2012 Mule Deer and White-tailed Deer Census and Population Density Estimate

Rocky Mountain Arsenal National Wildlife Refuge

Commerce City, Colorado 80022

Background

On August 6th 2012 a single male mule deer (*Odocoileus hemionus*) was discovered dead along the south perimeter fence in section 4SC. The deer appeared emaciated, had a small amount of blood-tinged saliva draining from its mouth, and appeared to have fallen over, kicked a few times, and expired. The carcass was transported and submitted to the CSU Veterinary Diagnostics Laboratory in Ft Collins for necropsy and disease related panels. The histology revealed the presence of Epizootic hemorrhagic disease (EHD) and Chronic Wasting Disease (CWD), the latter assuming the demise of the animal. This is the first observation of CWD in the history of RMANWR. While deer have not been considered a species of concern at RMANWR, the manifestation of Chronic Wasting Disease (CWD) has instigated a need to better assess the mule deer and white-tailed deer (Odocoileus virginianus) populations.

Census Methods

Various census techniques were considered including: Drive, Helicopter, Mobile Line, Hahn Line, and Spotlight surveys. Factors considered for each method included advantages/disadvantages, quality of data, habitat accessibility, wildlife disturbance, personnel and training/qualifications, equipment, safety, time, and cost; details of the evaluation can be found at S:\TASK1COM\Deer classification surveys\2012 Census\2012 Deer Census - Method Decision Points.doc. A combination of techniques was selected including Mobile Line (complimenting methods employed in previous years), Hahn Line (supplementing road-driven routes with transects walked between road delineations), and Mobile Hahn Line transects (ORUV driven transects incorporated between road delineations where rolling hills preclude observation of wildlife and fewer deer were expected) within the bison enclosure, ICS, Basin F, and larger prairie sections within the northeast portion of RMA; an equipment preparation checklist is located at S:\TASK1COM\Deer classification surveys\2012 Census\2012 Deer Census - Preparation Checklist.docx. Specific backpack contents for Hahn-Lines, Job Hazard Analysis statements, and Volunteer Agreements are included in the following files (respectively): 2012 Deer Census Hahn Line Backpack Contents.xls; JHA-Deer Census - Hahn Line Transect - Walking.doc; Volunteer Agreement - Deer Census.docx.

Each method was completed at least twice, with exception of the Spotlight survey. Observers counted groups of deer, classifying the groups into MD/WT or mixed groups, then further classified the sex and age composition of each group by individual species. Initial observations were made with the naked eye and classification observations were assisted with binoculars. Field data was recorded on pre-printed forms and transferred to Microsoft Excel for analysis; census routes are indicated on the map included in Appendix A.

The direction of observation was dictated for each road traveled to eliminate/limit duplication of counts: roads running east and west were restricted to observing either north or south where they were utilized by two groups (i.e. Green and Red both utilized 6th Ave with Green observing to the north and Red observing to the south). The observed distances for Mobile-Line routes were restricted to a maximum of 880 yards in either direction perpendicular to the route traveled and measured at ¼ mile intervals (reflecting observable distance restrictions in previous year's surveys); observable range was estimated with a laser range finder by the vehicle driver seated within the vehicle cab to the apex of obstructed vision or the maximum of 880 yards (whichever came first); deer observed beyond 880 yards were not included in those observations.

Potentially one-half of the maximum observable distance of Mobile line surveys (the distance of 440 to 880 yards) overlaps the observable distance of Hahn line surveys (440 yards); this presents the potential for duplicating counts of groups of deer within the overlapping areas. Whether or not any duplicate counts actually occurred is unknown. However, duplicate counts may correlate with observations of acreage utilized by deer exceeding 100% observed. To compensate for the potential duplication of groups and strive to determine a conservative population density estimate, daily totals were reduced by the percentage of observed acres exceeding 100%.

Hahn Line

This technique involves two people walking a two mile transect that bisects east and west bound roads paralleling two adjacent sections across RMANWR. One or two observers counted and classified observed deer while guided by another surveyor on an east-west path (during sunrise surveys) or west-east path (during sunset surveys) who estimated visible ranges at 80 yard intervals (all team members determined their 80 yard pace count prior to departing for routes, designated guides used hand tally counters to maintain pace count/range intervals); routes were completed in an average of 1:31 (hours:minutes). Safety and site familiarity considerations compelled assignment of a USFWS employee assigned to RMANWR as the Hahn line guide, with volunteers assigned as observers. Shult, 1999 prescribes one Hahn-line per 1,000 acres (if possible), equating a possibility of sixteen Hahn line transects total on RMANWR. While this method provides quality data, especially in wooded areas with limited visibility, observation in the short-grass prairie portions of RMA are limited more by rolling-hill terrain features and were assessed with Mobile-Hahn Lines (see description in next section).

Six Hahn lines supplementing Mobile line routes were designated to assess the southern portion of RMA where observation is restricted by dense growth in wooded sections. Five of the designated routes were completed twice each; not enough personnel were available to complete the sixth Hahn line. The sixth Hahn-line was re-designated to a Mobile-Hahn Line and surveyed with an Off-Road Utility Vehicle (ORUV).

Mobile-Hahn Line

The northern two-thirds of RMANWR (approximate) consist of short- or mixed-grass prairie habitat with rolling-hill terrain features occasionally limiting observation from roadways; the Mobile-Hahn-Line was employed to survey the obscured areas within this habitat. This technique is a

Results

Population density was estimated for each of the three days census activity; the combined population density estimate of Mule deer and White-tailed deer assessed between October 10, 2012 and October 19, 2012 is estimated at **368** deer, Table 1. Summary data averaging each day's census activity is presented in Table 2. The Spotlight census estimated a significantly lower population density (171 deer, well below the number of deer physically observed during daylight surveys); therefore the statistic was not included in the equation determining the final estimated population density.

The estimated population density is broken down by groups observed, species, sex, and age distribution in Table 3. Please note: the species, sex, and age distribution in Table 3 is a compilation of averages excluding results from the Spotlight census; the sex/age ratio expresses the average of both species. A complete summary of all census activity can be found at S:\TASK1COM\Deer classification surveys\2012 Census\2012 deer census data - final totals.xlsx.

Note: No observed deer exhibited any signs of ill health during any of the census activity.

CENSUS OVERALL AVERAGES (25.13 Square Miles (16,083 acres))	DATE	RMA ACRES UTILIZED BY DEER	Acres Observed	Percentage of Acres Observed	Acres per Deer	Estimated Population Density
	10/16/12	**14,481**	**16,025.70**	**110.67%**	**37.17**	**368**

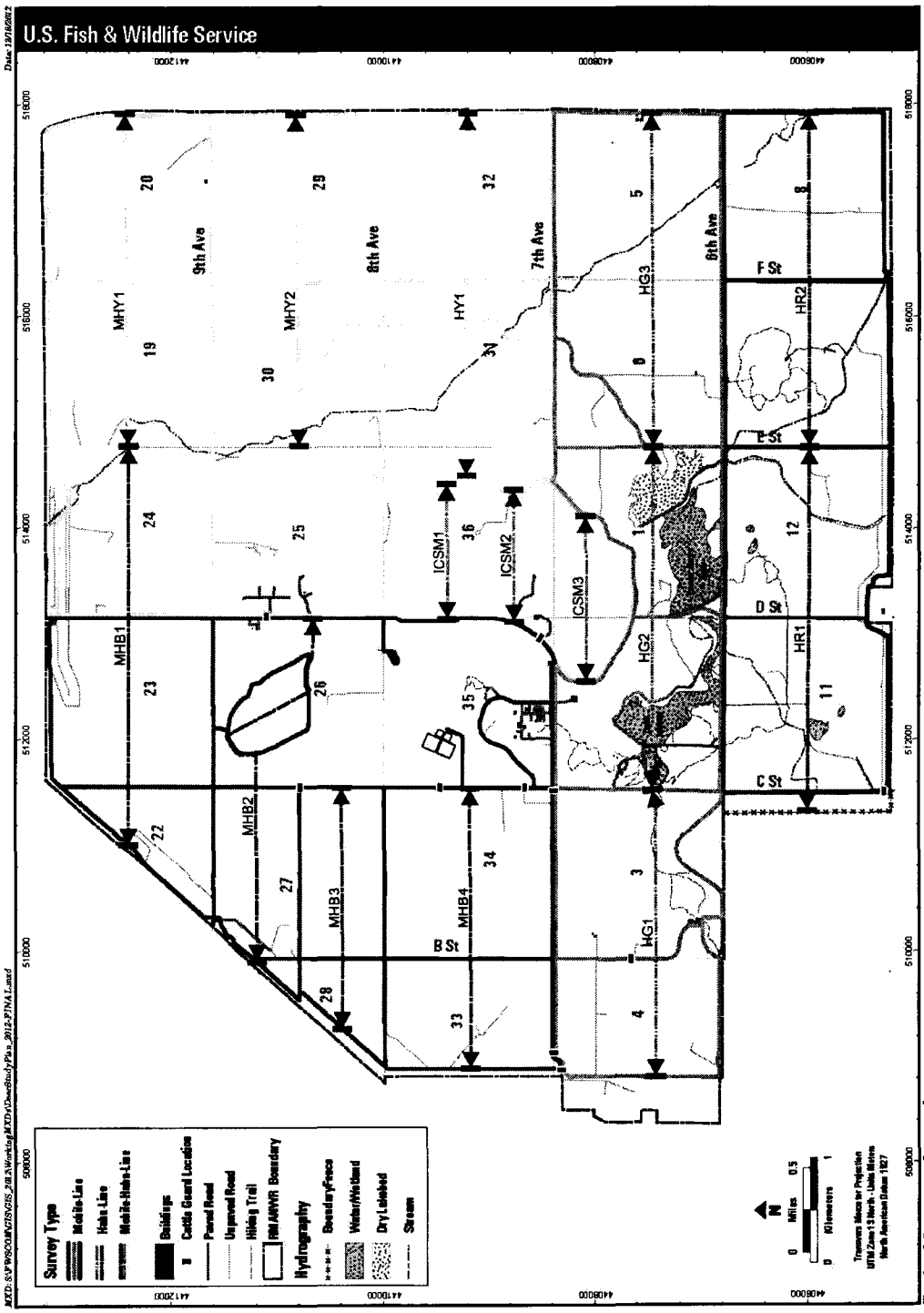
Table 1. Estimated Population Density 2012

CENSUS	DATE	RMA ACRES UTILIZED BY DEER	Acres Observed	Percentage of Acres Observed	Acres per Deer	Estimated Population Density
SPOTLIGHT	**10/10/2012**	14481	**13,455.39**	**92.92%**	**78.69**	**171**
MOBILE LINE - PM	10/12/2012	14481	13,884.32	95.88%	57.61	251
HAHN LINE - PM	10/12/2012	14481	950.16	6.56%	23.17	625
Daily Total	**10/12/2012**	**14481**	**14,834.48**	**102.44%**	**39.41**	**427**
MOBILE HAHN LINE - AM	10/19/2012	14481	975.60	6.74%	0.00	0*
MOBILE HAHN LINE - PM	10/19/2012	14481	1,473.91	10.18%	50.82	285
HAHN LINE - AM	10/19/2012	14481	1312.01	9.06%	24.75	585
MOBILE LINE - AM	10/19/2012	14481	13,455.39	92.92%	53.61	270
Daily Total	**10/19/2012**	**14481**	**17216.91**	**118.89%**	**34.93**	**308**

*No deer were observed on these AM routes; shortage of personnel required the remainder of the routes to be completed in the afternoon (PM).

Table 2. Daily Census Density Estimates

Appendix A. 2012 Deer Census Route Map



If the percentage observed exceeded 100%, it is assumed that the value in excess of 100% represents an overlap of observations among census routes, thereby requiring a reduction in values that utilize the number of acres observed within their calculations (acres per deer and estimated population density) for that day's census.

Note: On 10/19/2012 the percentage observed was 118.89%; the values for acres per deer and estimated population density for the day's census were accordingly reduced by 18.89% (the amount of overlapping observations as represented by percentage observed)

Acres per Deer

For each route, the number of acres a single deer utilized within the acreage observed was calculated with the following equation: $\mathbf{A_{pd} = A_o/T_{d/r}}$ where:

$\mathbf{A_o}$ = acres observed

$\mathbf{A_{pd}}$ = acres per deer

$\mathbf{T_{d/r}}$ = total number of deer observed (per route)

Estimated Population Density

Population densities (N) were estimated for each route observed where $\mathbf{N = A_o/A_{pd}}$, then averaged to obtain the estimated population density

$\mathbf{A_o}$ = acres observed

$\mathbf{A_{pd}}$ = acres per deer

N = estimated population density

Surveys were conducted on three different days within a ten day period and the estimated population densities from each day were then averaged.

Note: comparative analysis of the daily estimates indicated the "Spotlight" census provided the least reliable data and therefore was not used in the final total (population density estimates were 45% to 60% less than estimates on the other days).

Route Distances

Designated census route distances were obtained utilizing ArcGIS and RMA mapping data.

Acknowledgements

Thanks to all those who helped prepare and conduct the 2012 deer census! Special thanks to Acting Refuge Manager Bruce Hastings and Senior Biologist Mindy Hetrick for guidance and collaboration while preparing the census; Biological Science Technician Holly D'Oench, Volunteer Tari (Therese) Runyan, and Park Ranger Abby Wright for assisting with the preparation of vehicles, equipment, data sheets, data entry, and anything else I forgot to mention; Scott Quayle and Abby Wright for assistance preparing and proofing portions of the report; and to all the employees and volunteers who participated in each of the censuses:

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Kristene Foster, RMANWR Volunteer

Mindy Hetrick, USFWS RMANWR

Zach Kincaid, USFWS RMANWR

Sonia Kumar, RMANWR Volunteer

William Kutosky, USFWS RMANWR

Oliver Lawrence, RMANWR Volunteer

Shane Michael, RMANWR Volunteer

Scott Quayle, USFWS RMANWR

Shannon Rosebush, RMANWR Volunteer

James Runyan, RMANWR Volunteer

Tari (Therese) Runyan, RMANWR Volunteer

Jim Schroeder, RMANWR Volunteer

Doug Wesley, Rocky Mountain Mule Deer Foundation, RMANWR Volunteer

Abby Wright, USFWS RMANWR

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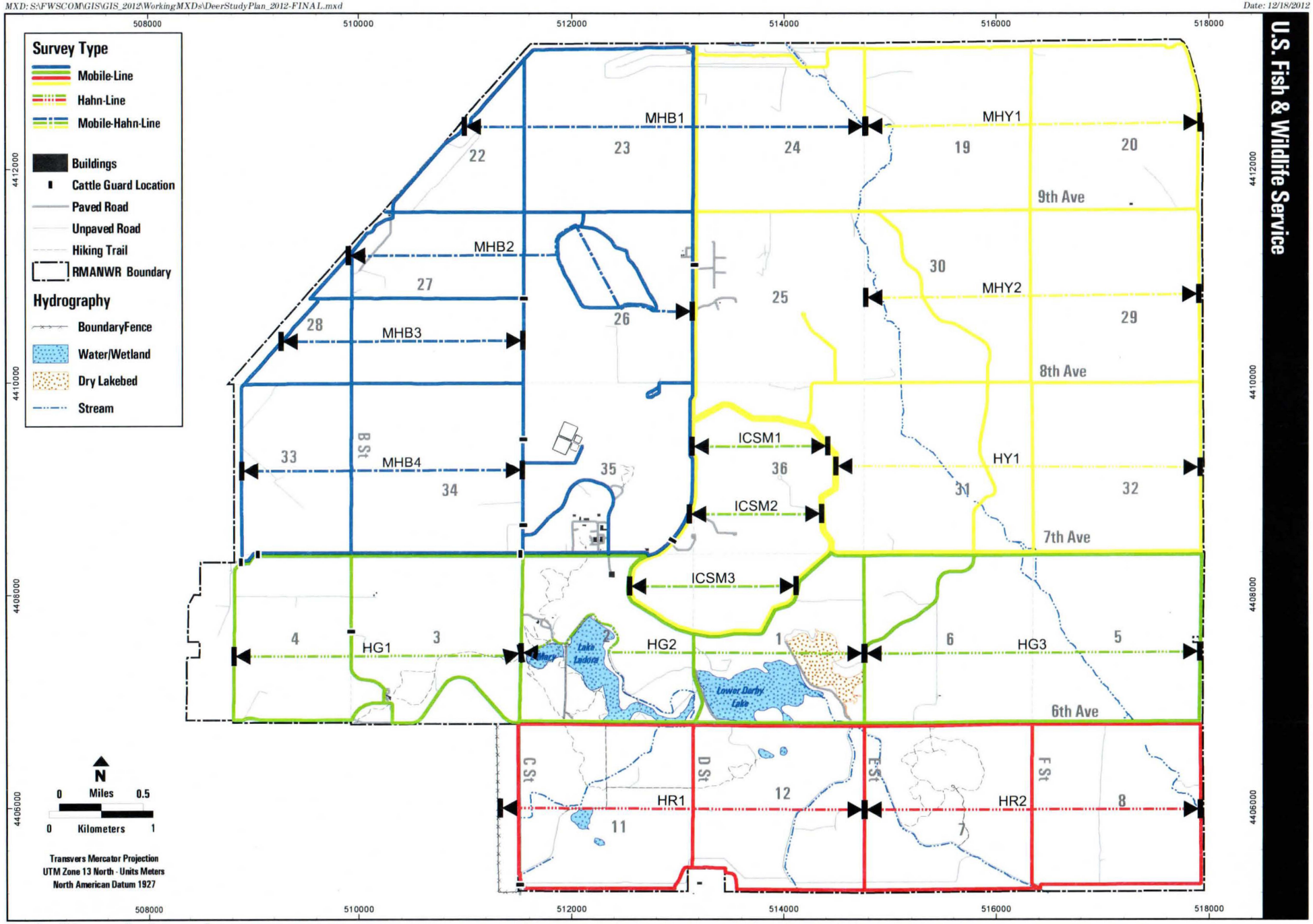
Date: 12/18/2012



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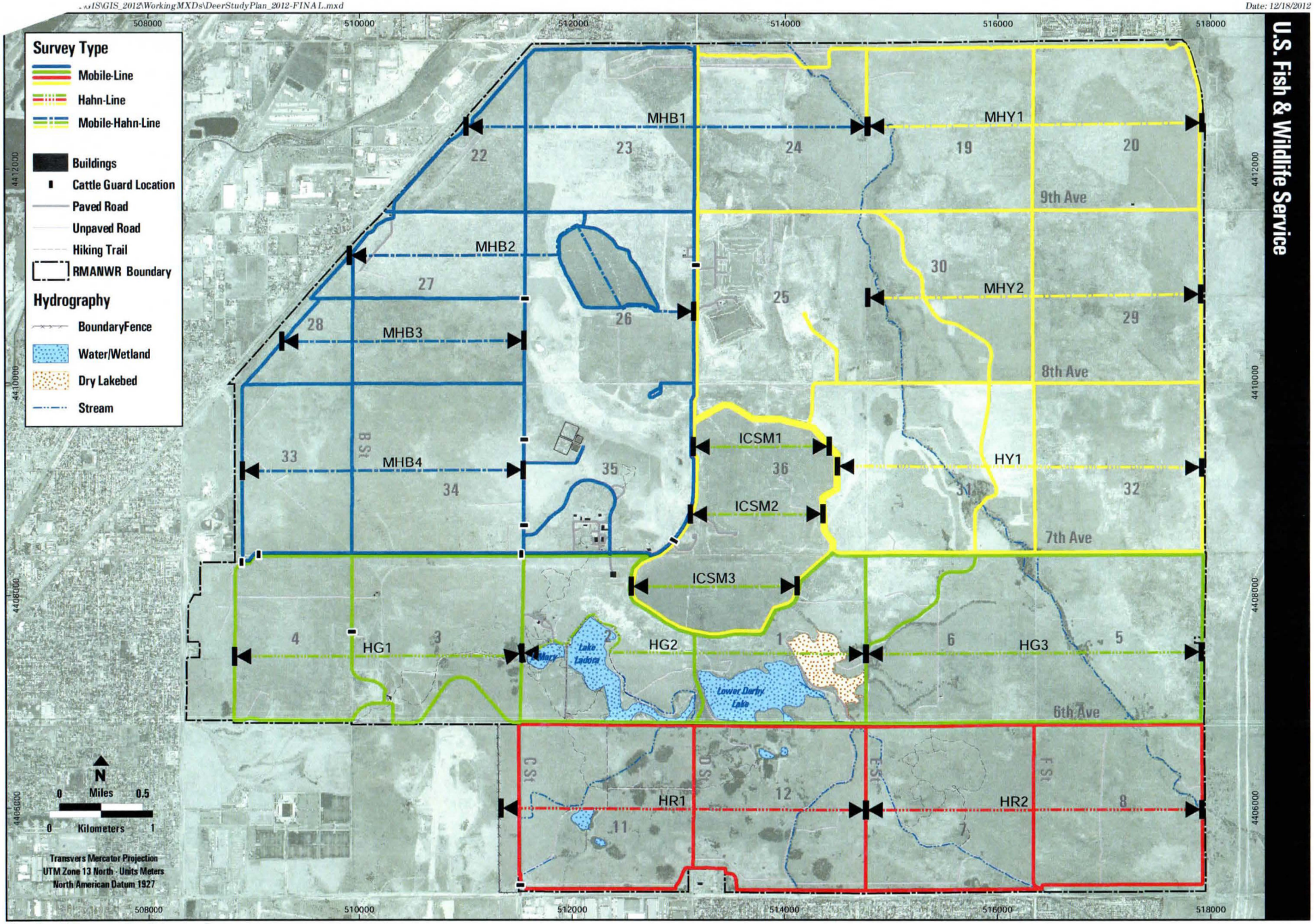

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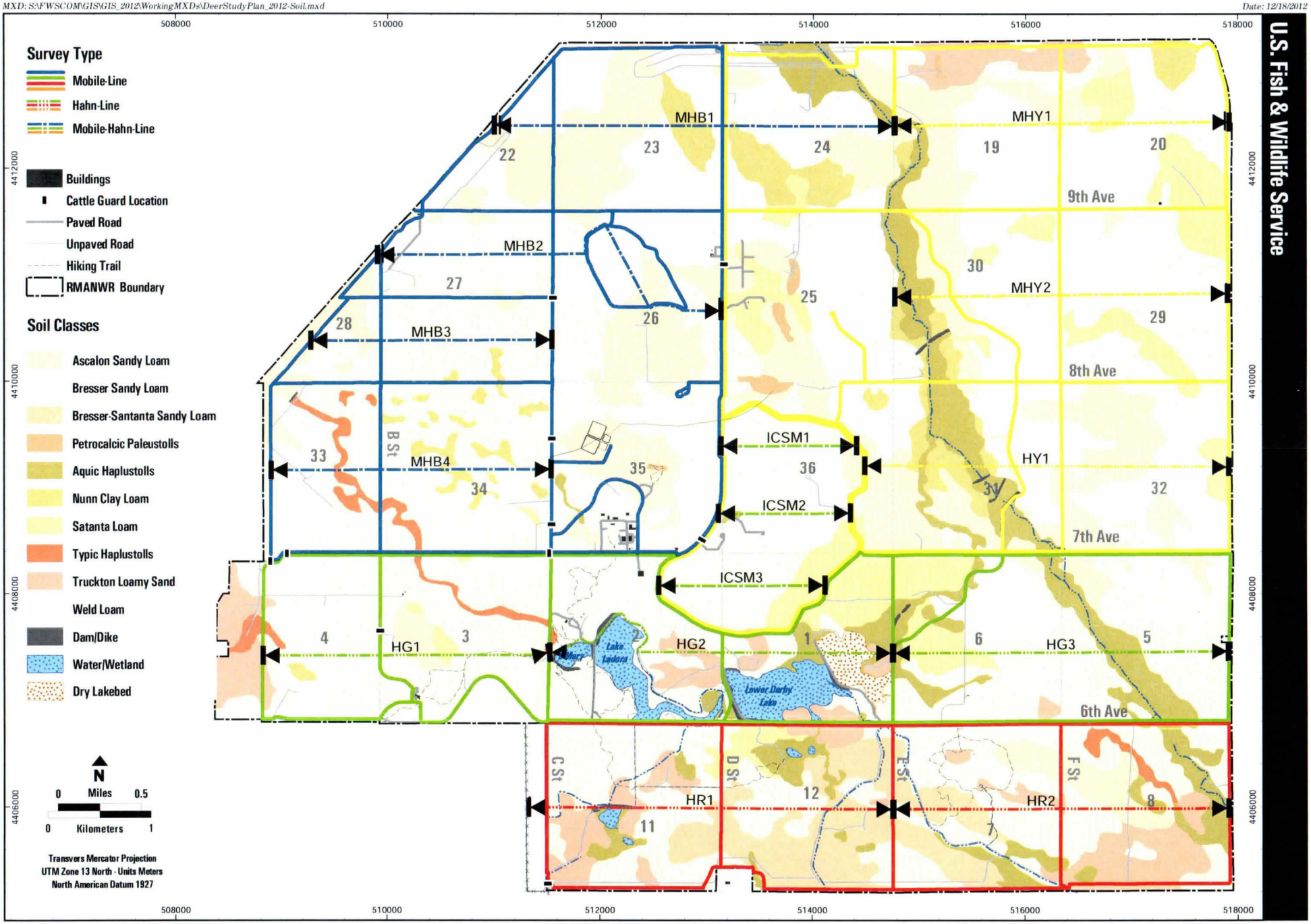

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National Wildlife Refuge
2012 Deer Survey

Date 10/10/2012 **Spot-Light**

Weather Mostly clear, Partly cloudy Temp (°F) 55 Wind (mph) 0-3 Clouds (%) 5 -25 variable

Start Time 8:00 PM End Time 12:30 AM 25.13 Square Miles (16,083 acres) Estimated Population Density 184.03

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed (Miles)	Acres Observed	Acres Per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
Blue	6.00	17	465.24	23.11	3,909.99	230.00	15	0	2	4	13	0
Yellow	19.00	60	558.46	27.90	5,665.72	94.43	38	16	6	23	5	0
Green	22.00	43	329.18	19.79	2,369.00	55.09	10	3	30	12	8	0
Red	23.00	51	417.06	12.82	1,944.55	38.13	14	15	22	5	19	5
Total	70.00	171	442.48	83.62	13,455.39	78.69	77	34	60	44	45	5

Date 10/12/2012 **Mobile Line - PM**

Weather and brief Temp (°F) 46 - 65 Wind (mph) 3 - 8 Clouds (%) 5 -25 variable

Start Time 3:15pm End Time 7:00pm 25.13 Square Miles (16,083 acres) Estimated Population Density 251.36

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed	Acres Observed	Acres per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
Blue	7.00	41	707.16	23.11	5,943.18	144.96	41	0	0	19	20	2
Yellow	11.00	57	608.04	27.90	6,168.79	108.22	36	21	0	32	18	1
Green	22.00	84	358.84	19.79	2,582.44	30.74	19	65	0	39	31	14
Red	11.00	59	152.31	12.82	710.17	12.04	55	4	0	10	38	11
Total	51.00	241	456.59	83.62	13,884.32	57.61	151	90	0	100	107	28

Date 10/12/2012 **Hahn Line - PM**

Weather partly cloudy Temp (°F) 57 Wind (mph) 7 Clouds (%) 47

Start Time End Time 25.13 Square Miles (16,083 acres) Estimated Population Density 624.86

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed	Acres Observed	Acres per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
Red 1	0	0	434.55	2.14	337.38	0.00	0	0	0	0	0	0
Green 1	1	3	704.95	1.68	431.51	143.84	0	3	0	0	3	0
Yellow 3	5	38	178.17	2.13	138.04	3.63	26	12	0	20	18	0
Total:	6	41	439.22	5.95	950.16	23.17	26	15	0	20	21	0

Mobile Line - AM

Date 10/19/2012
Weather Clear, Cloudy, and brief Thunderstorm near end
Temp (°F) 46 - 65
Wind (mph) 3 - 8
Clouds (%) 5 -25 variable
Start Time 3:15pm
End Time 7:00pm
25.13 Square Miles (16,083 acres)
Estimated Population Density 270.13

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed (Miles)	Acres Observed	Acres Per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
Blue	4.00	23	465.24	23.11	3,909.99	170.00	23	0	0	14	9	0
Yellow	21.00	60	558.46	27.90	5,665.72	94.43	43	14	3	45	15	0
Green	14.00	52	329.18	19.79	2,369.00	45.56	24	28	0	19	33	0
Red	19.00	116	417.06	12.82	1,944.55	16.76	81	35	0	21	56	40
Total	**58.00**	**251**	**442.48**	**83.62**	**13,455.39**	**53.61**	**171**	**77**	**3**	**99**	**113**	**40**

Hahn Line - AM

Date 10/19/2012
Weather Clear-p.Cloudy
Temp (°F) 35-49
Wind (mph) 0-5
Clouds (%) 5-30
Start Time 7:24 AM
End Time 11:05 AM
25.13 Square Miles (16,083 acres)
Estimated Population Density 354.74

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed	Acres Observed	Acres per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
Green 1	1	2	264	1.68	161.55	80.78	2	0	0	2	0	0
Green 2	7	18	245	2.45	218.77	12.15	2	16	0	4	10	1
Green 3	5	24	399	1.96	284.70	11.86	0	24	0	1	15	0
Red 1	1	2	461	2.14	357.61	178.81	0	2	0	0	1	1
Red 2	3	7	401	1.96	285.75	40.82	6	1	0	5	2	0
Total:	**17**	**53**	**353.97**	**10.19**	**1312.01**	**24.75**	**10**	**43**	**0**	**12**	**28**	**2**

Mobile Hahn Line - AM

Date 10/19/2012
Weather Clear, Cloudy, and
Temp (°F) 46 - 65
Wind (mph) 3 - 8
Clouds (%) 5 -25 variable
Start Time 3:15pm
End Time 7:00pm
25.13 Square Miles (16,083 acres)
Estimated Population Density 0.00

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed (miles)	Acres Observed	Acres per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
ICS	0	0	218.33	2.56	203.01	0.00	0	0	0	0	0	0
Blue 1	0	0	385.62	2.35	328.92	0.00	0	0	0	0	0	0
Blue 2	0	0	244.50	2.44	217.06	0.00	0	0	0	0	0	0
Blue 3	0	0	217.57	1.42	111.99	0.00	0	0	0	0	0	0
Blue 4	0	0	223.00	1.65	133.58	0.00	0	0	0	0	0	0
Total:	**0**	**0**	**257.80**	**10.41**	**975.60**	**0.00**	**0**	**0**	**0**	**0**	**0**	**0**

Mobile Hahn Line - PM

Date 10/19/2012
Weather sunny - P. cloudy
Start Time 12:40 PM
Temp (°F) 70-76
End Time 3:00 PM
Wind (mph) 0-9
Clouds (%) 30-50
25.13 Square Miles (16,083 acres)
Estimated Population Density 284.92

Route	# of Groups	Total # Deer	Average Yards Observed	Distance Observed	Acres Observed	Acres per Deer	Species			Buck	Doe	Fawn
							MD	WT	UNK			
Yellow 1	1	3	841.13	1.96	599.05	199.68	3	0	0	3	0	0
Yellow 2	2	2	453.88	1.95	321.82	160.91	1	1	0	2	0	0
Yellow 3	8	24	718.50	2.13	556.69	23.20	21	3	0	24	0	0
Total:	**11**	**29**	**671.17**	**6.04**	**1,473.91**	**50.82**	**25**	**4**	**0**	**29**	**0**	**0**

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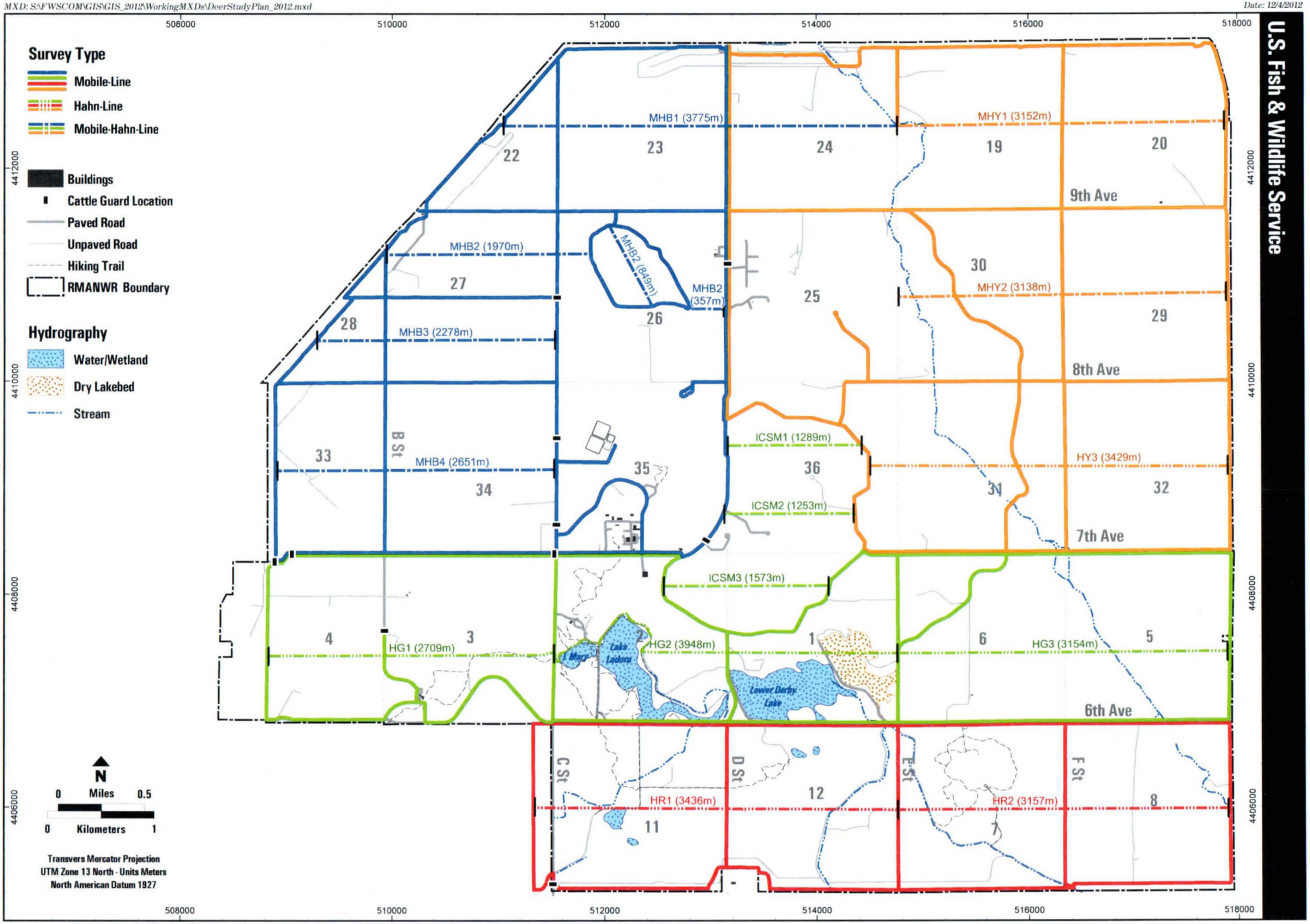

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