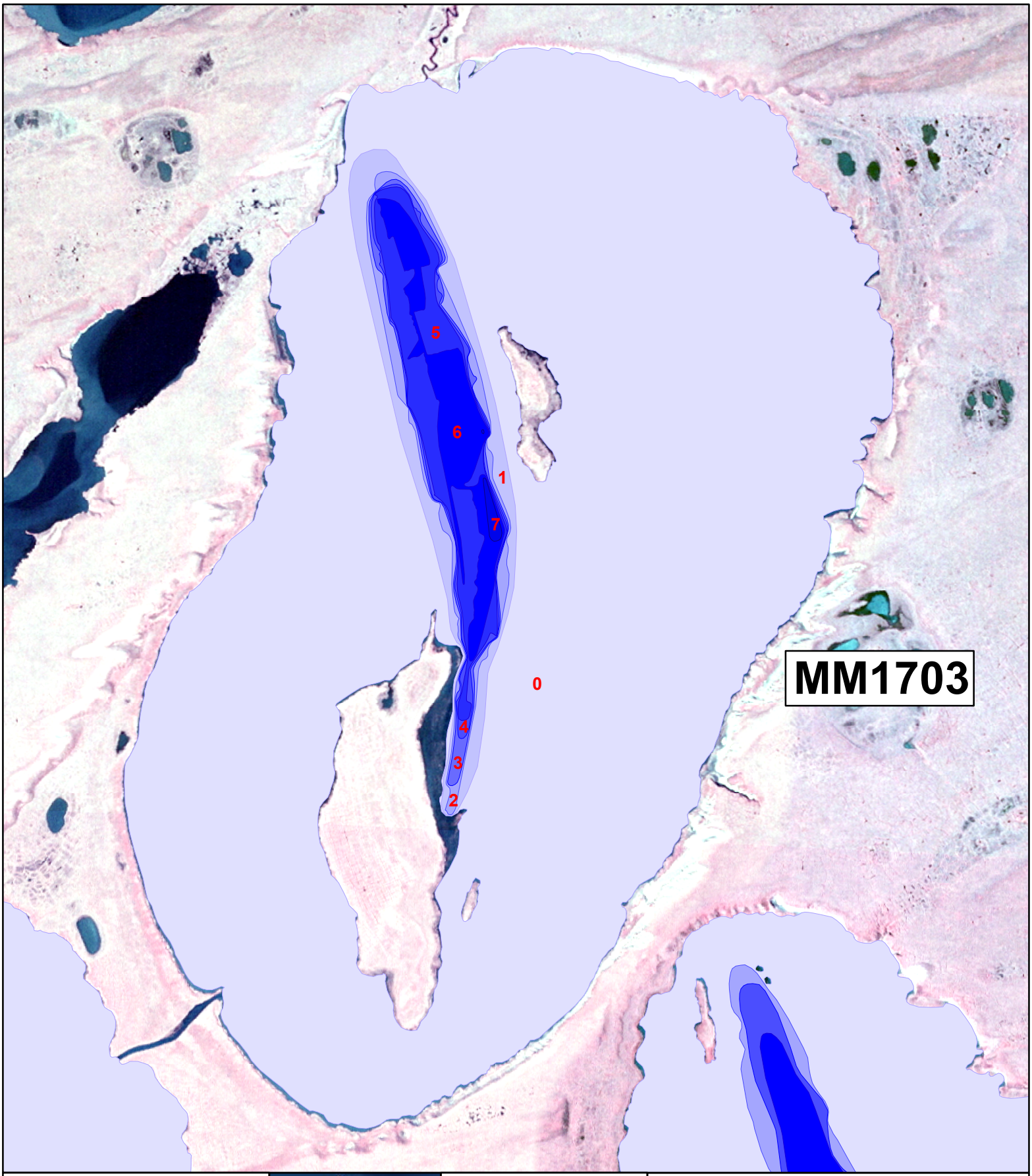
Depth Transects Surveyed at Lake MM1702

surveyed on July 17, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250
Feet

N



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1703

based on transects surveyed on July 19, 2017

SCALE:

500 250 0 500 1,000 1,500
Feet

N

Lake MM1703

Other Names: None known
Location: 70.26214°N 152.43966°W
USGS Quad Sheet: Harrison Bay B-5: T10N R2W Sec. 4,5; T11N R2W Sec. 32,33
Habitat: Drainage lake
Area: 683 acres
Maximum Depth: 7.8 feet
Active Outlet: Yes
Total Lake Volume: 169.61 million gallons (July 19, 2017 data)
Water Volume Under 4 ft of ice: 21.04 million gallons
Water Volume Under 5 ft of ice: 9.90 million gallons
Water Volume Under 7 ft of ice: 0.08 million gallons

Potential Ice Aggregate: 647.2 acres (water depth 4 ft or less)
33.8 million gallons

Maximum Recommended Winter Removal: **0.012 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

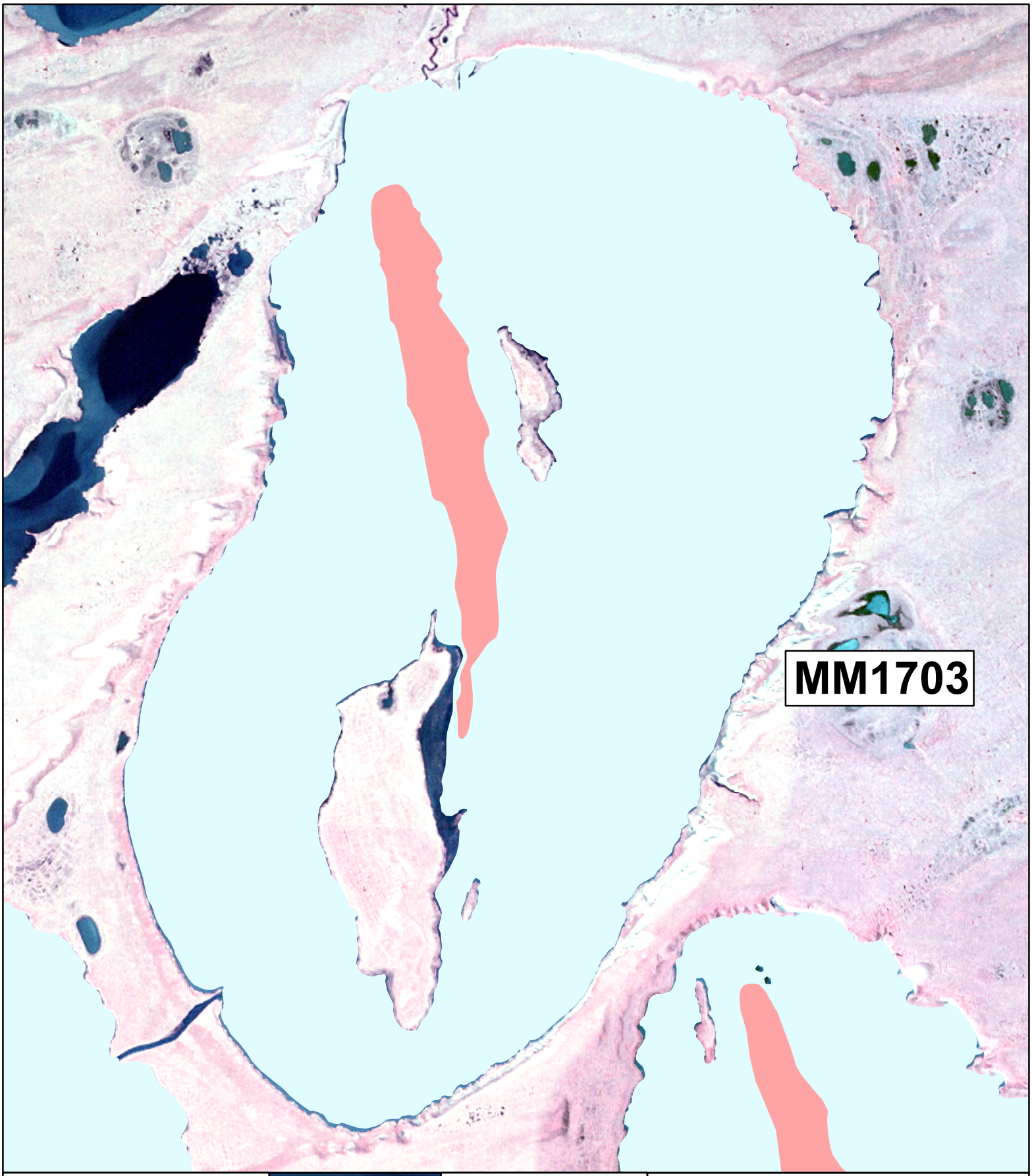
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	34.0	3.9	6.6	12.0	100.0	218.2	0.8	8.36	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 19 2017	4.6	Least cisco	53	116-332
Minnow Trap	Jul 19 2017	12.4	None	0	

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake MM1703

based on transects surveyed on July 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 1,500 Feet

N

Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

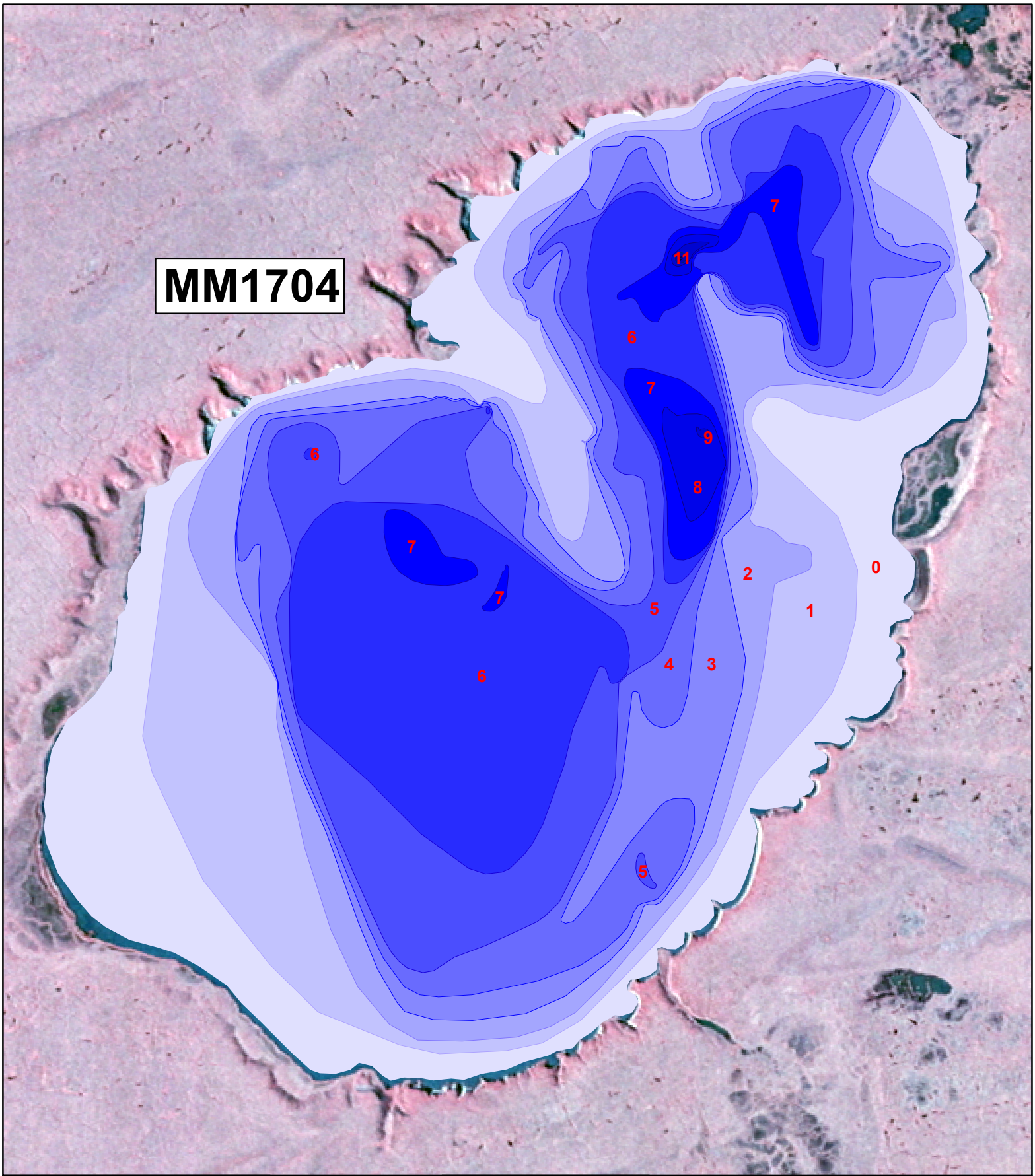
Depth Transects Surveyed at Lake MM1703

surveyed on July 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 1,500 Feet

N



Depth in Feet

0 3 6 9
1 4 7 10
2 5 8 11

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Transects Surveyed at Lake MM1704

based on transects surveyed on July 19, 2017

SCALE:

250 125 0 250 500 750 1,000
Feet

N

Lake MM1704

Other Names: None known
Location: 70.25898°N 152.38707°W
USGS Quad Sheet: Harrison Bay B-4: T10N R2W Sec. 3,4; T11N R2W Sec. 33,34
Habitat: Tundra lake
Area: 316 acres
Maximum Depth: 11.1 feet
Active Outlet: No
Total Lake Volume: 364.49 million gallons (July 19, 2017 data)
Water Volume Under 4 ft of ice: 85.12 million gallons
Water Volume Under 5 ft of ice: 44.19 million gallons
Water Volume Under 7 ft of ice: 2.97 million gallons

Potential Ice Aggregate: 172.9 acres (water depth 4 ft or less)
51.3 million gallons

Maximum Recommended Winter Removal: **13.26 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

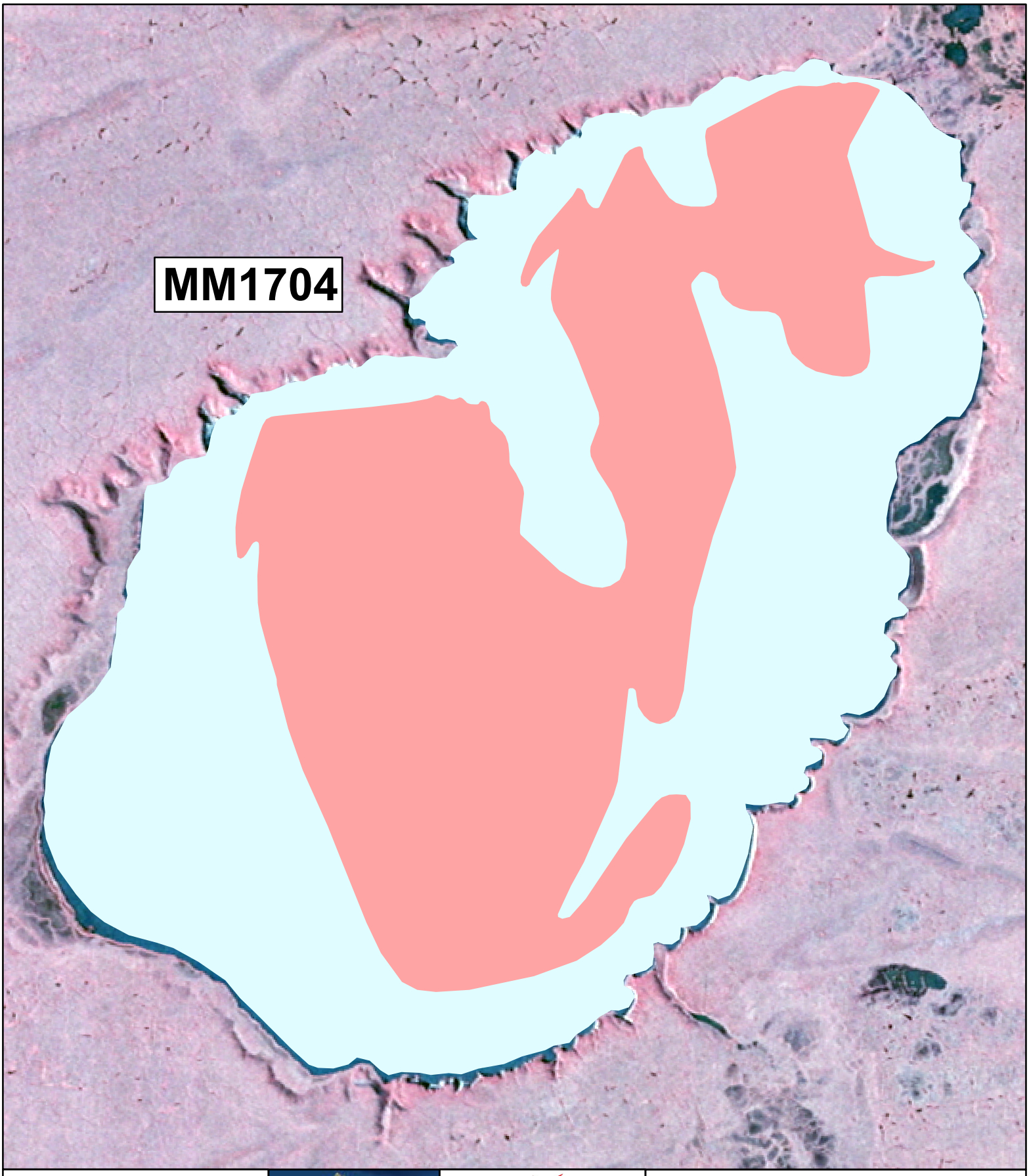
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	25.0	2.9	4.9	10.0	75.0	165.9	0.7	8.42	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 2017	9.1	None	0
Minnow Trap	Jul 19 2017	10.4	Ninespine Stickleback	3

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deepper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

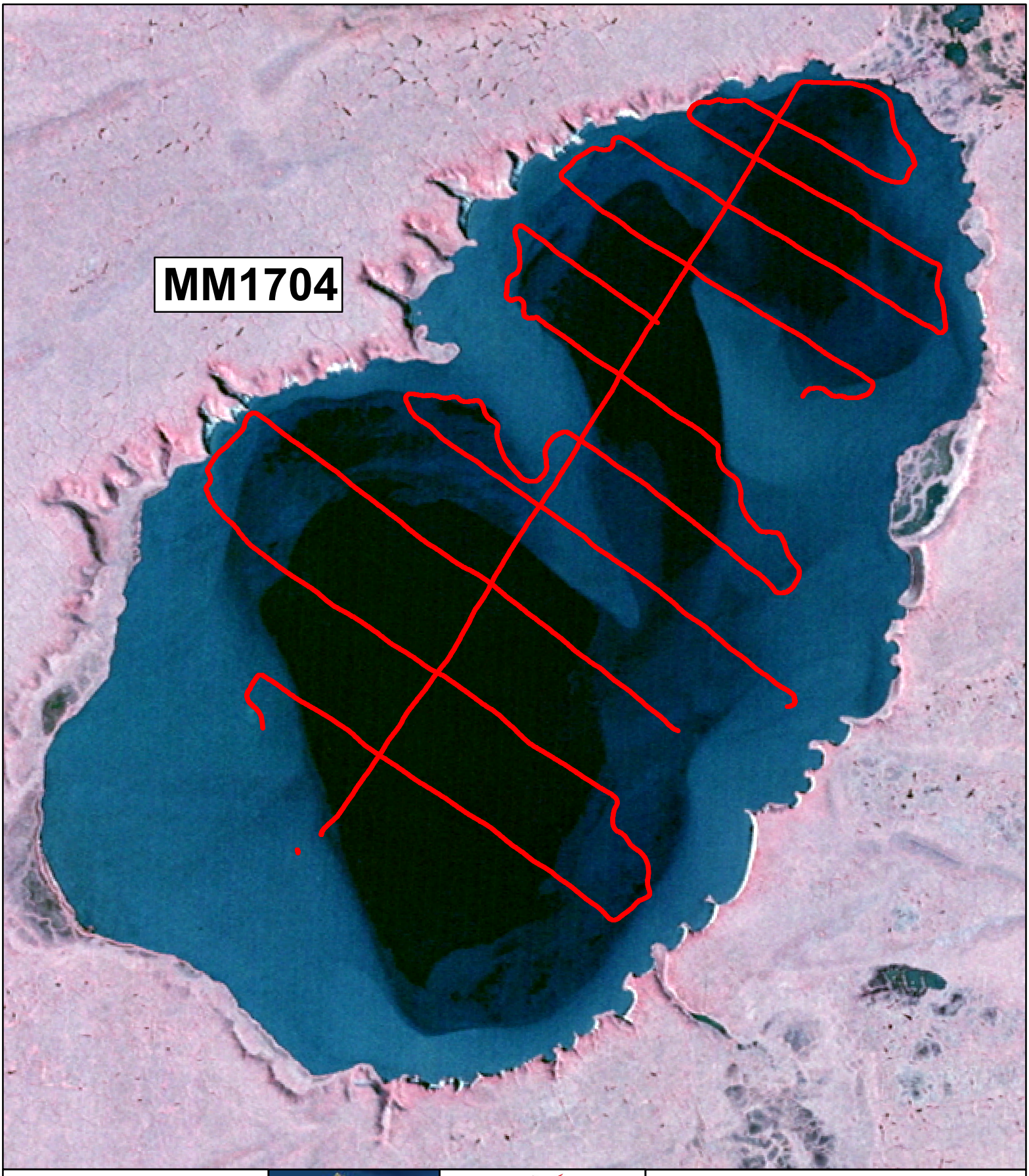
Area Available for Ice Chip Collection at Lake MM1704

based on transects surveyed on July 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 1,000 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

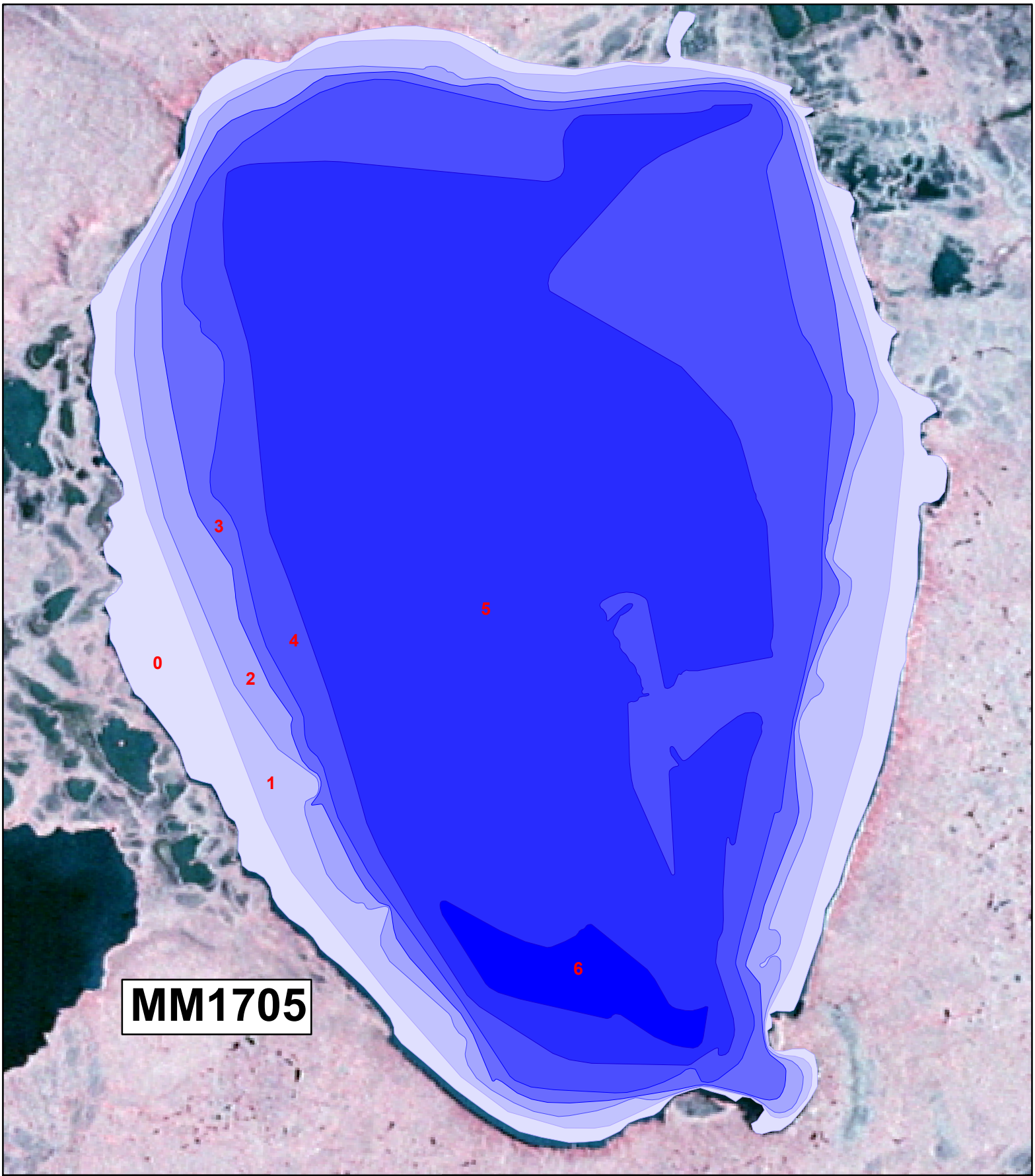
Depth Transects Surveyed at Lake MM1704

surveyed on July 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 1,000 Feet

N



Depth in Feet

0 2 4 6
1 3 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1705

based on transects surveyed on July 22, 2017

SCALE:

250 125 0 250 500
Feet

N

Lake MM1705

Other Names: None known
Location: 70.26069°N 152.31546°W
USGS Quad Sheet: Harrison Bay B-4: T10N R2W Sec. 2; T11N R2W Sec. 35
Habitat: Tundra lake
Area: 205 acres
Maximum Depth: 7.0 feet
Active Outlet: No
Total Lake Volume: 274.73 million gallons (July 22, 2017 data)
Water Volume Under 4 ft of ice: 52.58 million gallons
Water Volume Under 5 ft of ice: 13.82 million gallons
Water Volume Under 7 ft of ice: 0.00 million gallons

Potential Ice Aggregate: 63.5 acres (water depth 4 ft or less)
18.8 million gallons

Maximum Recommended Winter Removal: **4.15 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

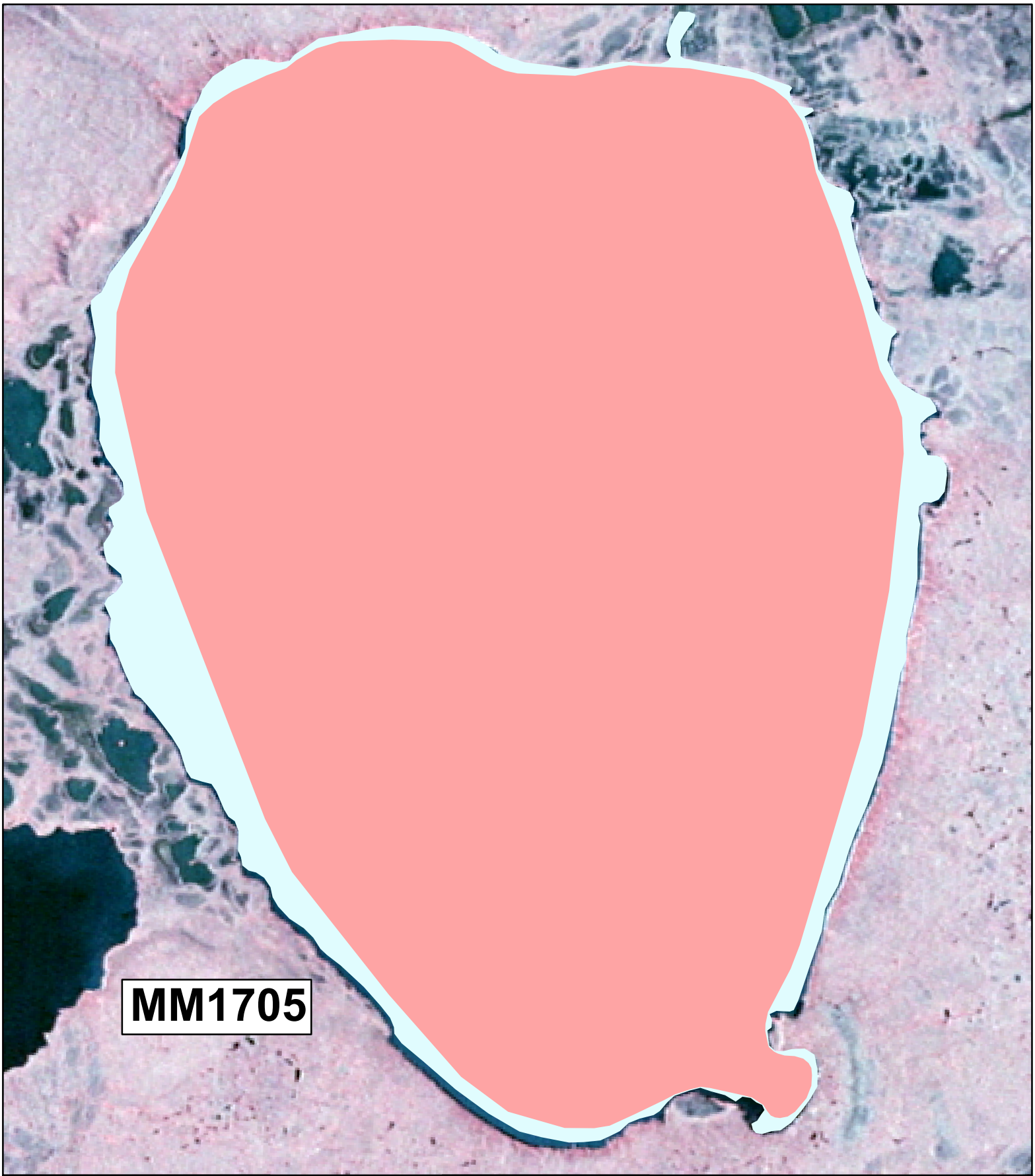
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	34.0	4.0	10.0	25.0	100.0	239.2	3.9	8.21	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 22 2017	10.0	None	0
Visual survey+dipnet	Jul 22 2017	14.4	Ninespine Stickleback	1

Data Last Revised: September 11, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake MM1705

based on transects surveyed on July 22, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N

Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

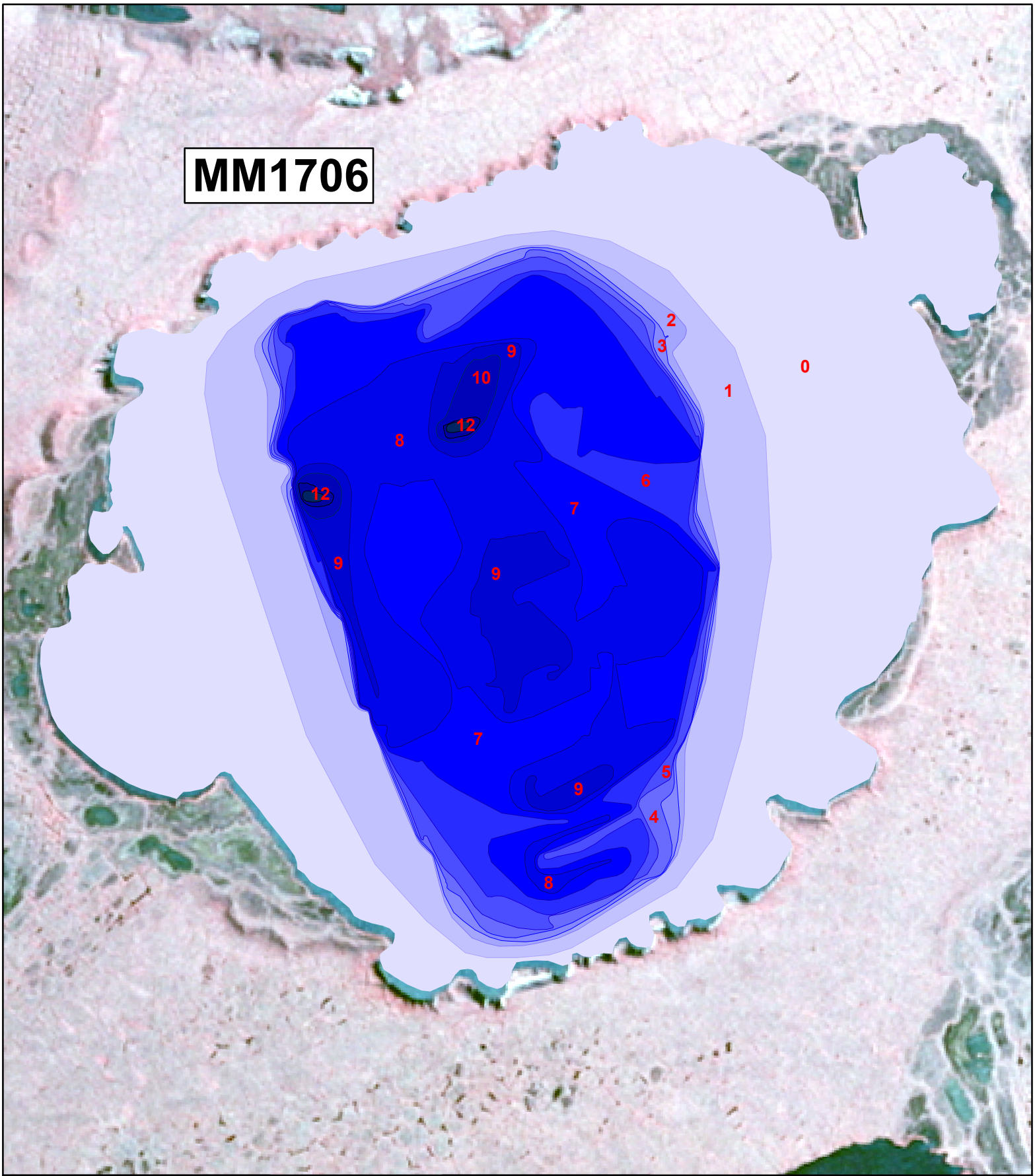
Depth Transects Surveyed at Lake MM1705

based on transects surveyed on July 22, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth in Feet

0 3 6 9 12
1 4 7 10
2 5 8 11

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Transects Surveyed at Lake MM1706

based on transects surveyed on July 23, 2017

SCALE:

250 125 0 250 500 Feet

N

Lake MM1706

Other Names: None known
Location: 70.20335°N 152.36404°W
USGS Quad Sheet: Harrison Bay A-5: T10N R2W Sec. 22,27
Habitat: Tundra lake
Area: 171 acres
Maximum Depth: 12.9 feet
Active Outlet: No
Total Lake Volume: 191.01 million gallons (July 23, 2017 data)
Water Volume Under 4 ft of ice: 78.48 million gallons
Water Volume Under 5 ft of ice: 57.59 million gallons
Water Volume Under 7 ft of ice: 19.84 million gallons

Potential Ice Aggregate: 105.6 acres (water depth 4 ft or less)
31.3 million gallons

Maximum Recommended Winter Removal: **17.28 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

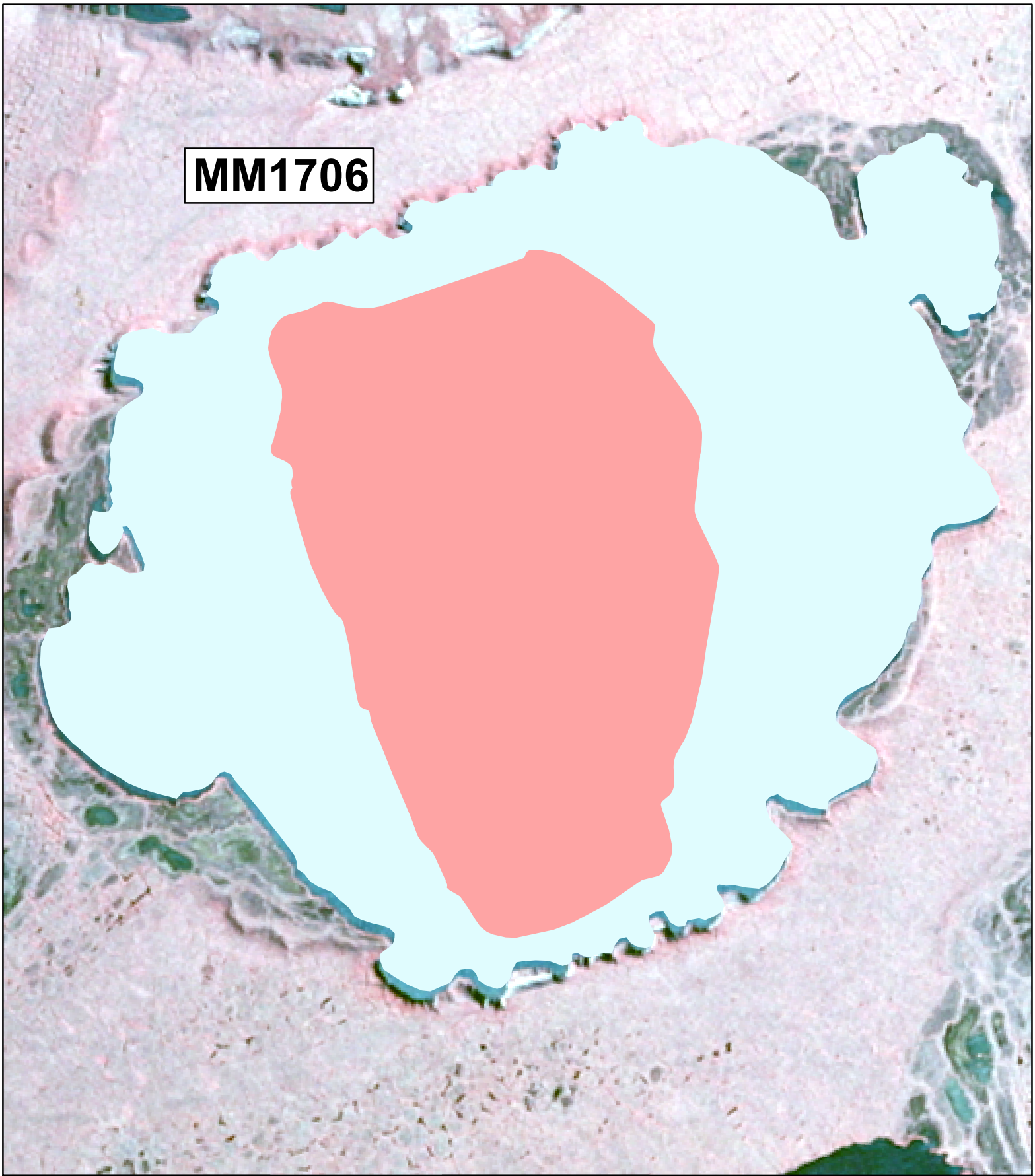
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	31.0	5.2	12.0	29.0	97.0	248.7	0.9	8.30	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 23 2017	9.3	None	0
Minnow Trap	Jul 23 2017	17.1	Ninespine Stickleback	1
Seine Net	Jul 23 2017	1 haul	None	0
Visual survey+dipnet	Jul 23 2017	100 yds	Ninespine Stickleback	0

Data Last Revised: September 14, 2017



Ice Chip Area

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

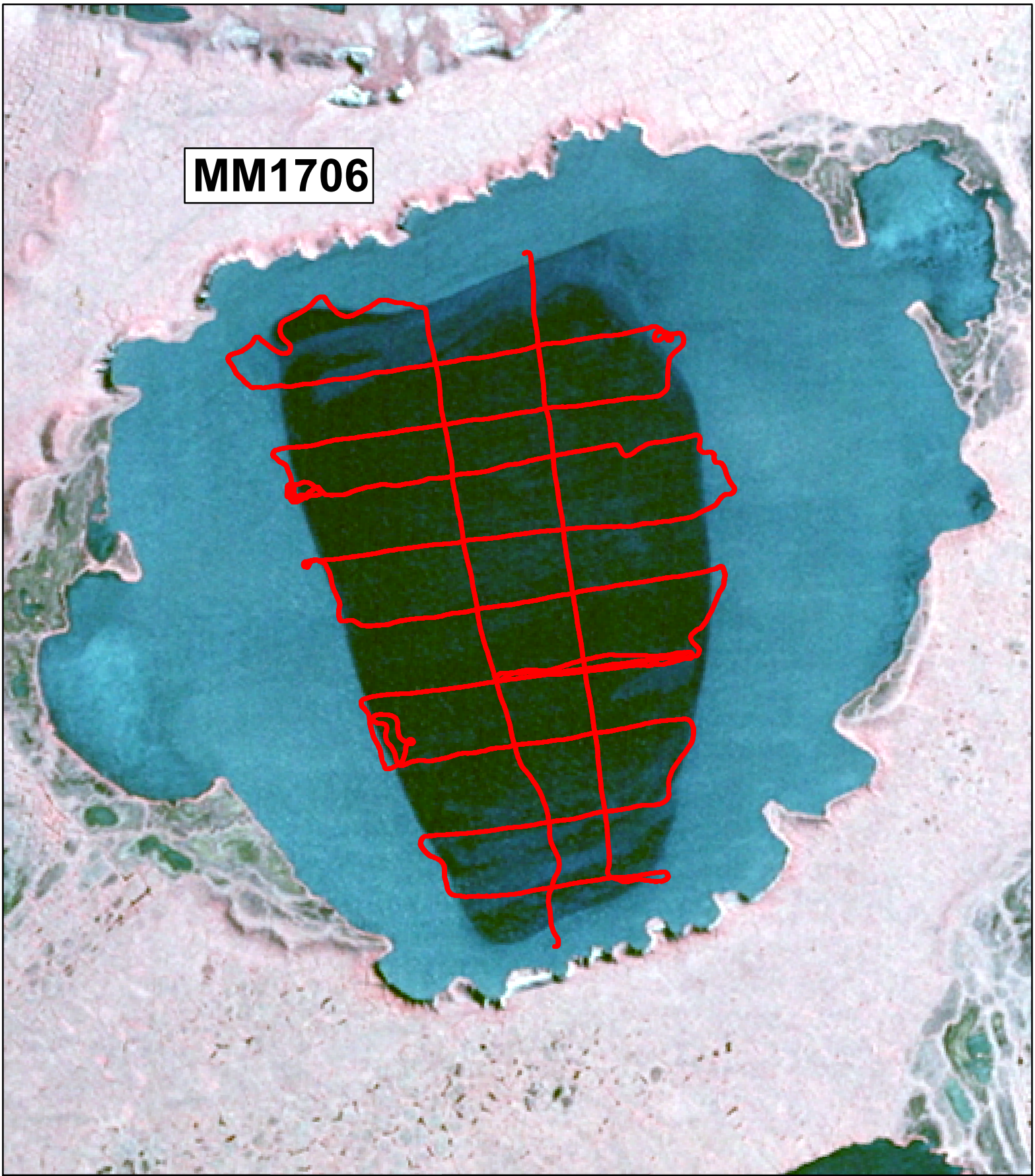
Area Available for Ice Chip Collection at Lake MM1706

based on transects surveyed on July 23, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500
Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

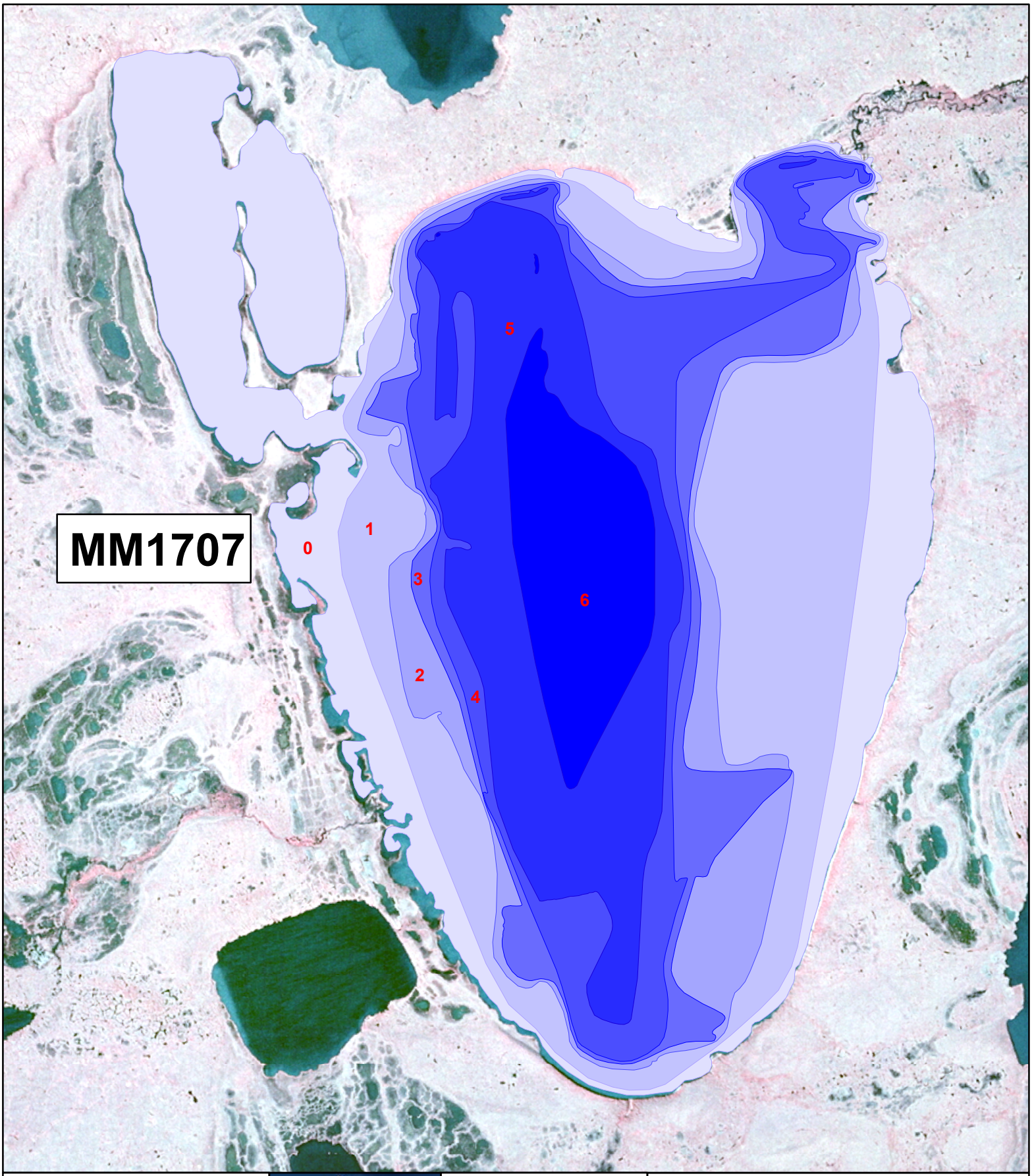
Depth Transects Surveyed at Lake MM1706

surveyed on July 23, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth in Feet

0 1 2 3 4 5 6

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1707

based on transects surveyed on July 25, 2017

SCALE:

500 250 0 500 1,000 1,500 Feet

N

Lake MM1707

Other Names: None known
Location: 70.20165°N 152.30995°W
USGS Quad Sheet: Harrison Bay A-4: T10N R2W, Sect 14,23,24,25,26
Habitat: Drainage lake
Area: 657 acres
Maximum Depth: 6.7 feet
Active Outlet: Yes
Total Lake Volume: 622.55 million gallons (July 25, 2017 data)
Water Volume Under 4 ft of ice: 104.32 million gallons
Water Volume Under 5 ft of ice: 39.27 million gallons
Water Volume Under 7 ft of ice: 0.00 million gallons

Potential Ice Aggregate: 416.1 acres (water depth 4 ft or less)
123.4 million gallons

Maximum Recommended Winter Removal: **0.00 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

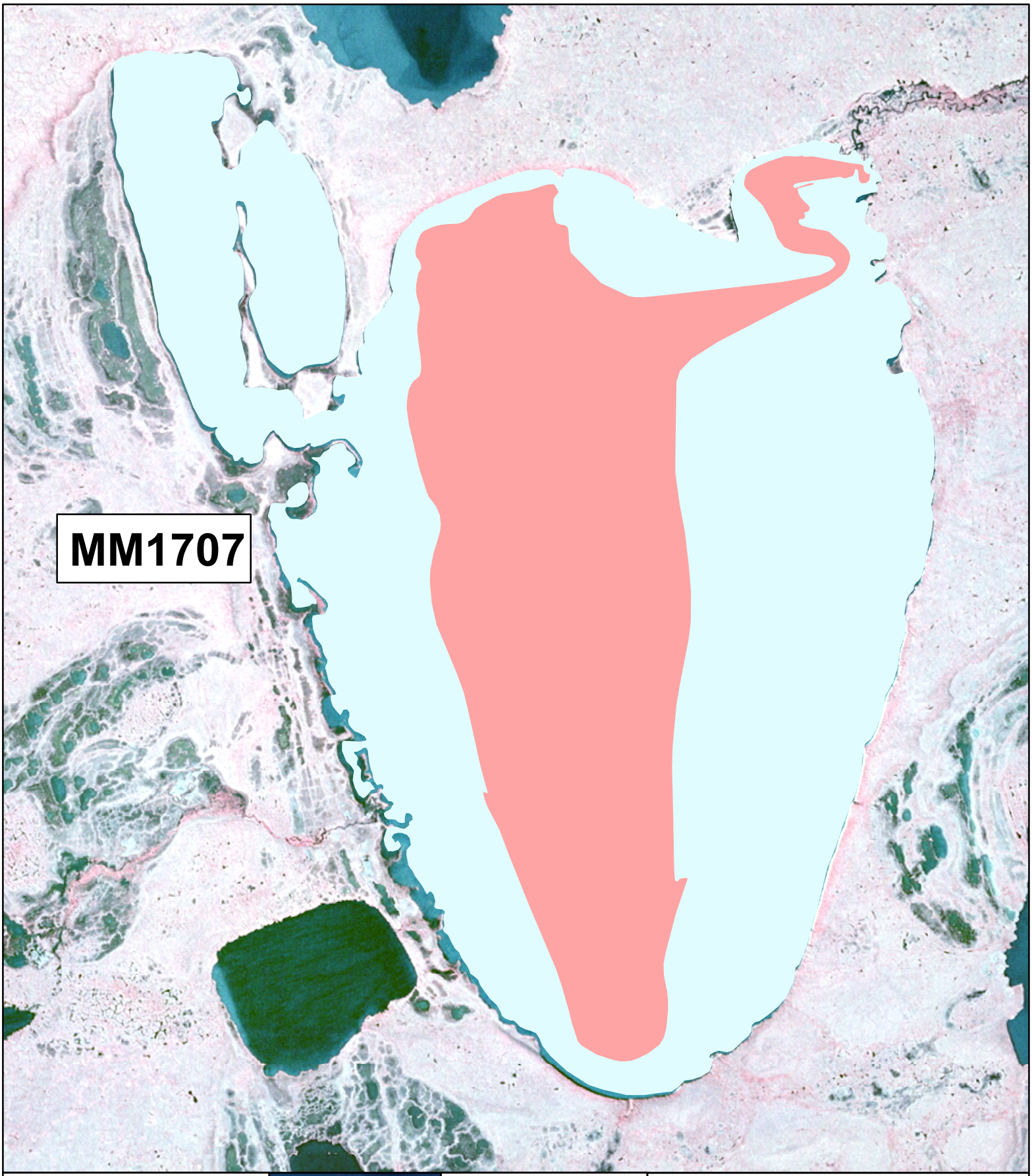
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	24.0	4.1	9.5	24.0	77.0	195.7	1.3	8.05	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 26 2017	7.7	BDWF	5	404-482
			GRAY	2	105, 107
Minnow Trap	Jul 26 2017	8.3	None	1	

Data Last Revised: August 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

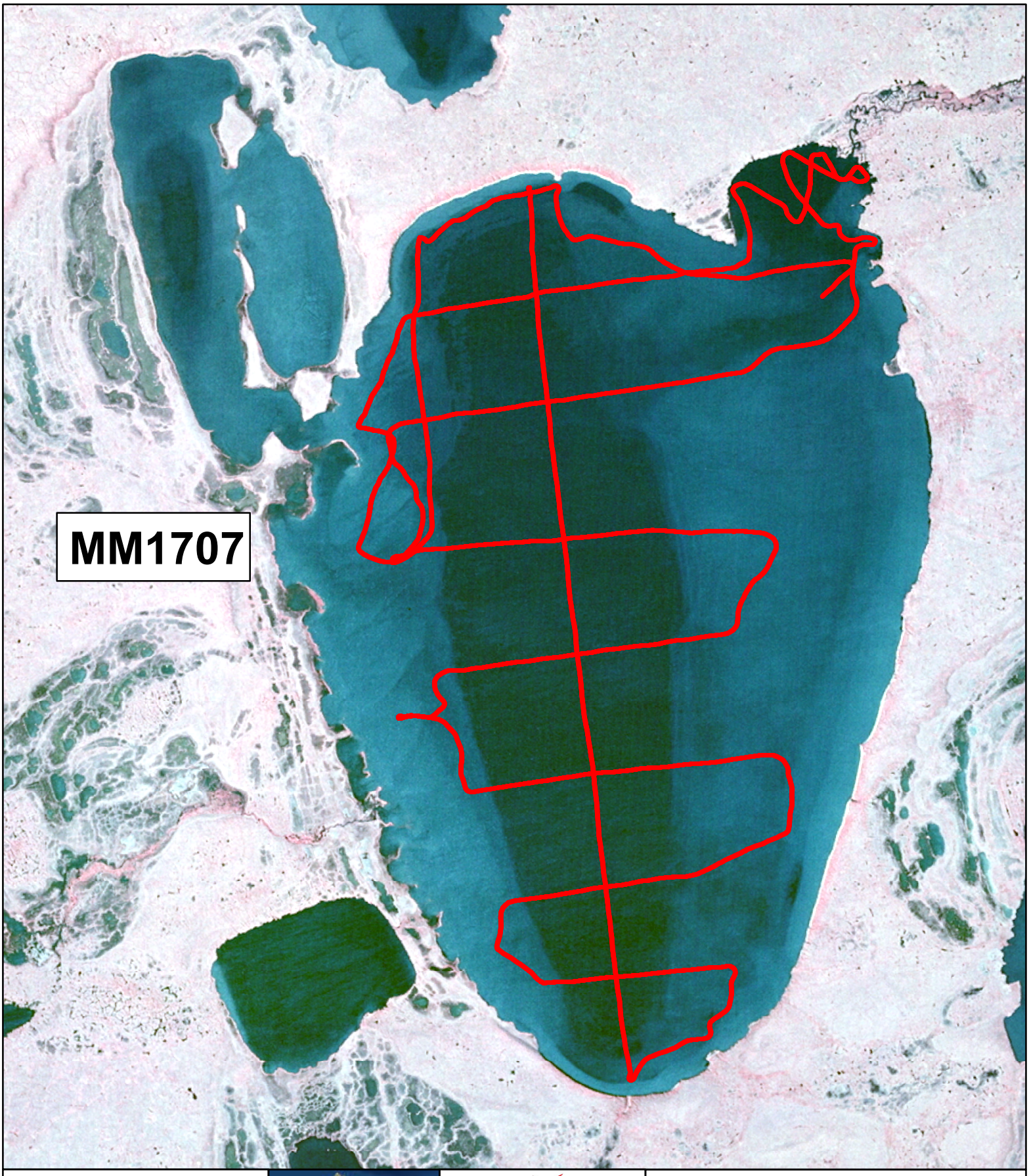
Area Available for Ice Chip Collection at Lake MM1707

based on transects surveyed on July 25, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 1,500 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

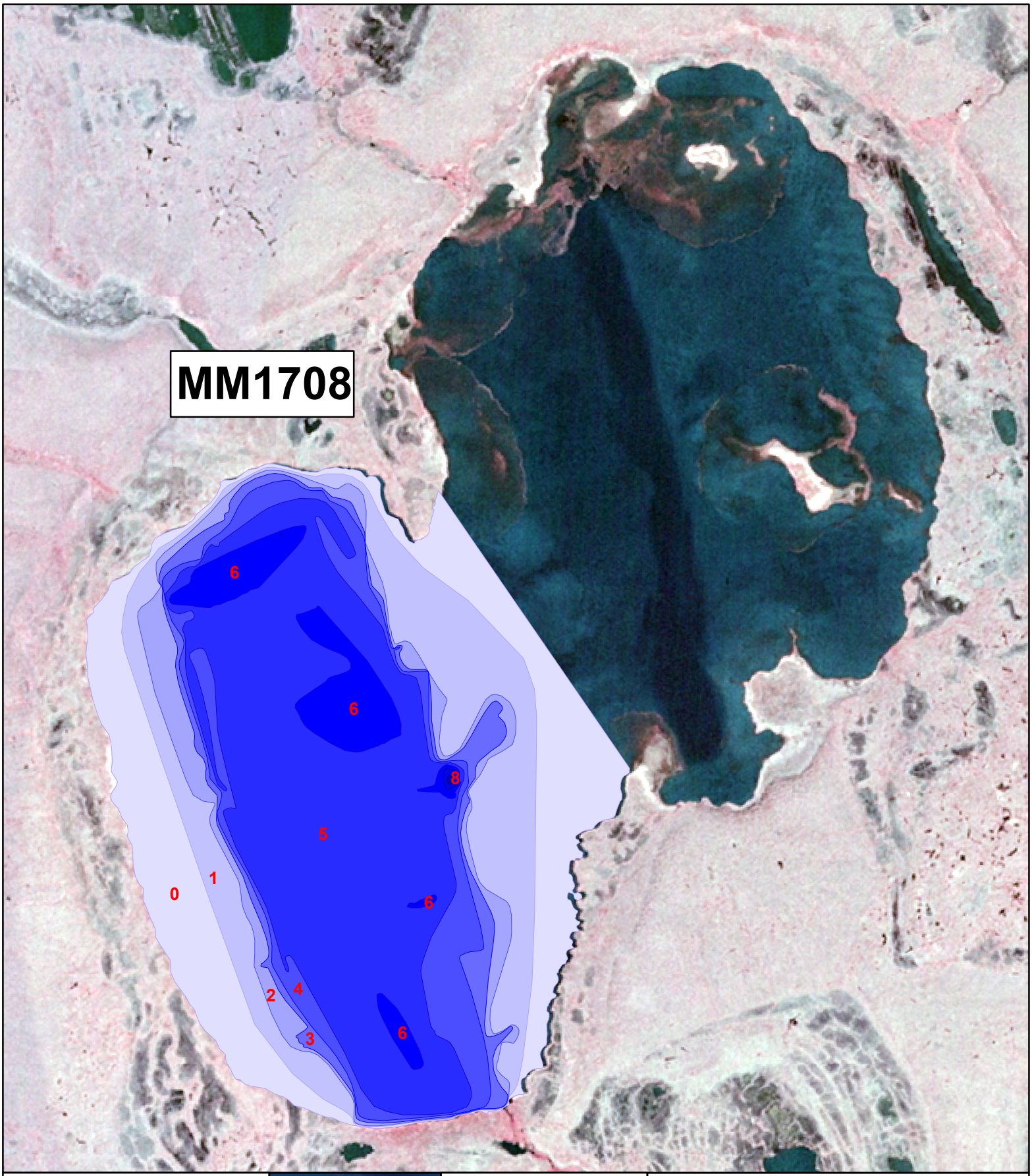
Depth Transects Surveyed at Lake MM1707

surveyed on July 25, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 1,500 Feet

N



Depth in Feet

0	3	6
1	4	7
2	5	8

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1708

based on transects surveyed on July 26, 2017

SCALE:

250125 0 250 500 750 1,000
Feet

N

Lake MM1708

Other Names: None known
Location: 70.19194°N 152.23439°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W, Sect 19,29,30
Habitat: Tundra lake
Area: 162 acres
Maximum Depth: 8.4 feet
Active Outlet: No
Total Lake Volume: 175.15 million gallons (July 26, 2017 data)
Water Volume Under 4 ft of ice: 35.52 million gallons
Water Volume Under 5 ft of ice: 12.04 million gallons
Water Volume Under 7 ft of ice: 0.029 million gallons

Potential Ice Aggregate: 82.70 acres (water depth 4 ft or less)
24.52 million gallons

Maximum Recommended Winter Removal: **3.61 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

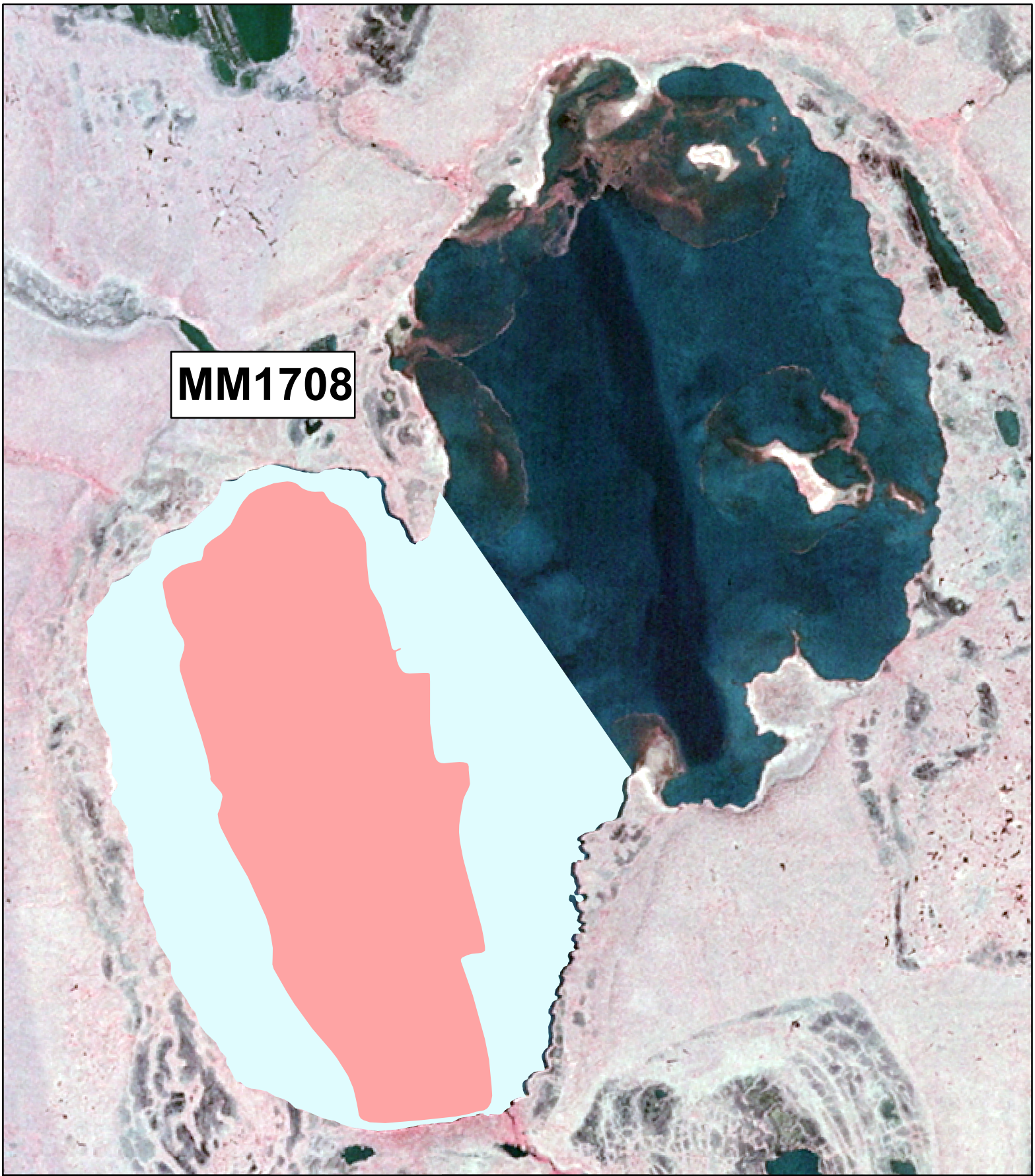
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	6.2	1.4	3.3	7.6	21.0	60.2	1.5	7.29	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 26 2017	7.7	None	0
Minnow Trap	Jul 26 2017	8.3	Alaska blackfish	1

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips

Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

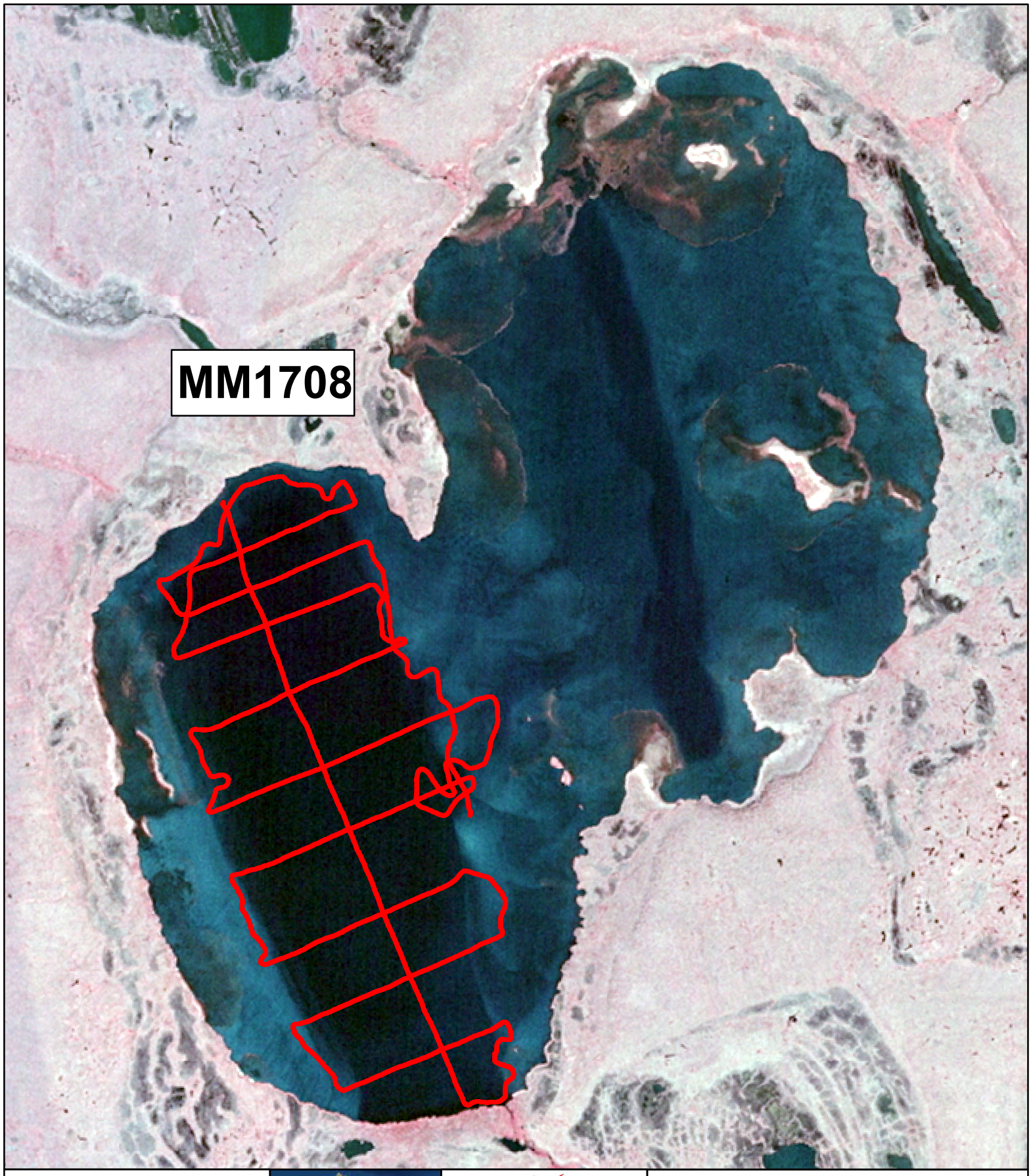
Area Available for Ice Chip Collection at Lake MM1708

based on transects surveyed on July 26, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250125 0 250 500 750 1,000 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

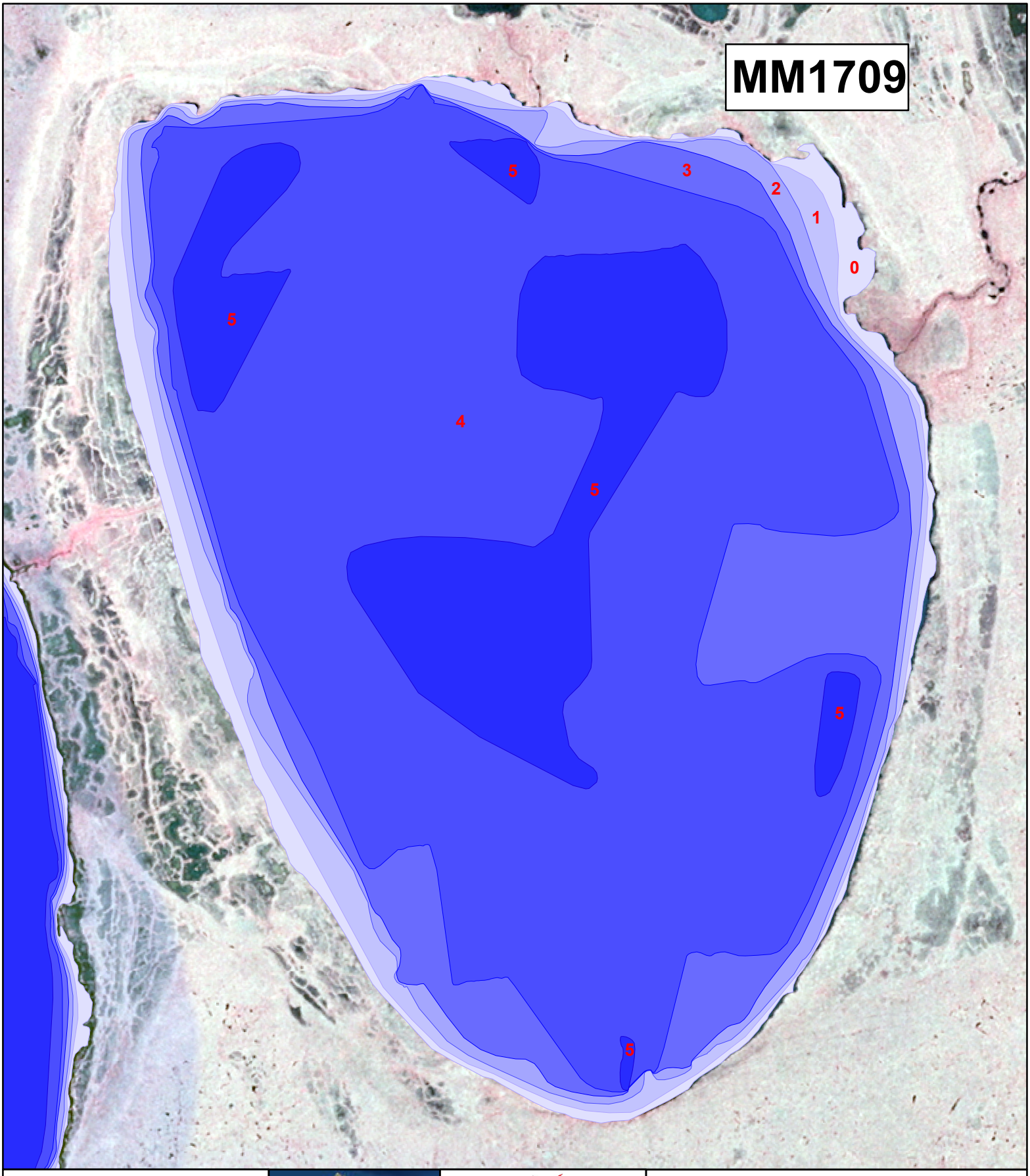
Depth Transects Surveyed at Lake MM1708

surveyed on July 26, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250125 0 250 500 750 1,000
Feet

N



Depth in Feet

0 1 2 3 4 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1709

based on transects surveyed on July 25, 2017

SCALE:

500 250 0 500 1,000 Feet

N

Lake MM1709

Other Names: None known
Location: 70.17585°N 152.22278°W
USGS Quad Sheet: Harrison Bay A-4: T9N R1W Sec. 5,6; T10N R1W Sec. 31,32
Habitat: Drainage lake
Area: 517.1 acres
Maximum Depth: 5.9 feet
Active Outlet: Yes
Total Lake Volume: 687.23 million gallons (July 25, 2017 data)
Water Volume Under 4 ft of ice: 78.91 million gallons
Water Volume Under 5 ft of ice: 8.86 million gallons
Water Volume Under 7 ft of ice: 0.00 million gallons

Potential Ice Aggregate: 131.10 acres (water depth 4 ft or less)
38.88 million gallons

Maximum Recommended Winter Removal: **0.000 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	13.0	2.4	7.7	18.0	43.0	123.8	3.8	7.72	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 25 2017	2.6	Least cisco	1	336

Data Last Revised: September 14, 2017

Ice Chip Areas

- 4 feet or shallower - available for ice chips
- Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake MM1709

based on transects surveyed on July 25, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 Feet

N

Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

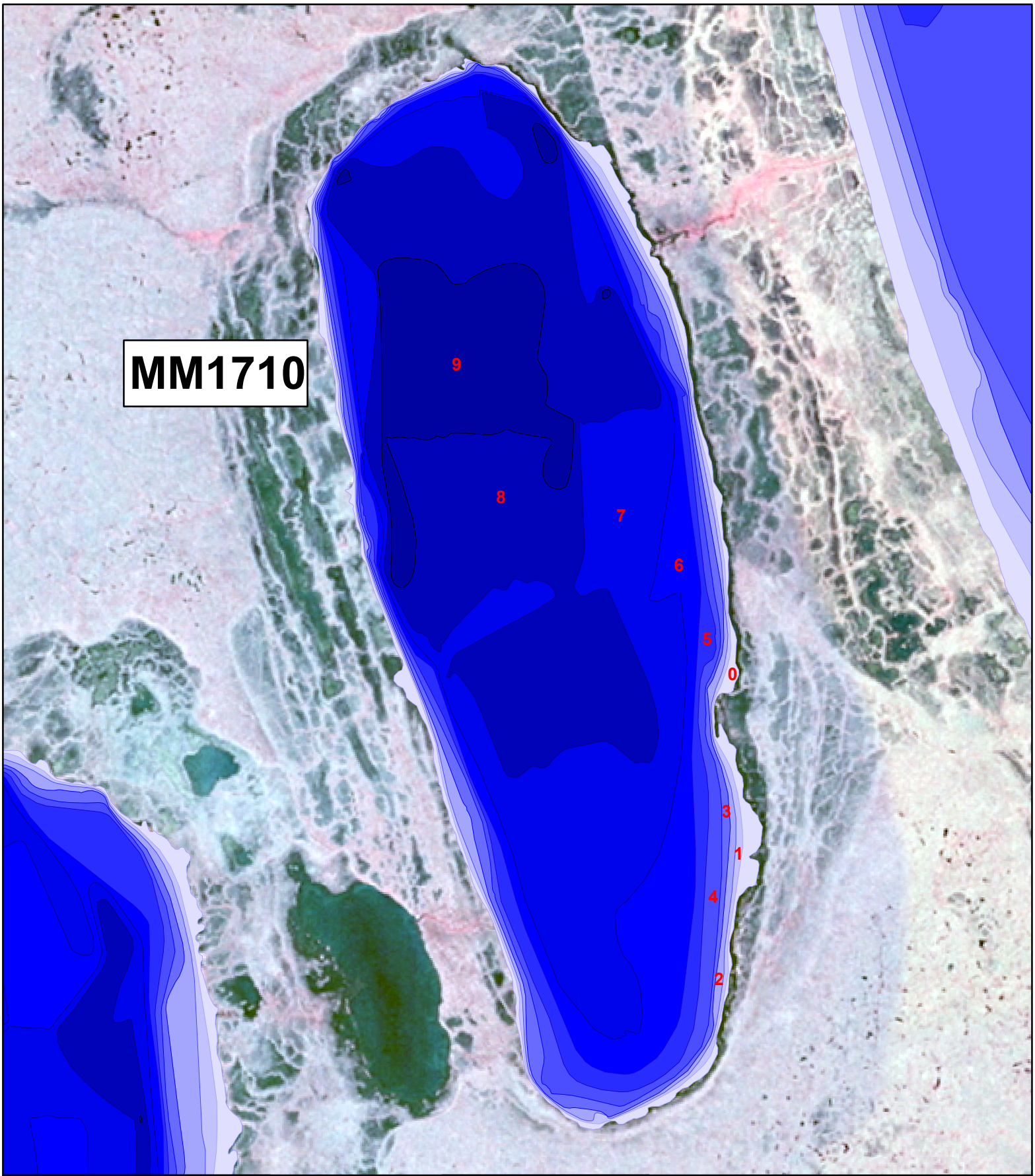
Depth Transects Surveyed at Lake MM1709

surveyed on July 25, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 Feet

N



Depth in Feet

0 1 2 3 4 5 6 7 8 9

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1710

based on transects surveyed on July 24, 2017

SCALE:

250 125 0 250 500 750 Feet

N

Lake MM1710

Other Names: None known
Location: 70.17117°N 152.25340°W
USGS Quad Sheet: Harrison Bay A-4: T9N R1W Sec. 6; T9N R2W Sec. 1; T10N R1W Sec. 31; T10N R2W Sec. 36
Habitat: Tundra lake
Area: 136 acres
Maximum Depth: 10.0 feet
Active Outlet: No
Total Lake Volume: 308.14 million gallons (July 24, 2017 data)
Water Volume Under 4 ft of ice: 141.71 million gallons
Water Volume Under 5 ft of ice: 103.89 million gallons
Water Volume Under 7 ft of ice: 36.27 million gallons

Potential Ice Aggregate: 16.10 acres (water depth 4 ft or less)
4.79 million gallons

Maximum Recommended Winter Removal: **31.17 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	6.4	1.5	5.4	14.0	22.0	74.1	0.8	7.20	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 24 2017	7.9	None	0
Minnow Trap	Jul 24 2017	0.3	Ninespine stickleback	1
Visual survey+dipnet	Jul 24 2017	5 yds	Ninespine stickleback	3

Data Last Revised: September 14, 2017

Ice Chip Areas

- 4 feet or shallower - available for ice chips
- Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

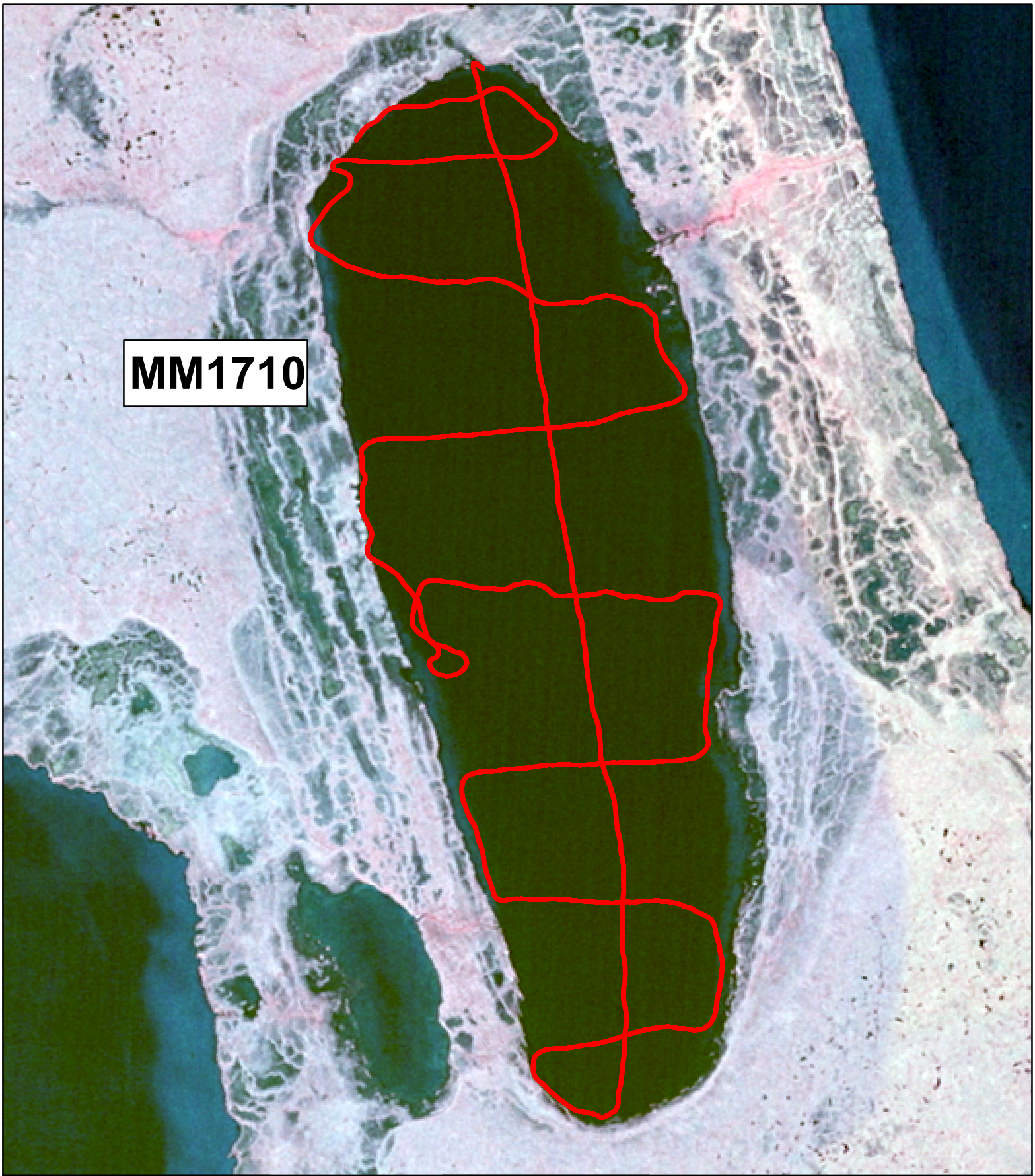
Area Available for Ice Chip Collection at Lake MM1710

surveyed on July 24, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

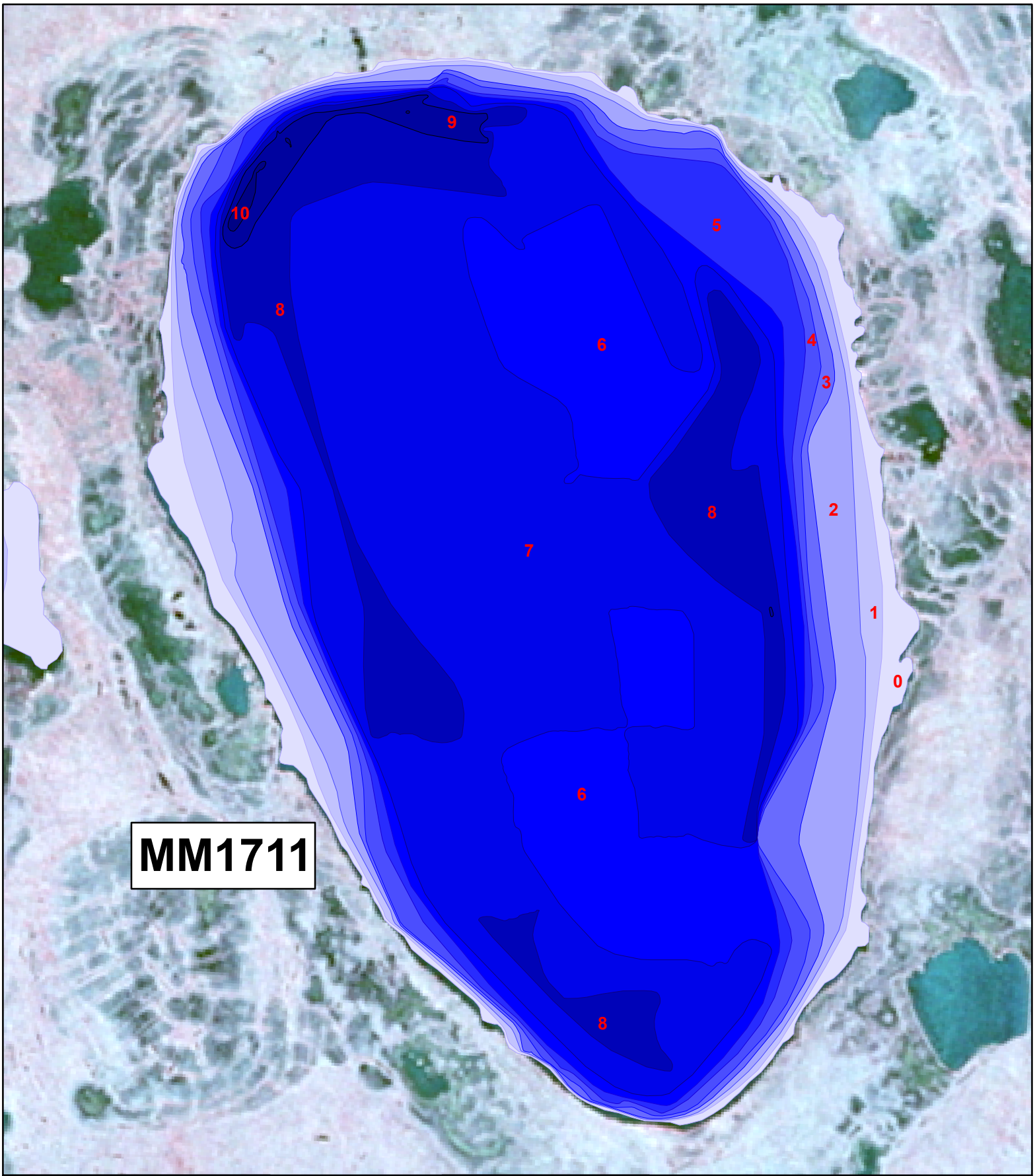
Depth Transects Surveyed at Lake MM1710

surveyed on July 24, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth in Feet

0	3	6	9
1	4	7	10
2	5	8	

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1711

based on transects surveyed on July 24, 2017

SCALE:

250 125 0 250 500 Feet

N

Lake MM1711

Other Names: None known
Location: 70.16356°N 152.27127°W
USGS Quad Sheet: Harrison Bay A-4: T9N R2W, Sec. 1
Habitat: Tundra lake
Area: 122 acres
Maximum Depth: 10.4 feet
Active Outlet: No
Total Lake Volume: 241.7 million gallons (July 24, 2017 data)
Water Volume Under 4 ft of ice: 98.93 million gallons
Water Volume Under 5 ft of ice: 68.15 million gallons
Water Volume Under 7 ft of ice: 14.75 million gallons

Potential Ice Aggregate: 24.70 acres (water depth 4 ft or less)
7.33 million gallons

Maximum Recommended Winter Removal: **20.44 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

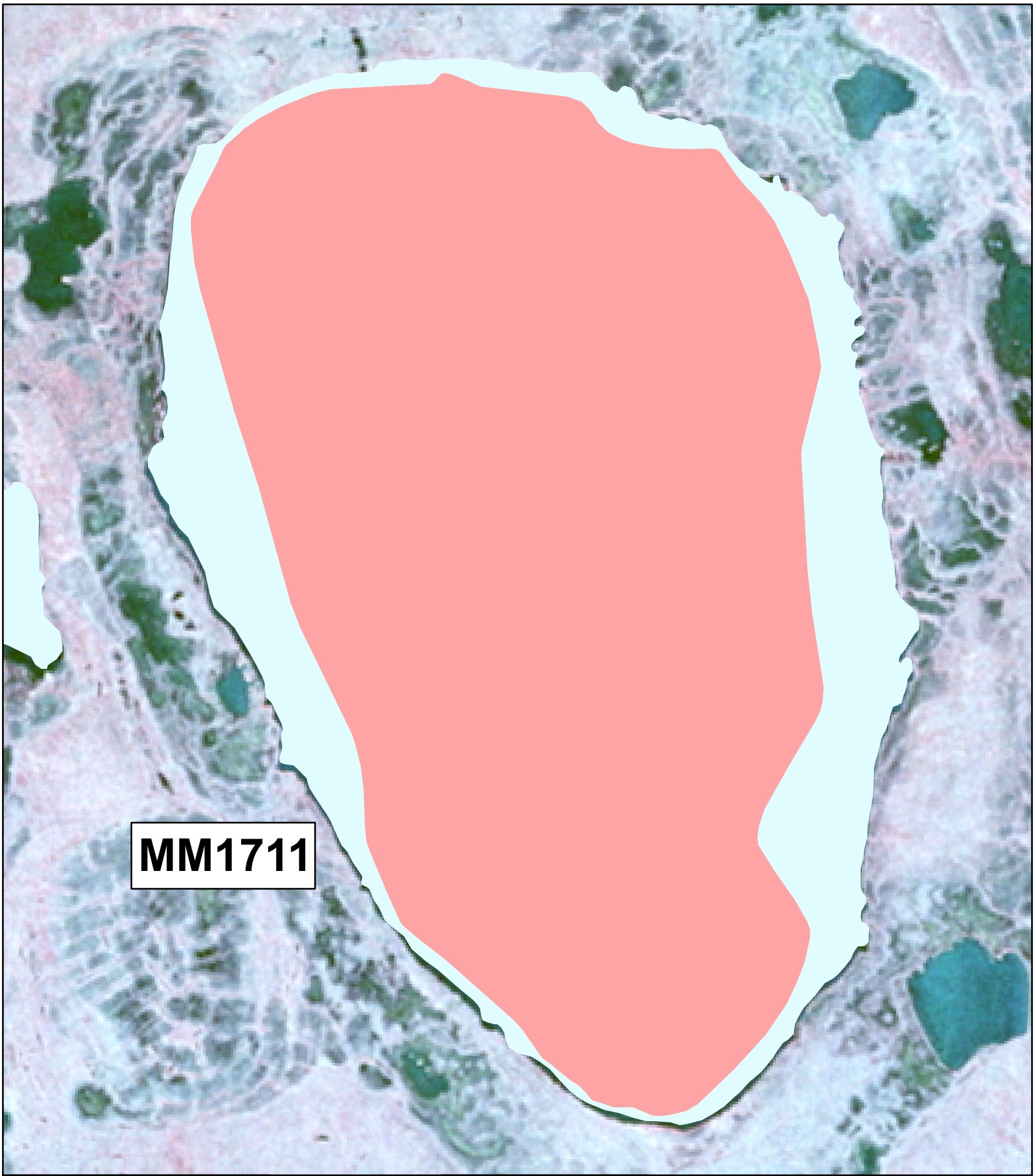
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	8.4	2.1	7.7	18.0	30.0	102.6	0.7	7.52	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 24 2017	8.8	None	0
Minnow Trap	Jul 24 2017	1.3	None	0
Visual survey+dipnet	Jul 24 2017	20 yds	Ninespine stickleback	1

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips

Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

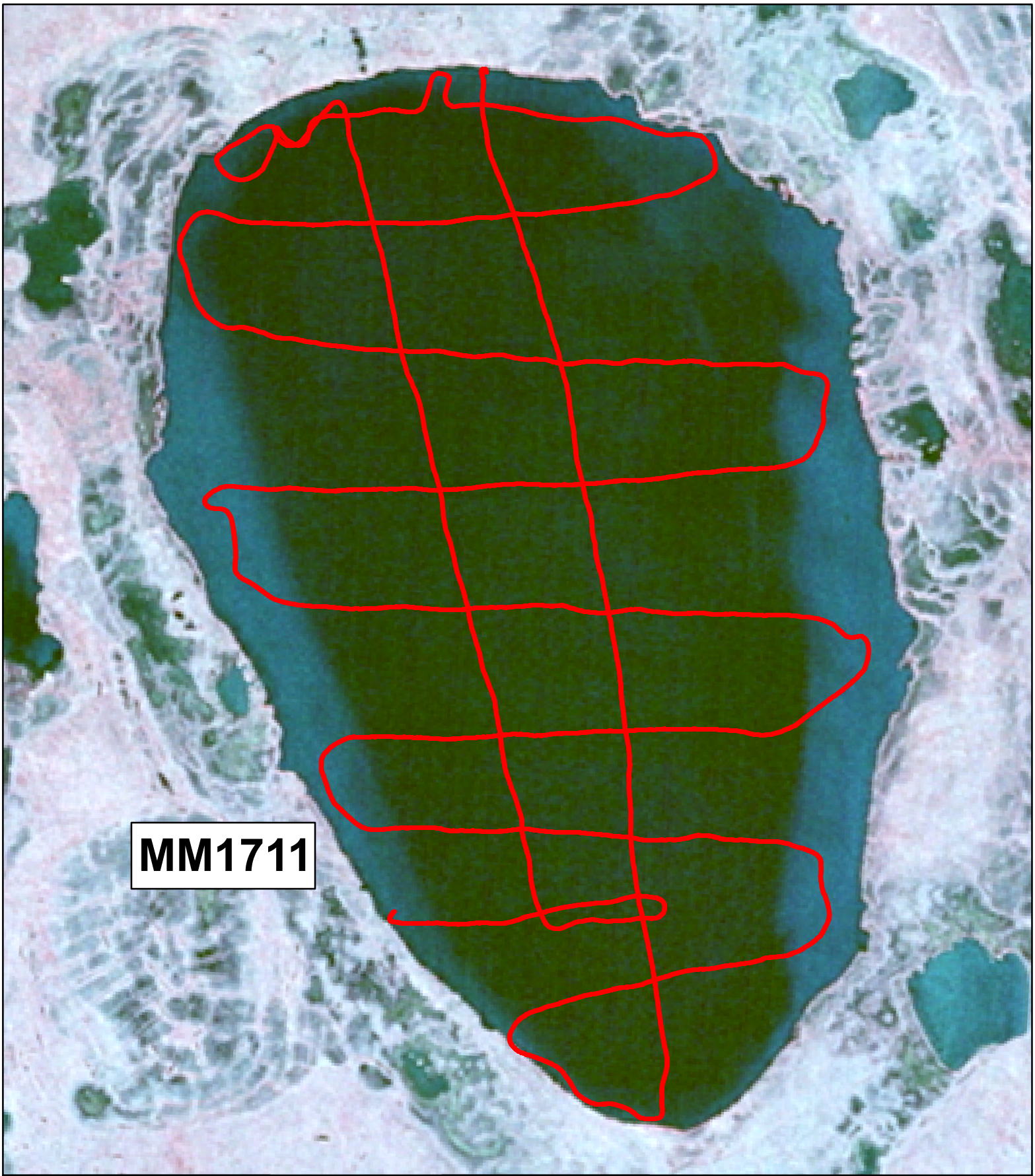
Area Available for Ice Chip Collection at Lake MM1711

based on transects surveyed on July 24, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

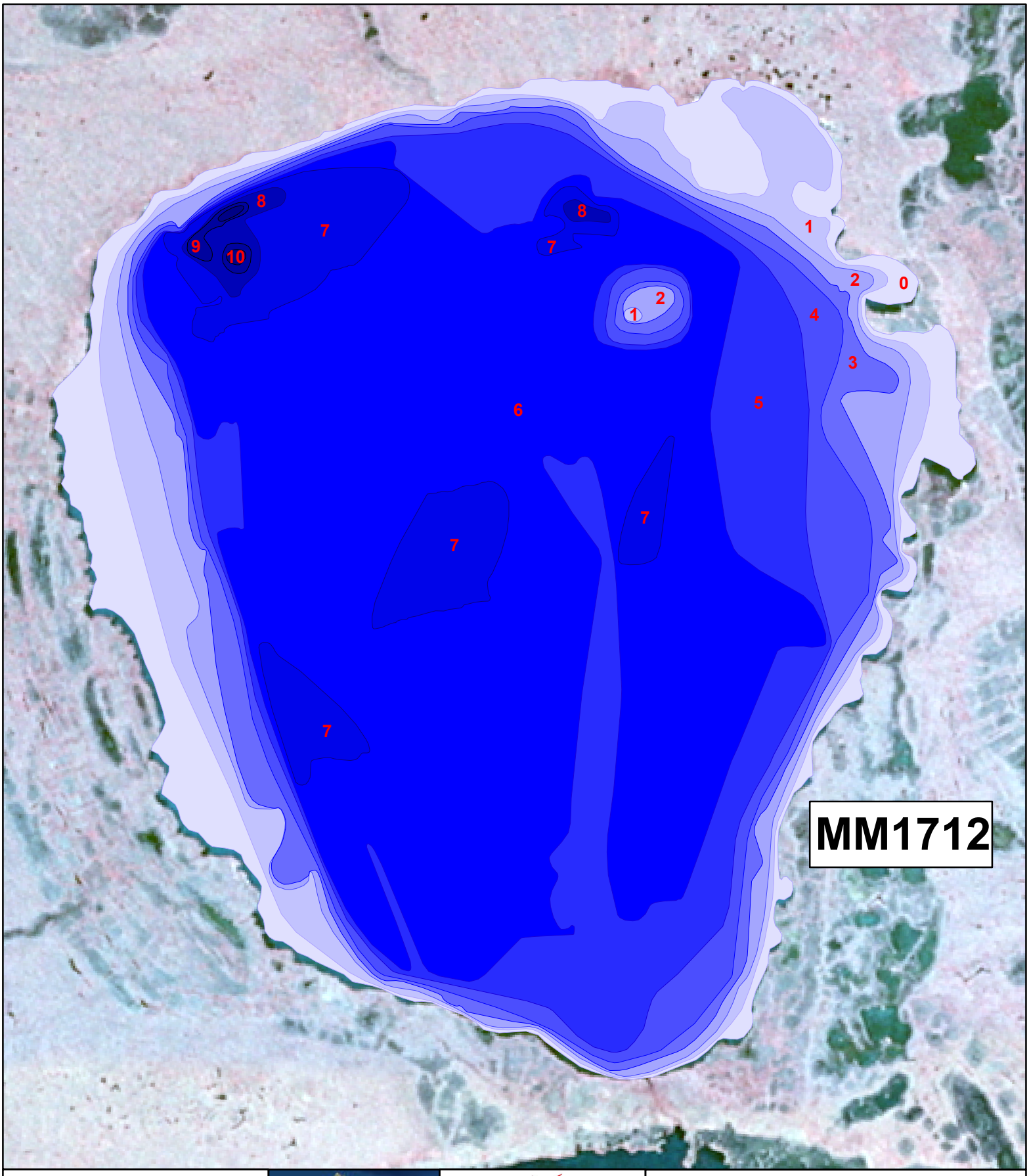
Depth Transects Surveyed at Lake MM1711

surveyed on July 24, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth in Feet

0	3	6	9
1	4	7	10
2	5	8	

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1712

based on transects surveyed on July 27, 2017

SCALE:

250 125 0 250 500 750 Feet

N

Lake MM1712

Other Names: None known
Location: 70.12167°N 151.08479°W
USGS Quad Sheet: Harrison Bay A-4: T9N R2W, Sec. 1,2
Habitat: Tundra lake
Area: 196.6 acres
Maximum Depth: 10.8 feet
Active Outlet: No
Total Lake Volume: 324.0 million gallons (July 27, 2017 data)
Water Volume Under 4 ft of ice: 104.7 million gallons
Water Volume Under 5 ft of ice: 58.89 million gallons
Water Volume Under 7 ft of ice: 2.91 million gallons

Potential Ice Aggregate: 50.10 acres (water depth 4 ft or less)
14.85 million gallons

Maximum Recommended Winter Removal: **17.67 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

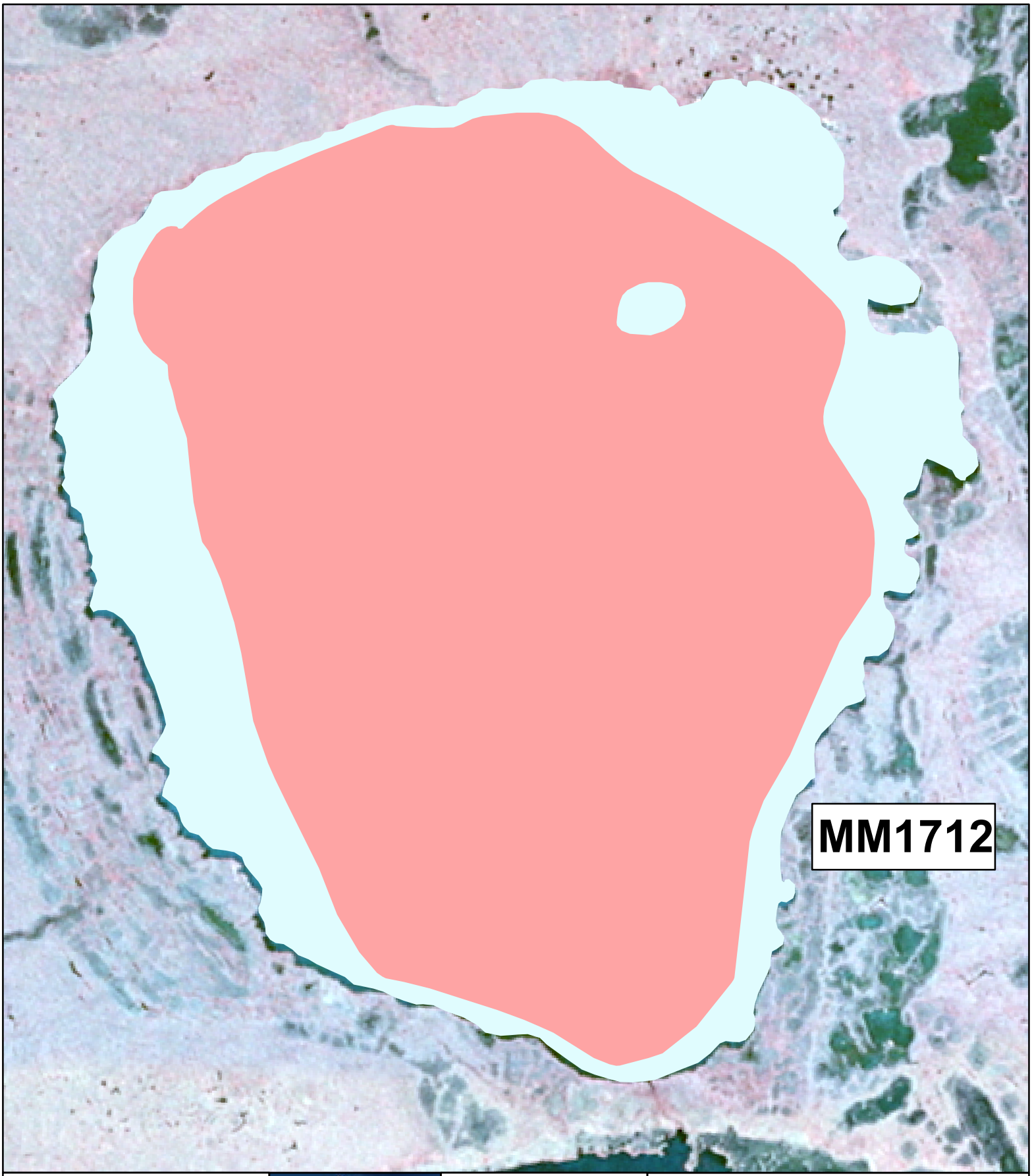
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	11.0	2.9	8.0	22.0	41.0	126.9	1.6	7.64	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 27 2017	9.4	None	0
Minnow Trap	Jul 27 2017	12.6	Ninespine stickleback	1

Data Last Revised: September 14, 2017



Ice Chip Areas

- 4 feet or shallower - available for ice chips
- Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

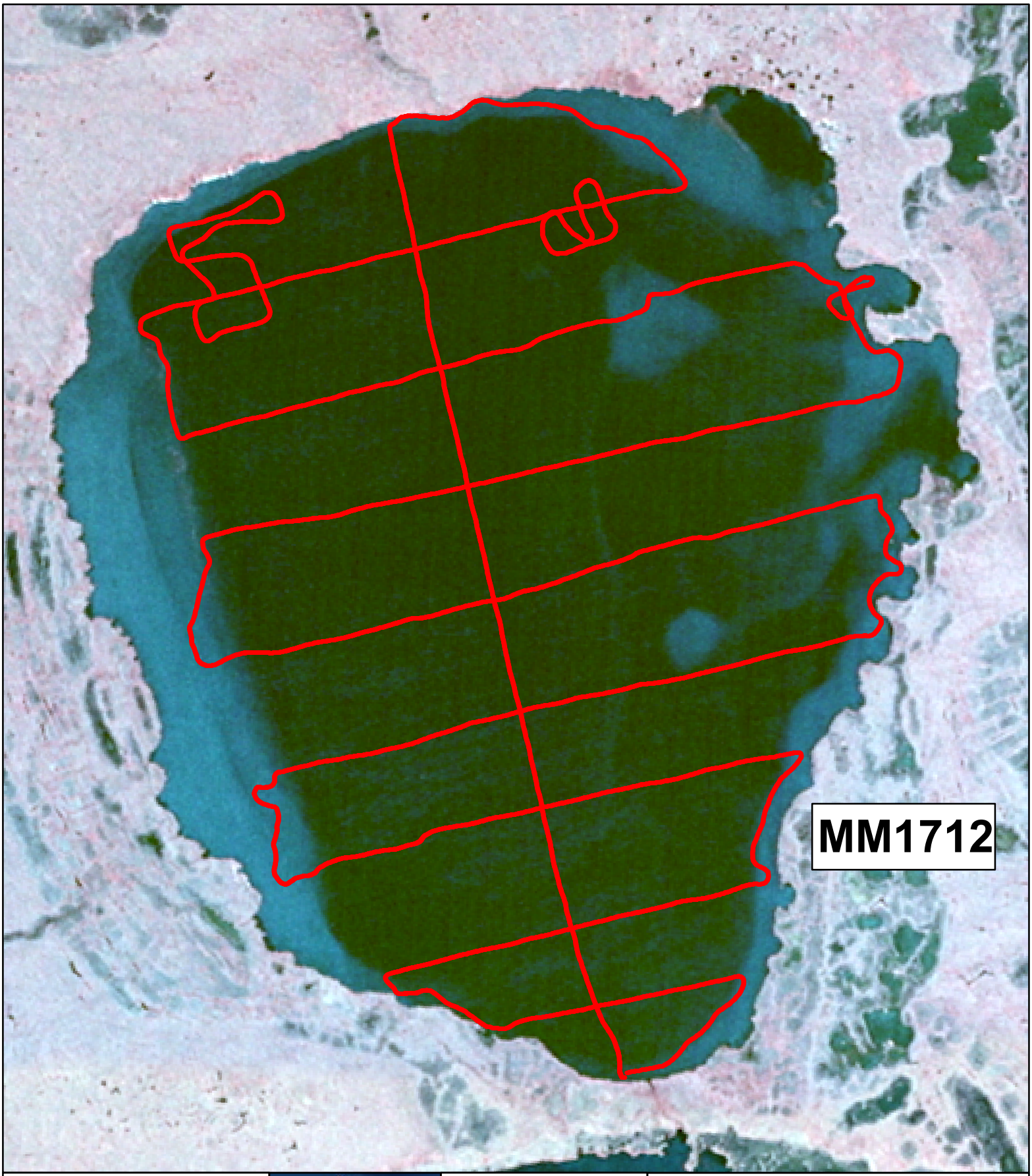
Area Available for Ice Chip Collection at Lake MM1712

based on transects surveyed on July 27, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

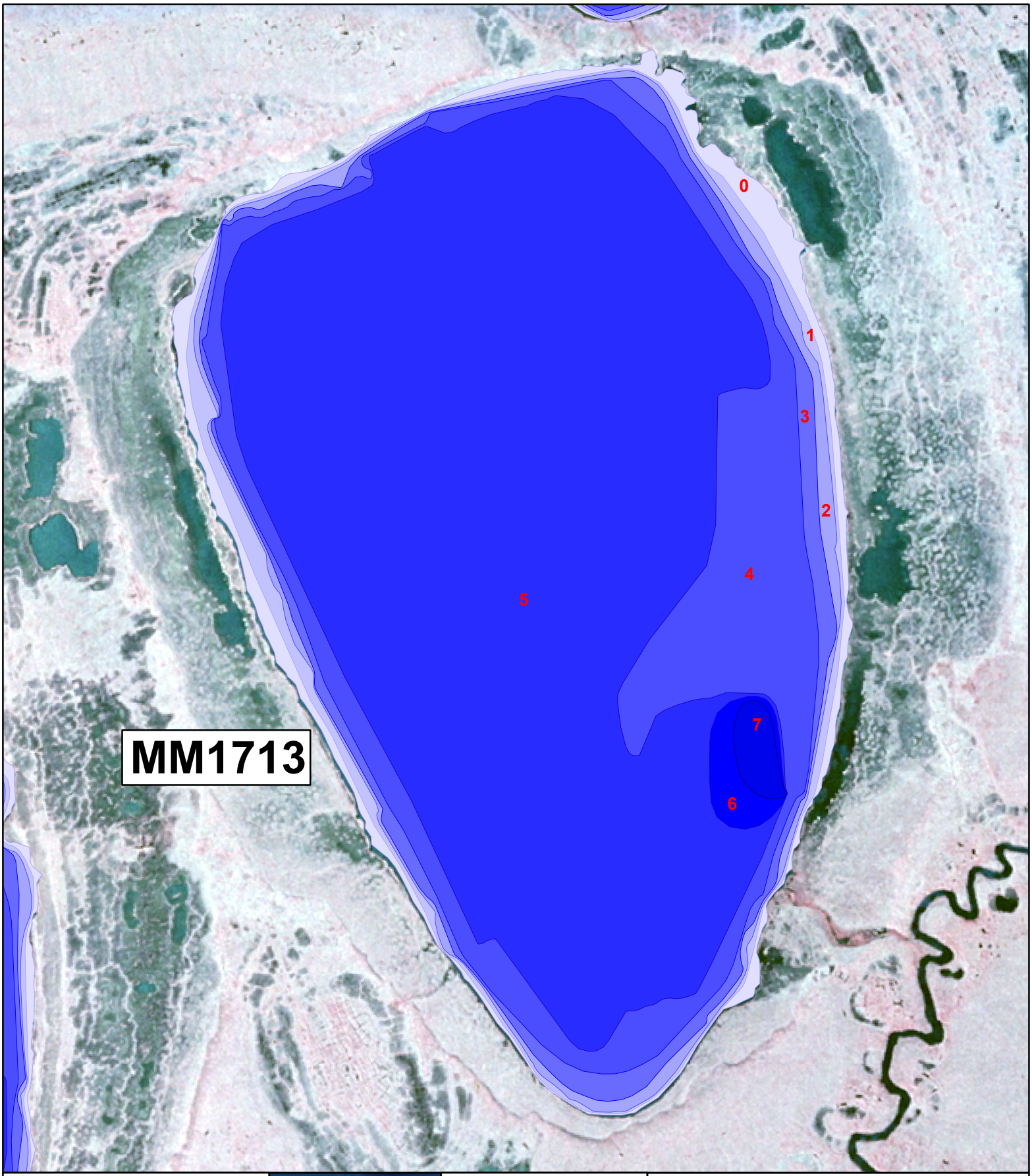
Depth Transects Surveyed at Lake MM1712

surveyed on July 27, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1713

based on transects surveyed on July 27, 2017

SCALE:

250125 0 250 500 750 1,000
Feet

N

Lake MM1713

Other Names: None known
Location: 70.14892°N 152.29318°W
USGS Quad Sheet: Harrison Bay A-4: T9N R2W Sec. 1,11,12
Habitat: Drainage lake
Area: 332.6 acres
Maximum Depth: 7.0 feet
Active Outlet: Yes
Total Lake Volume: 517.16 million gallons (July 27, 2017 data)
Water Volume Under 4 ft of ice: 114.68 million gallons
Water Volume Under 5 ft of ice: 31.09 million gallons
Water Volume Under 7 ft of ice: 0.26 million gallons

Potential Ice Aggregate: 49.00 acres (water depth 4 ft or less)
14.54 million gallons

Maximum Recommended Winter Removal: **0.039 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

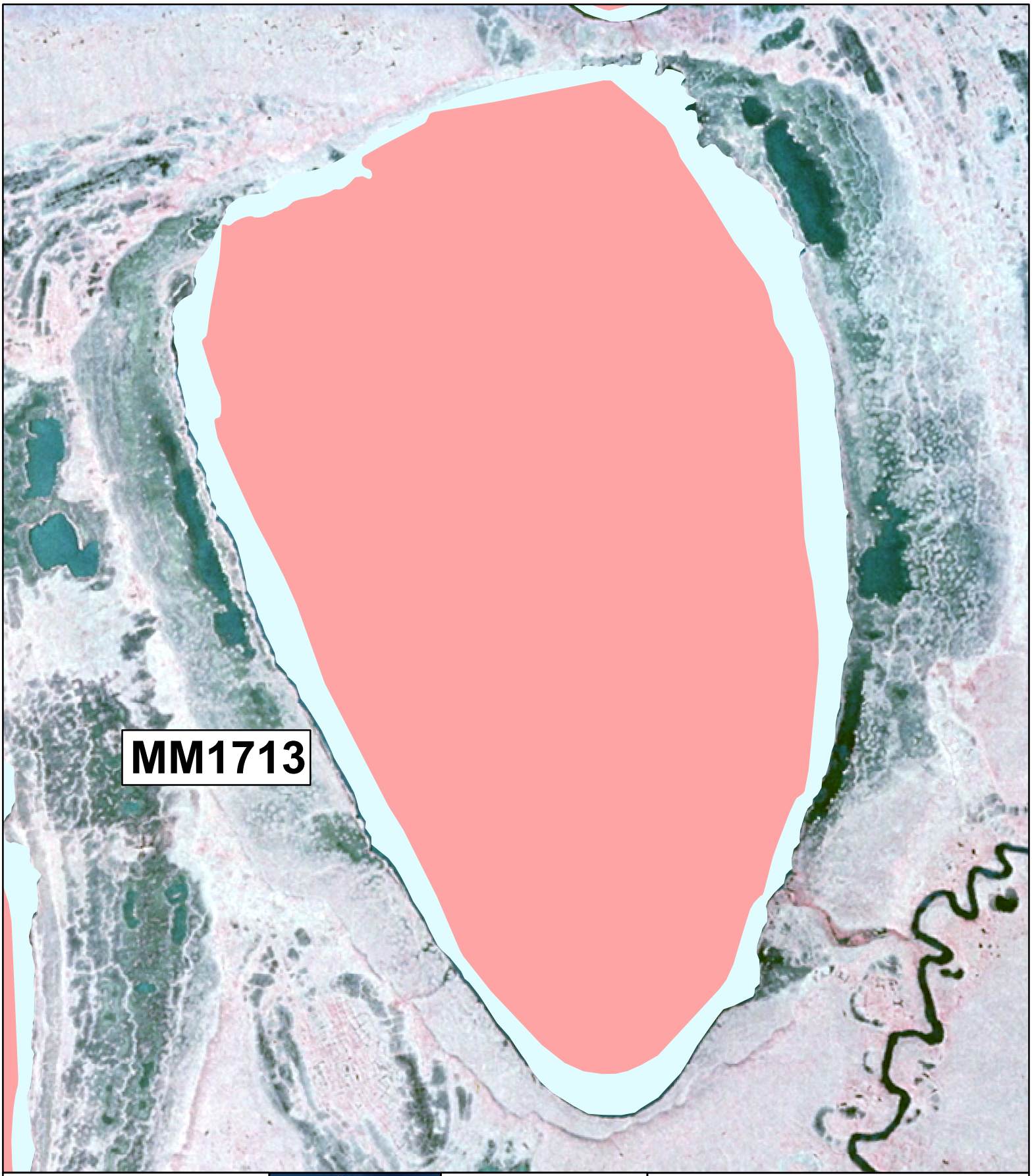
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	11.0	2.5	7.8	19.0	38.0	119.7	1.1	7.67	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 27 2017	9.0	Arctic grayling	1	210
Minnow Trap	Jul 27 2017	12.0	Ninespine stickleback	15	

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

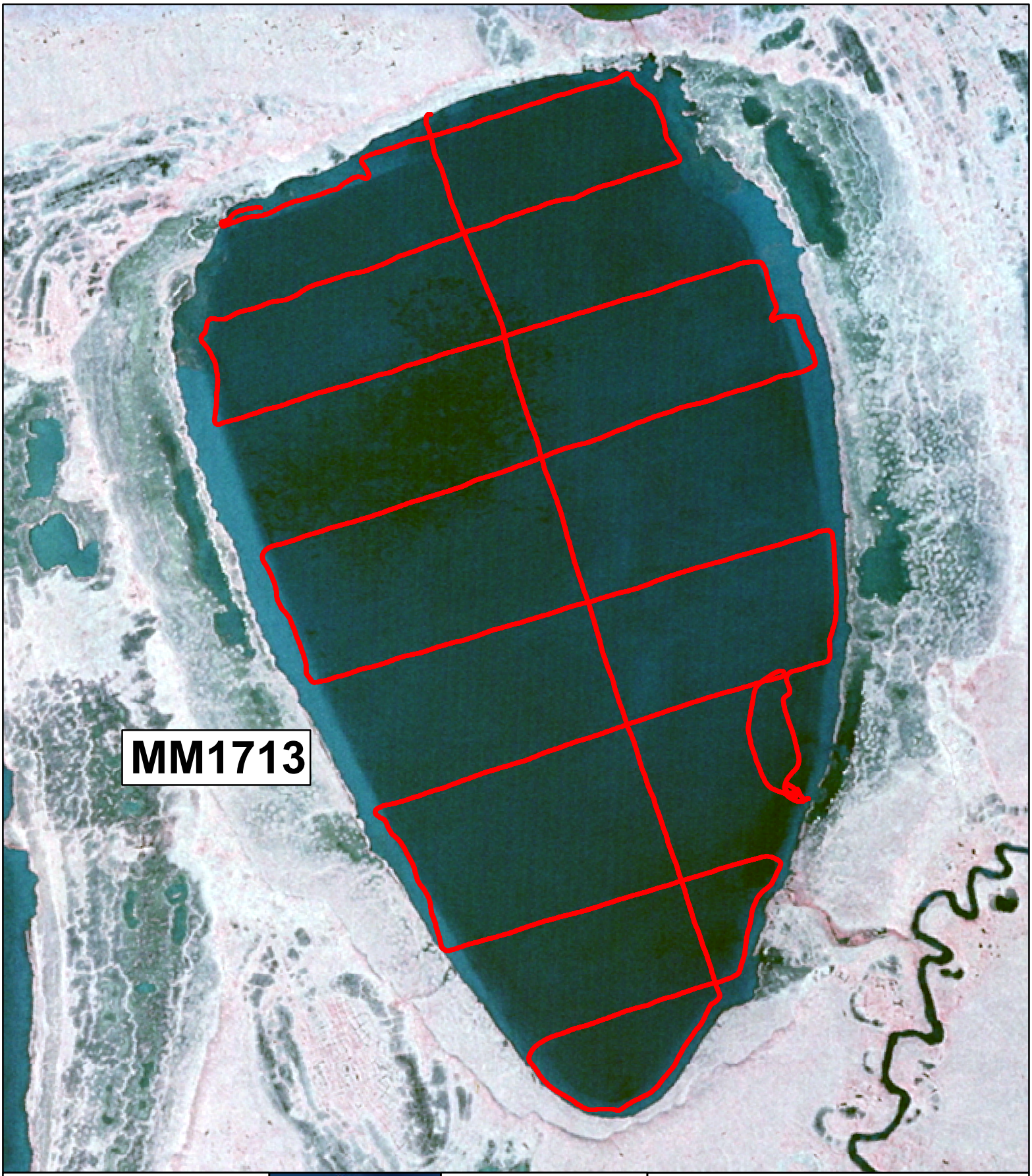
Area Available for Ice Chip Collection at Lake MM1713

based on transects surveyed on July 27, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250125 0 250 500 750 1,000
Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

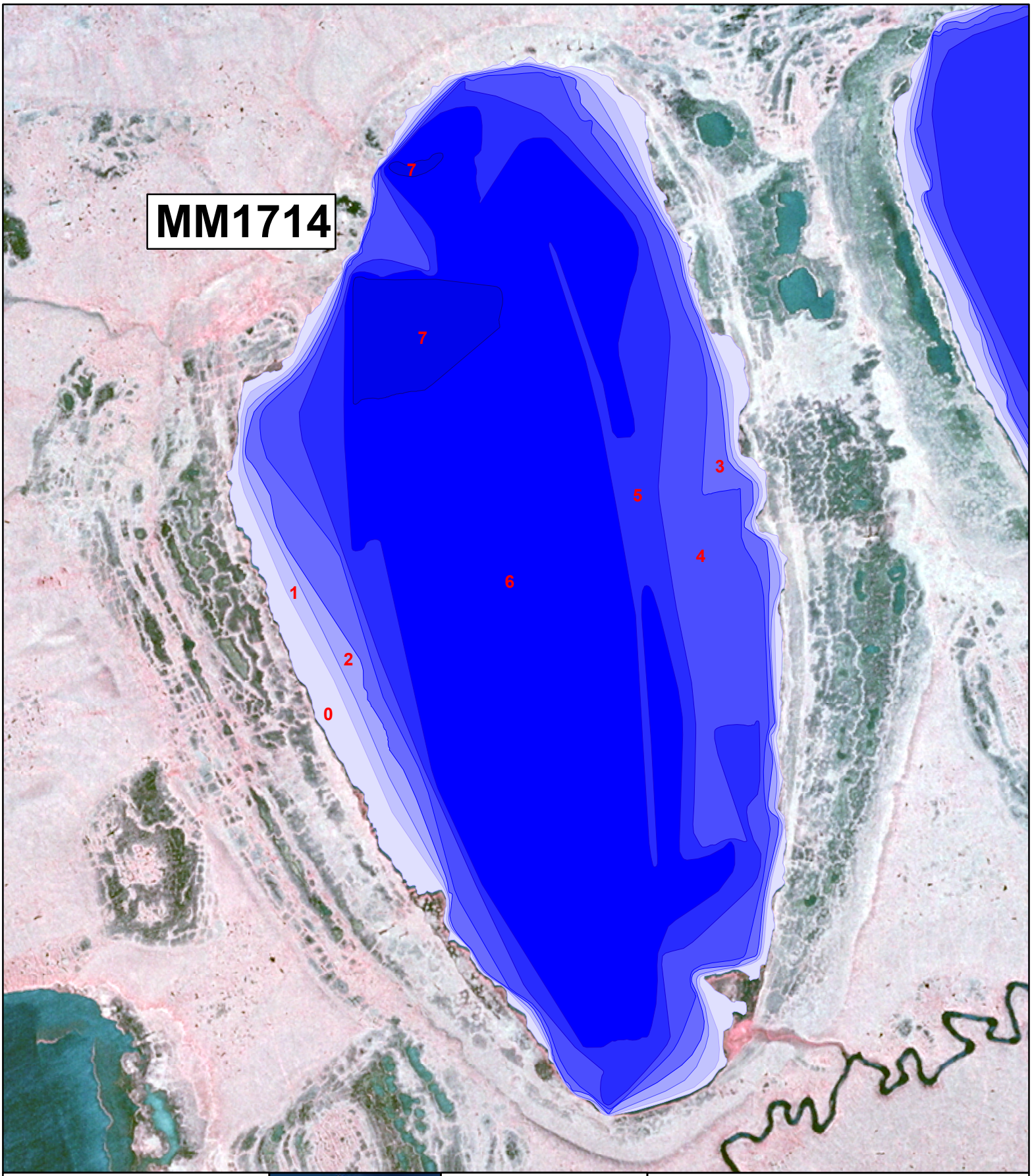
Depth Transects Surveyed at Lake MM1713

surveyed on July 27, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250125 0 250 500 750 1,000 Feet

N



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1714

based on transects surveyed on July 26, 2017

SCALE:

500 250 0 500 1,000
Feet

N

Lake MM1714

Other Names: None known
Location: 70.14300°N 152.33094°W
USGS Quad Sheet: Harrison Bay A-4: T9N R2W Sec. 10,11,14,15
Habitat: Drainage lake
Area: 411 acres
Maximum Depth: 7.9 feet
Active Outlet: Yes
Total Lake Volume: 697.59 million gallons (July 26, 2017 data)
Water Volume Under 4 ft of ice: 210.22 million gallons
Water Volume Under 5 ft of ice: 111.55 million gallons
Water Volume Under 7 ft of ice: 1.679 million gallons

Potential Ice Aggregate: 76.40 acres (water depth 4 ft or less)
22.65 million gallons

Maximum Recommended Winter Removal: **0.252 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	8.8	1.9	5.5	12.0	30.0	90.0	1.5	7.62	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 26 2017	1.4	Arctic grayling	2	114, 357
Minnow Trap	Jul 26 2017	12.5	Ninespine stickleback	2	

Data Last Revised: September 14, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

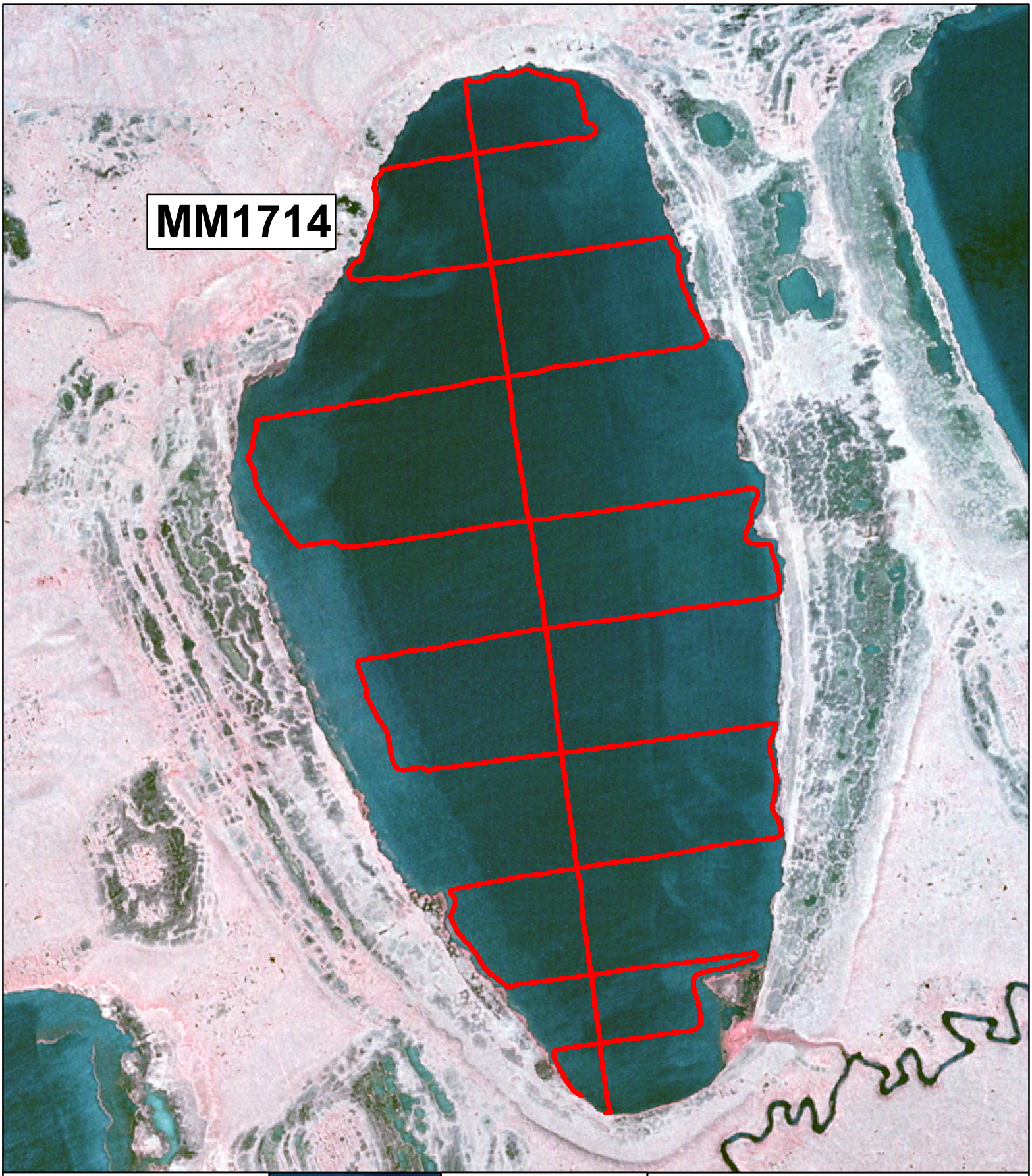
Area Available for Ice Chip Collection at Lake MM1714

based on transects surveyed on July 26, 2017
not to be used for navigation or to direct operation of heavy equipment

SCALE:

500 250 0 500 1,000 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

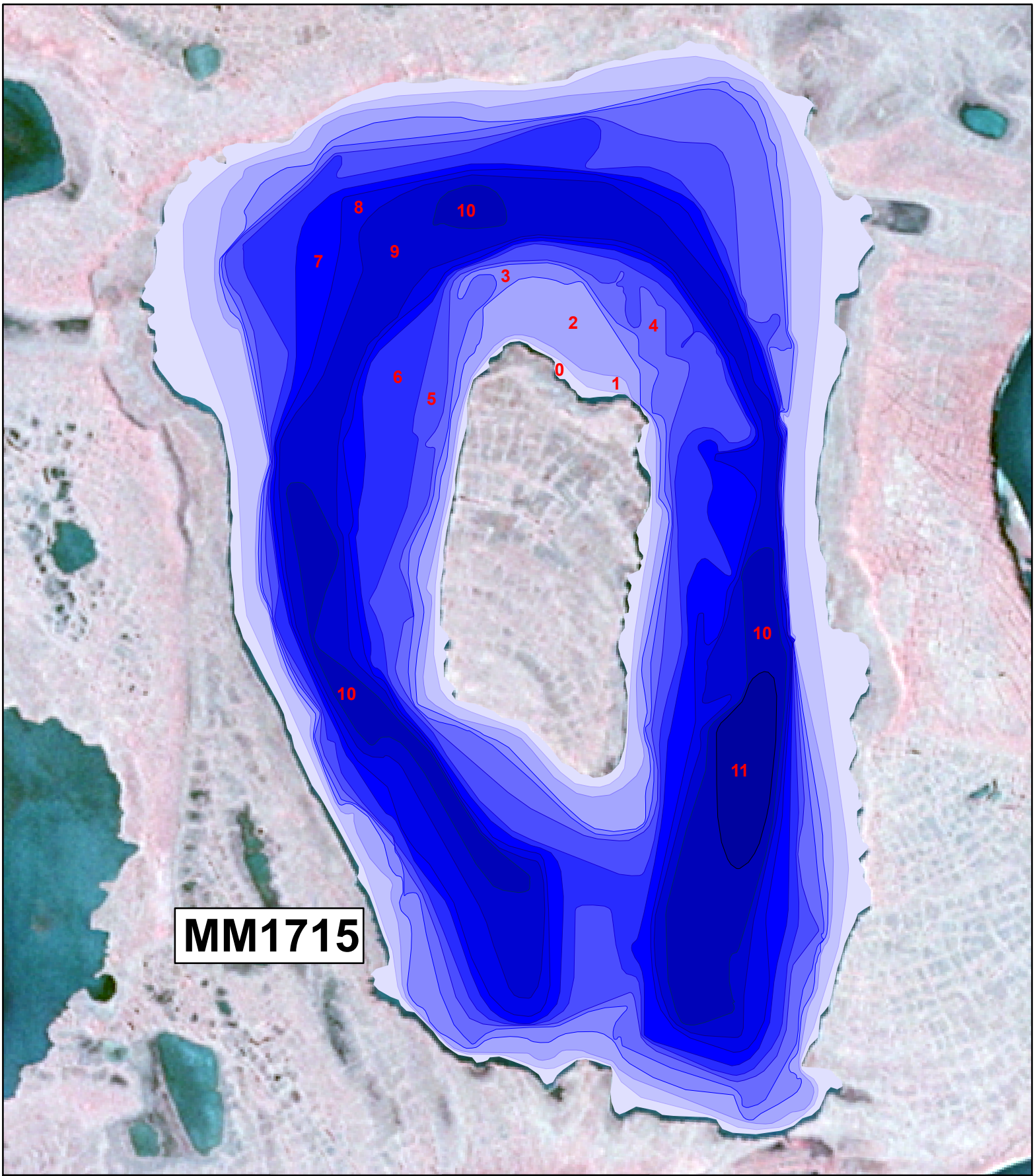
Depth Transects Surveyed at Lake MM1714

surveyed on July 26, 2017
not to be used for navigation or to direct operation of heavy equipment

SCALE:

500 250 0 500 1,000 Feet

N



Depth in Feet

0	3	6	9
1	4	7	10
2	5	8	11

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1715

based on transects surveyed on July 30, 2017

SCALE:

250 125 0 250 500 750 Feet

N

Lake MM1715

Other Names: None known
Location: 70.22889°N 152.35432°W
USGS Quad Sheet: Harrison Bay A-4: T10N R2W Sec. 10,15
Habitat: Tundra lake
Area: 150 acres
Maximum Depth: 11.7 feet
Active Outlet: No
Total Lake Volume: 269.26 million gallons (July 30, 2017 data)
Water Volume Under 4 ft of ice: 110.81 million gallons
Water Volume Under 5 ft of ice: 80.97 million gallons
Water Volume Under 7 ft of ice: 36.12 million gallons

Potential Ice Aggregate: 52.20 acres (water depth 4 ft or less)
15.48 million gallons

Maximum Recommended Winter Removal: **24.29 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

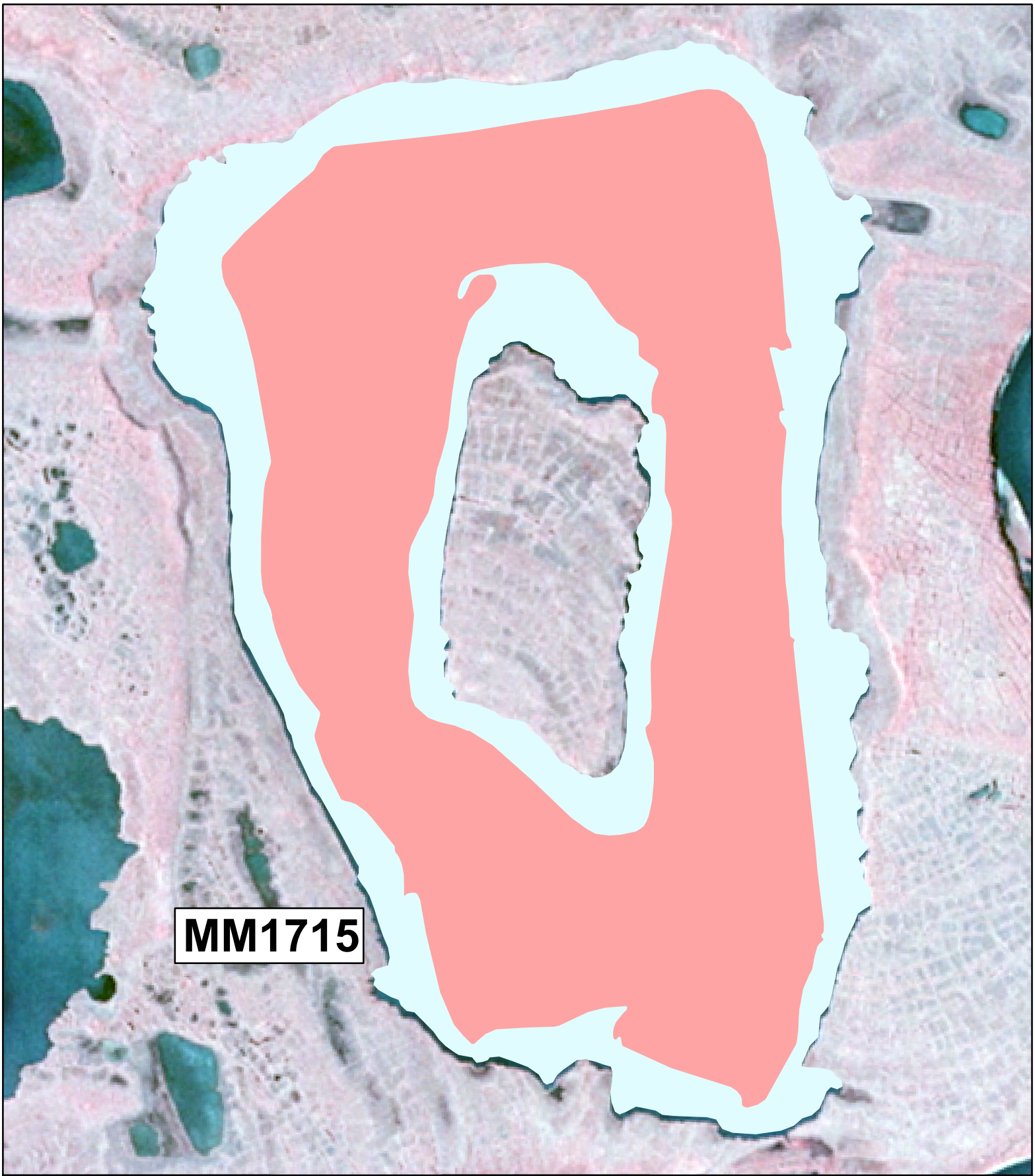
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	31.0	5.5	11.0	25.0	100.0	246.4	0.8	8.34	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 30 2017	9.1	None	0
Minnow Trap	Jul 30 2017	13.7	None	0
Seine Net	Jul 30 2017	1 haul	Ninespine stickleback	1
Visual survey+dipnet	Jul 30 2017	25 yds	Alaska blackfish	2

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deepper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

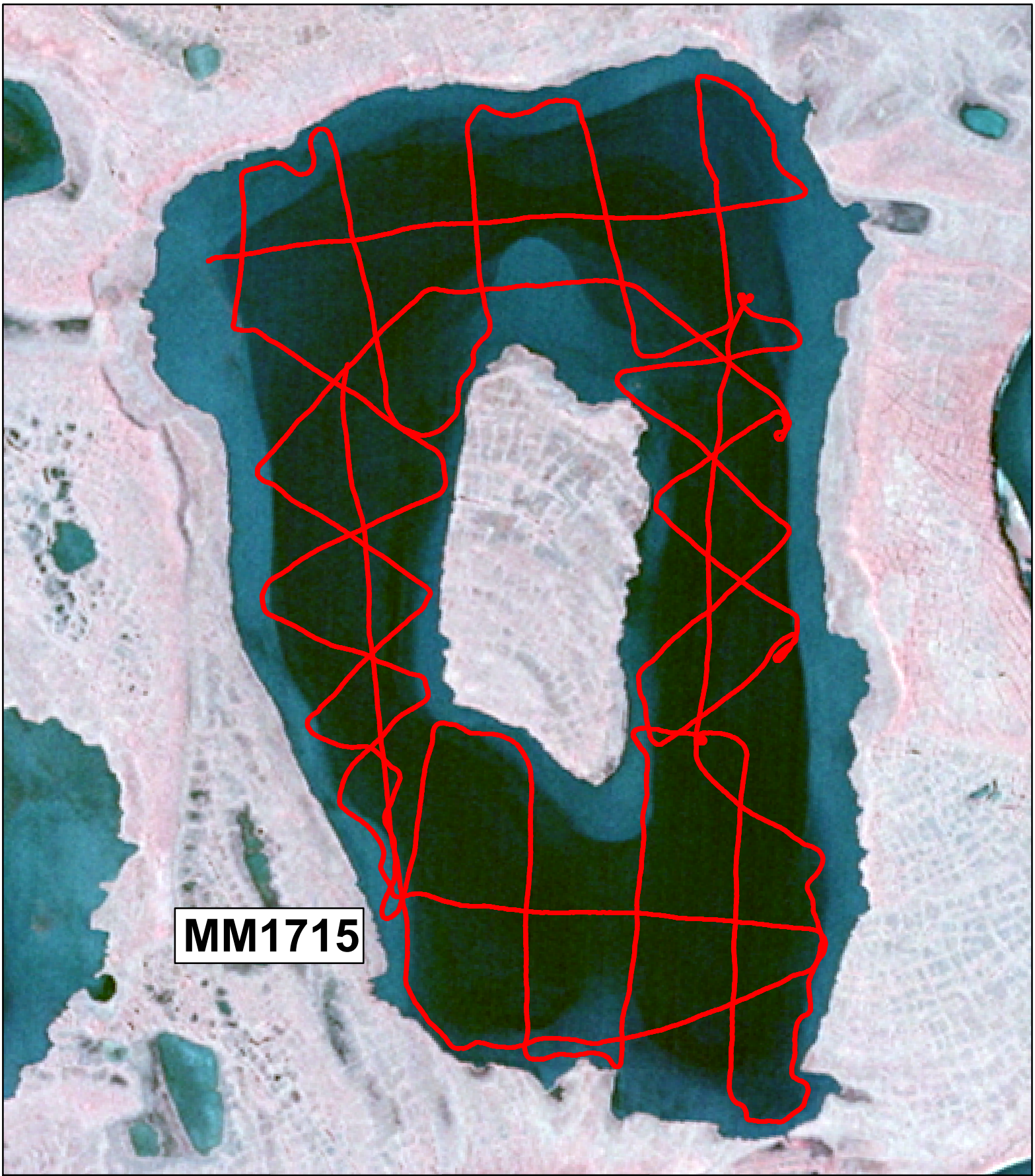
Area Available for Ice Chip Collection at Lake MM1715

based on transects surveyed on July 30, 2017
not to be used for navigation or to direct operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

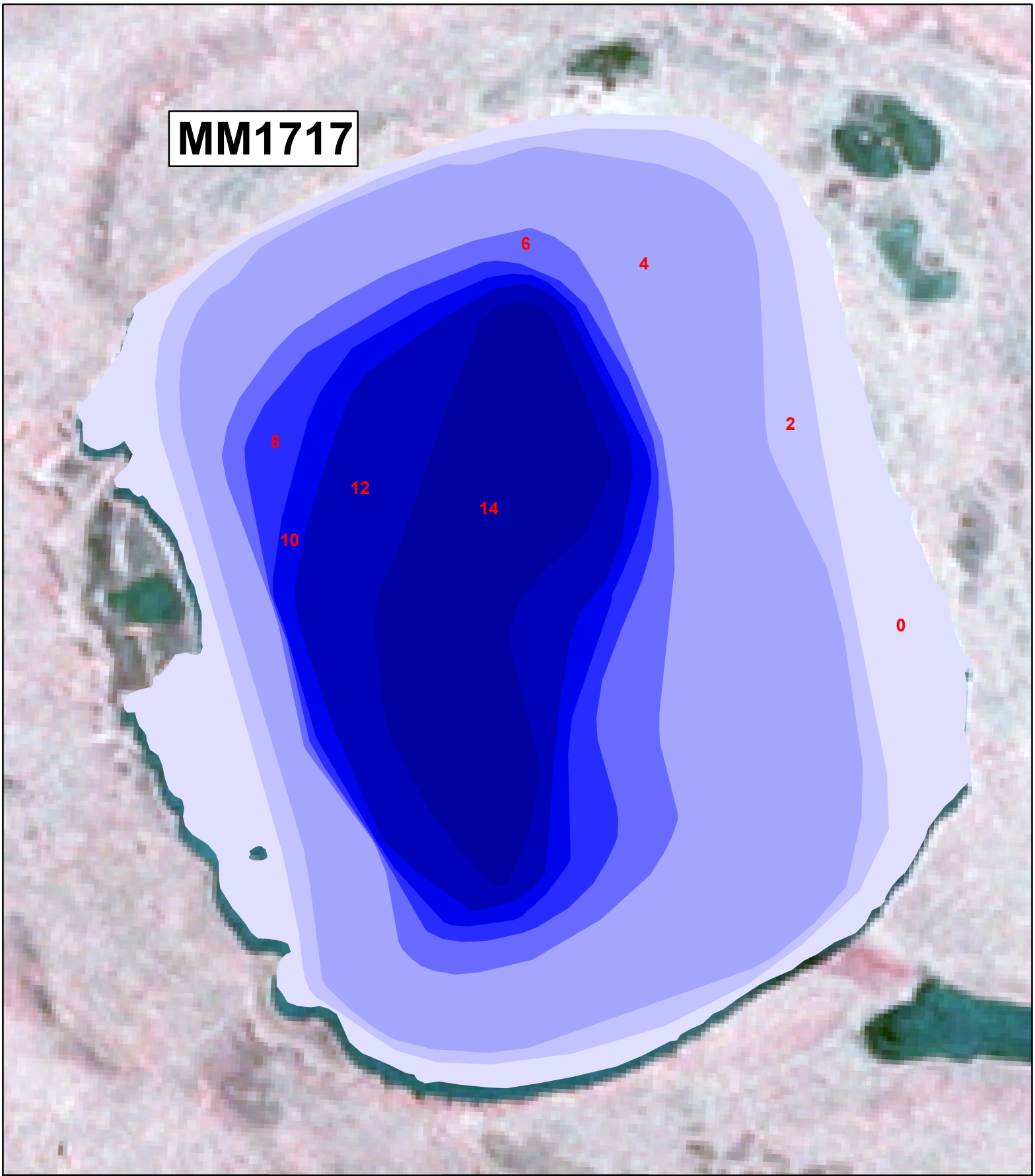
Depth Transects Surveyed at Lake MM1715

surveyed on July 30, 2017
not to be used for navigation or to direct operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth in Feet

0 6 12
2 8 14
4 10

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1717 (depth in 2 foot intervals)

based on transects surveyed on July 29, 2017

SCALE:

100 50 0 100 200 300 400
Feet

N

Lake MM1717

Other Names: None known
Location: 70.24660°N 152.36598°W
USGS Quad Sheet: Harrison Bay A-4: T10N R2W Sec. 3
Habitat: Tundra lake
Area: 47 acres
Maximum Depth: 15.9 feet
Active Outlet: No
Total Lake Volume: 119.51 million gallons (July 29, 2017 data)
Water Volume Under 4 ft of ice: 67.19 million gallons
Water Volume Under 5 ft of ice: 56.61 million gallons
Water Volume Under 7 ft of ice: 40.09 million gallons

Potential Ice Aggregate: 12.00 acres (water depth 4 ft or less)
3.56 million gallons

Maximum Recommended Winter Removal: **16.98 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

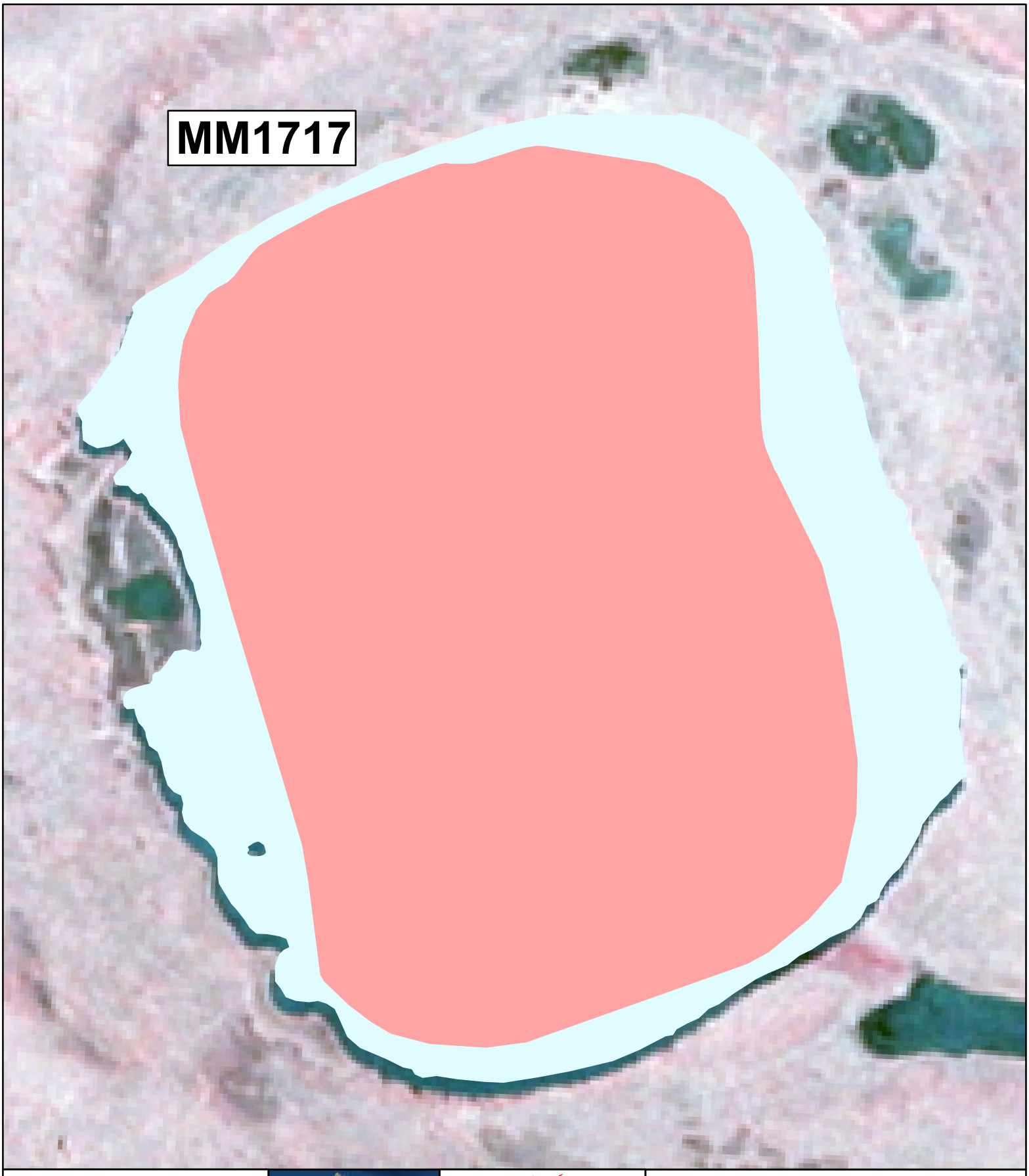
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	33.0	4.9	11.0	23.0	100.0	250.3	1.1	8.28	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 29 2017	7.2	None	0
Minnow Trap	Jul 29 2017	3.9	Ninespine stickleback	5

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake MM1717

based on transects surveyed on July 29, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 400 Feet

N

MM1717

Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

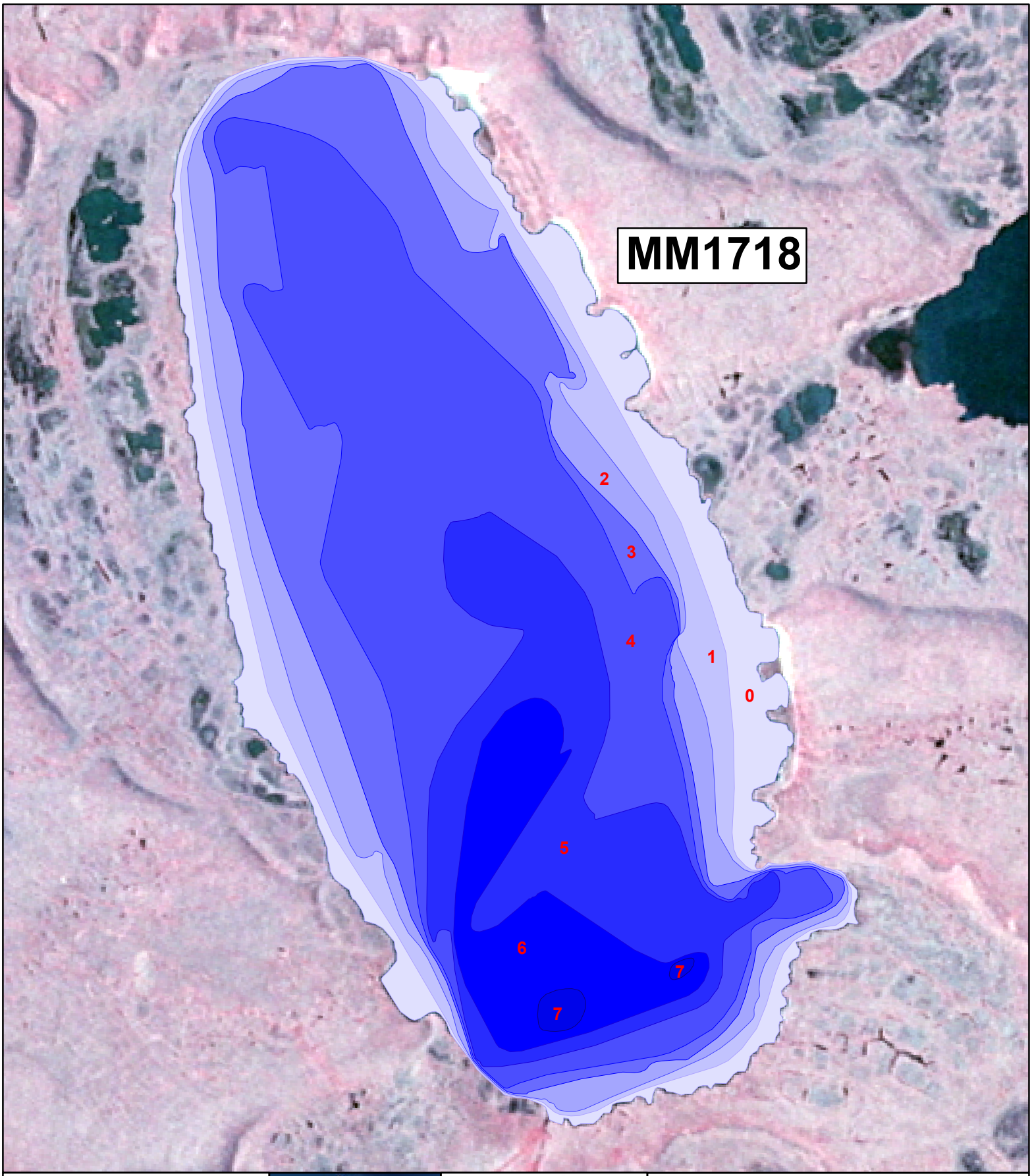
Depth Transects Surveyed at Lake MM1717

surveyed on July 29, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 400 Feet

N



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1718

based on transects surveyed on July 29, 2017

SCALE:

250 125 0 250 500
Feet

N

Lake MM1718

Other Names: None known
Location: 70.25495°N 152.34653°W
USGS Quad Sheet: Harrison Bay B-4: T10N R2W Sec. 2,3; T11N R2W Sec. 34,35
Habitat: Tundra lake
Area: 114.2 acres
Maximum Depth: 7.8 feet
Active Outlet: No
Total Lake Volume: 138.2 million gallons (July 29, 2017 data)
Water Volume Under 4 ft of ice: 20.5 million gallons
Water Volume Under 5 ft of ice: 6.8 million gallons
Water Volume Under 7 ft of ice: 0.1 million gallons

Potential Ice Aggregate: 53.60 acres (water depth 4 ft or less)
15.89 million gallons

Maximum Recommended Winter Removal: **2.05 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

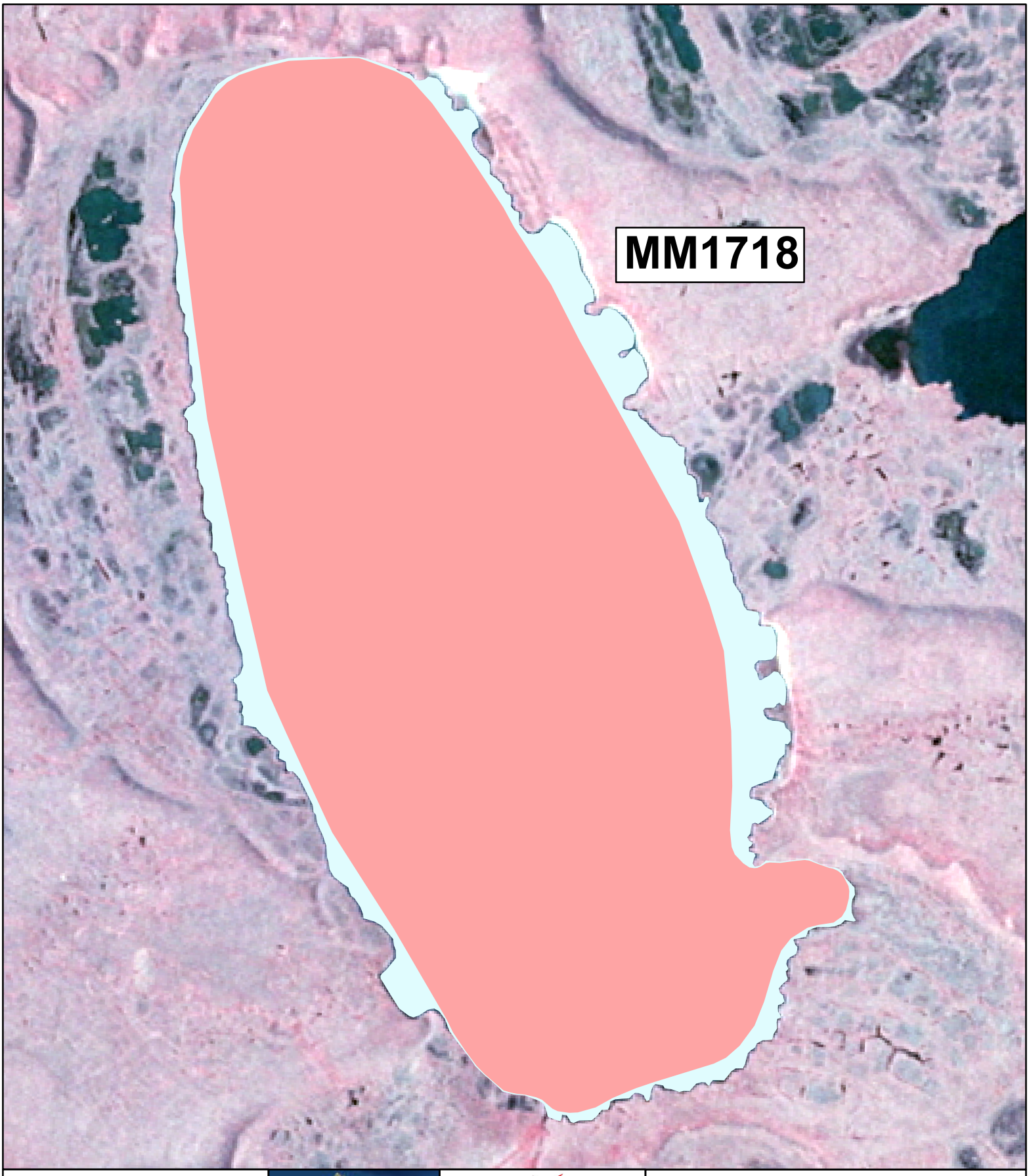
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	14.0	2.2	5.3	11.0	44.0	114	1	7.98	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 29 17	9.2	None	0
Minnow Trap	Jul 29 17	12.2	None	0
Visual+Dipnet	Jul 29 17		Ninespine Stickleback	1

Data Last Revised: September 11, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

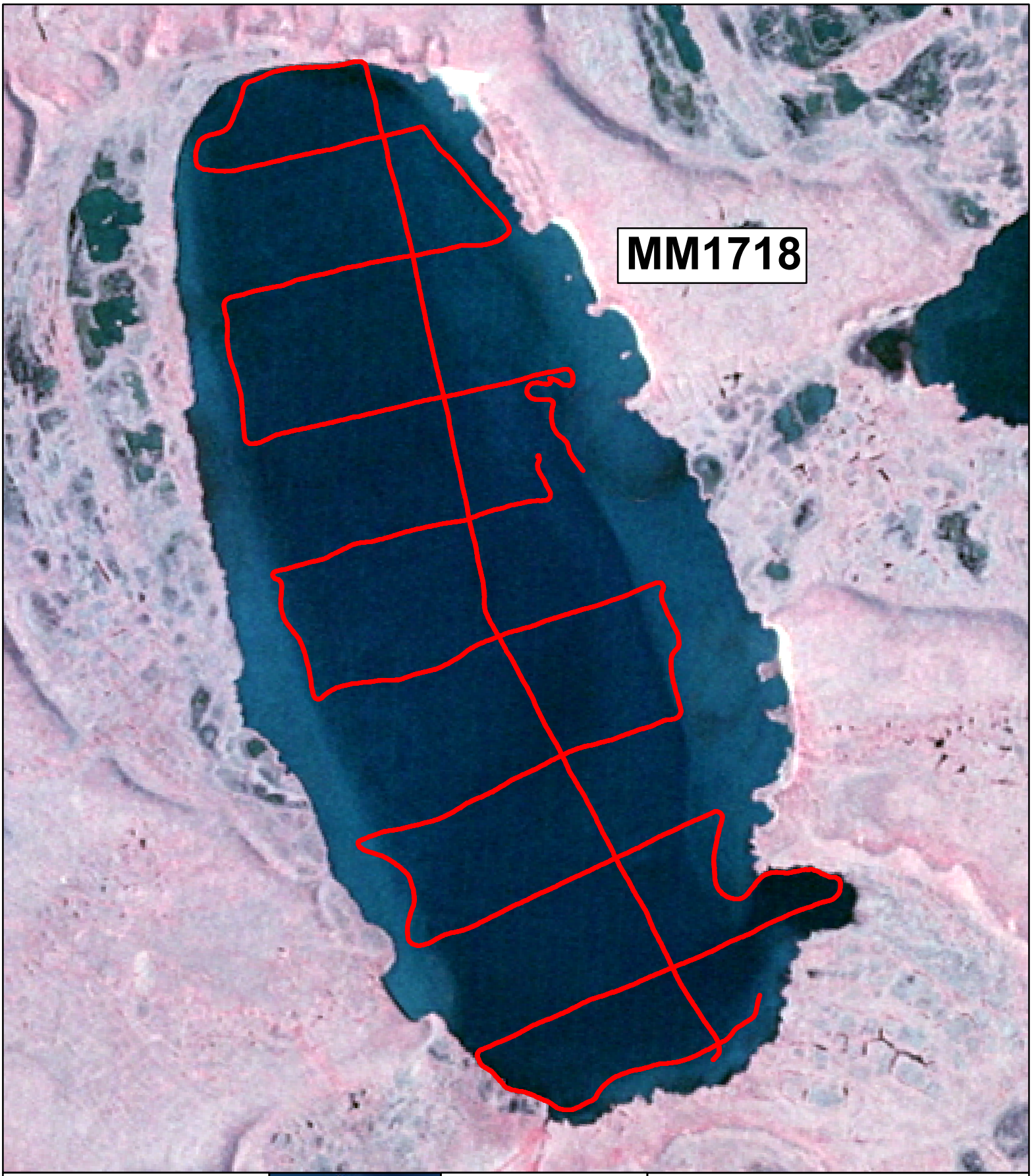
Area Available for Ice Chip Collection at Lake MM1718

based on transects surveyed on July 29, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

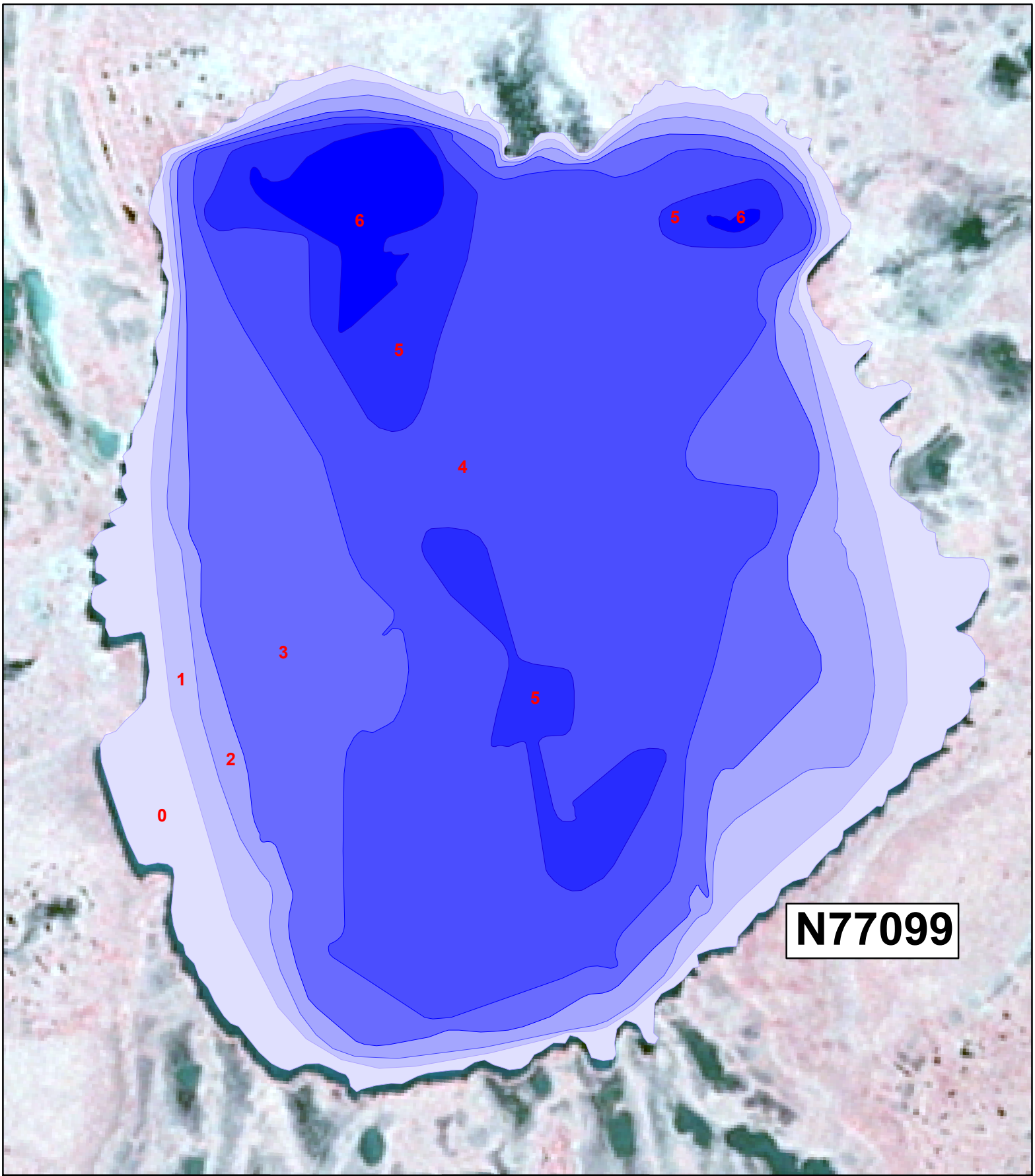
Depth Transects Surveyed at Lake MM1718

based on transects surveyed on July 29, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth in Feet

0 1 2 3 4 5 6

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake N77099

based on transects surveyed on July 22, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250
Feet

N

Lake N77099

Other Names: None known
Location: 70.19806°N 152.27242°W
USGS Quad Sheet: Harrison Bay A-4: T10N R2W Sec. 24,25
Habitat: Tundra lake
Area: 106.5 acres
Maximum Depth: 6.9 feet
Active Outlet: No
Total Lake Volume: 121.4 million gallons (July 22, 2017 data)
Water Volume Under 4 ft of ice: 12.5 million gallons
Water Volume Under 5 ft of ice: 2.6 million gallons
Water Volume Under 7 ft of ice: 0.0 million gallons

Potential Ice Aggregate: 52.50 acres (water depth 4 ft or less)
15.56 million gallons

Maximum Recommended Winter Removal: **24.28 million gallons**
(No fish present, 20% of total water volume)

Water Chemistry:

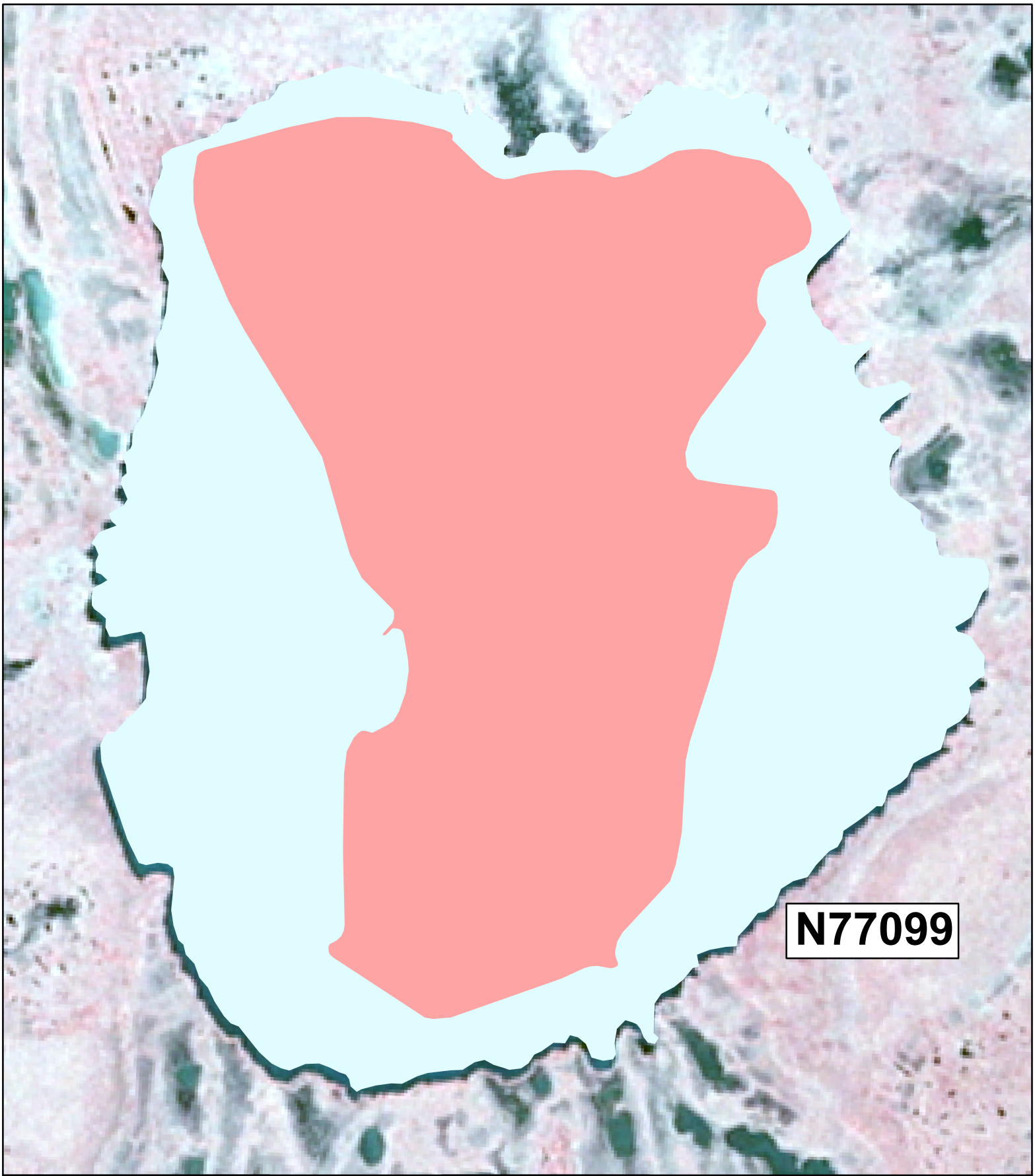
Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1977						196.9		7.70	Netsch
2017	25	3.3	6.7	17.0	75	176.1	2.54	8.23	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Aug 11 1977	12.0	None	0
	Jul 22 2017	8.8	None	0
Minnow Trap	Aug 11 1977	36.0	None	0
	Jul 22 2017	15.2	None	0
Seine Net	Aug 11 1977	6 hauls	Ninespine stickleback	1
	Jul 22 2017	3 hauls	None	0
Visual survey+dipnet	Jul 22 2017	200 yds	None	0

1977 data from Netsch (1977)

Data Last Revised: September 13, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

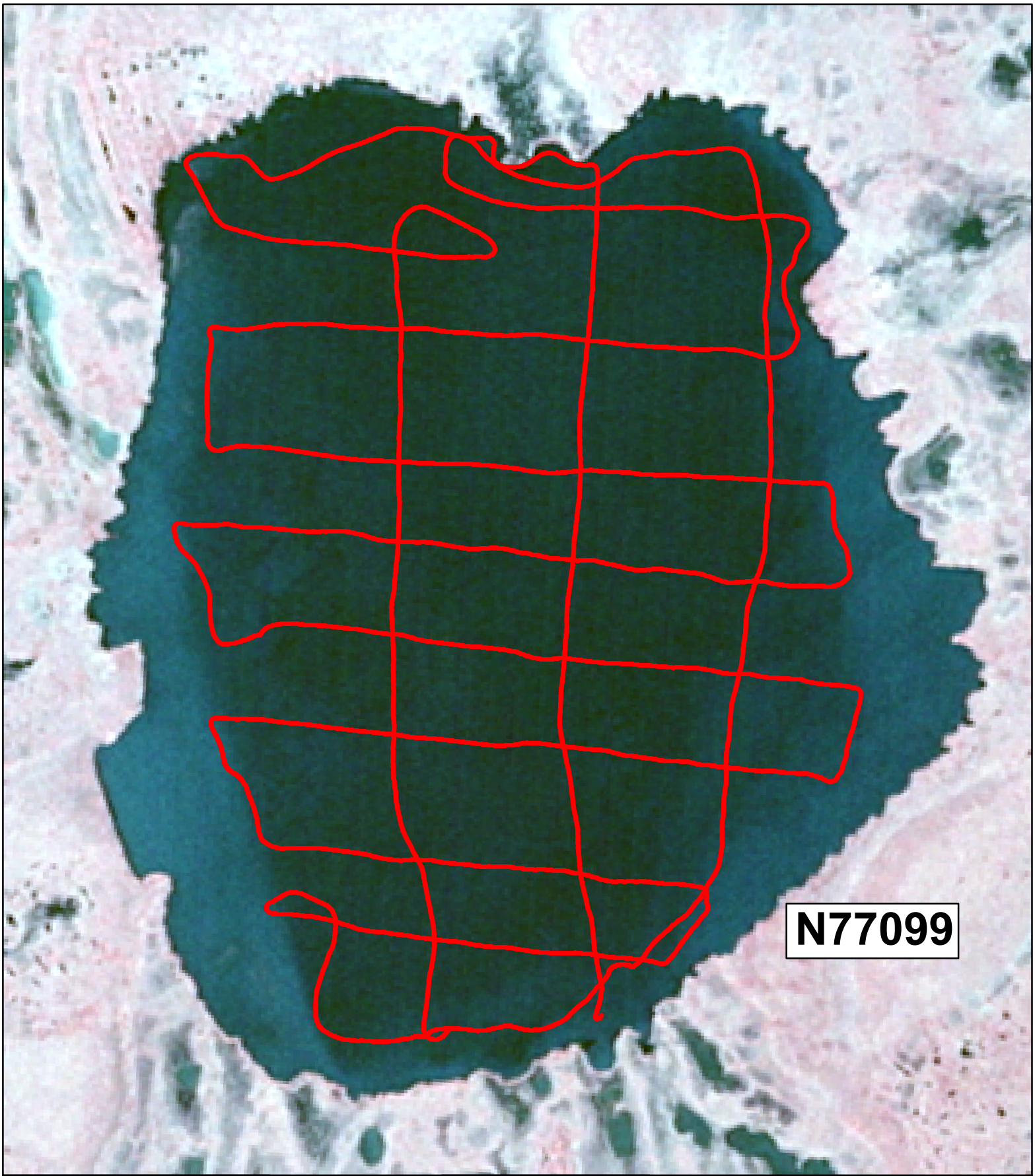
Area Available for Ice Chip Collection at Lake N77099

based on transects surveyed on July 22, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250
Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

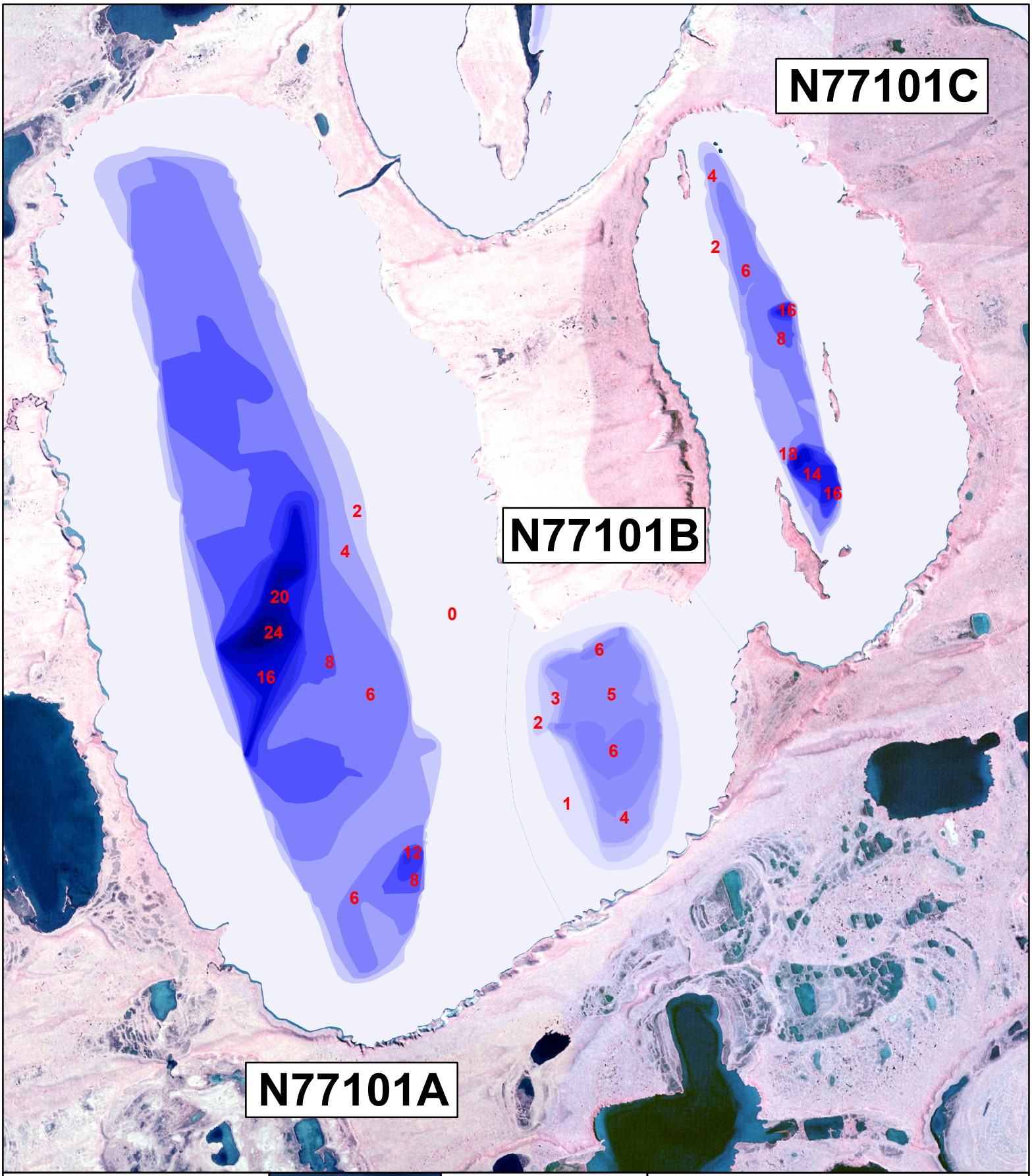
Depth Transects Surveyed at Lake N77099

surveyed on July 22, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250
Feet

N



Depth in Feet

0	4	8	16	24
1	5	10	18	
2	6	12	20	
3	7	14	22	

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake N77101

based on transects surveyed on July 26, 2017

SCALE:

1,000 500 0 1,000 2,000
Feet

N

Lake N77101

Other Names:			MM1716	
	Basin A	**Basin B**	**Basin C**	
Location:	70.23561°N 152.45667°W	70.22831°N 152.43343°W	70.24185°N 152.41704°W	
USGS Quad Sheet:	Harrison Bay A-5: T10N R2W Sec. 4-9, 16-18			
Habitat:	Drainage Lake	Drainage Lake	Drainage Lake	
Area:	1,328.6	233.6	482.6	acres
Maximum Depth:	25.1	6.6	18.2	feet
Active Outlet:	Yes	Yes	Yes	
Total Lake Volume:	1,546.03	164.61	415.76	
Water Volume Under 4 ft of ice:	619.63	29.14	192.44	
Water Volume Under 5 ft of ice:	474.48	10.77	173.47	
Water Volume Under 7 ft of ice:	244.46	0.00	146.84	
Potential Aggregate:	856.5	169.7	418.9	acres
	254.00	50.31	124.23	million gallons
		(2017 data)		

	Basin A	**Basin B**	**Basin C**	
Maximum Recommended Winter Removal:	**36.67**	**0.000**	**22.03**	**million gallons**

(Sensitive species present, 15% of water volume under 7 ft of ice)

Water Chemistry:

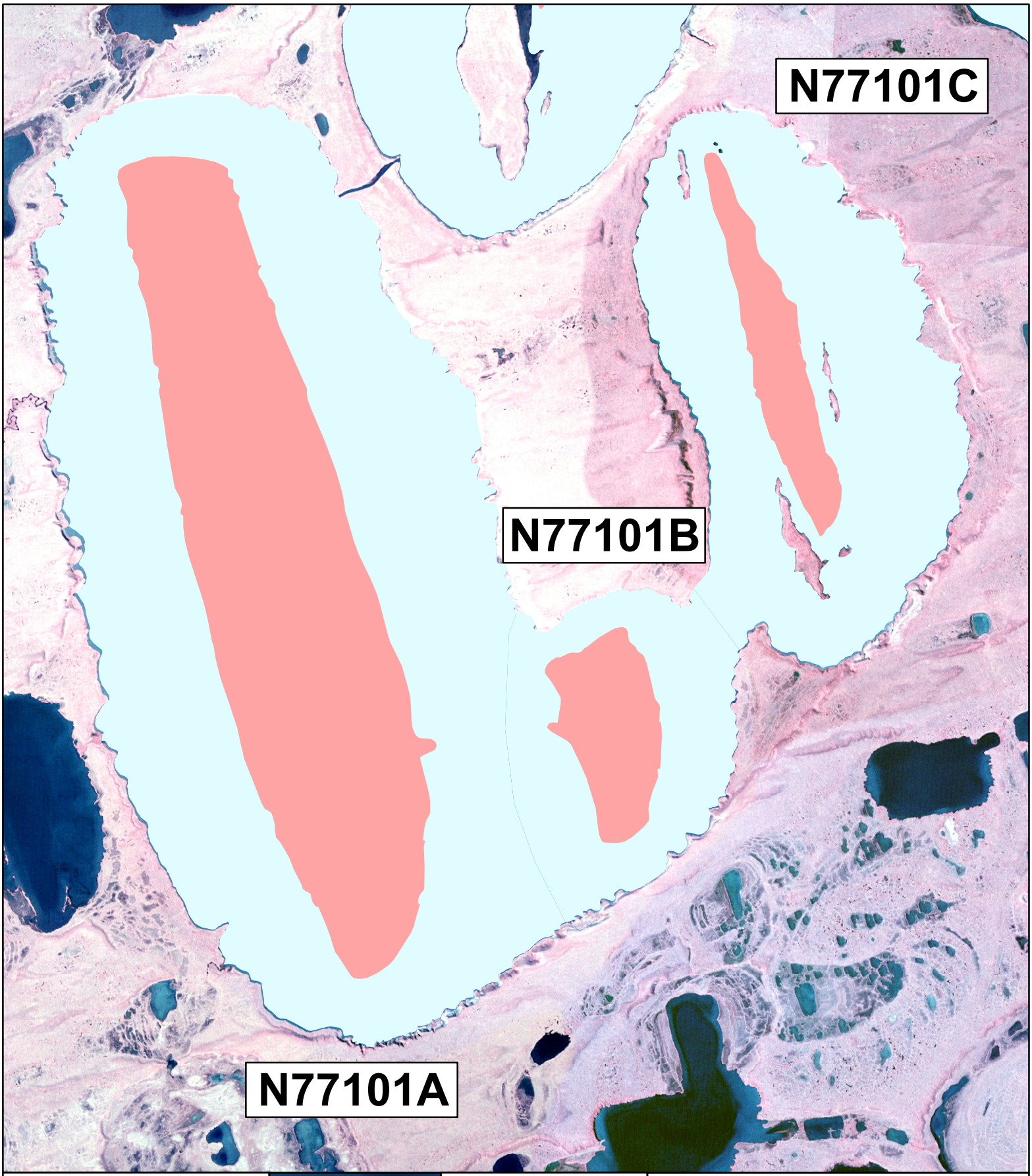
Year of Test	Calcium (mg/l	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1977						218.4		8.80	Netsch
2017	28.0	3.5	5.9	13.0	85	191.9	0.6	8.29	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Various	Aug 14 1977	--	Lake trout	3	695-850
			Least cisco	7	273-430
			Arctic grayling	4	318-348
			Burbot	1	
Gill Net	Jul 28 2017	2.5	Broad whitefish	2	503, 561
			Least cisco	17	226-380
Seine Net	Aug 14 1977	4 hauls	Ninespine stickleback	6	
Visual survey+dipnet	Jul 28 2017	0 yds	Ninespine stickleback	1	

1977 data from Netsch (1977)

Data Last Revised: September 15, 2017



Ice Chip Areas

4 feet and shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

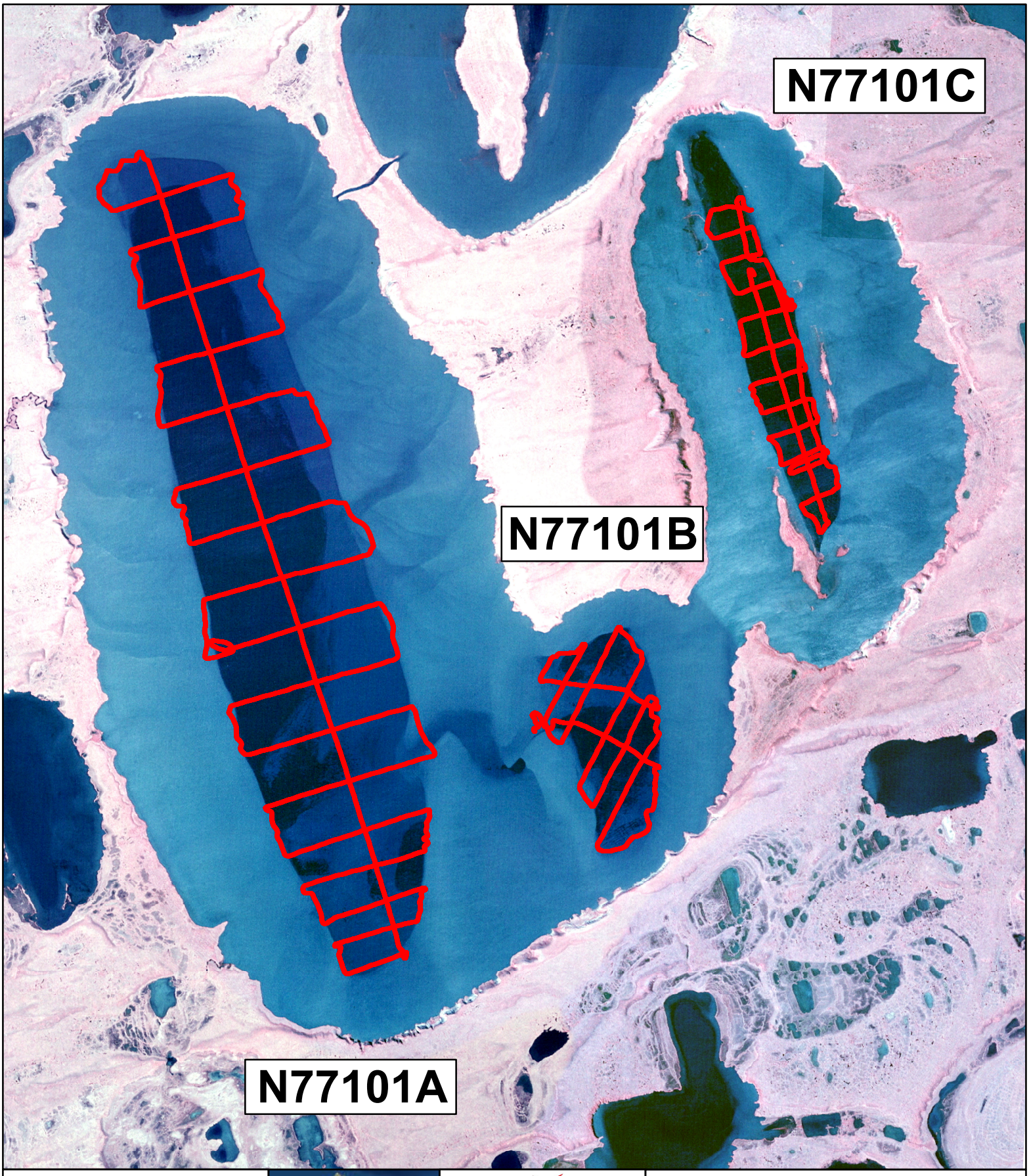
Area Available for Ice Chip Collection at Lake N77101

based on transects surveyed on July 26, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

1,000 500 0 1,000 2,000 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Transects Surveyed at Lake N77101

based on transects surveyed on July 28, 2017
not to be used for navigation or to direct the operation of heavy equipment

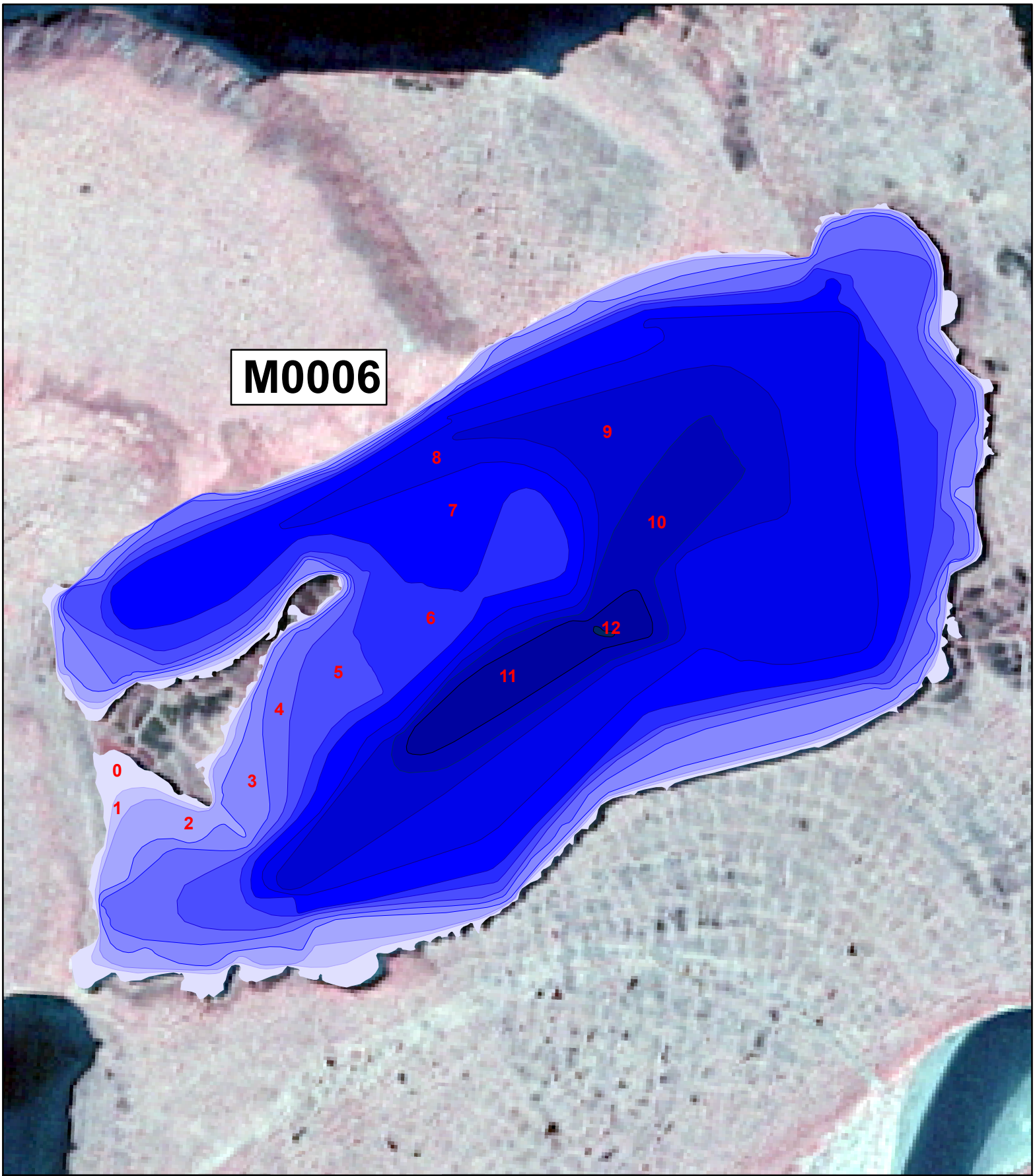
SCALE:

1,000 500 0 1,000 2,000 Feet

N

6. LAKE SUMMARIES

6.2 Lake Summaries for Lakes Sampled in the Willow East Area, 2017.



Depth in Feet

0 3 6 9 12
1 4 7 10
2 5 8 11

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0006

based on transects surveyed on July 16, 2017

SCALE:

100 50 0 100 200 300 400 500 Feet

N

Lake M0006

Other Names: None known
Location: 70.25718°N 152.03257°W
USGS Quad Sheet: Harrison Bay B-4: T10N R1W Sec. 1; T11N R1W Sec. 36
Habitat: Tundra lake
Area: 58 acres
Maximum Depth: 12.3 feet
Active Outlet: No
Total Lake Volume: 125.56 million gallons (July 16, 2017 data)
Water Volume Under 4 ft of ice: 55.63 million gallons
Water Volume Under 5 ft of ice: 41.06 million gallons
Water Volume Under 7 ft of ice: 16.84 million gallons

Potential Ice Aggregate: 134.1 acres (water depth 4 ft or less)
39.8 million gallons

Maximum Recommended Winter Removal: **12.32 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2000	27.4	5.1	9.7	21.2	89.4	223.4		7.97	L. Moulton
2017	28.0	5.8	11.0	25.0	95.0	240.5	0.8	8.21	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 15 2000	6.8	Alaska blackfish	1	111
	Jul 16 2017	6.2	None	0	
Minnow Trap	Jul 16 2017	9.0	Ninespine stickleback	5	
			Alaska blackfish	1	
Visual survey+dipnet	Jul 16 2017	0.0	Ninespine stickleback	15	

Data Last Revised: September 14, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

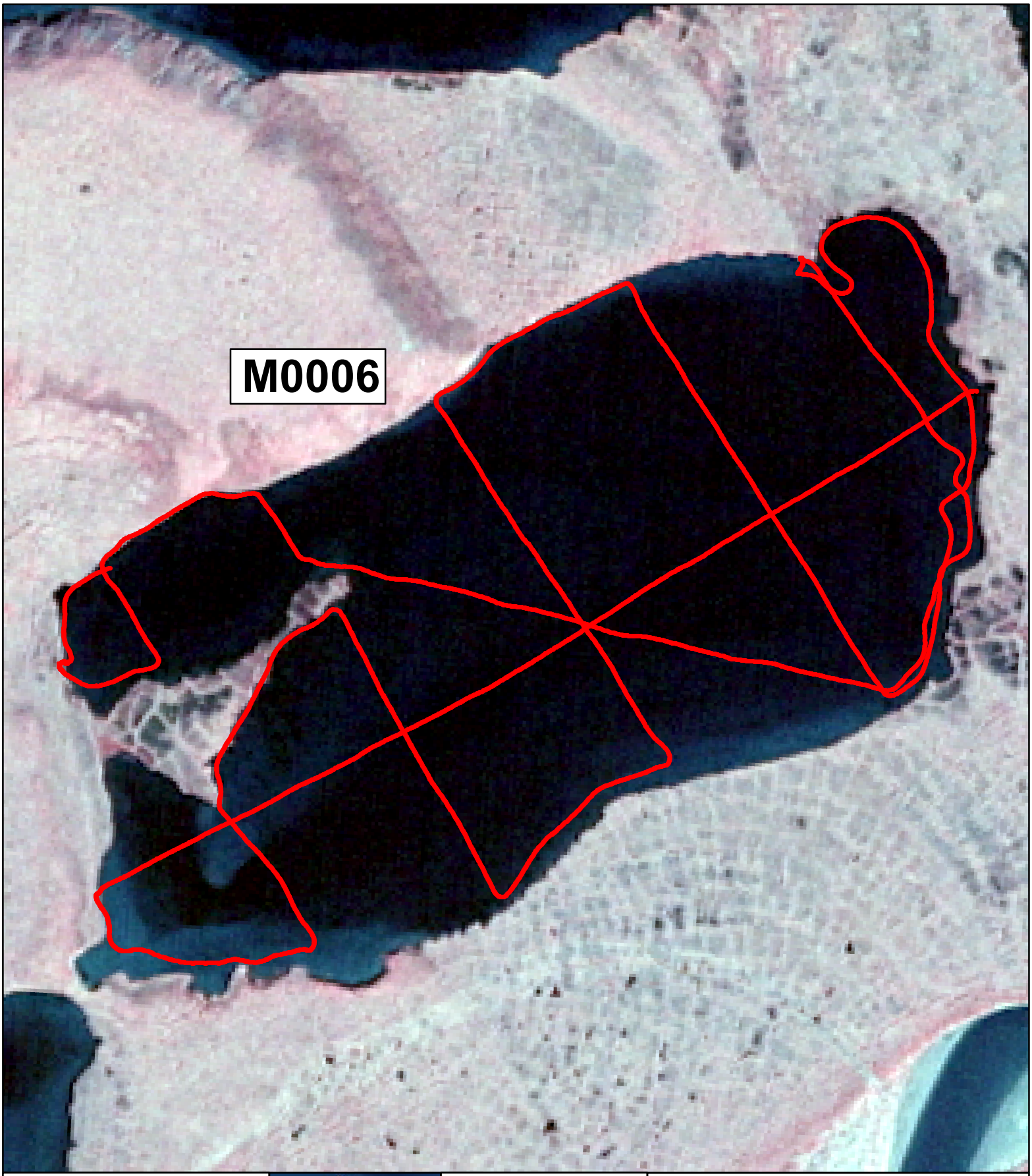
Area Available for Ice Chip Collection at Lake M0006

based on transects surveyed on July 16, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 400 500
Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

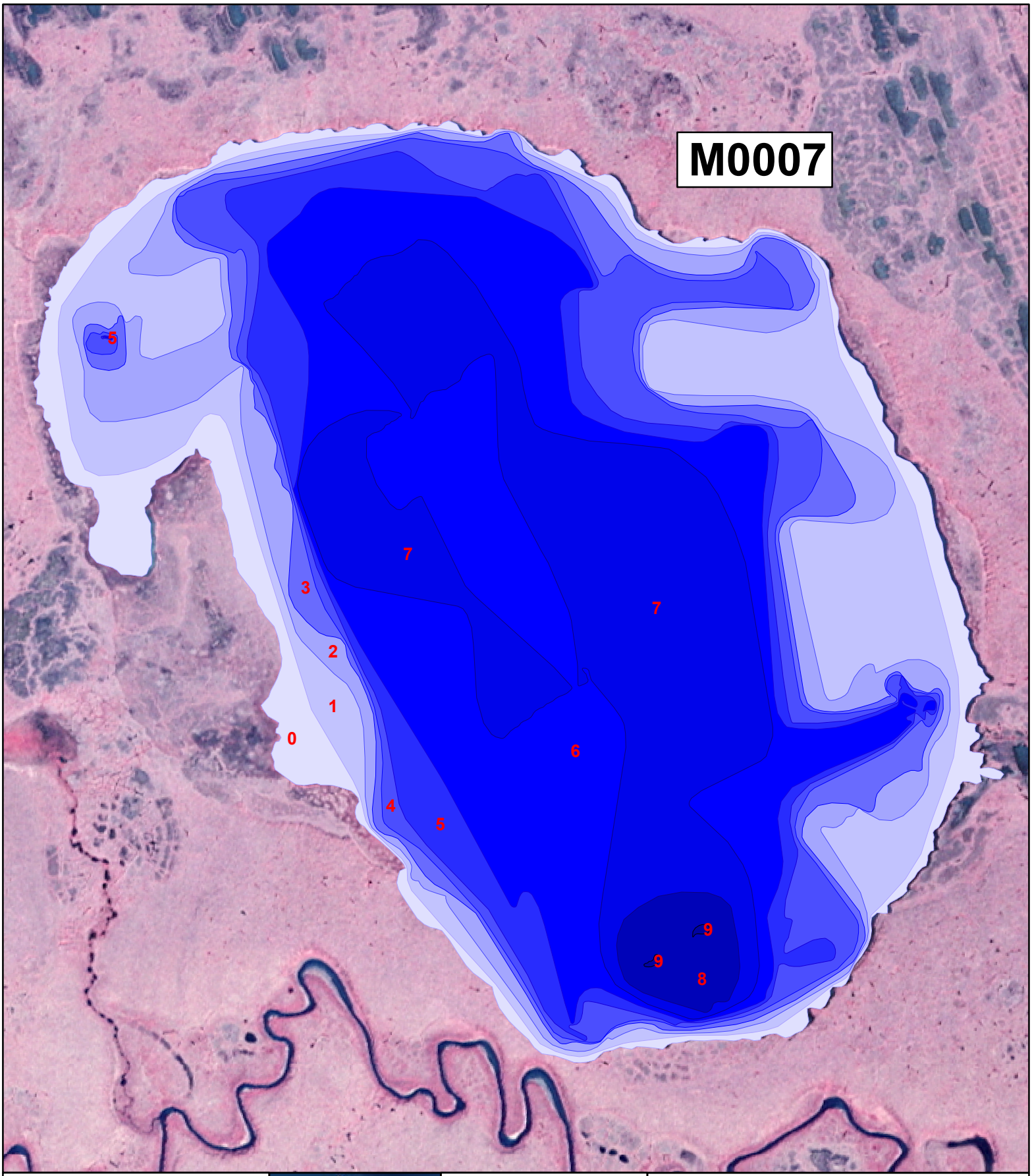
Depth Transects Surveyed at Lake M0006

surveyed on July 16, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

1005 0 0 100 200 300 400 500 Feet

N



Depth in Feet

0 3 6 9
1 4 7 10
2 5 8

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0007

based on transects surveyed on July 15, 2017

SCALE:

250125 0 250 500 750 1,000
Feet

N

Lake M0007

Other Names: None known
Location: 70.22240°N 151.99085°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1E Sec. 7,18; T10N R1W Sec. 12,13
Habitat: Tundra lake
Area: 370 acres
Maximum Depth: 9.3 feet
Active Outlet: No
Total Lake Volume: 576.24 million gallons (July 15, 2017 data)
Water Volume Under 4 ft of ice: 189.77 million gallons
Water Volume Under 5 ft of ice: 117.94 million gallons
Water Volume Under 7 ft of ice: 13.93 million gallons

Potential Ice Aggregate: 134.1 acres (water depth 4 ft or less)
39.8 million gallons

Maximum Recommended Winter Removal: **35.38 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

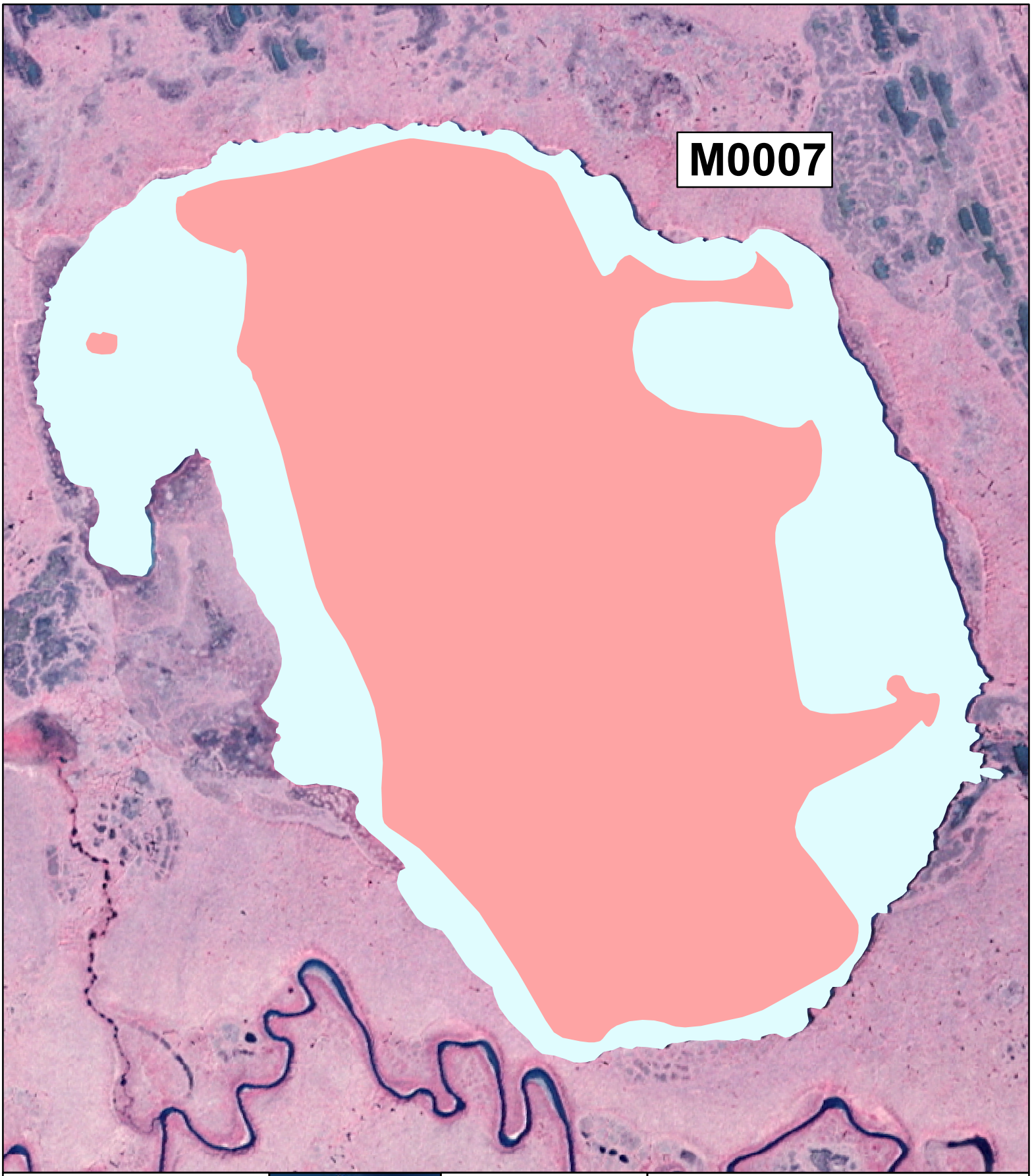
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2010	35.5	5.5	11.9	32.0	111.0	295.0		8.15	L. Moulton
2017	40.0	7.6	17.0	43.0	130.0	333.8	1.1	8.27	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 16 2000	8.7	None	0
	Jul 15 2017	6.2	None	0
Minnow Trap	Jul 15 2017	16.0	Ninespine stickleback	45
Visual survey+dipnet	Jul 15 2017	1 yds	Ninespine stickleback	10

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips

Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake M0007

based on transects surveyed on July 15, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250125 0 250 500 750 1,000 Feet

N

Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

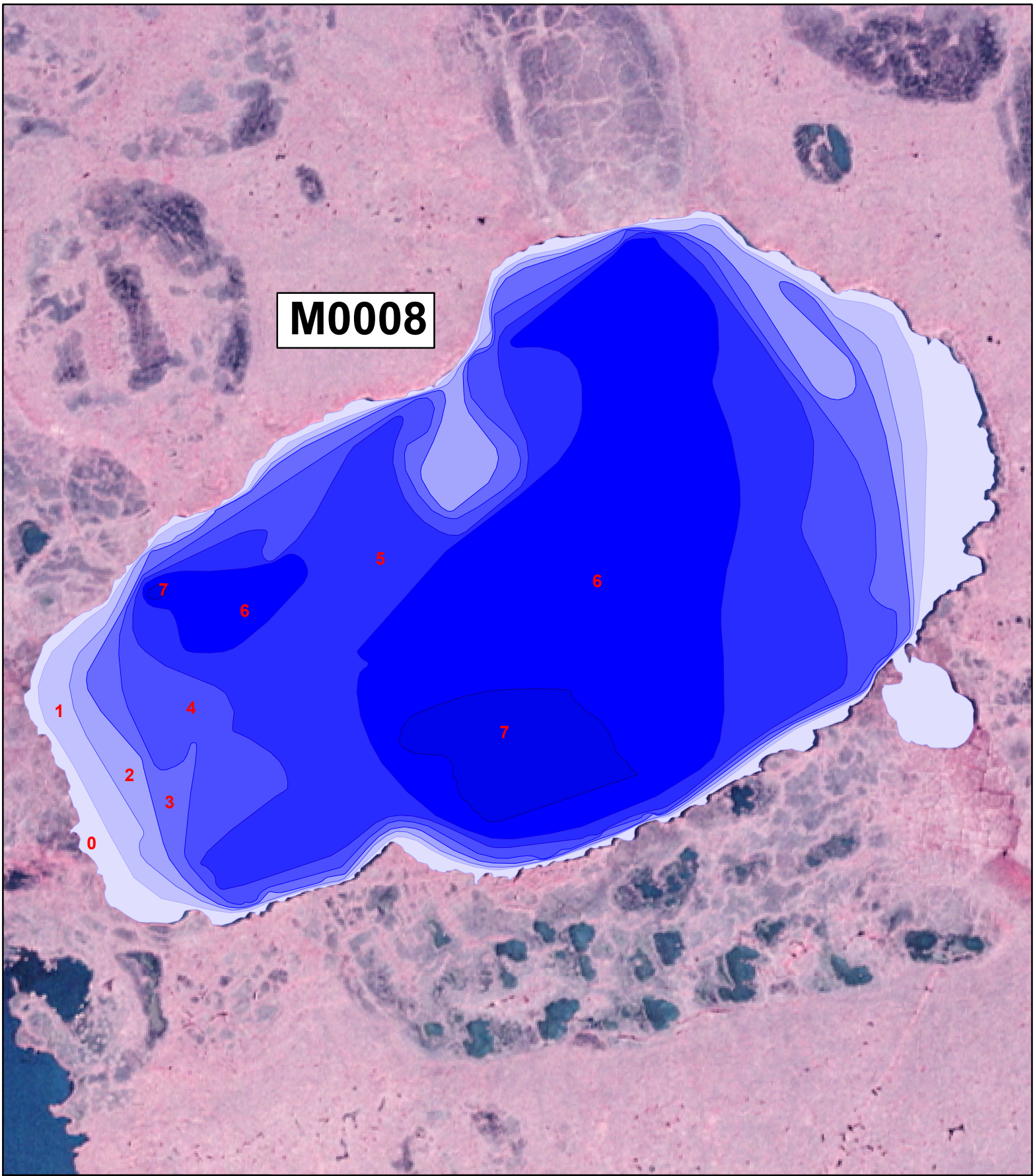
Depth Transects Surveyed at Lake M0007

surveyed on July 15, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250125 0 250 500 750 1,000 Feet

N



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0008

based on transects surveyed on July 15, 2017

SCALE:

250 125 0 250 500 750
Feet

N

Lake M0008

Other Names: None known
Location: 70.22501°N 152.03423°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W Sec. 12,13,14
Habitat: Tundra lake
Area: 182 acres
Maximum Depth: 7.6 feet
Active Outlet: No
Total Lake Volume: 279.70 million gallons (July 15, 2017 data)
Water Volume Under 4 ft of ice: 77.19 million gallons
Water Volume Under 5 ft of ice: 38.54 million gallons
Water Volume Under 7 ft of ice: 0.91 million gallons

Potential Ice Aggregate: 51.7 acres (water depth 4 ft or less)
15.3 million gallons

Maximum Recommended Winter Removal: **0.137 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

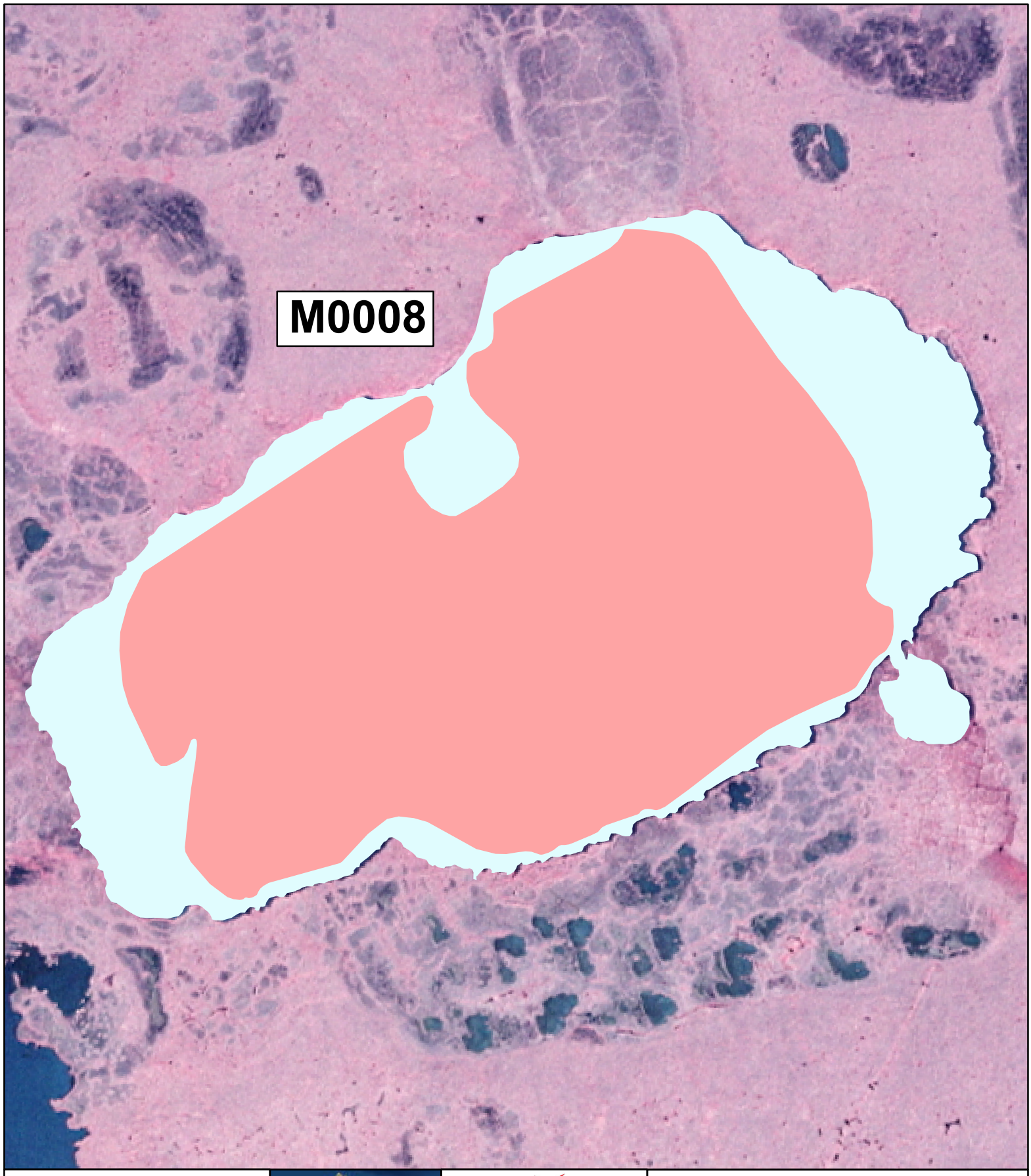
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2000	14.1	2.7	5.9	13.5	46.3	125.0		7.83	L. Moulton
2017	12.0	2.1	5.4	20.0	40.0	107.0	1.3	7.74	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 16 2000	5.2	None	0	
	Jul 15 2017	5.3	Arctic grayling	2	172, 294
Minnow Trap	Jul 15 2017	10.7	Ninespine stickleback	1	

Data Last Revised: September 15, 2017



Ice Chip Areas

- 4 feet or shallower - available for ice chips
- Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake M0008

based on transects surveyed on July 15, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N

Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

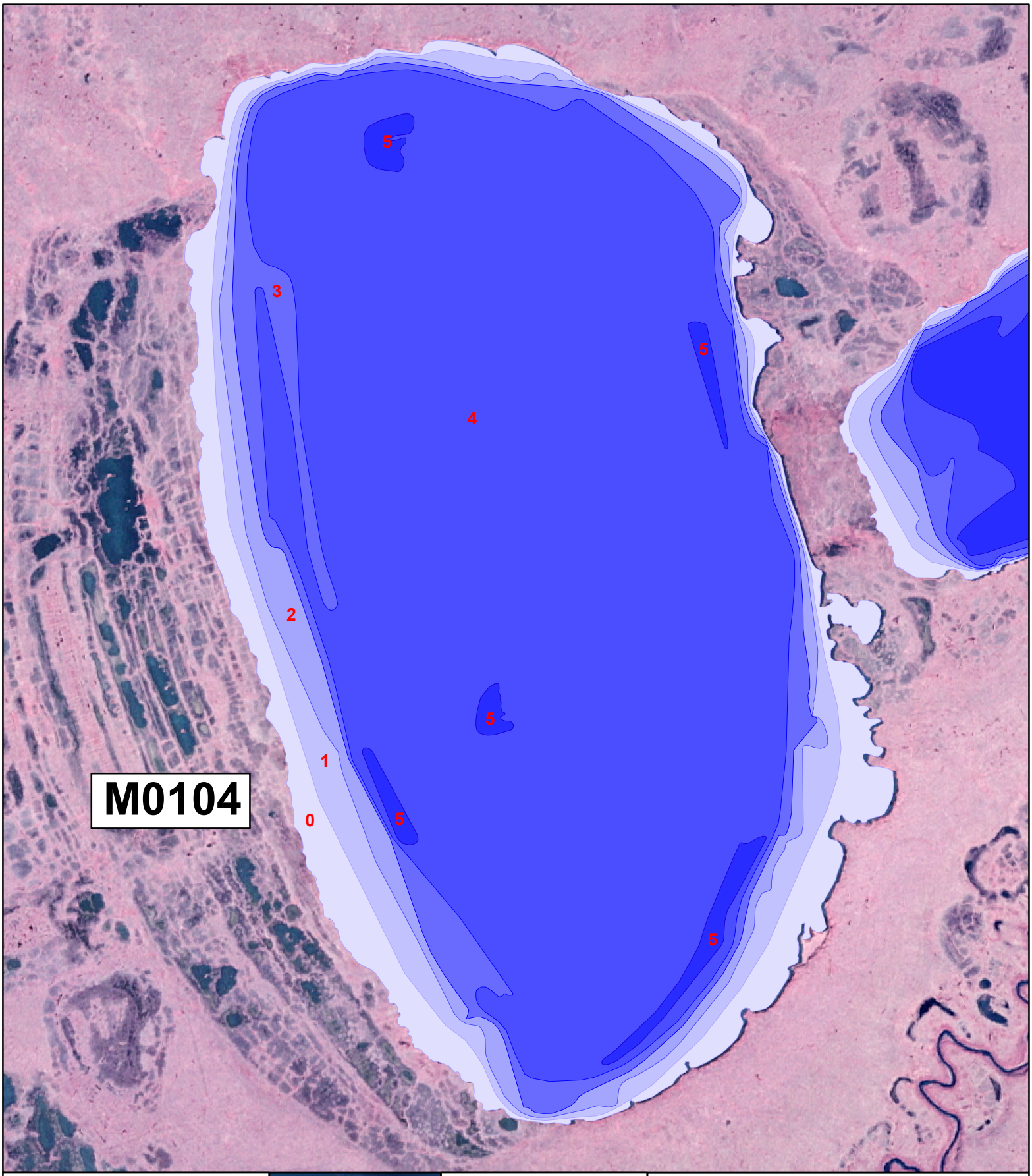
Depth Transects Surveyed at Lake M0008

based on transects surveyed on July 15, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth in Feet

0 2 4
1 3 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0104

based on transects surveyed on July 16, 2017

SCALE:

500 250 0 500 1,000
Feet

N

Lake M0104

Other Names: None known
Location: 70.22100°N 152.06825°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W Sec. 11,14,23
Habitat: Tundra lake
Area: 514 acres
Maximum Depth: 5.5 feet
Active Outlet: No
Total Lake Volume: 618.30 million gallons (July 16, 2017 data)
Water Volume Under 4 ft of ice: 48.91 million gallons
Water Volume Under 5 ft of ice: 1.05 million gallons
Water Volume Under 7 ft of ice: 0.00 million gallons

Potential Ice Aggregate: 142.8 acres (water depth 4 ft or less)
42.3 million gallons

Maximum Recommended Winter Removal: **0.315 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

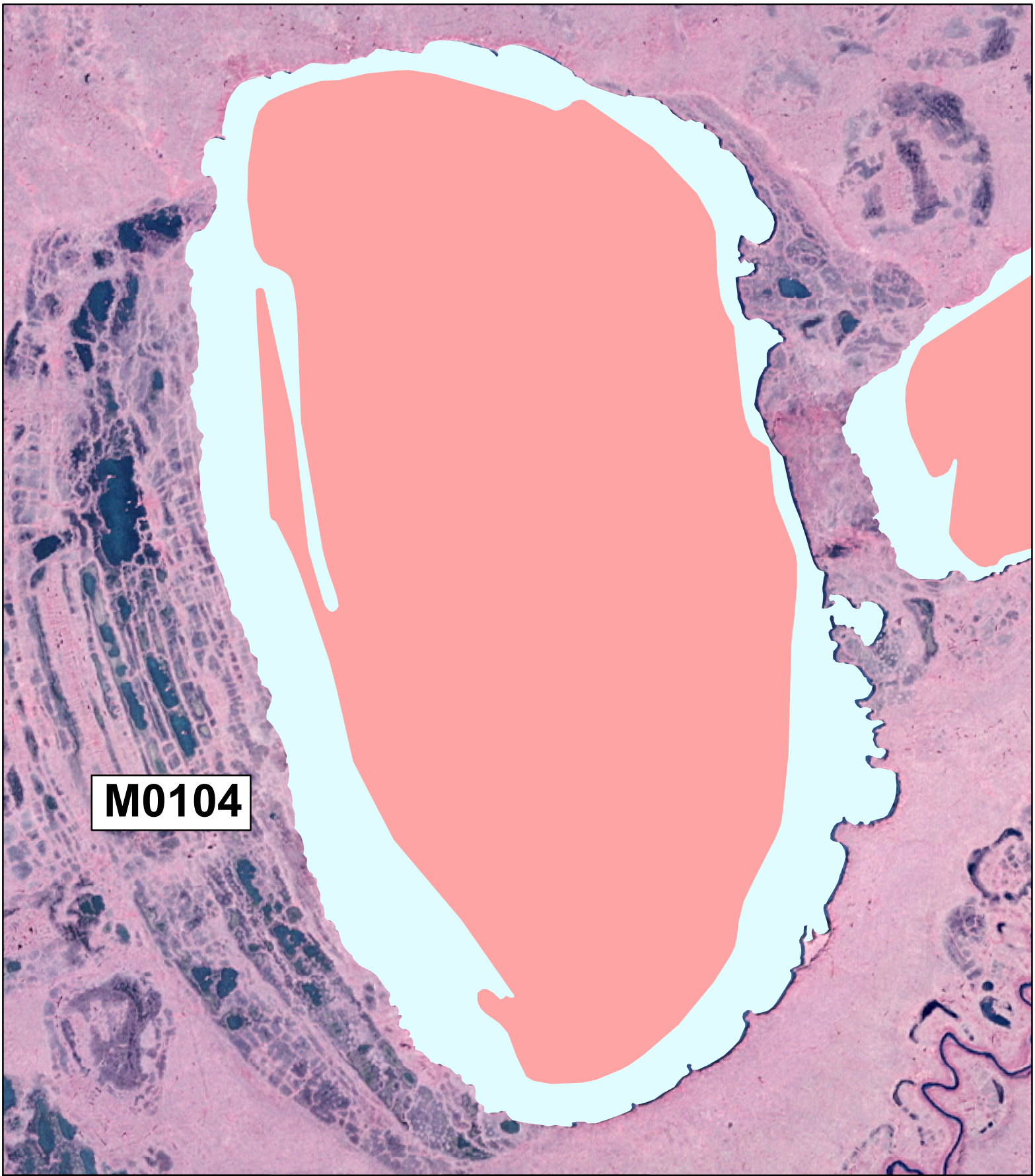
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2001	10.0	1.7	3.9	8.1	33.0	81.0	2.0	7.91	L. Moulton
2017	9.7	1.6	4.2	13.0	31.0	84.5	1.5	7.78	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 16 2001	9.6	None	0
Gill Net	Jul 16 2017	9.1	None	0
Minnow Trap	Jul 16 2017	10.3	Ninespine Stickleback	3

Data Last Revised: September 13, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake M0104

based on transects surveyed on July 16, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000 Feet

N

Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

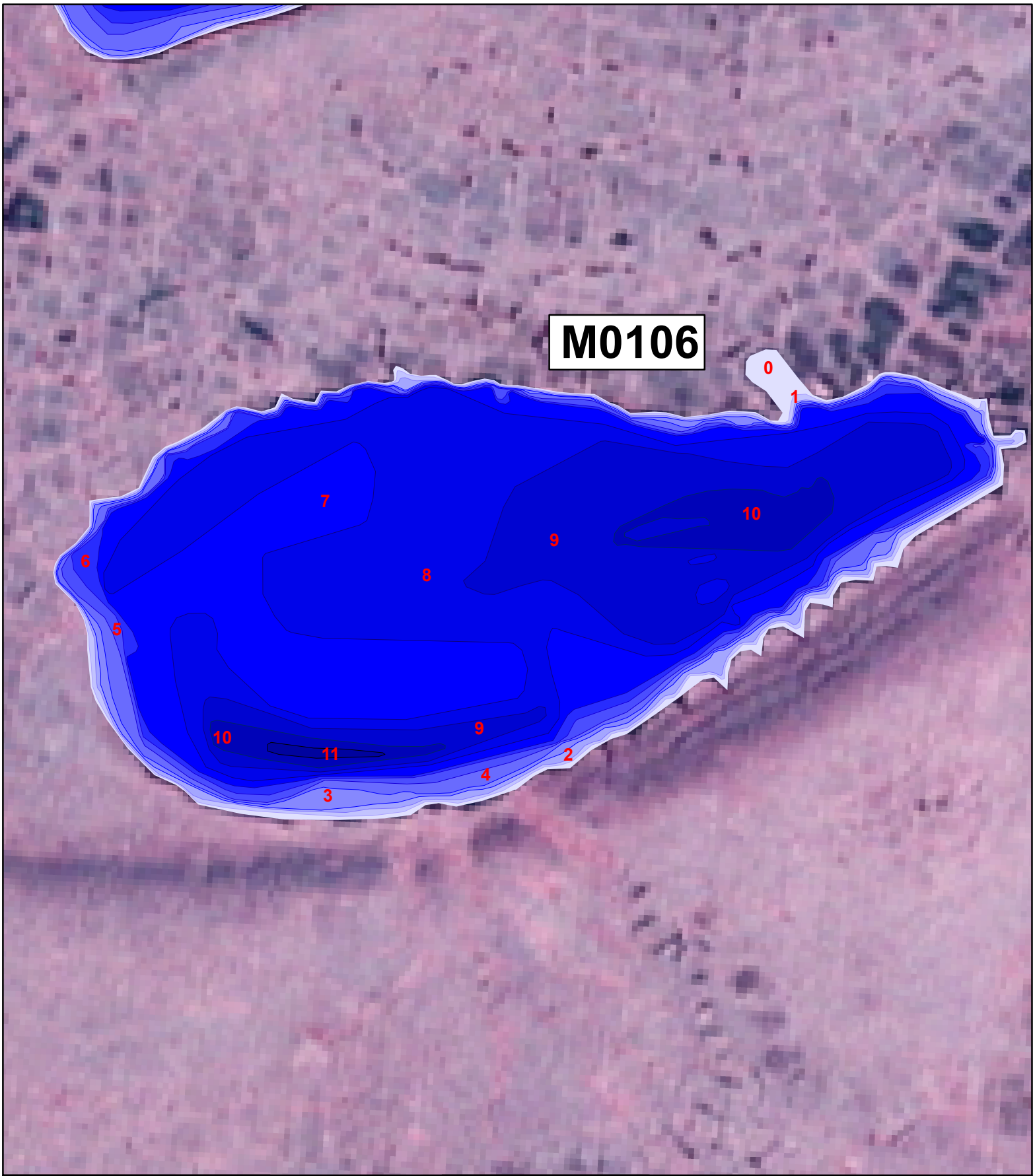
Depth Transects Surveyed at Lake M0104

surveyed on July 16, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

500 250 0 500 1,000
Feet

N



Depth in Feet

0 3 6 9
1 4 7 10
2 5 8 11

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0106

based on transects surveyed on August 19, 2017

SCALE:

100 50 0 100 200 300 Feet

N

Lake M0106

Other Names: None known
Location: 70.23899°N 152.09887°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W Sec. 10
Habitat: Tundra lake
Area: 14 acres
Maximum Depth: 11.3 feet
Active Outlet: No
Total Lake Volume: 34.71 million gallons (August 19, 2017 data)
Water Volume Under 4 ft of ice: 17.27 million gallons
Water Volume Under 5 ft of ice: 13.22 million gallons
Water Volume Under 7 ft of ice: 5.57 million gallons

Potential Ice Aggregate: 1.44 acres (water depth 4 ft or less)
0.428 million gallons

Maximum Recommended Winter Removal: **3.966 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2001	7.0	1.8	4.6	8.4	25.0	69.2	1.1	7.54	L. Moulton
2017	6.8	1.6	4.0	8.6	24.0	68.6	1.5	7.52	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 2001	10.0	None	0
Gill Net	Aug 19 2017	6.2	None	0
Visual survey+dipnet	Aug 19 2017	5 yds	Ninespine stickleback	1

Data Last Revised: September 15, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

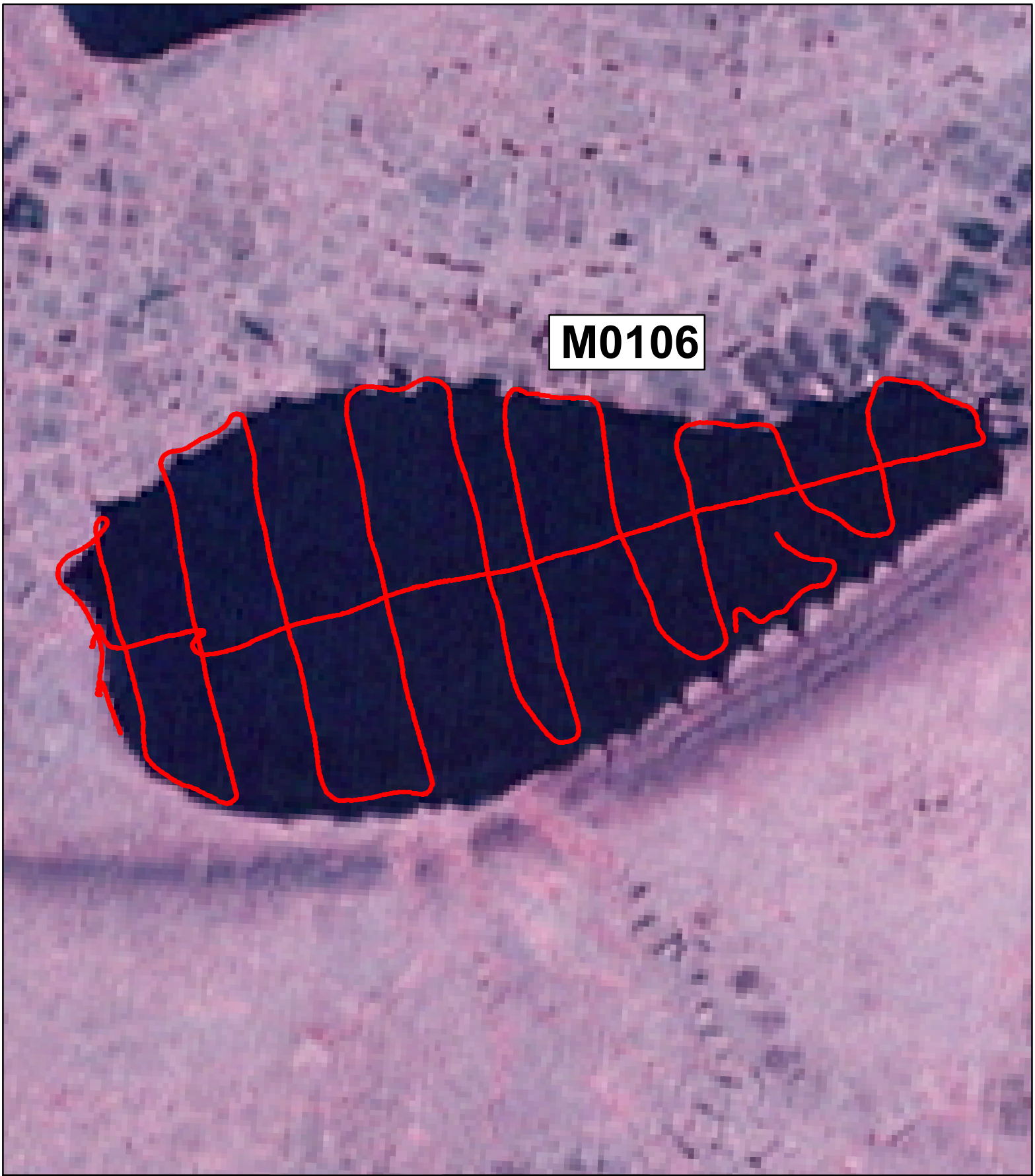
Area Available for Ice Chip Collection at Lake M0106

based on transects surveyed on August 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

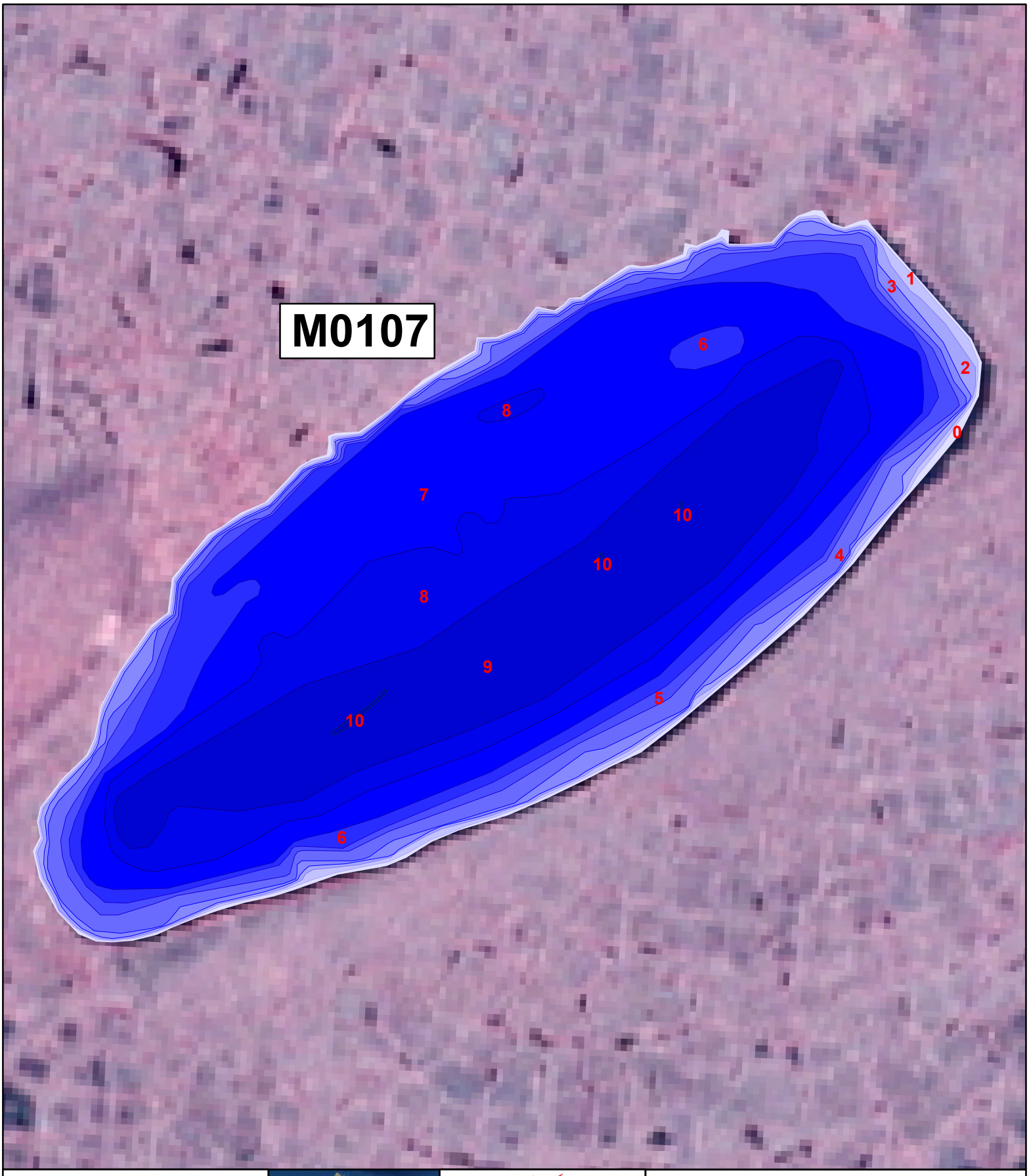
Depth Transects Surveyed at Lake M0106

surveyed on August 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 Feet

N



Depth in Feet

0 3 6 9
1 4 7 10
2 5 8

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0107

based on transects surveyed on August 19, 2017

SCALE:

100 50 0 100 200
Feet

N

Lake M0107

Other Names: None known
Location: 70.24229°N 152.09922°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W Sec. 3,10
Habitat: Tundra lake
Area: 15 acres
Maximum Depth: 10.1 feet
Active Outlet: No
Total Lake Volume: 34.49 million gallons (August 19, 2017 data)
Water Volume Under 4 ft of ice: 16.10 million gallons
Water Volume Under 5 ft of ice: 11.93 million gallons
Water Volume Under 7 ft of ice: 4.48 million gallons

Potential Ice Aggregate: 1.43 acres (water depth 4 ft or less)
0.424 million gallons

Maximum Recommended Winter Removal: **3.579 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

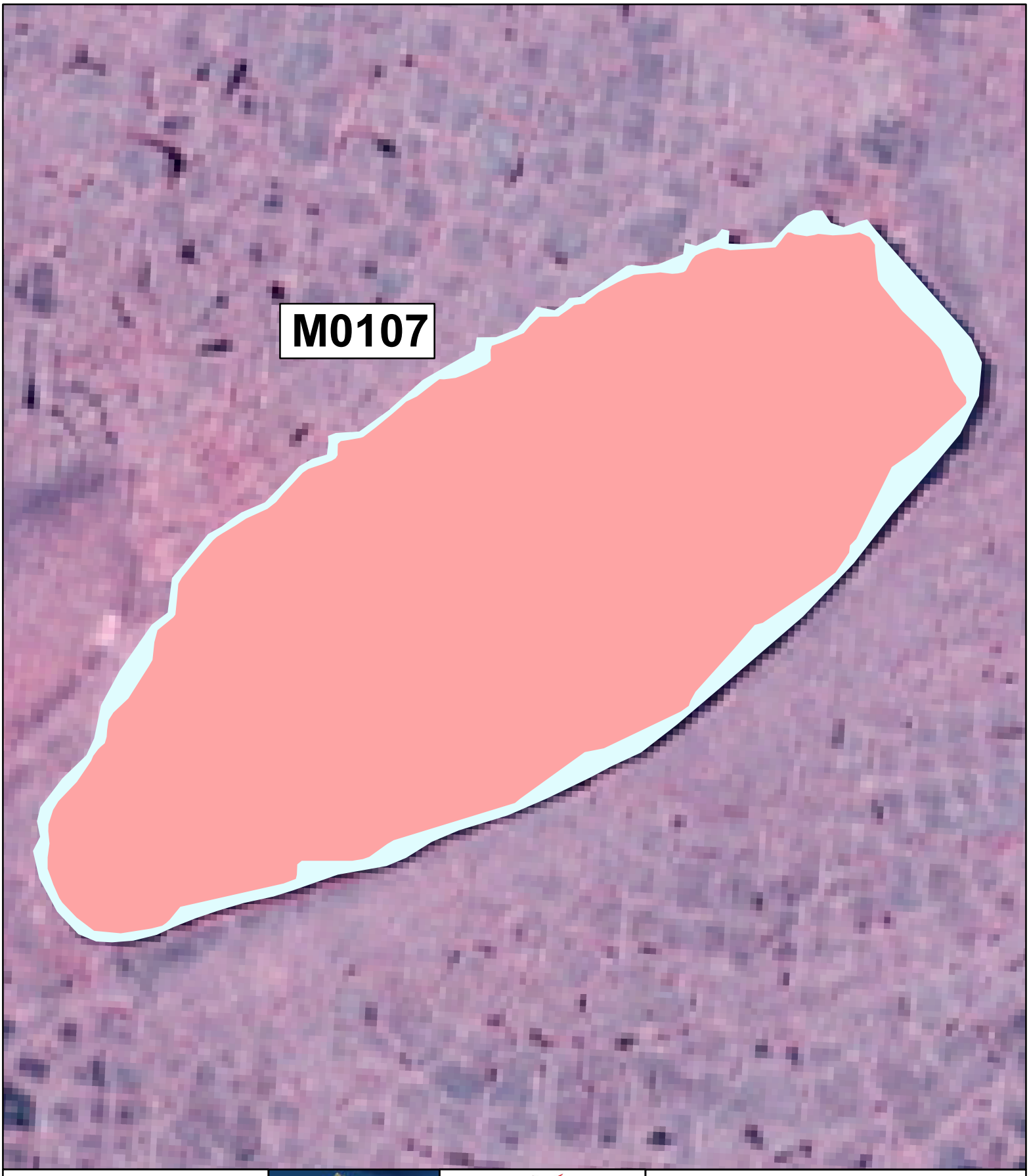
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2001	12.0	2.6	7.8	14.0	40.0	113.9	1.2	7.85	L. Moulton
2017	9.7	1.6	4.2	13.0	31.0	84.5	1.5	7.78	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 2001	9.7	None	0
Gill Net	Aug 19 2017	6.2	None	0
Minnow Trap	Aug 19 2017	0.5	Ninespine stickleback	1
Visual survey+dipnet	Aug 19 2017	20 yds	Ninespine stickleback	1

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deep than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

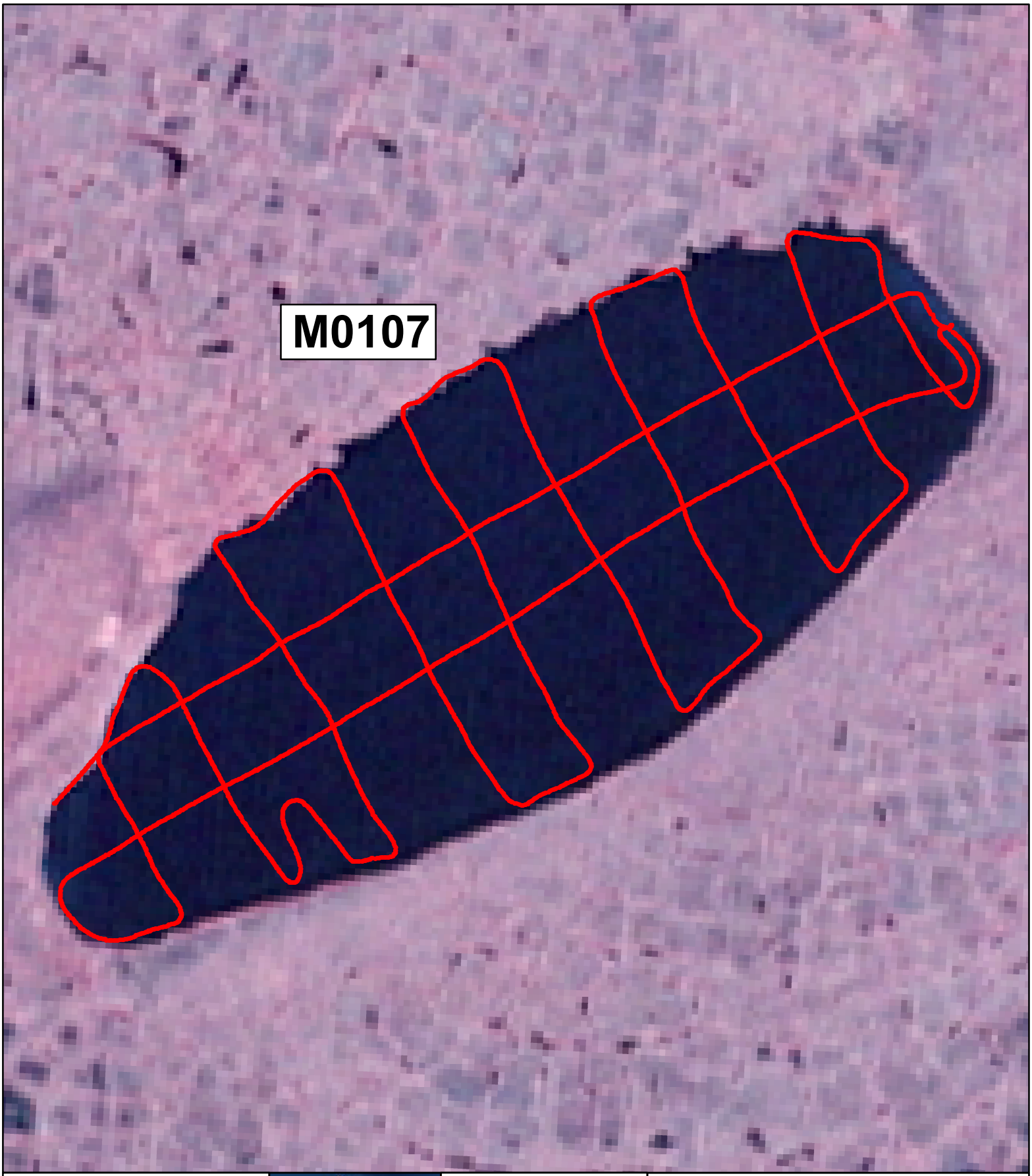
Area Available for Ice Chip Collection at Lake M0107

based on transects surveyed on August 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200
Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

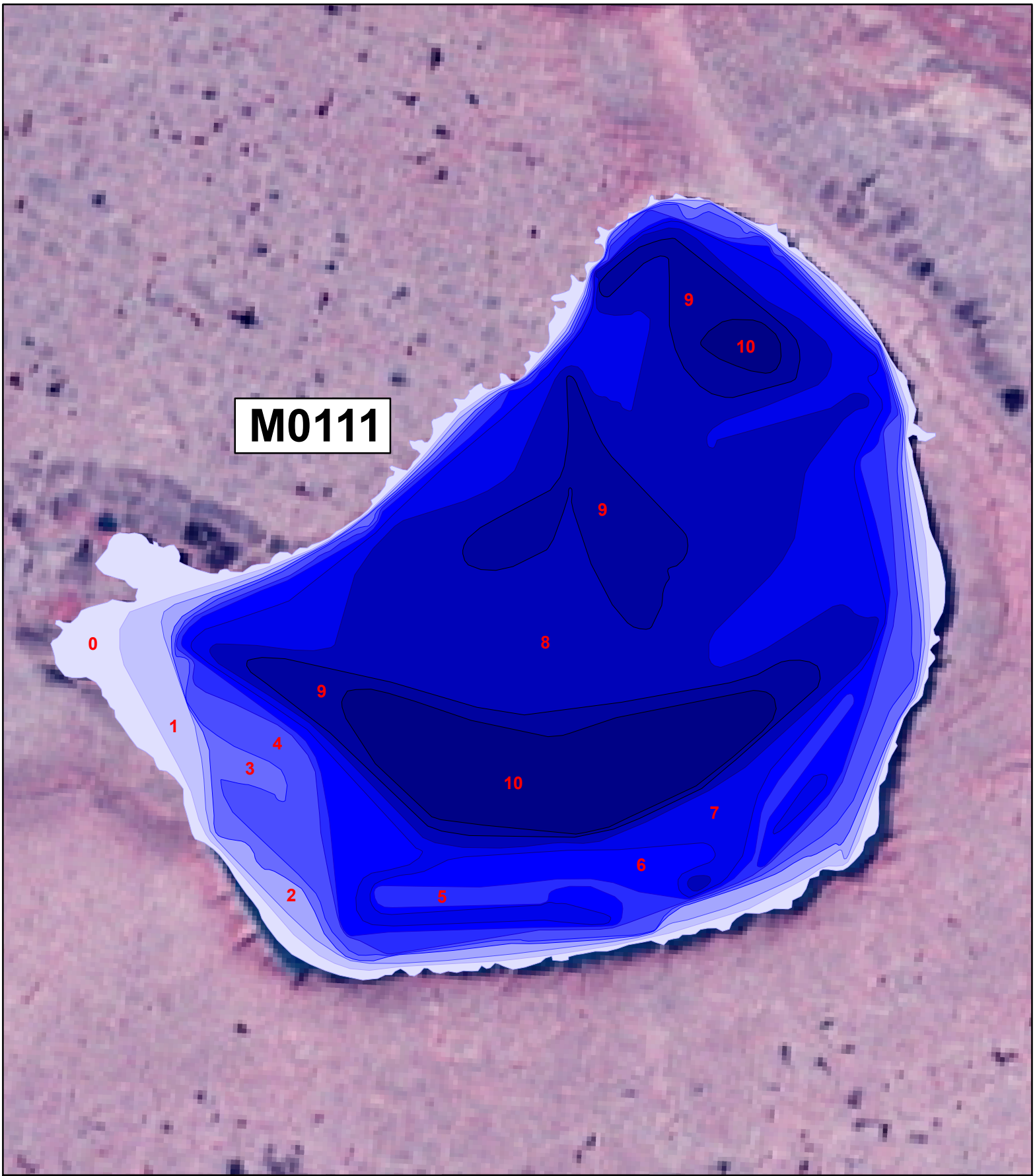
Depth Transects Surveyed at Lake M0107

surveyed on August 19, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200
Feet

N



Depth in Feet

0 3 6 9
1 4 7 10
2 5 8

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0111

based on transects surveyed on August 20, 2017

SCALE:

100 50 0 100 200 300
Feet

N

Lake M0111

Other Names: None known
Location: 70.24011°N 152.07377°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W Sec. 2,11
Habitat: Tundra lake
Area: 32 acres
Maximum Depth: 12.6 feet
Active Outlet: No
Total Lake Volume: 72.55 million gallons (August 20, 2017 data)
Water Volume Under 4 ft of ice: 34.83 million gallons
Water Volume Under 5 ft of ice: 26.48 million gallons
Water Volume Under 7 ft of ice: 11.72 million gallons

Potential Ice Aggregate: 5.43 acres (water depth 4 ft or less)
1.61 million gallons

Maximum Recommended Winter Removal: **7.944 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

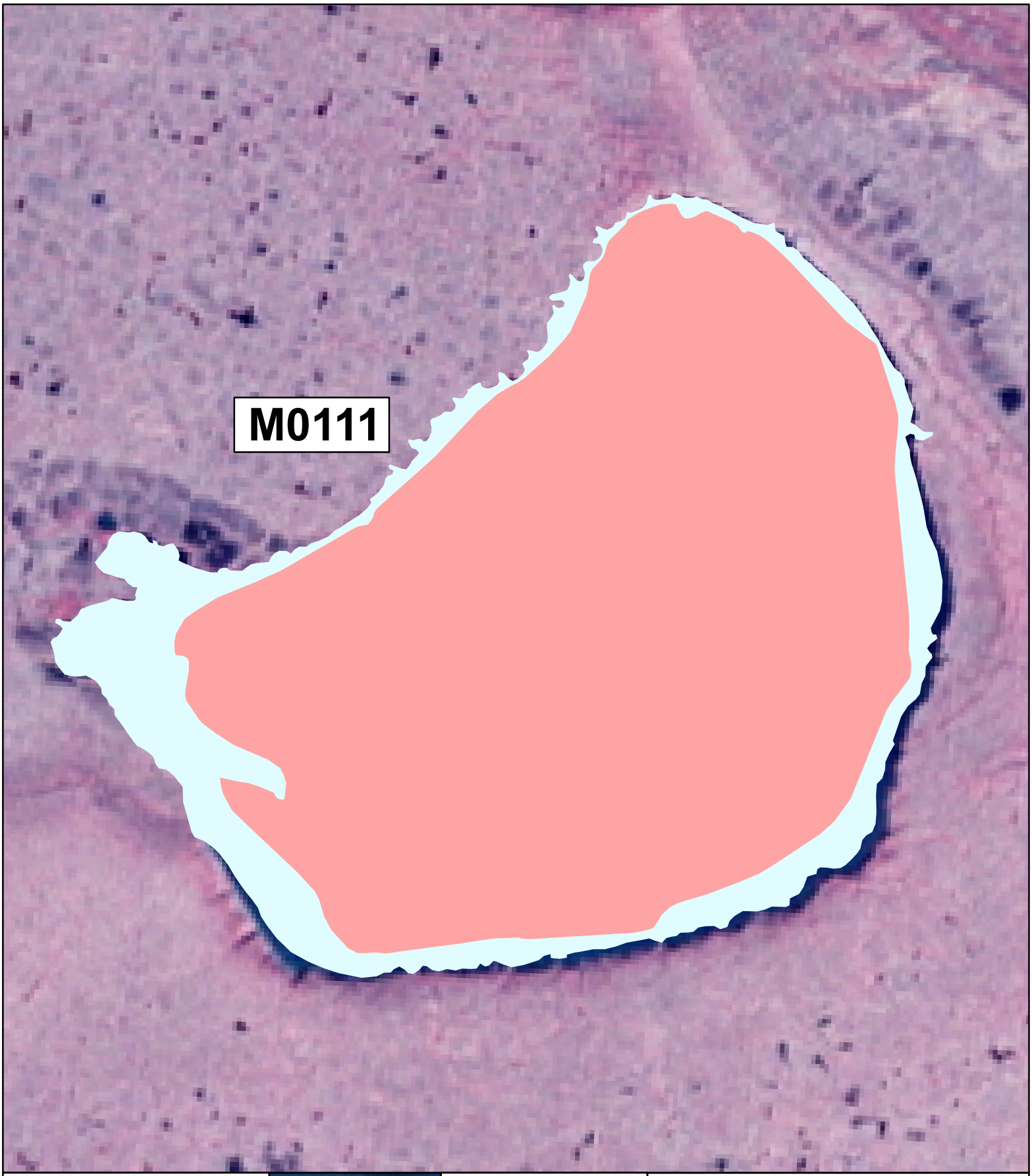
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2001	52.0	15.0	37.0	99.0	190.0	540.0	1.3	8.40	L. Moulton
2017	47.0	14.0	34.0	79.0	180.0	516.5	1.5	8.34	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 19 2001	7.9	None	0
Gill Net	Aug 20 2017	6.2	None	0
Visual survey+dipnet	Aug 20 2017	10 yds	Ninespine stickleback	1

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips

Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

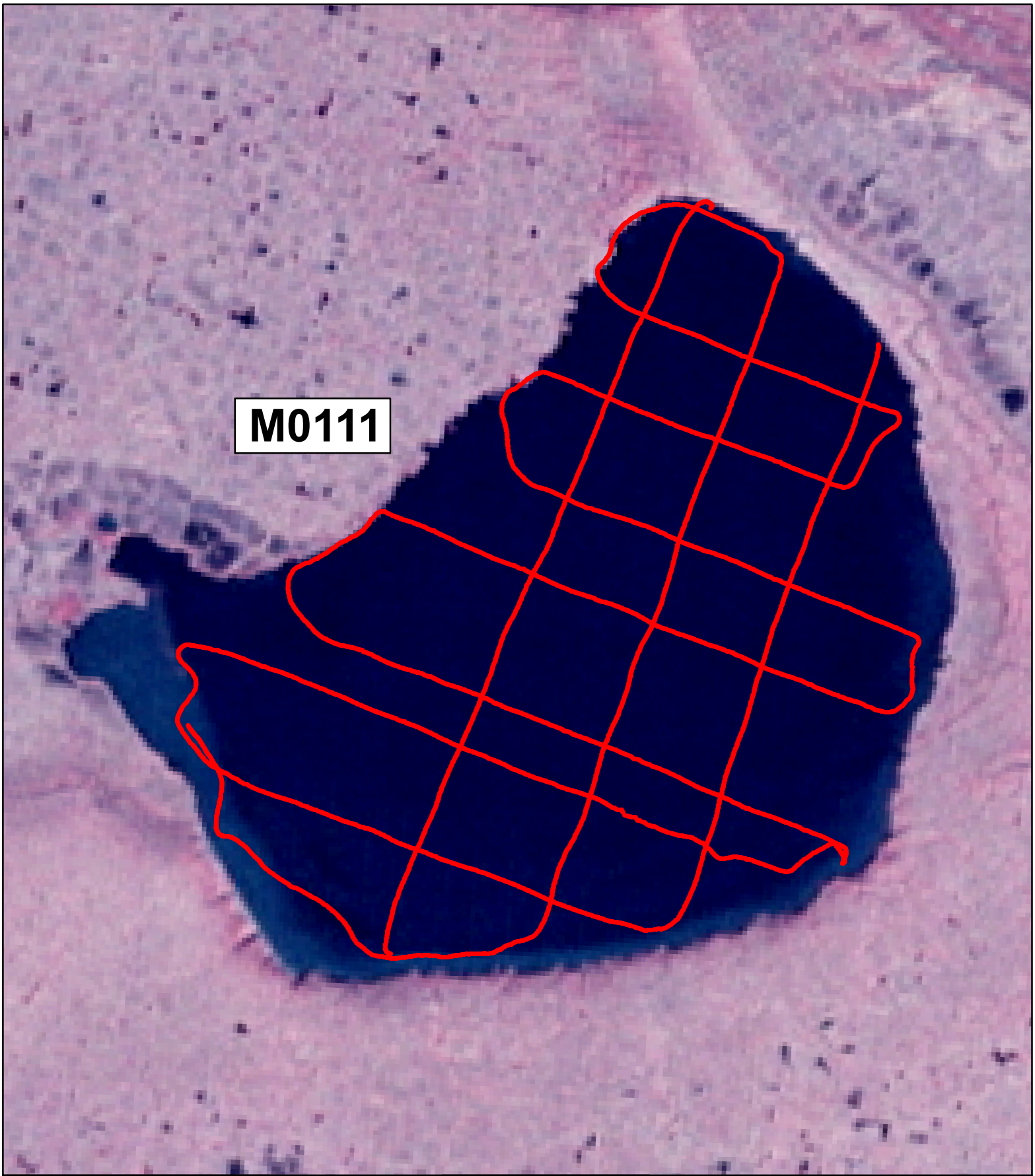
Area Available for Ice Chip Collection at Lake M0111

based on transects surveyed on August 20, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

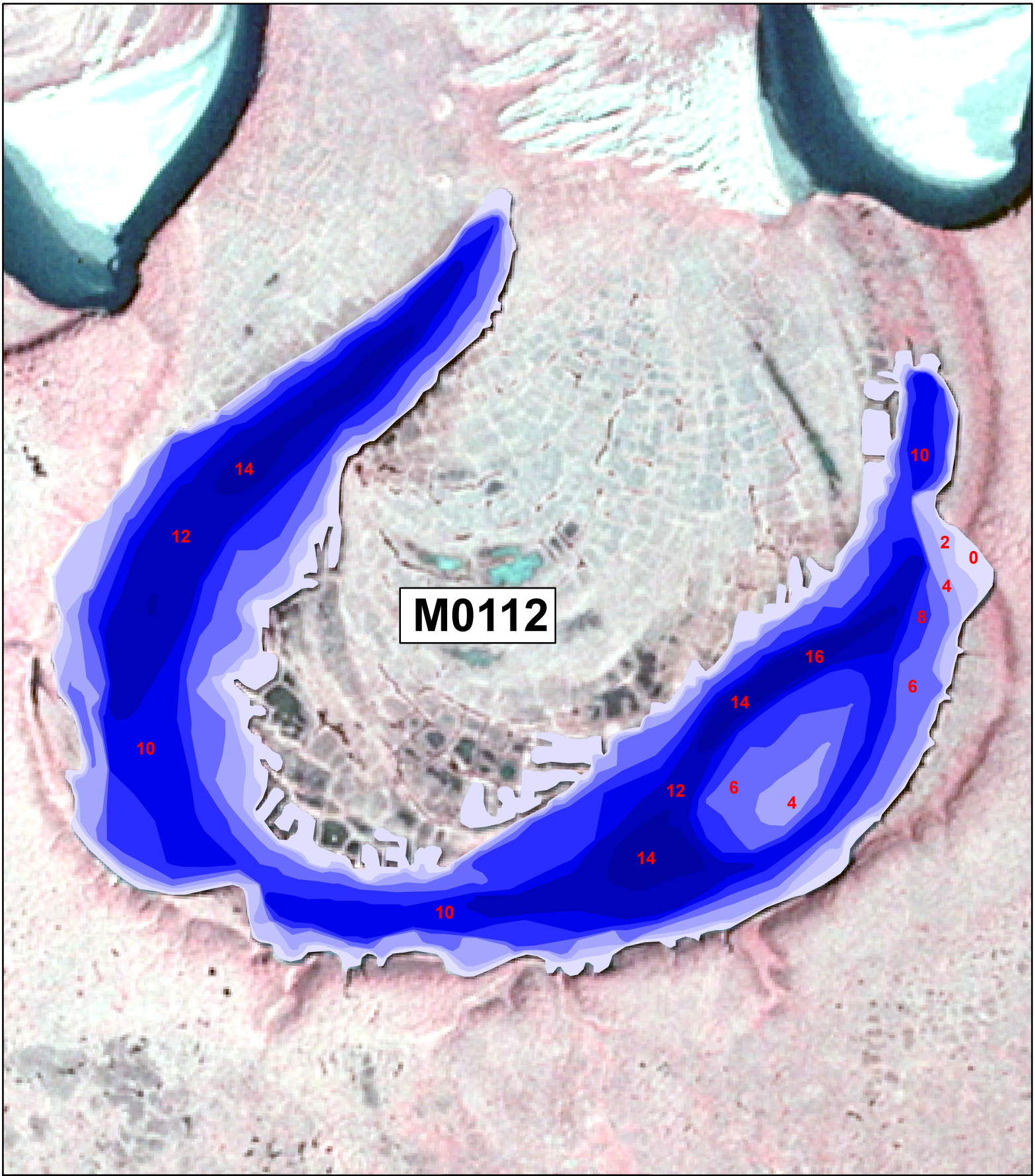
Depth Transects Surveyed at Lake M0111

surveyed on August 20, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

100 50 0 100 200 300 Feet

N



Depth in Feet

0 6 12
2 8 14
4 10 16

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M0112 (depth in 2 foot intervals)

based on transects surveyed on August 18, 2017

SCALE:

250 125 0 250 500 Feet

N

Lake M0112

Other Names: None known
Location: 70.24521°N 152.15701°W
USGS Quad Sheet: Harrison Bay A-4: T10N R1W Sec. 4
Habitat: Tundra lake
Area: 62 acres
Maximum Depth: 16.1 feet
Active Outlet: No
Total Lake Volume: 164.20 million gallons (July 16, 2017 data)
Water Volume Under 4 ft of ice: 91.54 million gallons
Water Volume Under 5 ft of ice: 75.53 million gallons
Water Volume Under 7 ft of ice: 47.08 million gallons

Potential Ice Aggregate: 11.49 acres (water depth 4 ft or less)
3.41 million gallons

Maximum Recommended Winter Removal: **22.659 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2001	15.0	3.3	8.9	19.0	51.0	162.0	0.8	8.00	L. Moulton
2017	15.0	3.4	8.4	19.0	52.0	145.2	1.0	7.77	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 20 2001	9.2	None	0
Gill Net	Aug 18 2017	8.1	None	0
Minnow Trap	Aug 18 2017	0.5	None	0
Visual survey+dipnet	Aug 18 2017	20 yds	Ninespine stickleback	1

Data Last Revised: September 14, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

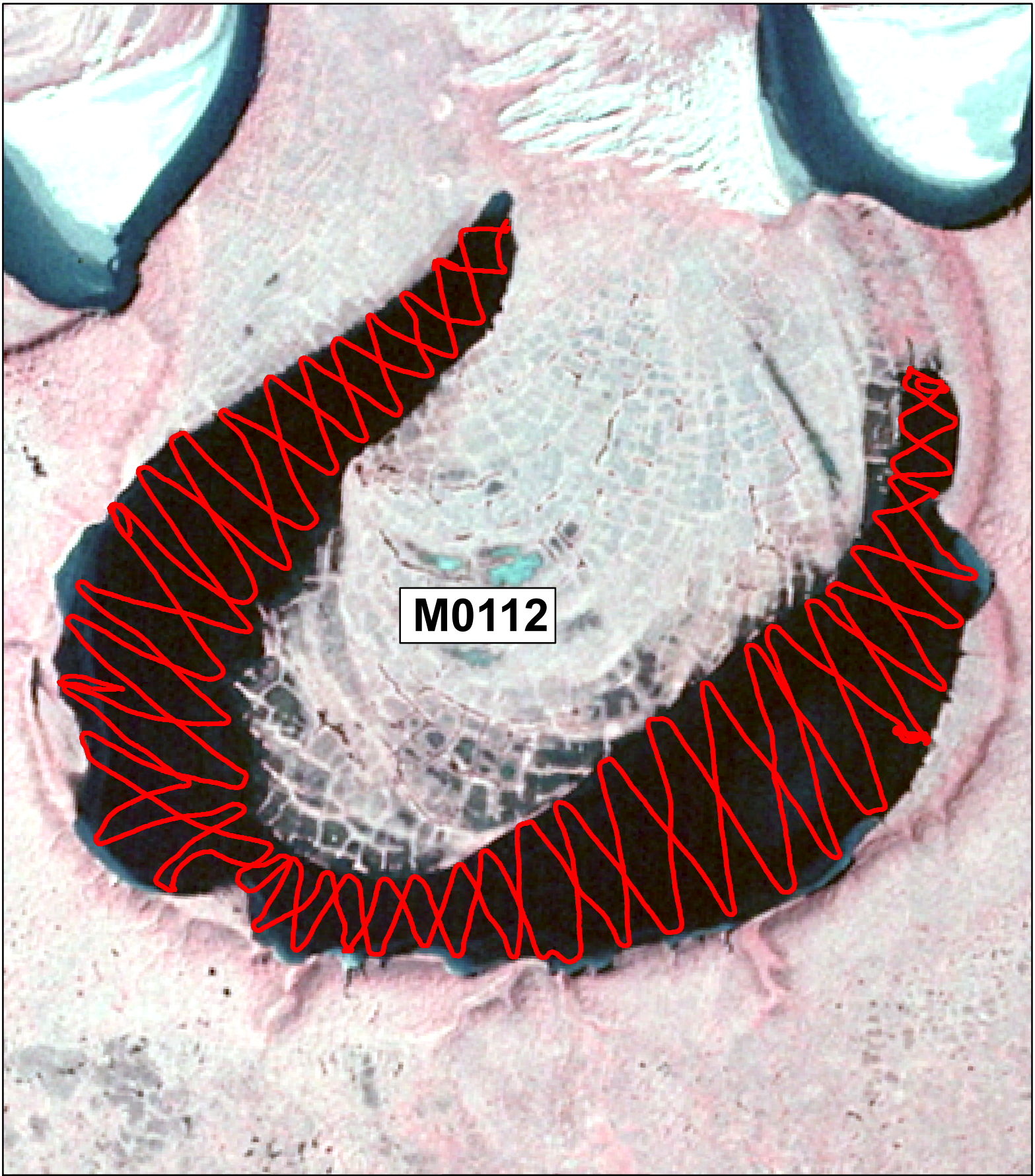
Area Available for Ice Chip Collection at Lake M0112

based on transects surveyed on August 18, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Transects Surveyed at Lake M0112

surveyed on August 18, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N

Depth in Feet

0 6 12
2 8 14
4 10 16

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M9901 (depth in 2 foot intervals)

based on transects surveyed on August 20, 2017

SCALE:

250 125 0 250 500
Feet

N

Lake M9901

Other Names: None known
Location: 70.23006°N 151.81838°W
USGS Quad Sheet: Harrison Bay A-3: T10N R1E Sec. 11,14
Habitat: Oxbow lake
Area: 68 acres
Maximum Depth: 17.6 feet
Active Outlet: No
Total Lake Volume: 150.83 million gallons (August 20, 2017 data)
Water Volume Under 4 ft of ice: 72.57 million gallons
Water Volume Under 5 ft of ice: 56.67 million gallons
Water Volume Under 7 ft of ice: 30.66 million gallons

Potential Ice Aggregate: 16.4 acres (water depth 4 ft or less)
4.9 million gallons

Maximum Recommended Winter Removal: **4.60 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1999	24.7	3.7	4.6	23.8	79.8	180.0		7.66	L. Moulton
2017	25.0	4.4	6.2	25.0	81.0	187.8	0.8	8.15	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 10 1999	3.2	Arctic grayling	32	166-433
	Aug 20 2017		Not sampled due to historic catch record		
Visual survey+dipnet	Aug 20 2017		Not sampled due to historic catch record		

Data Last Revised: September 14, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake M9901

based on transects surveyed on August 20, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N

Depth Transects Surveyed

— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

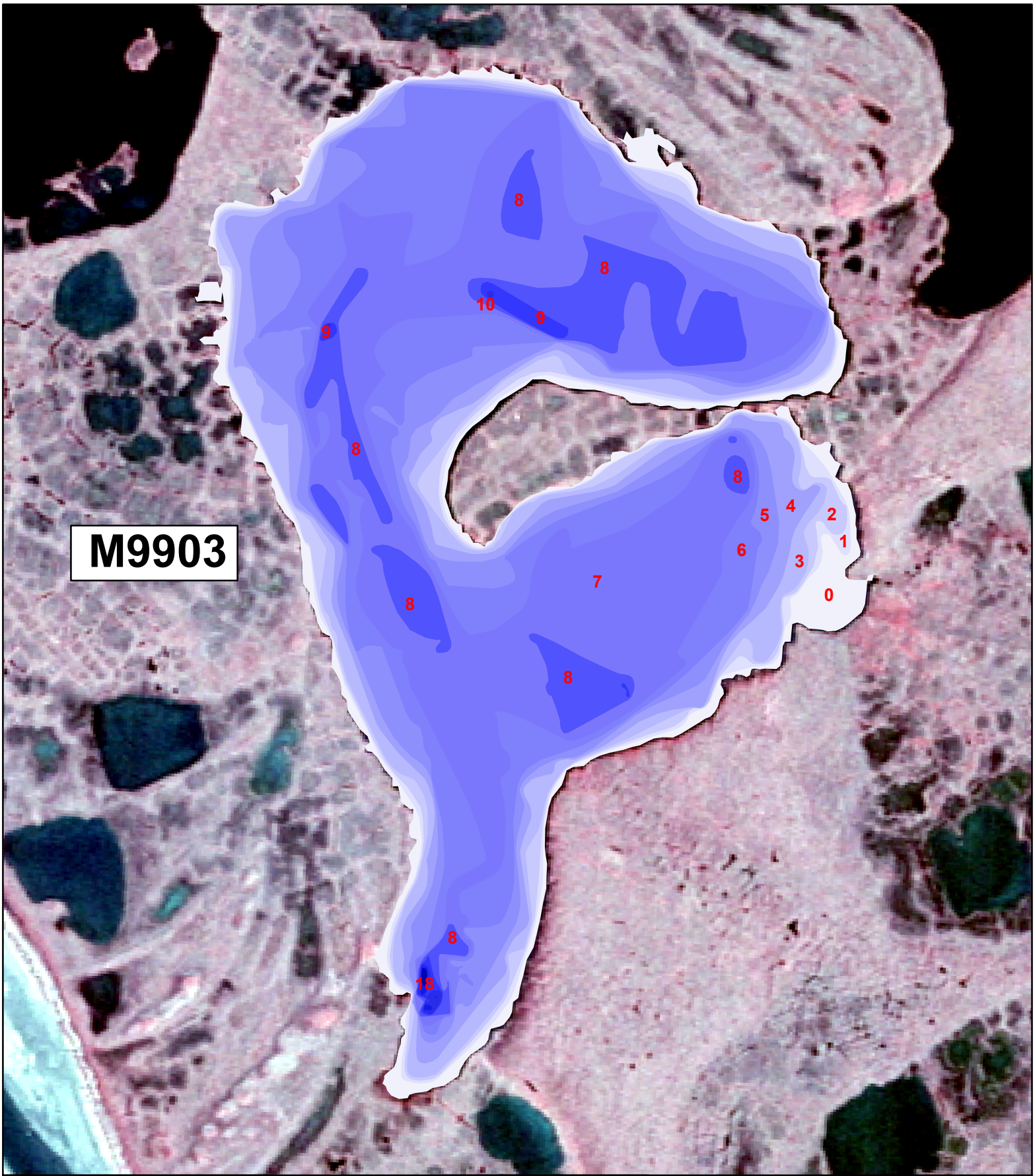
Depth Transects Surveyed at Lake M9901

surveyed on August 20, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500
Feet

N



Depth in Feet

0 3 6 9 14
1 4 7 10 16
2 5 8 12 18

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake M9903

based on transects surveyed on August 20, 2017

SCALE:

250 125 0 250 500 Feet

N

Lake M9903

Other Names: None known
Location: 70.23982°N 151.75726°W
USGS Quad Sheet: Harrison Bay A-3: T10N R1E, Sect 12
Habitat: Oxbow lake? (off Judy Creek)
Area: 71 acres
Maximum Depth: 18.8 feet
Active Outlet: No
Total Lake Volume: 134.02 million gallons (August 20, 2017 data)
Water Volume Under 4 ft of ice: 50.25 million gallons
Water Volume Under 5 ft of ice: 32.93 million gallons
Water Volume Under 7 ft of ice: 6.60 million gallons

Potential Ice Aggregate: 15.2 acres (water depth 4 ft or less)
4.50 million gallons

Maximum Recommended Winter Removal: **9.88 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
1999	9.7	1.9	2.8	7.9	33.2	87.0		8.11	L. Moulton
2017	12.0	2.2	3.6	9.1	38.0	187.8	0.8	8.15	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 10 1999	3.2	None	0
Gill Net	Jul 16 1999	4.6	None	0
Gill Net	Aug 21 2017	6.2	None	0
Visual survey+dipnet	Aug 21 2017	1 yds	Ninespine stickleback	1

Data Last Revised: September 15, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

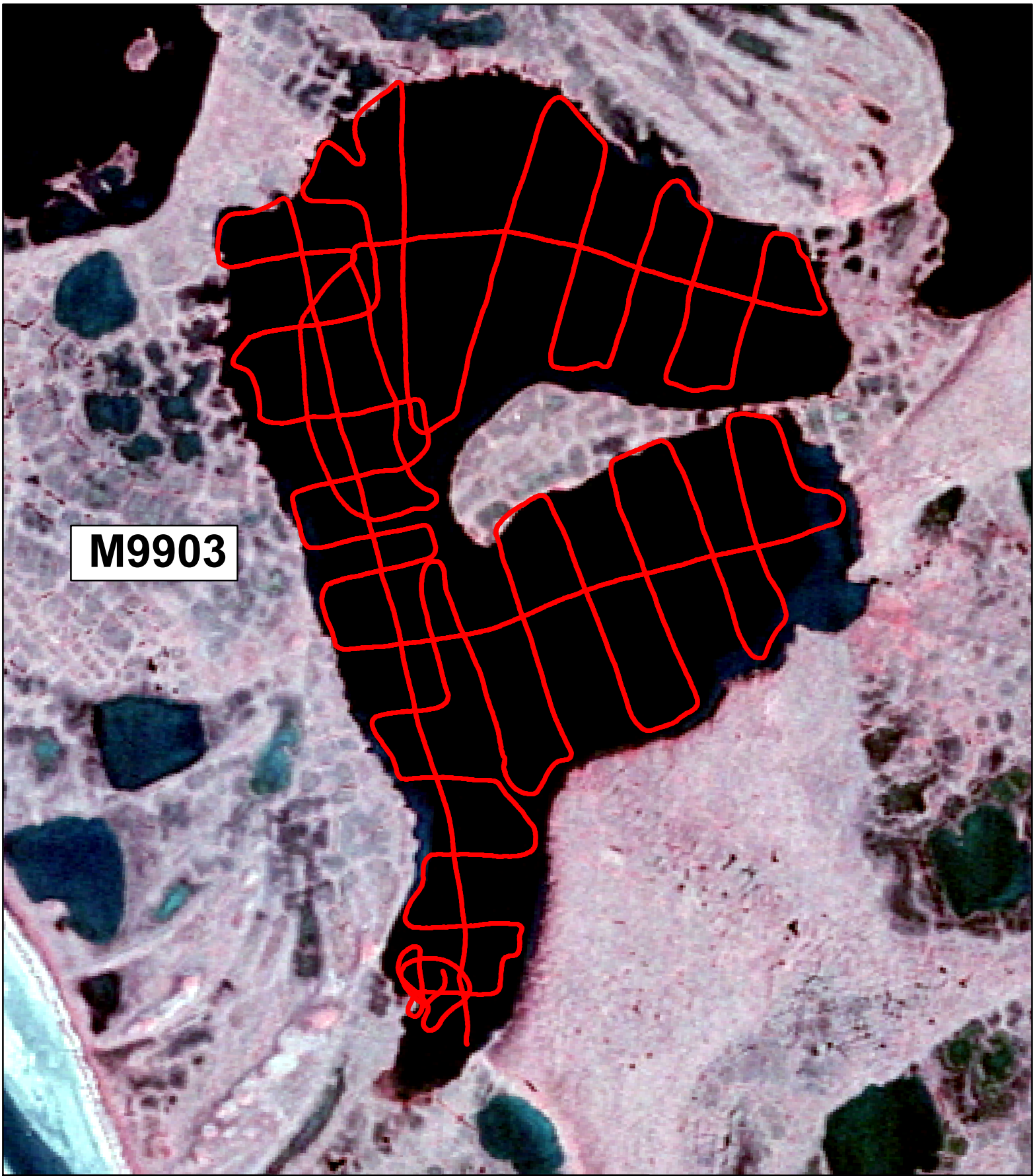
Area Available for Ice Chip Collection at Lake M9903

based on transects surveyed on August 20, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

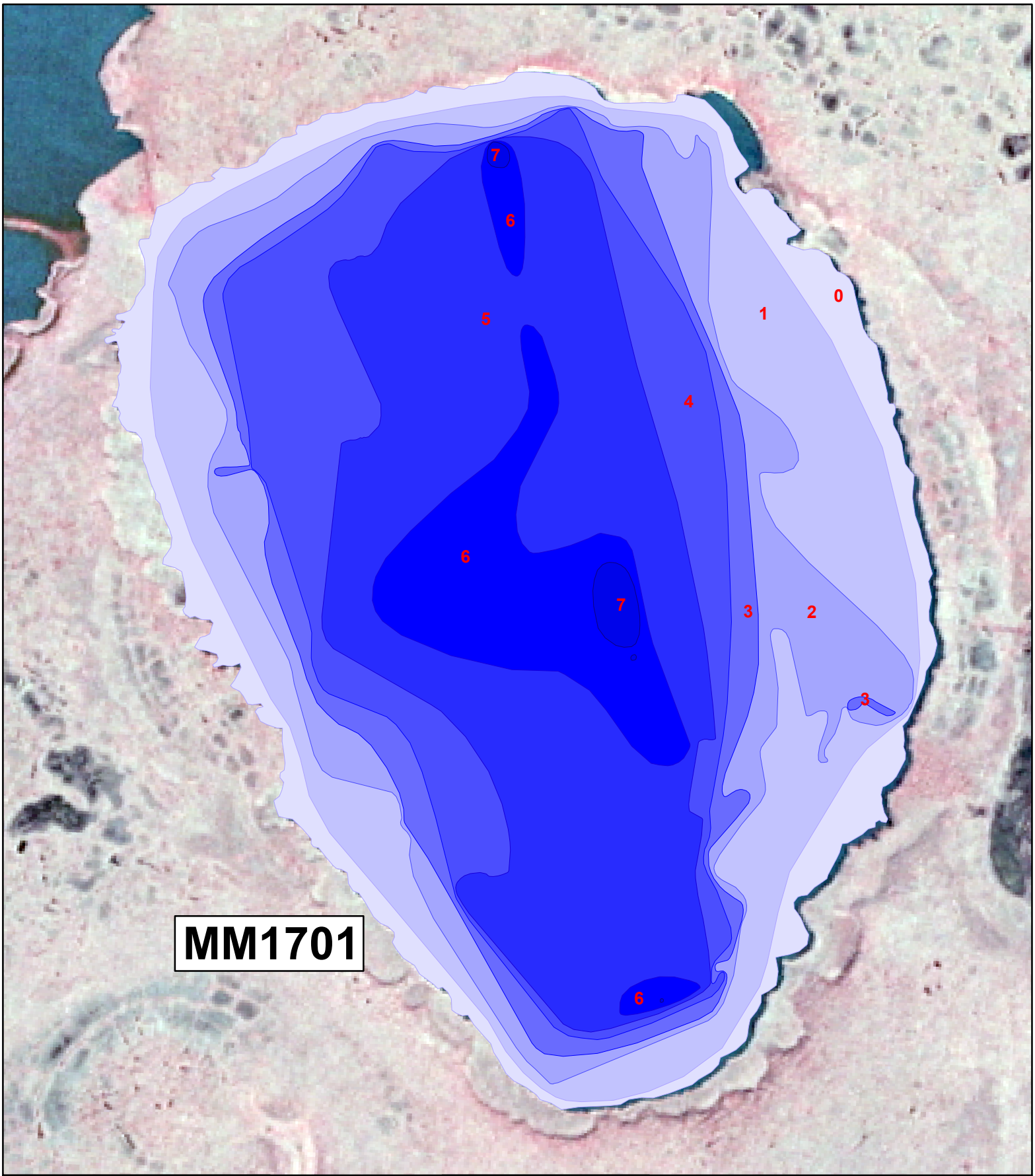
Depth Transects Surveyed at Lake M9903

surveyed on August 20, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth in Feet

0 3 6
1 4 7
2 5

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1701

based on transects surveyed on July 17, 2017

SCALE:

250 125 0 250 500
Feet

N

Lake MM1701

Other Names: None known
Location: 70.27257°N 152.04693°W
USGS Quad Sheet: Harrison Bay B-4: T11N R1W Sec. 25,26,35,36
Habitat: Tundra lake
Area: 126 acres
Maximum Depth: 8.1 feet
Active Outlet: Yes
Total Lake Volume: 151.77 million gallons (July 17, 2017 data)
Water Volume Under 4 ft of ice: 29.63 million gallons
Water Volume Under 5 ft of ice: 10.82 million gallons
Water Volume Under 7 ft of ice: 0.08 million gallons

Potential Ice Aggregate: 58.53 acres (water depth 4 ft or less)
17.36 million gallons

Maximum Recommended Winter Removal: **3.246 million gallons**
(Resistant species present, 30% of water volume under 5 ft of ice)

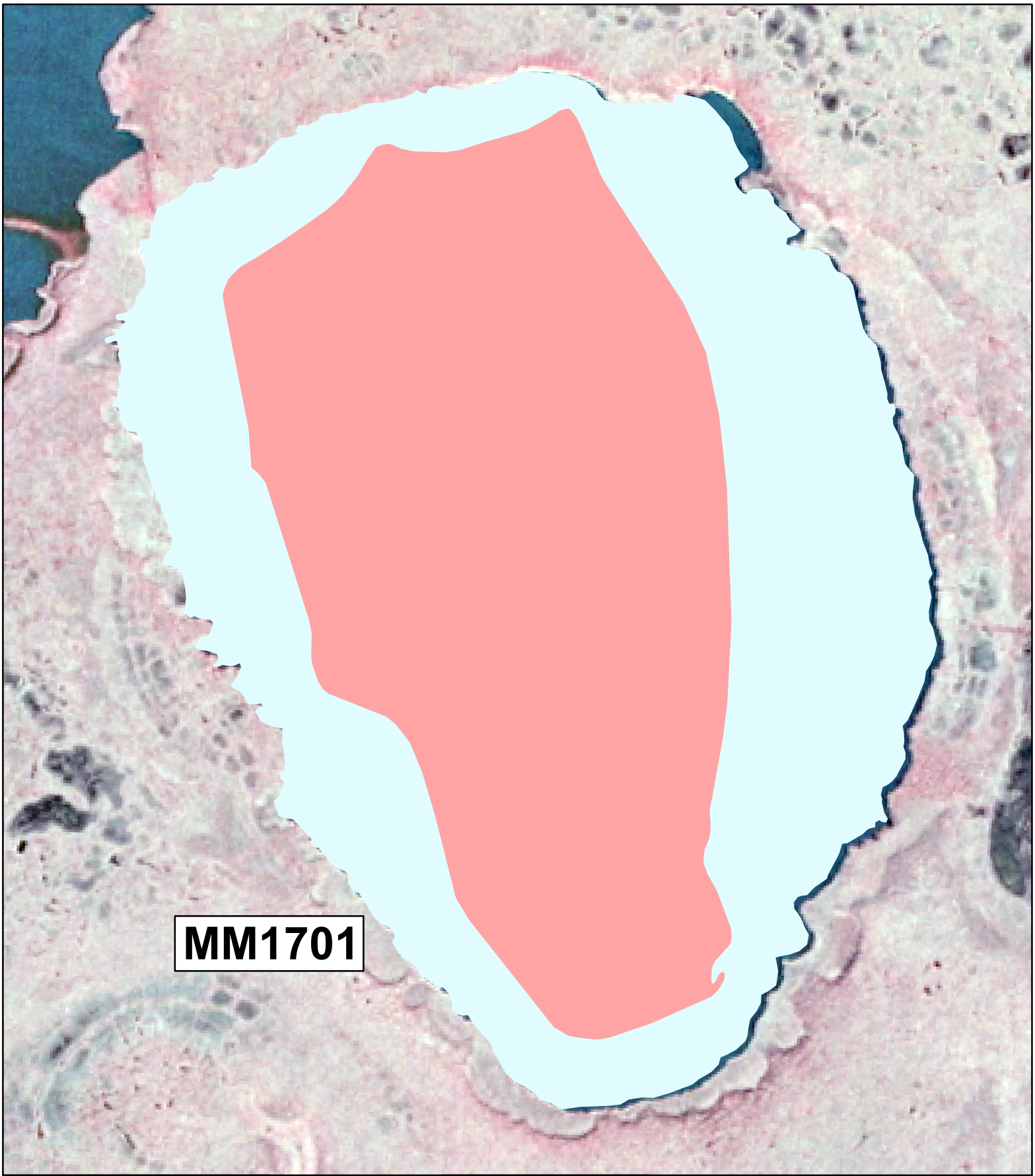
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	20.0	3.5	6.6	17.0	63.0	157.3	0.6	7.98	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught
Gill Net	Jul 17 2017	9.1	None	0
Minnow Trap	Jul 17 2017	9.7	Ninespine stickleback	2

Data Last Revised: September 14, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips
Deepest than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

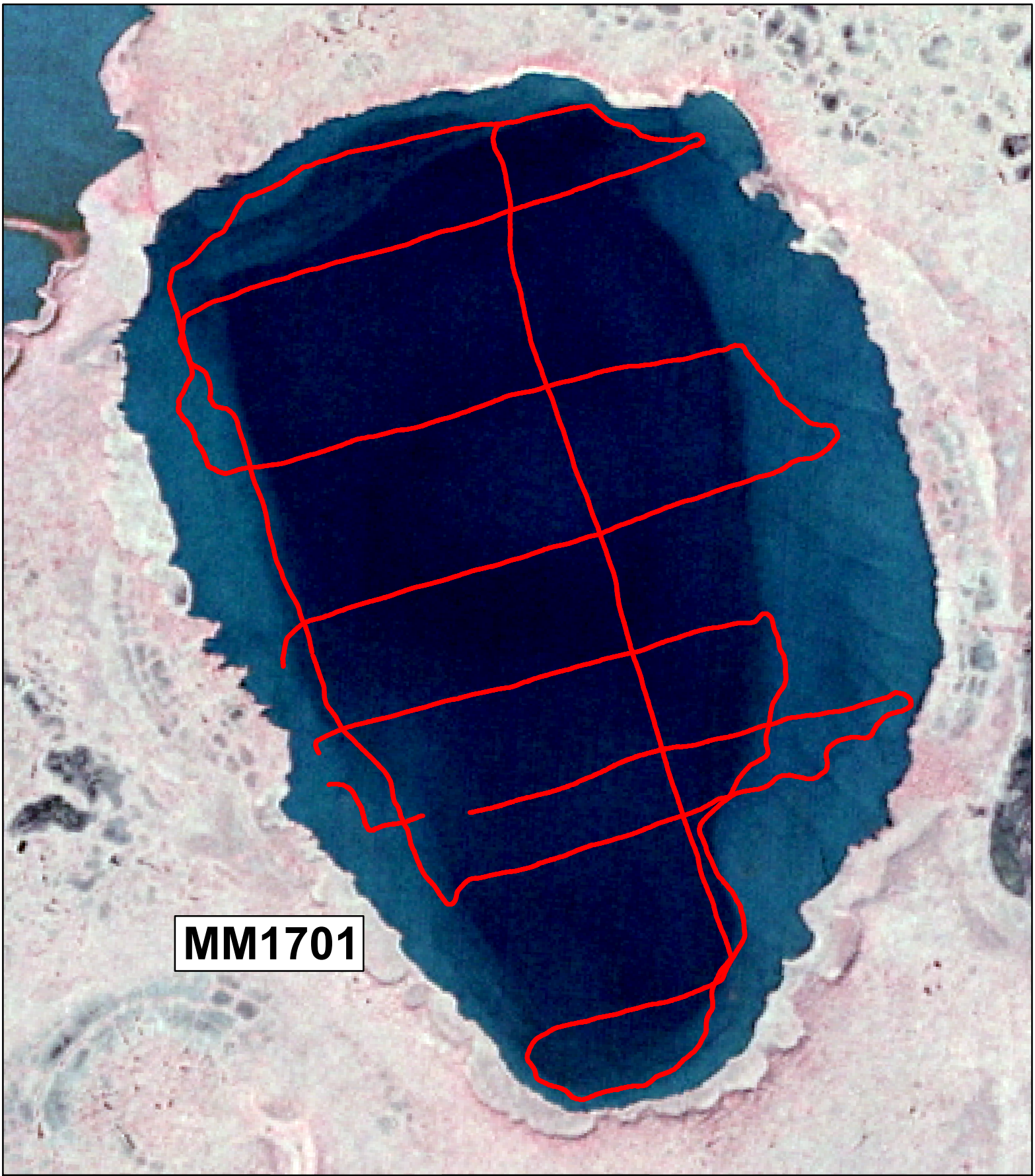
Area Available for Ice Chip Collection at Lake MM1701

based on transects surveyed on July 17, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

Depth Transects Surveyed at Lake MM1701

surveyed on July 17, 2017
not to be used for navigation or to direct the operation of heavy equipment

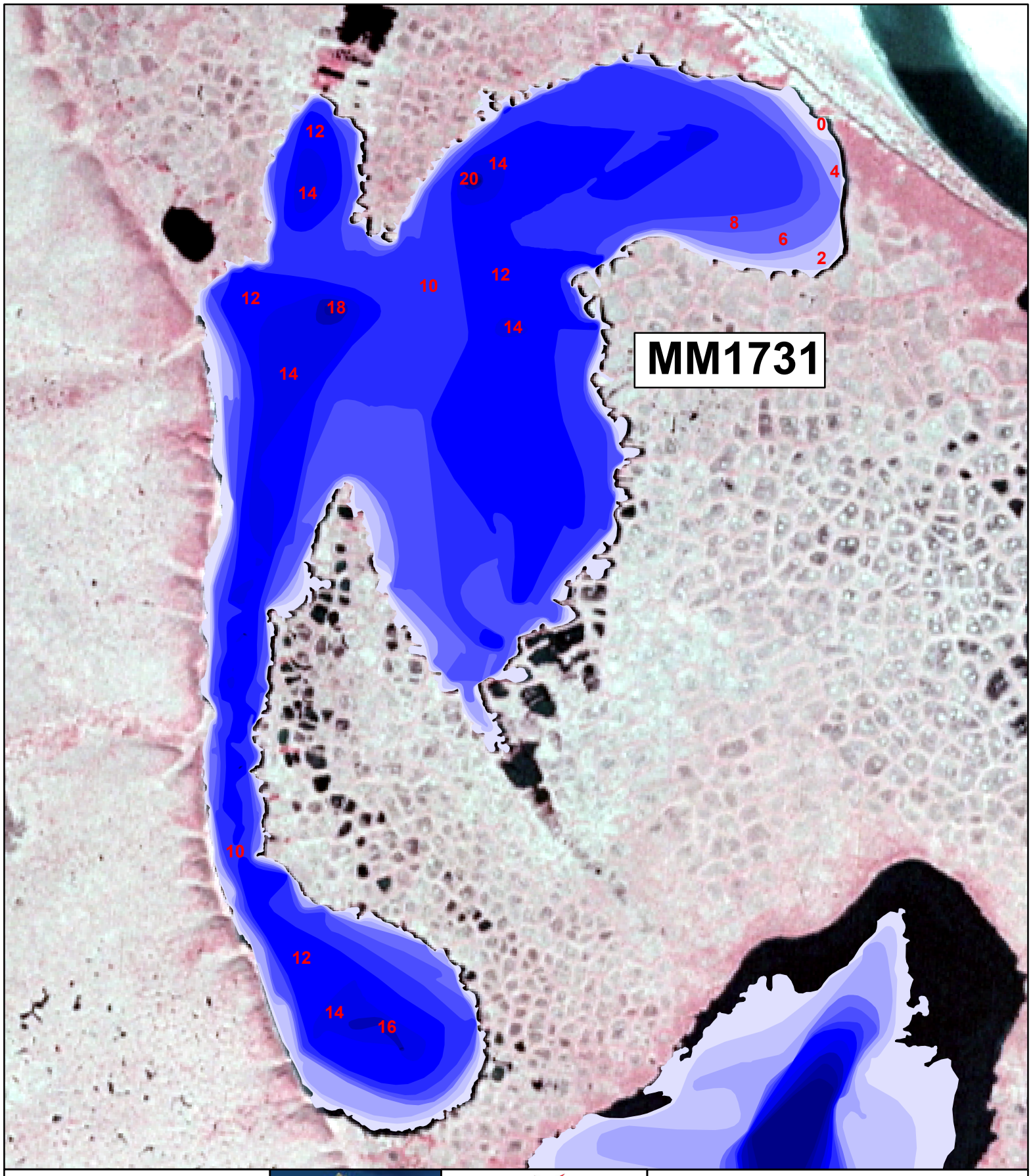
SCALE:

250 125 0 250 500 Feet

N

6. LAKE SUMMARIES

6.3 Lake Summaries for Lakes Sampled in the Stony Hill Area, 2017.



Depth in Feet

0 6 12 18
2 8 14 20
4 10 16

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1731 (depths in 2 foot intervals)

based on transects surveyed on August 18, 2017

SCALE:

250 125 0 250 500 Feet

N

Lake MM1731

Other Names: None known
Location: 70.09167°N 152.15456°W
USGS Quad Sheet: Harrison Bay A-2: T9N R4E, Sec. 33
Habitat: Tundra lake
Area: 81.9 acres
Maximum Depth: 21.9 feet
Active Outlet: No
Total Lake Volume: 272.4 million gallons (July 18, 2017 data)
Water Volume Under 4 ft of ice: 171.2 million gallons
Water Volume Under 5 ft of ice: 147.3 million gallons
Water Volume Under 7 ft of ice: 101.5 million gallons

Potential Ice Aggregate: 7.70 acres (water depth 4 ft or less)
2.28 million gallons

Maximum Recommended Winter Removal: **15.2 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	9.6	2.9	2.3	8.7	36	81.3	0.94	7.71	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 18 17	9.4	Least Cisco	1	286
			Northern Pike	3	553-600
			Broad Whitefish	4	385-513
Minnow Trap	Jul 18 17	12.6	9spine Stickleback	4	

Data Last Revised: August 31, 2017

Ice Chip Areas

4 feet or shallower - available for ice chips
Deeper than 4 feet - unavailable for ice chips

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Area Available for Ice Chip Collection at Lake MM1731

based on transects surveyed on August 18, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N

Depth Transects Surveyed

—— = Transect Survey Line

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

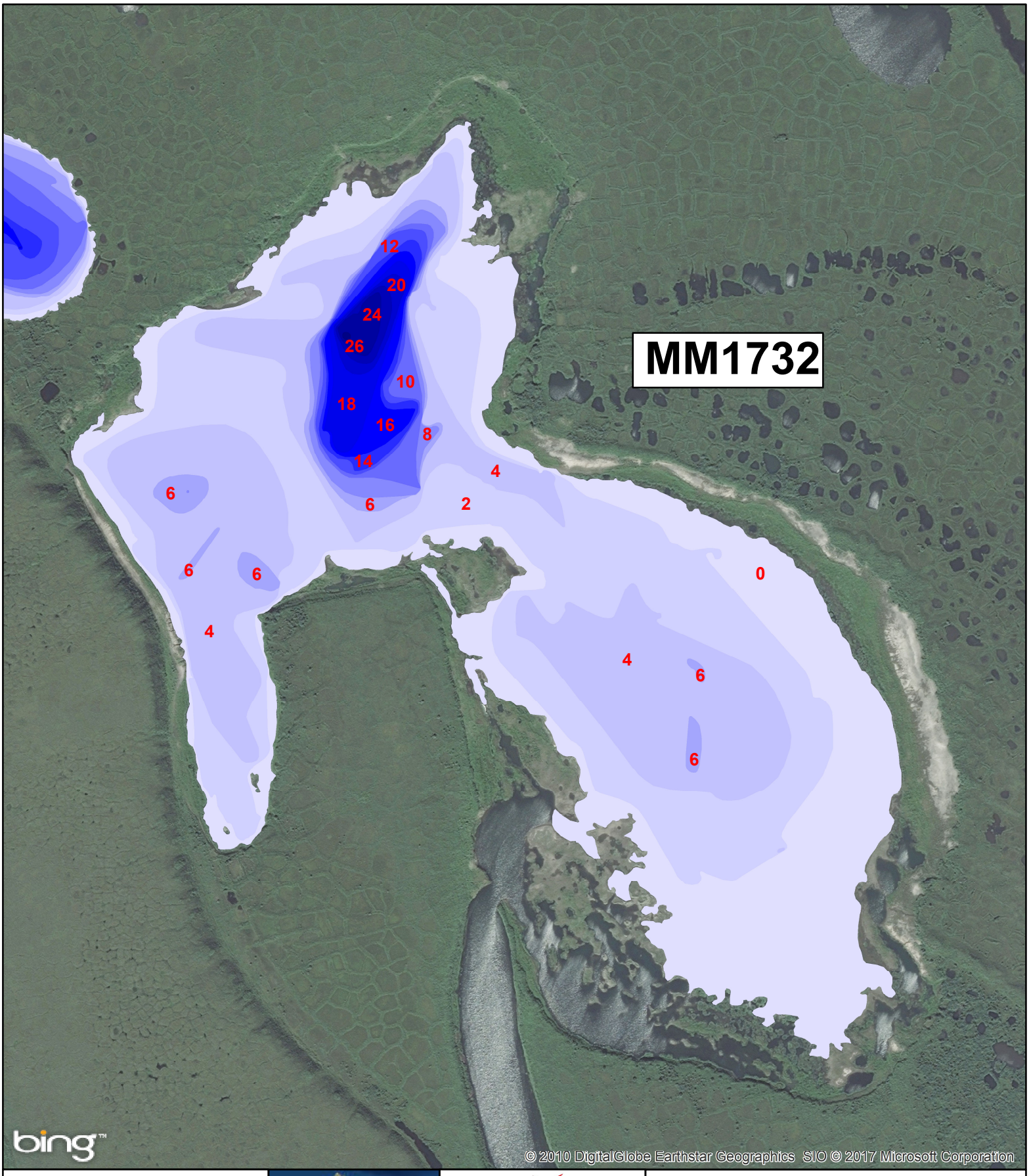
Depth Transects Surveyed at Lake MM1731

surveyed on August 18, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 Feet

N



Depth in Feet

0 6 12 18 24
2 8 14 20 26
4 10 16 22

Bing imagery used due to changing lake dimensions resulting from lake currently draining. Shoreline and depths valid in 2017

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Contours at Lake MM1732 (depth in 2 foot intervals)

based on transects surveyed on August 18, 2017

SCALE:

250 125 0 250 500 750 Feet

N

Lake MM1732

Other Names: None known
Location: 70.08250°N 152.13647°W
USGS Quad Sheet: Harrison Bay A-2: T8N R4E, Sec. 3,4; T9N R4E Sec. 33
Habitat: Tundra lake
Area: 109.0 acres
Maximum Depth: 26.7 feet
Active Outlet: No
Total Lake Volume: 142.2 million gallons (July 27, 2017 data)
Water Volume Under 4 ft of ice: 45.2 million gallons
Water Volume Under 5 ft of ice: 34.5 million gallons
Water Volume Under 7 ft of ice: 25.1 million gallons

Potential Ice Aggregate: 68.81 acres (water depth 4 ft or less)
20.41 million gallons

Maximum Recommended Winter Removal: **3.8 million gallons**
(Sensitive species present, 15% of water volume under 7 ft of ice)

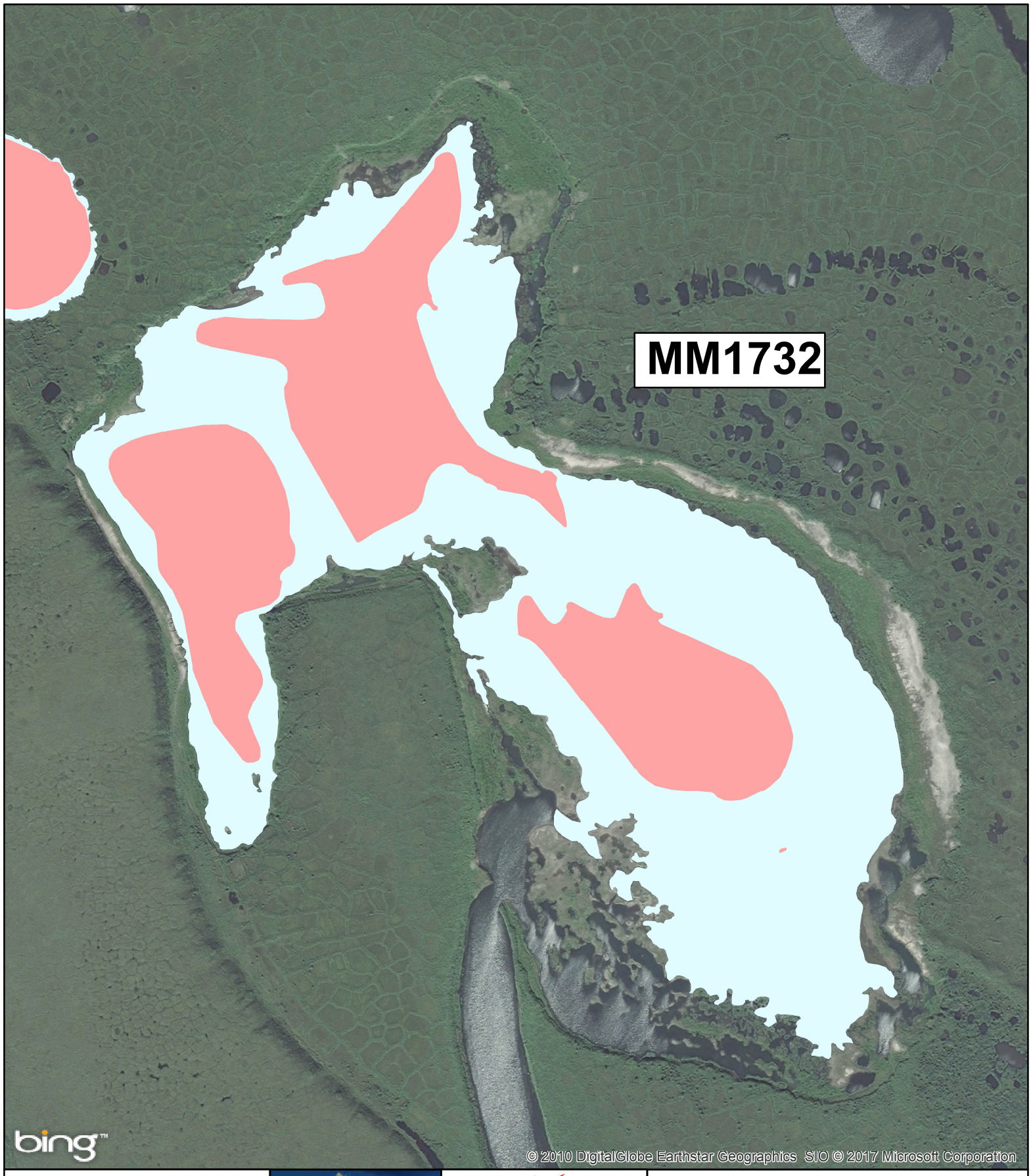
Water Chemistry:

Year of Test	Calcium (mg/l)	Magnesium (mg/l)	Sodium (mg/l)	Chloride (mg/l)	Total Hardness [CaCO3] (mg/l)	Specific Conductance (microS/cm)	Turbidity (NTU)	pH	Source
2017	16	5.6	3.1	2.8	64	133.6	1.43	8.62	C. Moulton

Catch Record:

Gear	Date	Effort (hours)	Species	Number Caught	Fork Length (mm)
Gill Net	Jul 18 17	9.4	Northern Pike	2	540-588
			Broad Whitefish	4	146-600
Minnow Trap	Jul 18 17	12.6	None	0	

Data Last Revised: August 31, 2017



Ice Chip Areas

4 feet or shallower - available for ice chips

Deeper than 4 feet - unavailable for ice chips

Bing imagery used due to changing lake dimensions resulting from lake currently draining. Shoreline and depths valid in 2017

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

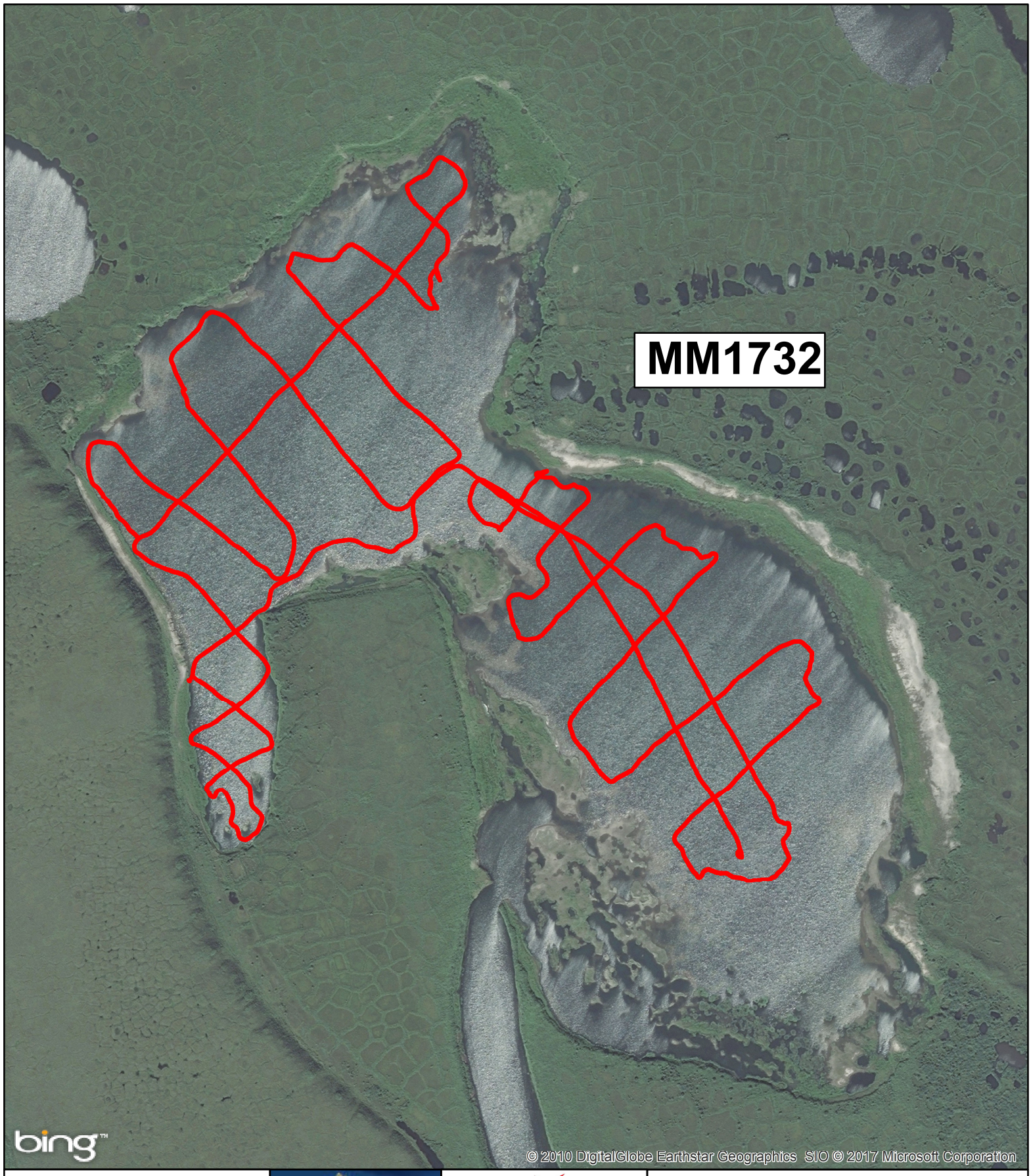
Area Available for Ice Chip Collection at Lake MM1732

based on transects surveyed on August 18, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N



Depth Transects Surveyed

—— = Transect Survey Line

Bing imagery used due to changing lake dimensions resulting from lake currently draining. Shoreline and depths valid in 2017

ConocoPhillips Alaska

Prepared by:

OWL RIDGE NATURAL RESOURCE CONSULTANTS

Depth Transects Surveyed at Lake MM1732

surveyed on August 18, 2017
not to be used for navigation or to direct the operation of heavy equipment

SCALE:

250 125 0 250 500 750 Feet

N

2002 BLM imagery to compare effects of draining on lake shorelines with modern aerial imagery.

Imagery used from BLM aerial photographs
July 18, 2002.
NAD83, UTM Zone 5

ConocoPhillips
Alaska

Prepared by:

OWL RIDGE
NATURAL RESOURCE CONSULTANTS

2002 BLM Imagery of Lake MM1732

SCALE:

250 125 0 250 500 750
Feet

N