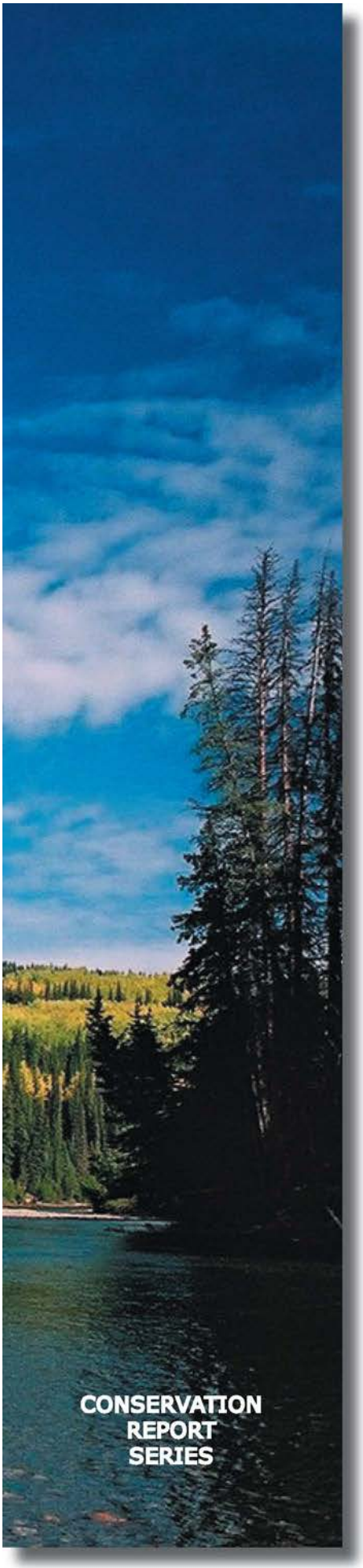

Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2013

Alberta Conservation Association

Conserving Alberta's Wild Side

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Hay-Zama Lakes Waterfowl Staging and Bald Eagle Nesting Monitoring Program, 2013

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EXECUTIVE SUMMARY

The Hay-Zama Lakes Complex (HZLC), located in the Boreal Forest Central Mixedwood Natural Subregion of Alberta, Canada, is an internationally recognized critical staging and nesting area for waterfowl and shorebirds. Numerous oil and gas producing wells located within the HZLC pose a risk to the aquatic ecosystem. The Hay-Zama Lakes Monitoring Program was initiated in 1978 to moderate the potential impacts of these industrial activities by monitoring waterfowl density and distribution. The Hay-Zama Lakes Monitoring Program is directed by the Hay-Zama Committee, and functions as a cooperative venture supported by a group of stakeholders representing the oil and gas industry, federal, provincial, and municipal government agencies, First Nations, and conservation groups. The Alberta Conservation Association is a member of the Hay-Zama Committee and has been monitoring migrating waterfowl and nesting bald eagles within the complex since 1997.

The primary purpose of the monitoring program is to survey waterfowl densities in close proximity to the producing oil and gas wells within the HZLC. If a large congregation of waterfowl is detected near a well site, the Energy Resources Conservation Board (ERCB; which became the Alberta Energy Regulator midway through 2013 survey season but will be referred to as ERCB for the duration of this report) has the authority to suspend extraction activity. The density necessary to suspend industrial activity was defined by Alberta Environment and Sustainable Resource Development at a threshold of 600 ducks and/or geese within a 30 m radius of a well site. Waterfowl monitoring occurs during spring and fall migration periods (approximately 15 April to 31 May and 15 August to 15 October) in compliance with the ERCB directive for this complex.

Secondary objectives were to estimate the number of staging waterfowl within the HZLC during the two migration periods, and to conduct a one-day survey of bald eagle nests, adults, and eaglets along a pre-existing survey route within the HZLC.

In 2013, I flew aerial surveys over the HZLC approximately seven days apart for four weeks in spring and for seven weeks in fall. Spring surveys commenced the second week of May immediately after ice break-up on the complex, while fall surveys

commenced the first week of September. The survey route covered all producing wells in the complex to monitor waterfowl numbers at the well sites, as well as additional transects throughout the complex to estimate staging waterfowl numbers. A single aerial survey for bald eagle nest sites within the HZLC was flown on 6 June 2013.

Waterfowl congregations were surveyed near 20 active wells on 13 sites within the HZLC (four sites contained multiple wells). Waterfowl were observed at 10 of these sites on at least one occasion over the 11 surveys, but congregations were below the threshold limit at all sites. The largest congregation of waterfowl within 30 m of an active well was 195 ducks in spring and 215 ducks in fall. Therefore, extraction activities were not suspended in 2013.

Throughout the HZLC, Canada goose (*Branta canadensis*) was the most abundant goose species observed during spring migration in 2013. Mallard *(Anas platyrhynchos)*, and to a lesser extent, northern pintail *(A. acuta)*, and American widgeon *(A. americana)* were the most abundant of the identified duck species observed. The highest spring aggregate counts for both ducks (n = 18,181) and geese (n = 5,529) staging over the entire complex occurred during the first survey week in the spring (9 May), similar to long-term trends (1994 – 2012).

Canada goose was also the most abundant goose species observed during the fall migration in 2013. Mallard, and to a lesser extent, canvasback *(Aythya valisineria)*, were the most abundant of the identified duck species observed. The highest fall aggregate count for both ducks (n = 46,821) and geese (n = 20,454) staging over the entire complex occurred during the third survey week in the fall (20 September), similar to long-term trends for geese and one week earlier for ducks.

Nine nesting pairs of bald eagles *(Haliaeetus leucocephalus)* were located during the one-day survey in 2013. This is greater than the six nests observed in 2012 as well as the range observed during annual surveys since 1994 (three to eight nesting pairs). The number of eaglets observed in the active nests ranged from one to two.

Key words: Hay-Zama lakes, wetlands, well site, waterfowl, bald eagle, staging, aerial survey.

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I am grateful to the following individuals, agencies, and corporations for their contributions and assistance in delivering this project. The Hay-Zama Committee oversaw all activities on the project and fostered a collaborative and cooperative approach to working with all stakeholders. Funding was provided by the committee's industry member, NuVista Energy Ltd. Doug Manzer (Alberta Conservation Association) reviewed this report and provided valuable insights and editorial suggestions.

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1.0 INTRODUCTION

1.1 General introduction

The Hay-Zama Lakes Complex (HZLC), located in the Boreal Forest Central Mixedwood Natural Subregion of Alberta, has gained international recognition for its significance for staging waterfowl and shorebirds. Official recognition includes the 1982 Ramsar Convention designation of a "Wetland of International Importance, especially as Waterfowl Habitat", and nomination by the World Heritage Convention as a World Heritage Site in 1990. In 1999 it was designated as a Wildland Provincial Park by the Province of Alberta.

The HZLC has a long history of industrial activity. Oil and gas exploration has occurred on the complex since 1965, and currently there are 20 producing oil and gas wells located on 13 sites within the complex boundaries. Stakeholders felt that the high level of industrial activity within the complex may have a negative effect on wildlife, particularly waterfowl. Risks to local wildlife populations range from harassment due to regular well maintenance activities to exposure to spills of crude oil or diesel used to power pump jacks. To moderate the impacts of oil and gas activities on aquatic ecosystems in the complex, the Hay-Zama Committee (HZC) was formed in 1978, which then initiated the Hay-Zama Lakes Monitoring Program (HZLMP), focusing on monitoring migrating waterfowl and nesting bald eagles.

The HZC consists of representatives from the oil and gas industry (NuVista Energy Ltd.), Dene Tha' First Nation, Energy Resources Conservation Board, municipal, provincial, and federal government agencies (M.D. of Mackenzie #23; Alberta Energy; Alberta Environment; Alberta Environment and Sustainable Resource Development (AESRD), Fish and Wildlife, and Public Lands and Forests Divisions; Alberta Tourism, Parks and Recreation; Environment Canada; Department of Fisheries and Oceans), and environmental and conservation organizations (Alberta Conservation Association (ACA); Alberta Wilderness Association; Ducks Unlimited Canada). The HZC collaboratively directs industrial activities within the HZLC. Although waterfowl monitoring on the complex began in 1978 and includes all migration seasons except 1979, methods and effort have varied since the inception of the program. To

standardize monitoring efforts, the HZC enlisted the Government of Alberta, Fish and Wildlife Division to carry out wildlife monitoring activities. This task was delegated to the ACA by the government in 1997.

1.2 Survey rationale

Oil and gas operations within the HZLC are regulated by the Energy Resources Conservation Board (ERCB; which became the Alberta Energy Regulator midway through 2013 survey season but will be referred to as ERCB for the duration of this report.). In 1995, ERCB in consultation with the HZC revised regulations for oil and gas operations within the HZLC. Boundaries were defined around the wetland complex to include the areas most environmentally sensitive to industrial activity (Alberta Energy and Utilities Board 1996). Monitoring protocols of select wildlife species (waterfowl and bald eagles) within the new boundaries were developed by the HZC to comply with the following clause in the ERCB guidelines pertaining to general drilling and production activities:

1. During a 5-week spring period (commencing mid-April) and an 8-week fall period (commencing mid-August) each year, the company shall:
    a. Suspend well production and helicopter operations, or
    b. AEP [Alberta Environmental Protection, presently AESRD] and operators within the Complex will monitor fish and wildlife activity in the Complex and, in consultation with the Fish and Wildlife Division of AEP, determine for which wells, if any, suspension of production and helicopter operations is required and for what period of time.
2. Suspension of operation shall include:
    a. Consultation with the EUB [Energy and Utilities Board, predecessor to ERCB] to establish appropriate shutdown procedures and sequences,
    b. Shutting in the wells, and
    c. Depressurizing all pipelines and vessels.
3. All wells, batteries, compressor stations, satellites, and pipeline routes shall be patrolled within 24 hours of production being suspended.

These monitoring efforts allow for continued oil and gas production unless a threshold of 600 ducks and/or geese is present within a 30 m radius of the well site, at which point well production must be suspended. A suspended well must be surveyed again within 24 h and ERCB advised of the updated waterfowl count. Guidelines suggest ERCB will allow production to be resumed as soon as waterfowl numbers are below threshold levels.

The alternative, as defined by ERCB, is a general suspension of production on the complex during the migration periods (approximately 15 April to 31 May and 15 August to 15 October). This strategy was developed by the HZC to ensure that a minimum number of waterfowl would be affected in the event of a blowout or oil spill. This was determined by the committee to be an acceptable compromise between economic activity and ecological integrity within the HZLC. Alberta Conservation Association is responsible for monitoring and reporting to ERCB the waterfowl congregations at producing well sites, but does not have any regulatory authority in this matter. Energy Resource Conservation Board has the authority to suspend production of any wells when threshold numbers are detected.

1.3 Survey objectives

There are three objectives for this program. The primary objective is to monitor waterfowl numbers near producing oil and gas wells at regular intervals throughout the spring and fall migration periods and report to ERCB any incidents of waterfowl congregations that exceed the defined threshold.

The secondary objectives are to estimate staging waterfowl numbers for the HZLC during spring and fall migration periods for comparison with previous years and to gauge progress of the season's migration and finally, to estimate the number of bald eagle nests, nesting adults, and eaglets on the complex.

2.0 SURVEY AREA

2.1 Description

The Hay-Zama lakes are part of a unique and diverse wetland complex located in northwestern Alberta at 58°45'N, 119°00'W (Figure 1). Comprised of over 48,000 ha of open water, wet meadows, rivers, and floodplain woodlands, this area is characterized by highly variable water levels both on a seasonal and annual basis (Fearon and Larsen 1986).

The major fluvial system, Hay River, meanders through the HZLC, separated from lacustrine cells by high levees. Other fluvial systems entering the complex include Sousa Creek to the southeast, Vardie River, Amber River, and Zama River all to the north, and Mega River to the west, as well as several unnamed creeks (Figure 1). Major lacustrine cells include Hay, Zama, Duck, and Sand Lakes. Numerous unnamed sloughs make up the remainder of the complex's wetland area. During spring runoff, high water in the Hay River backs up Omega River and Sousa Creek filling the complex. After peak runoff, the complex slowly discharges into the Hay River via these same drainages. By mid-summer some of the large ephemeral lacustrine cells recede into vast grasslands.

Three Indian Reserves (Hay Lake, Amber River, and Zama Lake) border the HZLC. People of the Dene Tha' First Nation have used and continue to use the complex and surrounding areas for traditional purposes such as hunting, fishing, trapping, gathering, and traditional ceremonies.

Oil and gas wells within the wetlands are situated on man-made islands with caissons around the well head and accompanying infrastructure to protect them from high water. Construction of the islands and caissons, including their height, are regulated by ERCB (Alberta Energy and Utilities Board 1996).

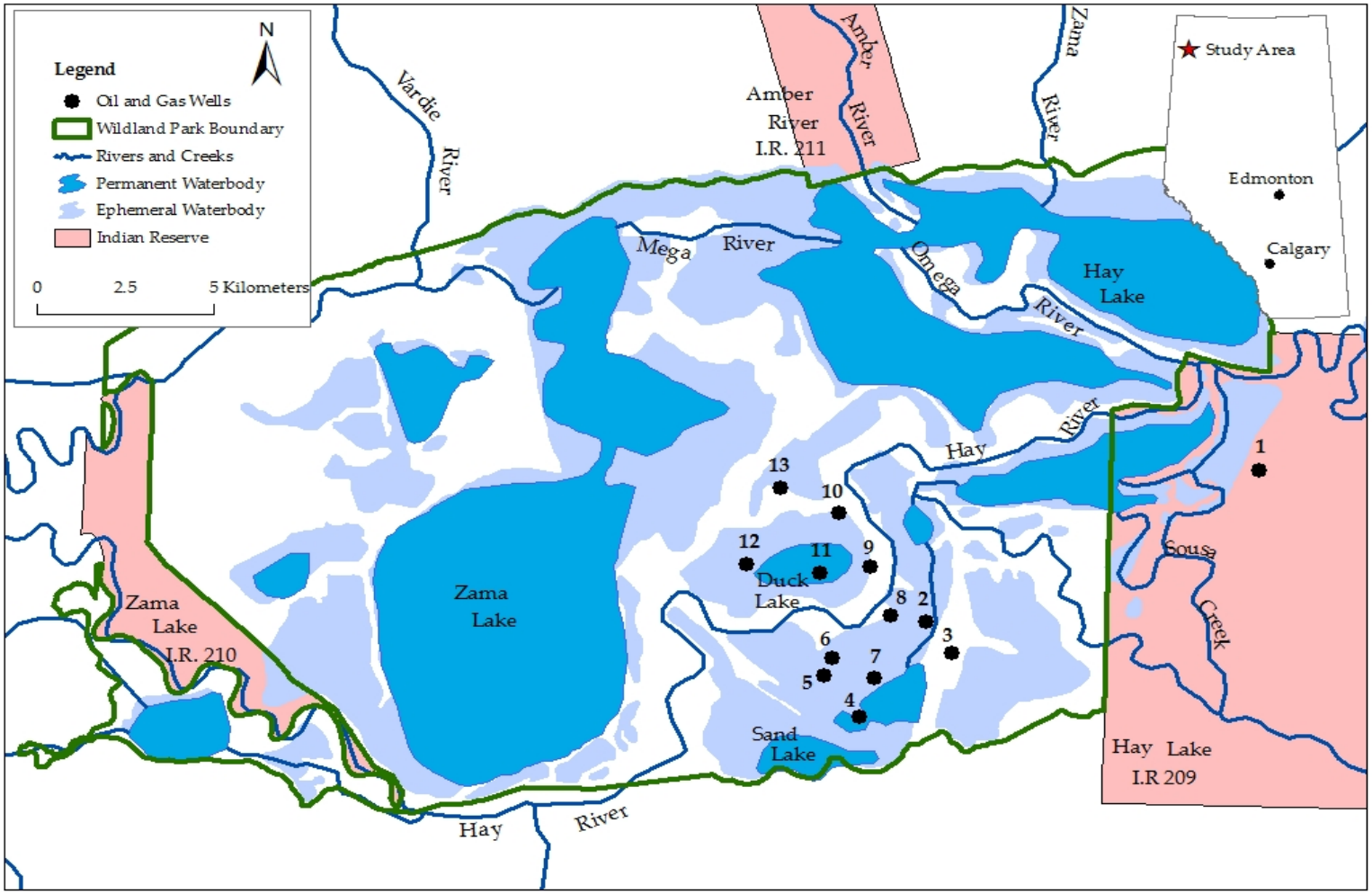

Figure 1. Location of Hay-Zama lakes survey area and oil and gas well sites monitored from 9 to 31 May and 5 September to 18 October, 2013.

2.2 Natural region, forest cover, and soils

The HZLC occurs in the Boreal Forest Central Mixedwood Natural Subregion (Natural Regions Committee 2006). The climate is characterized by relatively low annual precipitation (Strong and Leggat 1992), short, warm summers, and long, cold winters (Natural Regions Committee 2006).

Forest cover in the ecoregion is dominated by trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*), with understories commonly containing blue joint (*Calamagrostis canadensis*), prickly rose (*Rosa acicularis*), bunchberry (*Cornus canadensis*), wild sarsaparilla (*Aralia nudicaulis*), dewberry (*Rubus pubescens*), and common fireweed (*Epilobium angustifolium*) (Strong and Leggat 1992).

Soils in the survey area include luvisols, regosols, gleysols, and organic types (Bentz et al. 1994). Luvisolic soils dominate the well-drained upland sites where glaciolacustrine deposits form the dominant parent material. Regosolic soils are prominent on recently deposited sediments of fluvial origin like the floodplains of the Hay River and its tributaries. Gleysolic soils are very common in poorly drained areas, often overlain by organic layers or peat (Bentz et al. 1994).

2.3 Plant and animal communities

Fluctuating water levels in the HZLC are an important attribute of the region and profoundly influence the structure and functioning of plant communities. Annual and seasonal fluctuations of up to 2 m have been recorded by Environment Canada (2007). Aspen and balsam poplar dominate the limited upland sites with sporadic occurrence of white spruce (*Picea glauca*) and paper birch (*Betula papyrifera*). Fluvial deposits adjacent to watercourses are dominated by balsam poplar, with a dense understory of willow (*Salix* spp.), red-osier dogwood (*Cornus stolonifera*), and chokecherry (*Prunus virginiana*). Dense willow thickets, often associated with thick grass and sedge meadows (*Carex spp*.), cover the poorly drained transitional areas between the river levees and the ephemeral lacustrine basins. Sedges, slough grass (*Beckmannia syzigachne*), water smartweed (*Polygonum* spp.), yellow cress (*Rorippa palustris*), and

small bedstraw (*Galium trifidum*) cover the ephemeral lacustrine basins once water levels have receded (Bentz et al. 1994).

In addition to abundant migrating waterfowl, several other wildlife species occur in the complex (Wright 1998). These include raptors, gulls, terns, and numerous songbirds. Bald eagles (*Haliaeetus leucocephalus)* nest in the treed areas along the Hay River or in aspen uplands bordering the complex. Northern harriers (*Circus cyaneus*) are commonly observed, and short-eared owls (*Asio flammeus*) are occasionally observed during surveys. Wright (1999) reported 34 species of neotropical migrants in a 1998 mist-netting survey on riparian habitats in the complex.

Ungulates include moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), as well as a wood bison herd (*Bison bison athabascae*) considered to be the only free-ranging, disease-free herd in Alberta. Larger carnivores include black bear (*Ursus americanus*), wolf (*Canis lupus*), and red fox (*Vulpes vulpes*). Beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) have been observed in past monitoring surveys and their dams, lodges, and push-ups are evident throughout the complex (Saxena et. al 1995; Wright 1998).

Fish species in the Hay River and tributaries include northern pike (*Esox lucius),* walleye (*Sander vitreus*), burbot (*Lota lota*), white sucker (*Catostomus commersoni*), and longnose sucker (*C. catostomus*) (Shaffe and Wright 1997). Additionally, flooded grasslands in spring provide critical spawning and rearing habitat for northern pike (Moller and Rosin 1994; Shaffe and Wright 1997; Wright 1998).

3.0 MATERIALS AND METHODS

3.1 Waterfowl monitoring near well sites

Aerial surveys were flown at approximately weekly intervals during the target 15 April to 31 May and 15 August to 15 October migration periods. Although five surveys were scheduled for spring, the complex was completely ice-covered for the 2 May survey

date. Accordingly, spring surveys occurred from 9 to 31 May (four one-day surveys). Eight surveys were scheduled for fall; however, heavy fog prevented aircraft flight for the 29 August survey date, and thus fall surveys occurred from 5 September to 18 October (seven one-day surveys). My survey route was similar to previous surveys (Saxena et al. 1995; Schaffe and Wright 1997) and survey time for this portion of the flight was 1.0 h (Appendix 1). Overall, I monitored 13 sites, containing 20 producing wells (Figure 1). The four sites containing multiple wells were regarded as single sites. Aerial surveys were flown in an R-44 rotary wing aircraft equipped with pop-out floats at an altitude of approximately 30 m and ground speeds of 60 to 100 km/h. Flight speed was reduced at well sites to minimize disturbance and to facilitate accurate waterfowl (ducks and geese) counts. The aircraft was oriented to allow an unobstructed view from the front left side, and if required, would circle the well site for an accurate count. Waterfowl counts at the well sites encompassed a radius of 30 m around the well caisson.

The aerial survey approach for monitoring waterfowl around producing wells has a number of assumptions, as well as limitations, for assessing harm to waterfowl from industrial activities. First, I assume waterfowl near well sites are detected before they attempt to move and avoid disturbance from the aircraft. Second, I assume all individuals can be counted within 30 m of the caisson, and that counts are not biased as densities increase. Third, the detection of waterfowl aggregations does not account for issues that occur if chronic contamination were to occur near wells, either affecting waterfowl directly or by degrading their habitat and food web. Fourth, this survey intensity was limited to 11 days within a 67 day migration period over spring and fall, which limits the ability to detect high congregations of waterfowl should they occur. Fifth, I am not able to conduct surveys in periods of adverse weather conditions (wind speed >50 km/h), which may preclude the detection of waterfowl seeking refuge from heavy weather on the sheltered side of the well structures.

3.2 Waterfowl staging numbers within the HZLC

Following each well site survey, I flew around the perimeter (approximately 200 m from the shoreline) of all the major wetlands in the HZLC to count the number of waterfowl over the migration periods. Flight time for this portion of the survey ranged

from 1.0 to 1.5 h (Appendix 1). All waterfowl observed within 200 m of either side of the survey route were recorded and identified to species, where possible. For all of the surveys I was the lone observer in the aircraft. These observations are compiled and used as a comparison to counts from previous years and to gauge progress of the season's migration. I compared my weekly counts with mean (± standard deviation) counts recorded for this area since 1994 (Saxena et al. 1995; Schaffe and Wright 1997; Wright 2013).

The survey approach for monitoring staging waterfowl within the HZLC has some assumptions and limitations for assessing staging population numbers. First, I assumed most waterfowl present on the complex are congregated or are visible from the perimeter of the major wetlands. This is sufficient for the smaller wetlands, but has some limitations for the larger water bodies. Second, I assumed minimal movement of waterfowl between wetlands during the survey, preventing multiple counts of individuals. Additionally, the assumptions regarding survey intensity and weather conditions listed previously also apply to monitoring of staging waterfowl.

3.3 Bald eagle nesting survey

I monitored nesting sites of bald eagles on the HZLC in a single aerial survey on 6 June 2013, a time of year when adults will flush from the nest more readily, allowing an accurate count of eggs or eaglets in the nest (Wright 2004). My survey route covers all areas within the Wildland Park boundaries that have large mature trees, and includes all nest sites identified in previous surveys (Saxena et al. 1995; Schaffe and Wright 1997; Wright 2013). Flight time for this survey was 2.6 h (Appendix 1). I geo-referenced locations of nests with a Global Positioning System (GPS) unit and recorded numbers of adults, eaglets, or eggs, and nest status using the following categories:

1. Brooding - if eggs or brooding adults were observed in the nest.
2. Rearing - if eaglets were observed in the nest.
3. Empty - if no evidence of nesting was observed.
4. Absent - if the nest was not found in this year's survey but historically existed at the location.

The bald eagle nesting survey approach assumes that the date of the survey was late enough to ensure all breeding eagles have nested and that any new nests, not observed in previous surveys, were visible from the aircraft and detected in the current survey.

4.0 RESULTS

4.1 Waterfowl monitoring near well sites

During the 2013 spring and fall migration period surveys, waterfowl counts remained below threshold densities at all well sites in the HZLC. I observed waterfowl at 10 of the 13 well site locations in the survey area (Tables 1 and 2). There were very few waterfowl present at any of the well sites during spring migration, with the highest count of 195 ducks recorded at site #11 on 23 May (Table 1). The highest fall survey count was 215 ducks at site #5 on 3 October (Table 2). Brief summaries of waterfowl observations and general habitat descriptions for each of the 13 well site locations monitored in this survey are provided in Appendix 2.

Table 1. Summary of the total waterfowl observed at each well site during spring migration (9 to 31 May 2013).

Site #	9 May	16 May	23 May	31 May
1	0	0	0	0
2	0	3	0	2
3	0	0	0	0
4	19	4	0	4
5	1	1	0	6
6	0	0	0	0
7	3	4	14	0
8	0	2	0	0
9	0	0	0	0
10	0	3	0	16
11	59	0	195	0
12	11	9	0	8
13	0	4	0	0

Table 2. Summary of the total waterfowl observed at each well site during fall migration (5 September to 18 October 2013).

Site #	5 Sep	12 Sep	20 Sep	26 Sep	3 Oct	11 Oct	18 Oct
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	50	140	30	26	45	80
5	0	55	90	125	215	90	0
6	0	0	0	0	0	0	0
7	0	0	2	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	16	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	30	85
12	0	0	0	0	32	8	0
13	0	0	0	0	0	0	0

4.2 Waterfowl staging numbers within the HZLC

In spring 2013, I observed the greatest aggregate counts for both geese and ducks (n = 5,529 geese; n = 18,181 ducks) during the 1st survey week (9 May) (Table 3), which is equivalent to the modal (most common) week for both geese and ducks from 1994 to 2012 (Appendices 3 and 4). For geese, this one day count in 2013 is similar to the long term mean and considerably lower than the 2012 greatest aggregate count (n = 5,538 ± 3,350; n = 11,832 respectively) (Appendix 3). For ducks, it is lower than both the long term mean and the 2012 greatest aggregate count (n = 26,698 ± 12,979; n = 23,980 respectively) (Appendix 4).

Canada geese (*Branta canadensis*) were the most abundant of the goose species I observed during spring monitoring. Greater white-fronted geese *(Anser albifrons)* were observed on 9 and 16 May, and lesser snow geese (*Chen caerulescens*) were observed on 9 May (Appendix 5). Swans were present on all spring survey dates in low to moderate

numbers (range: 3 – 71) (Table 3). I was unable to determine whether they were trumpeter (*Cygnus buccinator*) or tundra swans (*C. columbianus*), as the similarities of these two species make accurate identification from the air difficult without undue harassment of the birds.

Table 3. Summary of the total number of waterfowl observed (identified and unidentified) during aerial surveys in the Hay-Zama Lakes Complex in spring 2013.

Date	Ducks	Geese	Swans
9 May	18,181	5,529	11
16 May	6,315	737	51
23 May	4,180	4	71
31 May	1,328	22	3
Total	**30,004**	**6,292**	**136**

Of the 28,595 ducks I identified during the spring surveys (only 4.7% of ducks were unidentifiable), mallard *(Anas platyrhynchos)* was the most abundant species, accounting for 31.3% of the total, followed by northern pintail *(A. acuta)* at 19.8% and American widgeon (*A. americana*) at 19.5% (Figure 2; Appendix 5). Canvasback *(Aythya valisineria)*, lesser scaup *(A. affinis)*, and green-wing teal (*Anas crecca)* were moderately abundant as well, accounting for 6.3%, 6.1% and 4.9% of the total, respectively.

The remaining 12.1% of duck species, in order of abundance, were gadwall *(Anas strepera)*, blue-wing teal (*A. discors)*, redhead (*Aythya americana)*, northern shoveler *(Anas clypeata)*, teal species (*A. crecca* or *A. discors)*, common goldeneye *(Bucephala clangula)*, ring-necked duck *(Aythya collaris*), bufflehead *(Bucephala albeola)*, ruddy duck *(Oxyura jamaicensis)*, white-winged scoter (*Melanitta fusca*), and surf scoter (*M. perspicillata*) (Figure 2). Other waterfowl species of note include American coot *(Fulica americana)*, common merganser (*Mergus merganser)*, eared grebe *(Podiceps nigricollis)*, red-necked grebe *(P. grisegena)*, and common loon (*Gavia immer*) (Appendix 5).

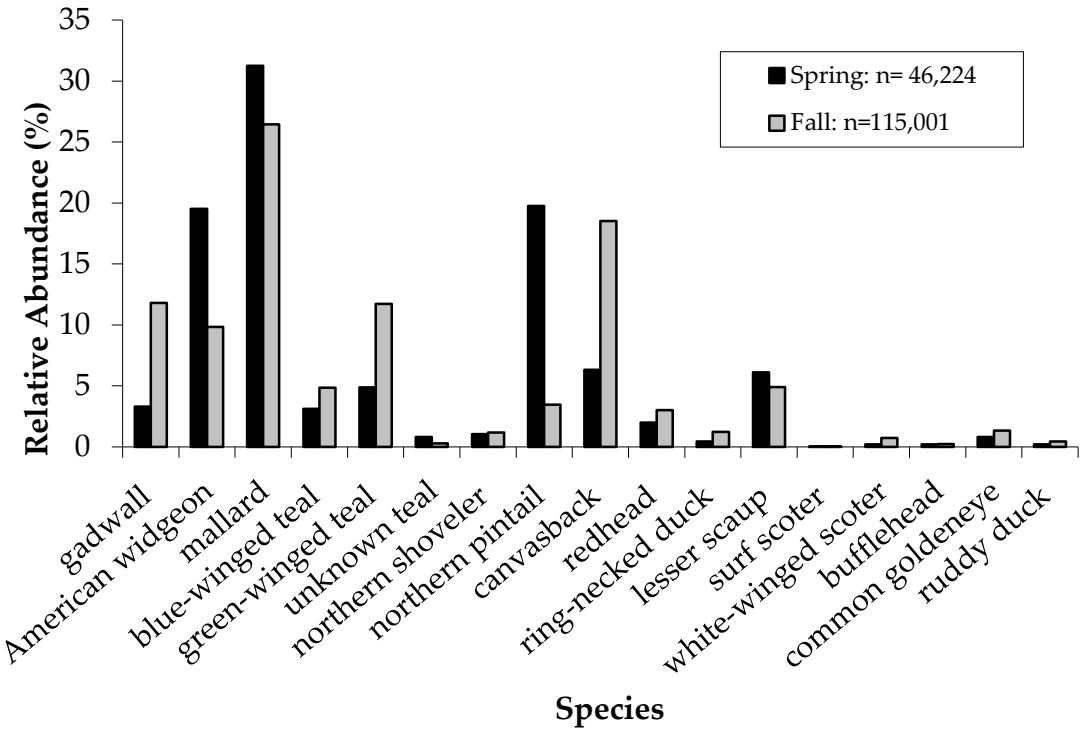

Figure 2. Relative abundance of identified duck species observed during the 2013 spring and fall migrations in the Hay-Zama Lakes Complex (4.7% during spring and 4.5% during fall were unidentified).

In fall 2013, Canada geese were the most abundant of the goose species I observed during monitoring. Lesser snow geese, although slightly less abundant, were present in very large numbers on week 3 (n = 12,278; 20 September) and on week 4 (n = 9,436; 26 September) (Appendix 6). Greater white-fronted geese were observed on the 1st and 2nd survey week (Appendix 6). The greatest aggregate count for geese was observed on week 3 (20 September) (Table 4), which is equivalent to the modal week from 1994 to 2012 and to the 2012 greatest aggregate count week (Appendix 3). The greatest aggregate count observed in 2013 (n = 20,454) was considerably higher than both the long term mean and the 2012 greatest aggregate count (n = 4,353 ± 3,540; n = 11,429 respectively) (Appendix 3).

For ducks, the greatest aggregate count was observed on week 3 (n = 46,821; 20 September) (Table 4), which is earlier than the modal week from 1994 to 2012 and the

2012 greatest aggregate count week (Appendix 4). Numbers observed were consistent with the long term mean and the previous year's observations (n = 45,399 ± 14,788; n = 44,003 respectively) (Appendix 4).

Table 4. Summary of the total number of waterfowl observed (identified and unidentified) during aerial surveys in the Hay-Zama Lakes Complex in fall 2013.

Date	Ducks	Geese	Swans
5 Sep	13,522	2,692	15
12 Sep	16,321	972	80
20 Sep	46,821	20,454	148
26 Sep	43,101	17,279	954
3 Oct	28,168	4,318	1,762
11 Oct	26,889	3,975	1,723
18 Oct	7,958	3,157	1,482
Total	**182,780**	**52,847**	**6,164**

Of the 174,829 ducks I identified during the fall surveys (4.5% of ducks were unidentifiable), mallard was the predominant species recorded, accounting for 26.4% of the total, followed by canvasback at 18.5% (Figure 2, Appendix 6). Gadwall, green-wing teal, and American widgeon were observed in moderate numbers, accounting for 11.8%, 11.7%, and 9.8% of the total, respectively.

The remaining 21.8% of duck species observed, in order of abundance, were lesser scaup, blue-wing teal, northern pintail, redhead, common goldeneye, ring-necked duck, northern shoveler, white-winged scoter, ruddy duck, teal species, bufflehead, and surf scoter (Figure 2). Other waterfowl species of note include American coot, common merganser, eared grebe, western grebe *(Aechmophorus occidentalis)*, and red-necked grebe (Appendix 6).

4.3 Bald eagle nesting survey

Bald eagle nesting sites have been monitored annually on the HZLC since 1994 (Appendix 7). By 2012, nineteen nesting sites had been identified (Table 5; Figure 3), and active nesting pairs observed on the complex have ranged from three to eight annually. The lowest count of three was coincident with a wildfire in late May 2001 that burned through several nesting sites along the Hay River (Wright 2002).

During the 6 June 2013 survey, I observed twelve of the historical nests and two additional nests which had not been seen in past surveys. In total I counted nine active bald eagle nests, which is higher than any observations from previous surveys (maximum = 8), and an increase from six active nests observed in 2012 (Table 5). The active nests contained broods ranging from one to two eaglets and had one or two adults present. Additionally, I observed one juvenile and three adult bald eagles that were not obviously associated with a nest site.

Seven nest sites present in past surveys were not observed during the 2013 survey: nest site #5 was burned in the 2001 wildfire; nest site #2 was last observed in 2007; nest sites #8 and #12 were last observed in 2010; nest site #14 was last observed in 2011; and nest sites #7 and #17 were last observed in 2012 (Table 5).

Table 5. Summary of bald eagle nests classed as brooding, rearing, empty, or absent (not found) along with the presence of adults, eaglets, and eggs in the Hay-Zama Lakes Complex during an aerial survey on 6 June 2013.

Site	Status	Number observed			Comments
		Adults	Eaglets	Eggs	
1	rearing	1	2	0	Nest empty in 2012.
2	absent	0	0	0	Not found. Last seen in 2007.
3	rearing	1	2	0	Rearing annually since 2009.
4	empty	0	0	0	Nest in good condition. Adult roosting in adjacent tree.
5	absent	0	0	0	Not found. Last seen in 2000.
6	empty	0	0	0	Nest in poor condition.
7	absent	0	0	0	Not found. Last seen in 2012.
8	absent	0	0	0	Not found. Last seen in 2010.
9	rearing	1	2	0	Rearing in 2011.
10	empty	0	0	0	Nest in good condition.
11	empty	0	0	0	Nest in good condition.
12	absent	0	0	0	Not found. Last seen in 2010.
13	empty	0	0	0	Nest in good condition.
14	absent	0	0	0	Not found. Last seen in 2011.
15	rearing	2	2	0	Nest empty in 2012.
16	rearing	1	1	0	Nest empty in 2012.
17	absent	0	0	0	Not found. Last seen in 2012.
18	rearing	1	1	0	Rearing annually since 2011.
19	rearing	1	2	0	Rearing in 2012.
20	rearing	1	2	0	Not observed prior to 2013.
21	rearing	1	1	0	Not observed prior to 2013.
Total	**9 active nests**	**10**	**15**	**0**	

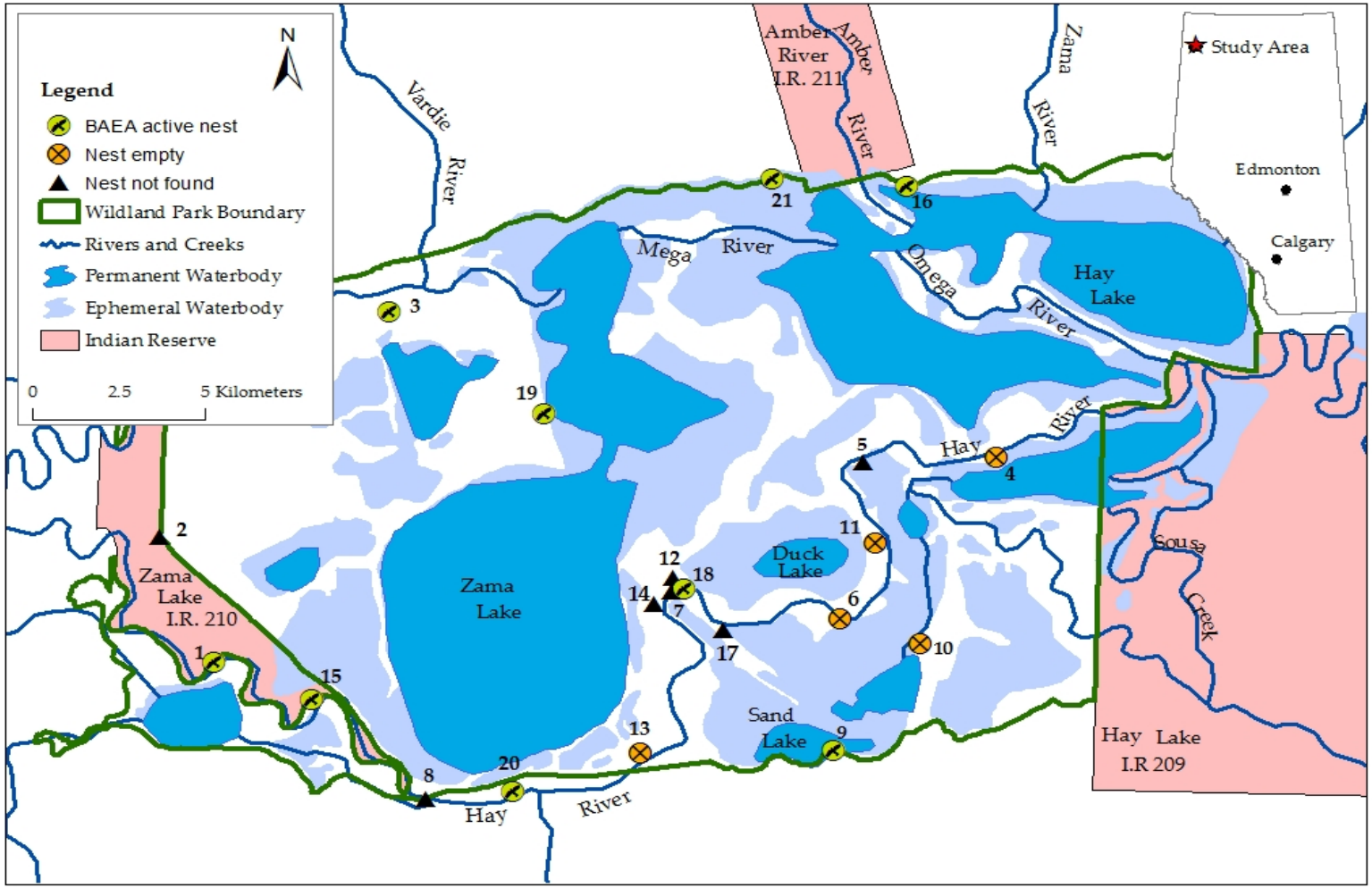

Figure 3. Location and status of bald eagle nest sites observed in an aerial survey in the Hay-Zama Lakes Complex, 6 June 2013.

4.4 Summary

The highest count of waterfowl observed at a single well site during the 11 one-day aerial surveys was 215 birds at Site #5, which is below the threshold limit of 600 birds within 30 m of a well caisson. Consequently, ERCB did not require suspension of production for any well sites in the HZLC in 2013.

Throughout the HZLC, Canada goose was the most common goose species observed during both the spring and fall surveys. Mallard was the most common duck species observed during both the spring and fall surveys.

Nine active bald eagle nests were observed during the 6 June 2013 survey. This is greater than the six active nests observed in 2012 and greater than the range of three to eight active nests recorded in 19 years of previous surveys in this area. The number of eaglets observed in the active nests ranged from one to two.

5.0 LITERATURE CITED

Alberta Energy and Utilities Board. 1996. Interim Directive ID96-1, Hay-Zama Lake Complex - special requirements. Produced by the Alberta Energy and Utilities Board, Calgary, Alberta, Canada. 9 pp.

Bentz, J.A., A. Saxena, and D. O'Leary. 1994. Biophysical inventory of shoreline areas of the Hay-Zama lakes, Alberta. Produced by Geowest Environmental Consultants Ltd., for Resource Information Division, Alberta Environmental Protection, Edmonton, Alberta, Canada. 105 pp.

Environment Canada. 2007. File data. Environment Canada, Meteorological Service of Canada, Water Survey Division, Peace River, Alberta, Canada.

Fearon, P.W., and G.I. Larsen. 1986. Hay Zama lakes survey report. Produced by Ducks Unlimited Canada, Edmonton, Alberta, Canada. 10 pp.

Moller, K., and J. Rosin. 1994. Preliminary investigation of pike spawning potential on the Hay Zama Wetland Complex. Produced by Alberta Environmental Protection, Peace River, Alberta, Canada. 7 pp.

Natural Regions Committee. 2006. Natural regions and subregions of Alberta. Publication Number T/852 produced by Government of Alberta, Edmonton, Alberta, Canada. 254 pp.

Saxena, A.J., A. Bentz, and D. O'Leary. 1995. Wildlife monitoring program, 1994, Hay-Zama lakes, Alberta. Produced by Geowest Environmental Consultants Ltd., for Granisko Resources Inc., Edmonton, Alberta, Canada. 99 pp.

Schaffe, C.M., and K.D. Wright. 1997. Hay-Zama lakes biological study. Produced by Alberta Environmental Protection, Peace River, Alberta, Canada. 16 pp.

Strong, W.L., and K.R. Leggat. 1992. Ecoregions of Alberta. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta, Canada. 55 pp + App.

Wright, K.D. 1998. Hay-Zama Lakes Complex fisheries and wildlife monitoring 1997/98. Produced by Alberta Conservation Association, Peace River, Alberta, Canada. 17 pp.

Wright, K.D. 1999. Hay-Zama Lakes Complex wildlife monitoring 1998/99. Produced by Alberta Conservation Association, Peace River, Alberta, Canada. 14 pp.

Wright, K.D. 2002. Hay-Zama Lakes Complex wildlife monitoring 2001. Produced by Alberta Conservation Association, Peace River, Alberta, Canada. 14 pp.

Wright, K.D. 2004. Hay-Zama lakes waterfowl staging and bald eagle nesting monitoring program, 2003. Data report, D-2004-021, produced by Alberta Conservation Association, Peace River, Alberta, Canada. 22 pp + App.

Wright, K.D. 2013. Hay-Zama lakes waterfowl staging and bald eagle nesting monitoring program, 2012. Data report, D-2013-002, produced by Alberta Conservation Association, Peace River, Alberta, Canada. 20 pp + App.

6.0 APPENDICES

Appendix 1. Flight conditions during aerial surveys of the Hay-Zama Lakes Complex for spring and fall migration periods and bald eagle (BAEA) nest survey in 2013.

Date	Flight duration (h)	Temp. (°C)	Wind direction; Speed (knots)	Cloud cover (%)	General conditions
Spring					
9 May	1.9	11	NNWW; 5 kts	90-40	HZLC mostly ice-covered; runoff water in ephemeral areas
16 May	2.3	15	W; 15-20 kts	0	Omega R flowing W; water level rising; wind gusting
23 May	2.6	24	SE; 20 kts	25	Omega R flowing W; water level continues to rise
31 May	2.5	22	ESE; 15 kts	70	Omega R flowing W; water level continues to rise
BAEA					
6 Jun	2.6	16	W; 25 kts	20	Strong, steady West wind
Fall					
5 Sep	1.4	24	S, W; 20 kts	10	Water levels low; shifting wind
12 Sep	2.9	25	SW; 15 kts	5	Moderate glare; wind steady
20 Sep	2.2	14	E; 15-20 kts	40	wind gusting
26 Sep	2.3	16	SW; 10 kts	20	Moderate glare; wind steady
3 Oct	2.2	8	SE; 5 kts	0	Moderate glare
11 Oct	2.2	6	W; 10 kts	0	Moderate glare
18 Oct	2.2	10	W; 15 kts	70	Ice forming on water edges

Appendix 2. Summary of observations of waterfowl and general habitat descriptions for each of the 13 well site locations monitored in the Hay-Zama Lakes Complex (9 to 31 May and 5 September to 18 October 2013).

Well location 1. Grid reference: 5-2-113-5-W6. This oil well is located within the Hay Lake Indian Reserve (I.R. 209) in a willow thicket adjacent to an ephemeral sheetwater area. There were no waterfowl observed at this site during the 2013 survey period.

Well location 2. Grid reference: 6-23-112-6-W6. This gas well is located in an ephemeral sheetwater area north of Sand Lake. Waterfowl were only present at this site in very low numbers during spring (range: 2 to 3) and absent in fall.

Well location 3. Grid reference: 9-14-112-6-W6. This gas well is located in an isolated ephemeral sheetwater area in the southeast portion of the wetland complex. There were no waterfowl observed at this site during the 2013 survey period.

Well location 4. Grid reference: 12-10-112-6-W6. This gas well is located on the west end of an unnamed permanent lake, north of Sand Lake. Waterfowl were present in very low numbers in spring (range: 2 to 15) and in low to moderate numbers during fall (range: 26 to 140).

Well location 5. Grid reference: 2-16-112-6-W6. This gas well is located in a permanent marsh north of Sand Lake. Waterfowl were present at this site in very low numbers during spring (range: 1 to 6). The highest numbers of waterfowl observed at a well site during fall (n = 215) was at this site.

Well location 6. Grid reference: 10-16-112-6-W6. This oil well is located in a permanent marsh north of Sand Lake. There were no waterfowl observed at this site during the 2013 survey period.

Well location 7. Grid reference: 7-15-112-6-W6. This site contains 2 oil wells (7-15 and 8-15-112-6-W6) and is situated in an ephemeral sheetwater area north of Sand Lake. Waterfowl were present at this site in very low numbers during spring and fall (range: 2 to 14).

Well location 8. Grid reference: 3-23-112-6-W6. This oil well is located in an ephemeral marsh. Waterfowl were present at this site on only one survey in spring (2 blue-winged teal) and absent in fall.

Well location 9. Grid reference: 6-27-112-6-W6. This gas well is located on the east shore of Duck Lake. Waterfowl were absent in spring and observed on only one survey in fall (14 gadwall and 2 swans).

Well location 10. Grid reference: 8-33-112-6-W6. This site contains 4 oil wells (8-33, 4-34, 4-34(2) and 6-34-112-6-W6) and is located in an ephemeral sheetwater area between Hay River and Duck Lake. Waterfowl were present at this site in very low numbers in spring (range: 3 to 16) and absent in fall.

Well location 11. Grid reference: 2-28-112-6-W6. This site contains 3 oil wells (2-28, 3-28(2) and 15-21-112-6-W6) and is situated in the permanent lake basin of Duck Lake. The highest numbers of waterfowl observed at a well site during spring (n = 195) was at this site. No waterfowl were present at this site in fall.

Well location 12. Grid reference: 7-29-112-6-W6. This site contains 2 oil wells (2-29 and 7-29-112-6-W6) and is situated in the permanent lake basin of Duck Lake. Waterfowl were present at this site in low numbers during spring and fall (range: 8 to 32).

Well location 13. Grid reference: 16-32-112-6-W6. This gas well is located in an ephemeral marsh north of Duck Lake. Waterfowl were present at this site very low numbers on only one survey in spring (4 blue-winged teal) and absent in fall.

Appendix 3. Summary of the survey week of highest aggregate count of geese observed from 1994 to 2013 during spring and fall migration in the Hay-Zama Lakes Complex. Modal (most common) week and mean counts (± standard deviation) for 1994 to 2012 are compared with 2013.

Year	Spring migration		Fall migration	
	Date of survey	Total # geese	Date of survey	Total # geese
1994	week 1	535	week 6	4,780
1995	week 1	9,082	week 3	7,122
1996	week 1	3,949	week 3	8,666
1997	week 2	3,973	week 2	222
1998	week 1	206	week 5	10,988
1999	week 1	6,975	week 3	7,570
2000	week 1	5,483	week 4	4,559
2001	week 1	4,252	week 3	4,332
2002	week 2	5,056	week 2	1,905
2003	week 1	7,879	week 4	5,035
2004	week 1	11,810	week 2	2,558
2005	week 2	7,113	week 6	2,904
2006	week 1	1,311	week 2	1,323
2007	week 1	1,363	week 3	1,036
2008	week 1	5,756	week 3	27
2009	week 2	6,354	week 2	350
2010	week 2	4,852	week 5	6,241
2011	week 2	7,446	week 4	1,660
2012	week 1	11,832	week 3	11,429
1994 – 2012	Mode = week 1	Mean = 5,538 ± 3,350	Mode = week 3	Mean = 4,353 ± 3,540
2013	week 1	5,529	week 3	20,454

Appendix 4. Summary of the survey week of highest aggregate count of ducks observed from 1994 to 2013 during spring and fall migration in the Hay-Zama Lakes Complex. Modal (most common) week and mean counts (± standard deviation) for 1994 to 2012 are compared with 2013.

Year	Spring migration		Fall migration	
	Date of survey	Total # ducks	Date of survey	Total # ducks
1994	week 5	18,417	week 2	35,525
1995	week 1	11,706	week 1	53,859
1996	week 1	19,810	week 4	28,255
1997	week 1	13,884	week 5	29,165
1998	week 2	32,676	week 2	62,941
1999	week 2	49,556	week 4	63,617
2000	week 1	29,307	week 5	32,902
2001	week 1	39,427	week 4	43,095
2002	week 3	52,725	week 4	43,095
2003	week 2	16,564	week 4	87,830
2004	week 1	43,111	week 3	32,016
2005	week 1	29,014	week 3	53,021
2006	week 1	15,951	week 4	42,295
2007	week 2	15,675	week 3	47,176
2008	week 1	12,666	week 4	27,796
2009	week 2	41,064	week 4	49,478
2010	week 1	24,708	week 4	40,481
2011	week 2	17,021	week 3	46,037
2012	week 1	23,980	week 4	44,003
1994 – 2012	Mode = week 1	Mean = 26,698 ± 12,979	Mode = week 4	Mean = 45,399 ± 14,788
2013	week 1	18,181	week 3	46,821

Appendix 5. Summary of the counts of waterfowl species during the 2013 spring migration in the Hay-Zama Lakes Complex.

	9 May	16 May	23 May	31 May
Canada goose (*Branta canadensis*)	5,357	727	4	22
greater white-fronted goose *(Anser albifrons)*	170	10	0	0
snow goose (*Chen caerulescens*)	2	0	0	0
swans (*Cygnus columbianus, C. buccinator*)	11	51	71	3
American coot (*Fulica americana*)	3	22	37	86
American widgeon (*Anas americana*)	4,530	707	274	61
blue-winged teal *(Anas discors)*	426	237	146	84
bufflehead (*Bucephala albeola*)	28	6	2	25
canvasback (*Aythya valisineria*)	542	189	932	137
common goldeneye (*Bucephala clangula*)	94	37	66	32
common merganser (*Mergus merganser*)	0	11	35	8
unidentified dabbler species	240	155	28	11
unidentified diver species	10	5	34	8
gadwall (*Anas strepera*)	2	695	213	32
eared grebe (*Podiceps nigricollis*)	0	6	14	48
red-necked grebe (*Podiceps grisegena*)	0	0	3	0
western grebe (*Aechmophorus occidentalis*)	0	0	0	0
green-winged teal (*Anas crecca)*	1,302	2	75	10
lesser scaup (*Aythya affinis*)	850	349	374	172
mallard (*Anas platyrhynchos*)	4,524	3,049	918	432
northern pintail *(Anas acuta)*	4,561	604	425	51
northern shoveler *(Anas clypeata)*	37	72	131	59
redhead (*Aythya americana*)	267	64	221	15
ring-necked duck *(Aythya collaris)*	3	30	23	70
ruddy duck (*Oxyura jamaicensis*)	21	3	20	14
surf scoter (*Melanitta perspicillata*)	6	0	0	0
unidentified teal species (*Anas* spp.)	222	0	5	5
unidentified duck species	465	96	258	99
white-winged scoter (*Melanitta fusca*)	51	4	0	3
Total	**23,724**	**7,131**	**4,309**	**1,487**

Appendix 6. Summary of the counts of waterfowl species during the 2013 fall migration in the Hay-Zama Lakes Complex.

	5 Sep	12 Sep	20 Sep	26 Sep	3 Oct	11 Oct	18 Oct
Canada goose (*Branta canadensis*)	2,492	803	8,168	7,843	3,563	2,995	3,097
white-fronted goose *(Anser albifrons)*	200	169	8	0	0	0	0
snow goose (*Chen caerulescens*)	0	0	12,278	9,436	755	980	60
swans (*Cygnus columbianus, C. buccinator*)	15	80	148	954	1,762	1,723	1,482
American coot (*Fulica americana*)	58	326	1,135	1,500	2,519	984	134
American widgeon (*Anas americana*)	10	297	5,797	5,930	2,954	1,661	465
blue-winged teal *(Anas discors)*	1,436	1,668	1,612	1,579	996	944	225
bufflehead (*Bucephala albeola*)	53	10	56	48	172	37	5
canvasback (*Aythya valisineria*)	200	3,487	11,092	9,828	4,052	3,156	430
common goldeneye (*Bucephala clangula*)	55	96	744	632	288	455	53
common merganser (*Mergus merganser*)	33	30	96	84	221	178	84
unidentified dabbler species	816	296	53	45	285	182	100
unidentified diver species	0	9	247	190	72	0	25
gadwall (*Anas strepera*)	1,306	1,647	5,463	5,621	2,997	2,940	562
eared grebe (*Podiceps nigricollis*)	58	93	127	104	140	224	10
red-necked grebe (*Podiceps grisegena*)	0	0	0	0	7	5	1
western grebe (*Aechmophorus occidentalis*)	0	0	0	12	99	8	10
green-winged teal (*Anas crecca)*	925	2,567	7,332	6,232	1,615	1,010	755
lesser scaup (*Aythya affinis*)	702	730	2,238	1,902	1,550	1,064	355
mallard (*Anas platyrhynchos*)	4,918	3,122	8,621	7,827	7,066	10,734	3,749
northern pintail *(Anas acuta)*	1,293	670	426	362	2,027	841	400
northern shoveler *(Anas clypeata)*	240	103	280	238	378	814	6
redhead (*Aythya americana*)	1,049	119	909	973	1,542	514	141
ring-necked duck *(Aythya collaris)*	0	34	890	756	330	70	62
ruddy duck (*Oxyura jamaicensis*)	21	13	129	114	159	294	35
surf scoter (*Melanitta perspicillata*)	0	0	0	0	0	42	0
unidentified teal species (*Anas* spp.)	6	20	21	20	0	200	210
unidentified duck species	387	1,326	761	660	1,004	1,265	228
white-winged scoter (*Melanitta fusca*)	72	77	54	60	460	488	68
Total	**16,345**	**17,792**	**68,685**	**62,950**	**37,013**	**33,808**	**12,752**

Appendix 7. Summary of active nests during bald eagle nesting surveys in the Hay-Zama Lakes Complex from 1994 to 2013.

Year	Active nests	Comments
1994	6	Source: Saxena et al. (1995)
1995	4	Source: Schaffe and Wright (1997)
1996	4	Survey area expanded
1997	5	
1998	7	
1999	5	
2000	7	
2001	3	Wildfire burned through east portion of survey area 2 days prior to survey
2002	6	
2003	7	
2004	5	
2005	4	Wildfire burned through much of survey area 3 weeks prior to survey
2006	4	
2007	7	
2008	5	
2009	6	
2010	8	One new nest found on survey route
2011	6	Two new nests found on survey route
2012	6	
2013	9	Two new nests found on survey route
Mean	**5.7 ± 1.5**	

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