Environmental Assessment

St. Paul Wind Power Expansion Project

TDX
TANADGUSIX CORPORATION

MAY 2005

Environmental Assessment

St. Paul Wind Power Expansion Project

prepared by
TDX Corporation
and DOWL Engineers

TDX
TAHADGUSIX CORPORATION

MAY 2005

Table of Contents

Summary v

Chapter 1. Introduction

Purpose and Need 1-3

Background 1-4

Public Scoping 1-4

Chapter 2. Description of Proposed Action and Alternatives

Proposed Action 2-1

No Action Alternative 2-4

Chapter 3. Existing Environment and Environmental Effects

Physical Resources

GEOLOGY 3-1

Existing Environment 3-1

Environmental Effects 3-2

SOILS 3-2

Existing Environment 3-2

Environmental Effects 3-3

NAVIGABLE AIR SPACE 3-3

Existing Environment 3-3

OBSTACLE FREE ZONE (OFZ) 3-3
RUNWAY SAFETY ZONE (RSZ) 3-3
RUNWAY PROTECTION ZONE (RPZ) 3-3
Environmental Effects 3-4
AIR QUALITY 3-4
Existing Environment 3-4
Environmental Effects 3-4
WATER RESOURCES AND WATER QUALITY 3-4
Existing Environment 3-4
Environmental Effects 3-5
Social Resources
SOCIOECONOMICS 3-5
Existing Environment 3-5
Environmental Effects 3-5
LAND USE 3-6
Existing Environment 3-6
Environmental Effects 3-6
VISUAL RESOURCES 3-6
Existing Environment 3-6
Environmental Effects 3-6
NOISE 3-6
Existing Environment 3-6
Environmental Effects 3-7
ARCHAEOLOGICAL AND CULTURAL RESOURCES 3-7
Existing Environment 3-7
HISTORICAL BACKGROUND 3-8
PREVIOUS ARCHAEOLOGICAL STUDIES 3-8

ON-SITE SURVEY RESULTS 3-10
Environmental Effects 3-11
Biological Resources
WETLANDS 3-11
Existing Environment 3-11
Environmental Effects 3-11
FLOODPLAINS 3-11
Existing Environment 3-11
Environmental Effects 3-11
COASTAL ZONE MANAGEMENT 3-12
Existing Environment 3-12
Environmental Effects 3-12
FISH AND MARINE AND TERRESTIAL MAMMALS 3-12
Existing Environment 3-12
FISH 3-12
MARINE MAMMALS 3-12
TERRESTRIAL MAMMALS 3-12
Environmental Effects 3-12
BIRDS 3-13
Existing Environment 3-13
Environmental Effects 3-14
THREATENED AND ENDANGERED SPECIES 3-17
Miscellaneous
SOLID AND HAZARDOUS WASTE 3-17
Existing Environment 3-17
Environmental Effects 3-18
Chapter 4. Required Permits 4-1

Chapter 5. Distribution 5-1

Chapter 6. List of Preparers and Contributors 6-1

Chapter 7. References 7-1

Appendix 1 ..... A-1

Appendix 1 ..... A-2

Environmental Assessment

St. Paul Wind Power Expansion Project

TDX

MAY 2005

Summary

Tanadgusix (TDX) Corporation owns and operates a wind power plant on St. Paul Island that was built in 1999. It proposes adding two Vestas V27 turbines to increase energy output.

TDX contracted with DOWL Consulting Engineers; with Dr. Doug Veltre, an anthropologist; and with Declan Troy, a field biologist and ornithologist, to prepare sections of the required environmental assessment. In preparation of the environmental assessment, two alternatives were evaluated: build and no build.

The build alternative would result in the installation of two Vestas V27 turbines and ancillary equipment to meet planned future development at the POSS Camp. The no build alternative would result in abandonment of development plans for the POSS Camp.

Based on data collected during preparation of the environmental assessment and the site surveys conducted, expanding the existing wind power plant would not cause any significant adverse environmental effects.

Chapter 1: Introduction

The St. Paul Wind Power Plant Expansion Project is proposed by Tanadgusix (TDX) Corporation to increase the output of the current wind power plant.

TDX owns and operates the existing wind power plant on St. Paul Island (see plate 1-1) located on Tract P-1 (Sec 17, T35S, R131W, Seward Meridian), approximately three miles south of the city of St. Paul (see figure 1-2), and north of the airport. It is expanding the plant to include two more turbines in order to generate an additional 500 kilowatts of energy.

The proposed action requires preparation of an environmental assessment for Department of Energy (DOE) approval as required by the National Environmental Policy Act.

This document includes four chapters:

Chapter 1 – A description of purpose and need, background, and public scoping actions.

Chapter 2 – Identification of the proposed action and the no action alternative.

Plate 1-1. *St. Paul Wind Turbine (left) and POSS Camp (right). The St. Paul airport is to the right of POSS Camp.*

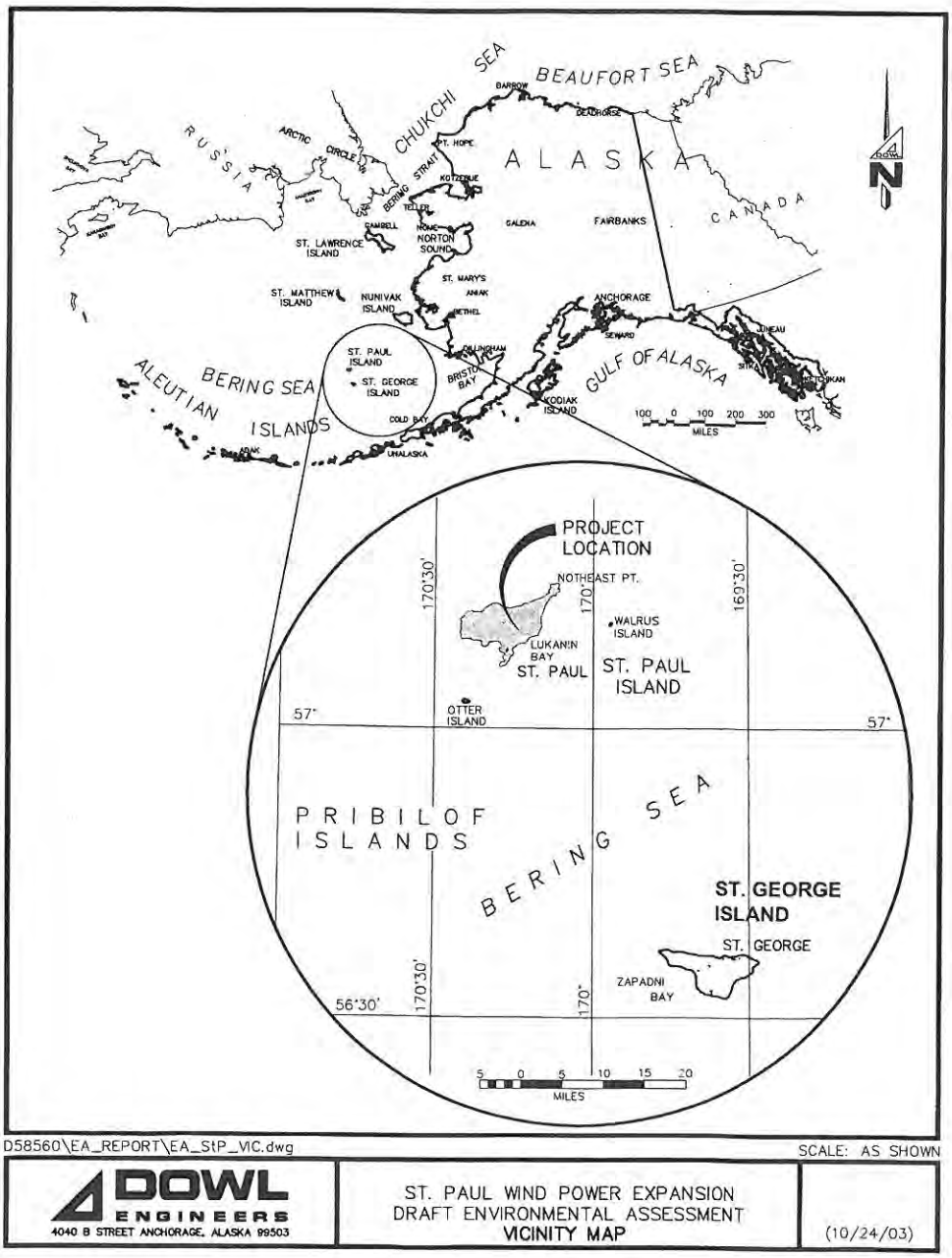


Figure 1-2. *Project site.*

Chapter 3 describes the existing environments for physical, social, and biological resources and any environmental effects that could result from the project.

Categories under physical resources are:

- Geology
- Soils
- Navigable Air Space
- Air Quality
- Water Resources and Water Quality

For social resources, the categories addressed are:

- Socioeconomics
- Land Use
- Visual Resources
- Noise
- Archaeological and Cultural Resources

Biological resources categories include:

- Wetlands
- Floodplains
- Fish and Marine and Terrestrial Mammals
- Birds
- Threatened and Endangered Species
- Miscellaneous

Purpose and Need

The original wind turbine was built in 1999 to provide base load electric and thermal energy to the POSS Camp, an industrial facility that presently includes office space for a contracted federal government project, the airport and airline offices, crew housing quarters, and equipment repair facilities. The 550 kilowatt (kW) wind power plant provides thermal energy to heat the POSS Camp and excess energy from the wind turbine is used to produce hot water, including producing heat for potable water.

To fulfill its local economic development mission, TDX has planned a variety of new commercial activities to be located in the underutilized POSS Camp building. Most of the commercial activities that are planned for the POSS Camp involve fish processing and storage facilities, which would include building a freezer.

Development of these new commercial activities is dependent upon the availability of abundant, low-cost electric power and facility heating. The capacity of the existing wind power plant was sized to meet the current electrical and heating load and is insufficient to meet the projected demand—approximately 500 kW beyond current capacity. In addition, TDX has been negotiating with the city of St. Paul for the long-term provision of wind-generated electricity.

Background

Until the 1960s, the economy of St. Paul Island was forged by nearly a century of fur seal harvesting, first under the rule of Russia, and then under the custodial auspices of the United States Government. Nearly 20 years after the Fur Seal Act of 1966, the Aleuts became self-governing and turned their attention to building an economy separate from the harvest of fur seals. Fishing became a primary interest, and an investment in an onshore processing plant was made. Tourism also became a focal point, and tours were developed to attract birders from around the world to view the many avifauna found on the island during spring, summer, and fall.

Today, the St. Paul community relies heavily on the commercial fishing industry. For the past four years, it has suffered from a poor economy in conjunction with reductions in the commercial crab fleet quotas. To attract more business, TDX has developed plans to offer additional services to the commercial fishing industry in the form of an onsite flash freeze storage facility.

TDX has operated the St. Paul Wind Power Plant since 1999. It is a 550-kW wind power plant that provides base load electric and thermal energy to the POSS Camp. POSS camp is the site of the airport and airline offices, crew housing quarters, and equipment repair facilities. The camp also provides office space for a confidential Federal government project.

In addition to providing thermal energy to heat the POSS Camp, excess energy from the wind turbine is used to produce hot water. Heat for potable water also is provided by the excess energy.

The complete wind turbine system includes dual Volvo diesel generators, a synchronous condenser, a binary dump load, one Vestas V27 wind turbine, and an insulated, 6,000-gallon thermal hydronic heating system. The hydronic tank includes electrical dump load immersion heaters, heat exchangers for each diesel engine, and domestic heating heat exchanger, and pumps and controls for zone heat distribution. System components were sized to meet the current needs of the POSS Camp.

PUBLIC SCOPING

Currently, only informal public scoping has been done for this project.

Chapter 2: Description of Proposed Action and Alternatives

Proposed Action

The proposed action consists of erecting two additional wind turbines to be located to the north and south of the existing wind turbine (see plate 2-1 for aerial view and figure 2-2 for a drawing of the site). Expansion of the existing wind power plant will consist of design, acquisition, and construction of the additional wind turbines and related equipment.

Preliminary engineering design to assure proper integration with the existing wind power plant is in progress.

TDX proposes expanding the existing wind power plant to include two additional Vestas V-27 wind turbines. An Industrial wind turbine, the Vestas V-27 produces 3-phase power and has a generator rated at 225 kW with winds of 32.6 mph. It has a range of 760 to 1008 RPM and an output of 480 VAC/3-phase/60 Hz.

The manufacturer specifications for the Vestas V-27 indicates that wind speeds averaging 13 mph produce a yearly output of 458, 000 kWh. In the proposed project area, wind speeds average 18 mph (approximately 15 knots).

Expansion of the existing wind farm is needed to meet projected increased demands at the POSS Camp. Components of the new turbines will be sized appropriately for expected demand. Two additional wind turbines would produce another 500 kW of power. The design and specifications for the two new turbines will be compatible with the existing turbine.

The addition of the two new wind turbines will require installation of a larger generator. However, the new generator will not increase fuel consumption. When the existing wind turbine was put into operation, fuel consumption dropped. With the addition of two wind turbines, another drop in fuel consumption most likely would occur.

The current generator is located in a shelter near the wind turbine. The existing diesel control shelter, diesel generator shelter, and thermal bay will support the proposed wind turbines, as well as the proposed generator.

The existing 3,000 gallon diesel storage tank is sufficiently sized to support the current wind turbine because no new diesel generation is proposed.

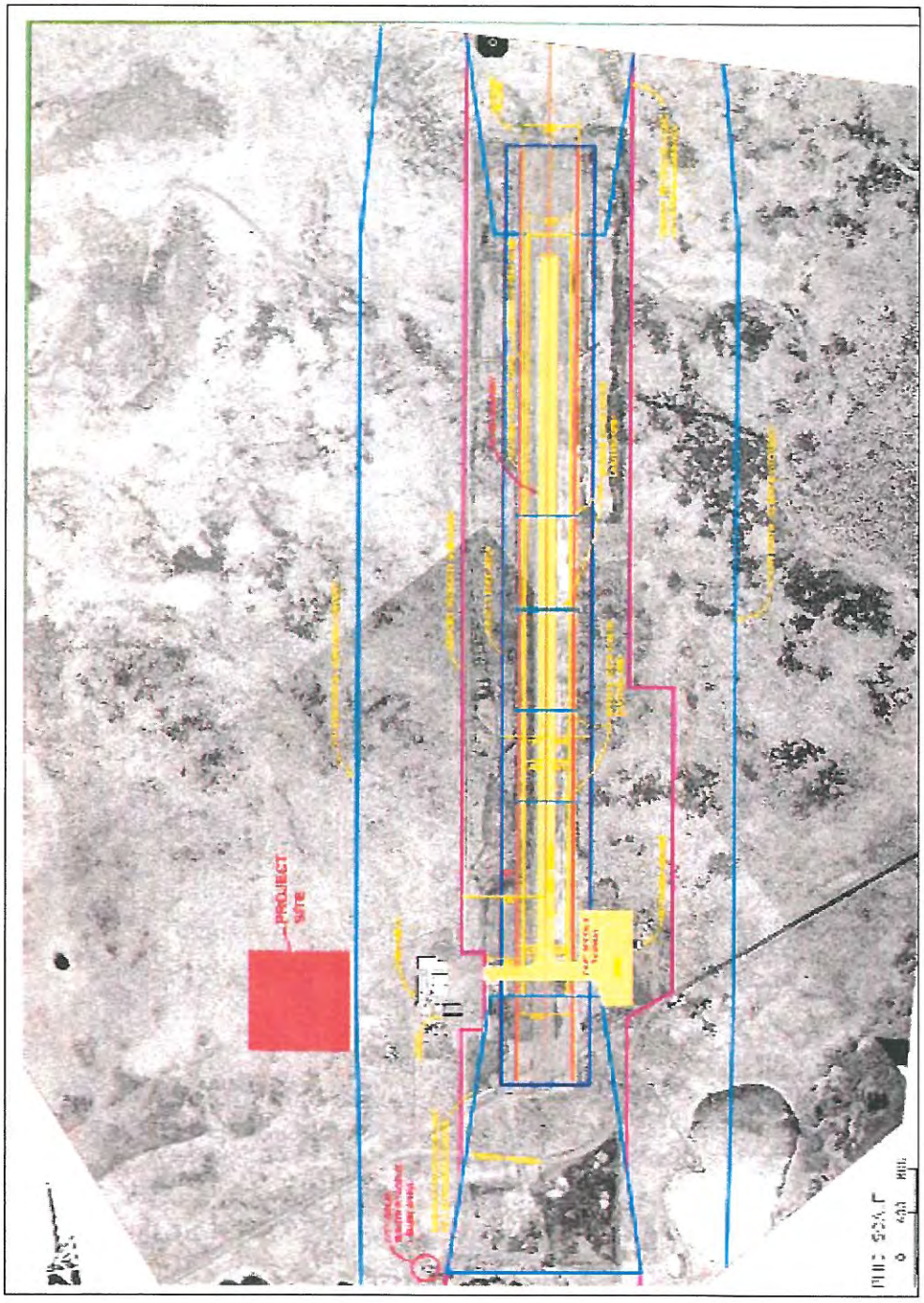


Plate 2-1. *Aerial view of project area with project site marked. Prepared by DOWL Engineers.*

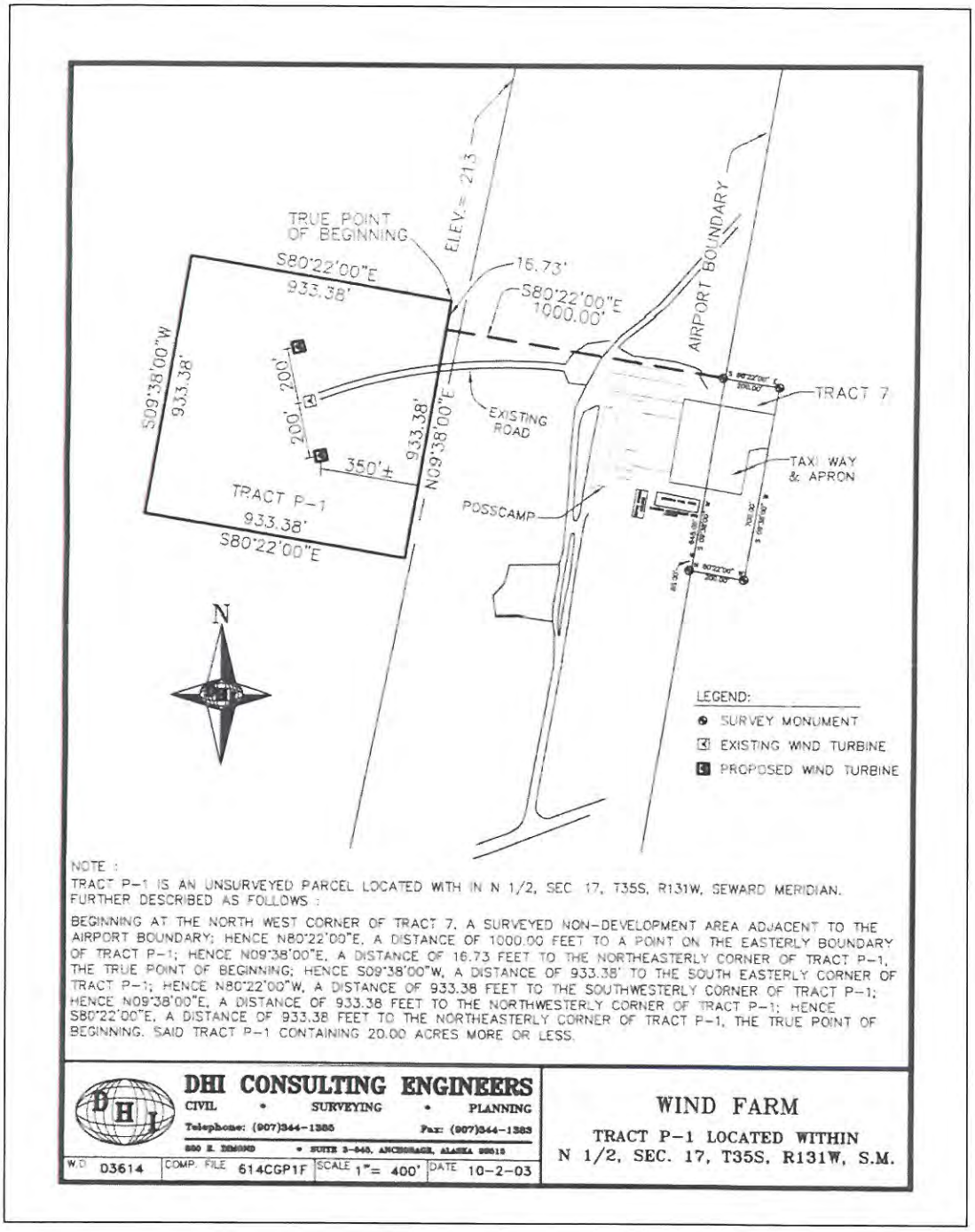


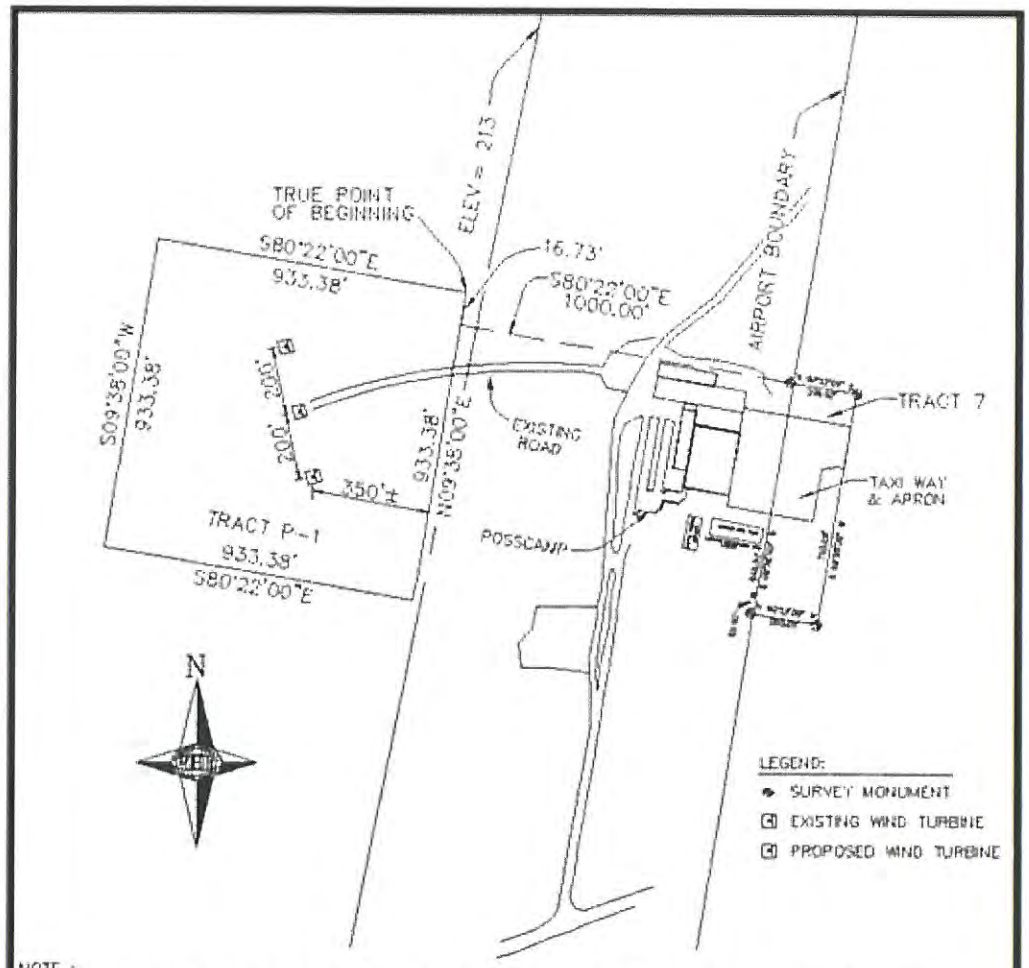
Figure 2-2. *Original site plan prepared by DHI Consulting Engineers.*

The configuration (see figure 2-3) of the proposed wind farm sites the two new turbines north and south of the existing turbine and will require excavation of less than an acre of land. Once the design is complete, the additional turbines, switchgear, controls, and other necessary equipment will be obtained and installed.

No Action Alternative

If chosen, the No Action Alternative would mean that TDX would be unable to move forward with future expansion projects planned for POSS Camp. This is due to the fact that the current power generated by the existing wind power plant is completely consumed by the current activities at the POSS Camp.

The No Action Alternative would not meet the purpose, nor satisfy the need for, the proposed project.



NOTE :
TRACT P-1 IS AN UNSURVEYED PARCEL LOCATED WITH IN N 1/2, SEC. 17, T35S, R131W, SEWARD MERIDIAN, FURTHER DESCRIBED AS FOLLOWS :

BEGINNING AT THE NORTH WEST CORNER OF TRACT 7, A SURVEYED NON-DEVELOPMENT AREA ADJACENT TO THE AIRPORT BOUNDARY; HENCE N80°22'00"E, A DISTANCE OF 1000.00 FEET TO A POINT ON THE EASTERLY BOUNDARY OF TRACT P-1, HENCE N09°38'00"E, A DISTANCE OF 16.73 FEET TO THE NORTHEASTERLY CORNER OF TRACT P-1, THE TRUE POINT OF BEGINNING; HENCE S09°38'00"W, A DISTANCE OF 933.38' TO THE SOUTH EASTERLY CORNER OF TRACT P-1; HENCE N80°22'00"W, A DISTANCE OF 933.38 FEET TO THE SOUTHWESTERLY CORNER OF TRACT P-1; HENCE N09°38'00"E, A DISTANCE OF 933.38 FEET TO THE NORTHWESTERLY CORNER OF TRACT P-1; HENCE S80°22'00"E, A DISTANCE OF 933.38 FEET TO THE NORTHEASTERLY CORNER OF TRACT P-1, THE TRUE POINT OF BEGINNING. SAID TRACT P-1 CONTAINING 20.00 ACRES MORE OR LESS.

DHI CONSULTING ENGINEERS
CIVIL • SURVEYING • PLANNING
Telephone: (907)344-1388 Fax: (907)344-1883
308 B. [illegible] • [illegible], ALASKA 99615

WIND FARM
TRACT P-1 LOCATED WITHIN
N 1/2, SEC. 17, T35S, R131W, S.M.

W.O. 03614 | COMP FILE 614CGP1F | SCALE 1"= 400' | DATE 4/25/05

Figure 2-3. *Plan showing location of two new wind turbines.*

Chapter 3: Existing Environment and Environmental Effects

Physical Resources

GEOLOGY

Existing Environment

St. Paul Island was created approximately 13 thousand years ago during the last major glacial meltdown.

Plate 3-1. *Southwest Point, an example of the island's geology.*

The island is composed primarily of basalt flows and various kinds of pyroclastic debris of Pleinstocene and Recent Age. There is no evidence of any glaciation affecting the existing surface. Many of the volcanic landforms are relatively fresh; suggesting that they were formed as recently as a few thousand years ago. Extensive sand dunes have formed in places, particularly on the northern and northeastern portion of the island.

Although flow rocs constitute the bulk of the island, it is apparent that in many places the flows are relatively thin and are separated by layers of pyroclastic material or scoriaceous rocks. Relatively recent volcanic ejecta also cover portions of St. Paul Island. The basaltic lava flows exposed on the surface have been weathered in place to boulder rubble by frost driving (breaking up bedrock by cycles of freezing and thawing).

Plate 3-2. *Looking northwest from the access road to the wind turbine toward the navigational dome on Lake Hill (on the horizon in the center of the picture). Undisturbed tundra extends from the road to Lake Hill.*

The topography of the island generally is low rolling plateaus punctuated with extinct volcanic

peaks. In the project area, topography ranges from flat to undulating.

Environmental Effects

Installation of two new wind turbines will not impact the geology of the area.

SOILS

Existing Environment

The proximity of the site of the wind power plant to areas where prior geotechnical investigations have been performed negated conduct of a new survey. It can be assumed that the soils found during the two previous geotechnical investigations, conducted nearly 10 years apart, would be similar in nature to the soils found within the project area.

The first geotechnical investigation was conducted in August 1994 by the Alaska Department of Transportation and Public Facilities (ADOT&PF) as part of an airport improvement project (see appendix 1). ADOT&PF drilled test pits and test holes at even intervals throughout the airport property. The southeast corner of the airport, around the airport apron, and south of the apron were excluded from the investigation.

The generalized soils profile shows approximately 0.5 feet of organic topsoil over 0.5 to 0.4 feet of organic silty sand. These soils transitioned into 2.0 to 6.0 feet of brown silt, sandy gravel, and/or sandy silty gravel. Test pits typically were advanced to basaltic bedrock, usually to a depth of 4.0 to 11.0 feet. Large boulders were encountered occasionally in some of the test pits.

The water table was encountered in a few of the test pits, and generally was observed to be perched above the bedrock. Surface water seeping into the test pits was found only sporadically. Groundwater levels fluctuate seasonally with the precipitation and runoff conditions. The general direction of the surface runoff is to the southeast.

In April 2003, ADOT&PF contracted with DOWL to perform a geotechnical investigation for the St. Paul Airport Pavement Project. Thirty-seven test borings were drilled, sampled, and logged to bedrock (auger refusal or five feet of continuous rock) at depths ranging from 11.5- to 30-feet between April 11 and April 24. Sixteen additional test pits were excavated in the safety areas to bedrock and at depths ranging from 1.5 to 12 feet.

During the 2003 geotechnical investigation, soil borings were done at the TDX apron, which is adjacent to the POSS Camp. The generalized soil profiles for this specific area show fill material over native soils and bedrock.

The fill material is as shallow as 2.5 feet and, in some areas, as deep as 5 feet. The composition of the fill was not consistent. Poorly and well-graded sands with silt were observed in the upper portion of the soil column. These soils then were followed by silty sands, poorly graded sands, and silt. Traces of organics were found at about 5 feet. Bedrock was present at depths between 12- and 20-feet below the surface. The fill typically is medium dense with some frost susceptibility. No groundwater was observed in any of the test borings.

It is important to note that during the installation of the first wind turbine, volcanic rock was encountered at a shallow depth to the west of the existing wind turbine location.

Environmental Effects

Installation of two new wind turbines will displace approximately 1500 cubic yards of soil. Material removed from the site will be used on the surrounding roadways for maintenance. A portion of the soils removed could be used by local residents for landscaping projects within the city of St. Paul.

The site of the wind power plant is relatively flat. The intent is to match existing ground once the two new wind turbines and associated equipment are installed. Neither the Proposed Action, nor the No Action Alternative are anticipated to have an effect on the geology and soils of the project area.

NAVIGABLE AIR SPACE

Existing Environment

TDX's St. Paul wind power plant is located near the southwest end of the St. Paul Airport. The St. Paul Airport consists of a paved runway (6,500 feet by 150 feet) and a paved taxiway and apron. As described next, there are several protection zones surrounding the runway.

OBSTACLE FREE ZONE (OFZ)

The OFZ is a three dimensional volume of airspace that provides protection for the transition of aircraft to and from the runway. It extends 200 feet beyond either end of the runway and 200 feet on either side of the runway centerline.

RUNWAY SAFETY ZONE (RSZ)

A defined surface surrounding the runway prepared, or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The RSZ for the St. Paul Airport is 250 feet on either side of the runway centerline.

RUNWAY PROTECTION ZONE (RPZ)

RPZs are a trapezoidal area at the end of a runway designed to enhance

the protection of people and property on the ground in the event of an aircraft landing or crashing beyond the end of the runway.

Environmental Effects

The project area is outside the airport's flight path and the OFZ, RSZ, and RPZ. A Federal Aviation Administration Notice of Construction has been completed and submitted to the FAA. This coordination with FAA will help ensure that there are no conflicts with the navigable airspace.

The No Action Alternative would have no effect on the navigable air space in the project area.

AIR QUALITY

Existing Environment

Emissions in the project area are limited to vehicles, airplanes, and some occasional heavy equipment. These emissions are considered negligible given the distance of the project area to the populated area on St. Paul Island, the physical location of the island, and its climatology.

Wind speeds on the island can range from an average of 1.7 mph (1.5 knots) to 81 mph (71 knots). In the project vicinity, wind speed averages 18 mph (approximately 15 knots).

The proposed project is located within an attainment area for air quality allowing for moderate growth with air quality maintenance according to the Alaska State Implementation Plan.

Environmental Effects

During project construction, heavy equipment exhaust fumes may temporarily decrease air quality in the immediate vicinity. Any decrease in air quality because of emissions from the diesel plant is expected to be negligible given the wind velocity in St. Paul. Even a slight decrease in air quality should not be significant enough to place the area into non-attainment. Therefore, no long-term environmental effects are expected from expansion of the wind power plant.

The No Action Alternative would not affect air quality in the project area.

WATER RESOURCES AND WATER QUALITY

Existing Environment

Water available to the city of St. Paul is supplied from seven deep wells located approximately one mile from the airport. Freshwater from rain infiltrates porous volcanic substrata and perches atop the ocean saltwater beneath. Consistent rainfall events and careful well withdrawals keep saltwater from wicking upward and contaminating freshwater drinking supplies. Water service reaches all residents through underground pipes.

Environmental Effects

Less than one acre will be disturbed by the construction of the two wind turbines, so National Pollutant Discharge Elimination System requirements would not be required for this project. The U.S. Environmental Protection Agency requires a Storm Water Pollution Prevention Plan (SWPPP) and a Notice of Intent to be submitted if more than one acre of land is disturbed during construction. Because the project would not impact an area greater than one acre, a Notice of Intent would not be filed.

Furthermore, the distance of the wind power plant from water bodies and from the Bering Sea lessons the risk to water quality or local drinking sources. Therefore, no adverse environmental effects to water resources or to water quality would occur during construction activities for the wind power expansion project.

The No Action Alternative would not affect water resources or water quality in the project area.

Social Resources

SOCIOECONOMICS

Existing Environment

St. Paul is a 2nd class city incorporated in July 1971. Located at approximately 57.12 degrees North Latitude and –170.28 degrees West Longitude (S25, T35S, R132W, Seward Meridian), the city encompasses 3 square miles on St. Paul Island, as well as Walrus and Otter Islands. Basic community services and facilities are managed by a seven-member city council and a city manager. The city provides basic services such as street maintenance, police protection and jail facilities, solid waste collection and disposal, fire protection, power, water, bulk fuel, port operations, and land use planning and zoning. According to the state of Alaska, the population in 2000 was 532 people of which approximately 86 percent are Alaska Native.

TDX is the village profit corporation formed in July 1973 under provisions of ANCSA. One of its primary missions is to identify and develop business opportunities that will increase economy on the island. Expansion of services to support commercial fishing and tourism are just two opportunities targeted by the corporation.

Environmental Effects

Expansion of the wind power plant will positively impact the community, temporarily creating jobs for the local labor force during construction and potentially providing employment for a part-time employee at the wind power plant when construction ends. Of greater benefit are the new jobs that could arise from the planned development at the POSS Camp.

No direct impact to the local economy would occur as a result of implementing the No Action alternative. However, the No Action Alternative would prevent the expansion of the commercial activities at the POSS Camp, which would have a negative impact on the local economy.

LAND USE

Existing Environment

The wind power plant is in an area zoned light industrial. The site is owned by TDX Corporation; subsurface rights are owned by The Aleut Corporation. The airstrip northeast of the wind power plant is owned or leased by the state of Alaska.

The island of St. Paul lies completely within the St. Paul Coastal Management District. Consultation with the Alaska Department of Natural Resources, Office of Project Management and Permitting has determined that the project is not subject to an Alaska Coastal Management Program review.

Environmental Effects

This project is an expansion of an existing wind power plant, which is consistent with the land use in this area. Therefore, neither the Proposed Action nor the No Action Alternative would have an effect on land use in the project area.

VISUAL RESOURCES

Existing Environment

As stated previously, the project site and adjacent properties are zoned light industrial. The site of the wind power plant is bounded to the east by the POSS Camp and airport runway. To the west is the U.S. Coast Guard Loran C Station.

There are no homes, churches, or schools in the area. Nor is the vicinity used for recreation.

Environmental Effects

Expanding the wind power plant to include two additional turbines would be consistent with the aesthetic value of existing facilities within the project area.

Neither alternative under consideration would result in impacts to the aesthetic value of the project are

NOISE

Existing Environment

The Vestas V-27 wind turbine produces approximately 96.5 dBA (decibel) of noise when operational.

Plate 3-3. *The Vestas V-27 wind turbine. In the background, slightly left of the turbine, the USCG's communication tower is visible.*

Commuter airplanes taking off and landing at the airport produce noise at 130- to 150-dBA, which is higher than the noise level of the wind turbine. Cargo planes generate even higher decibel levels.

Environmental Effects

Although the addition of two turbines to the wind power plant will increase the noise level when operational, any environmental impacts would be negligible for several reasons. First, there are no sensitive receptors (i.e., housing, church, and school) in the project area. The wind power plant is sited in an area that is virtually uninhabited—it lies 3.5 miles from the city. Second, the turbines operate only when wind conditions are optimal. Typically, there are higher winds in winter than summer, which means the turbines do not operate each day.

The No Action Alternative would have no effect on noise levels in the project area.

ARCHAEOLOGICAL AND CULTURAL RESOURCES

Anthropologist Douglas Veltre, Ph.D., conducted an on-site survey of possible archaeological and cultural resources in the project area during a summer 2003 field trip to St. Paul Island.

Existing Environment

The project area lies immediately to the west of the north-south road, which passes just to the west of the airport complex of buildings. Dr. Veltre's field procedures included walking over the area, as well as additional surrounding ground, several times. He examined the ground surface for any indications (e.g., non-natural surface irregularities, surface artifacts, and vegetational peculiarities) of cultural materials or activities. No subsurface testing of the project area was undertaken.

In addition to field examination of the project area, documentary sources

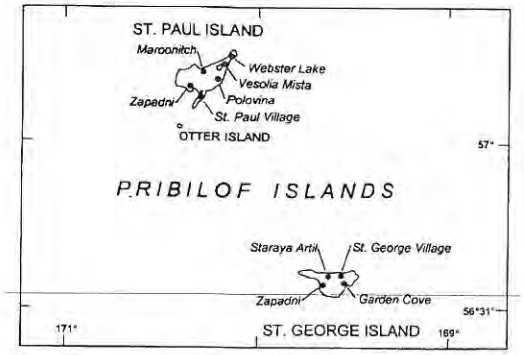
concerning the history of St. Paul Island were consulted, and results of previous archaeological research on the island were examined. The conclusions offered next are based on consideration of all of these sources.

HISTORICAL BACKGROUND

Oral tradition holds that the Pribilof Islands (St. Paul Island and St. George Island) were known to the Aleuts of the Aleutian Islands before the arrival of Russians in the region beginning in 1741. It does not appear that Aleuts—or any other Alaska Natives—settled on the islands or used them to any appreciable extent before Russian contact.

It was not until 1786 and 1787 that St. George Island and St. Paul Island, respectively, were located by Russian fur hunters who had spent years searching the waters of the Bering Sea for the islands that they expected to be there to serve as the breeding grounds for the Northern fur seal. Immediately after finding the Pribilofs, Russian fur hunters brought Aleut laborers to the islands to harvest the fur seals, first on a seasonal basis and later to live year-round in villages on each island. In those years before 1800, there existed multiple settlements on both St. Paul and St. George (plate 3-4), but these were consolidated into single villages (with outlying work camps) on each island by the early 1800s.

Plate 3-4. *Current and former settlements on St. Paul and St. George islands.*



Since nearly the sole reason Russians and Aleuts came to St. Paul Island was to harvest fur seal pelts, it is not surprising that all of the settlements and work camp locations were at, or very close to, the seal hauling areas and rookeries.

Originally, foot trails undoubtedly connected these, but in most areas later road development rendered such trails obsolete, their locations becoming lost over the years in the tundra and sand dunes.

PREVIOUS ARCHAEOLOGICAL STUDIES

The most comprehensive review of archaeological information concerning St. Paul Islands is that done by Veltre and McCartney (1994). In their report, the authors review the history of archaeological investigations on the island and present an inventory of all known and reported sites, including historical documentation concerning each.

Some of their overall conclusions (but not many individual site details) also are presented in Veltre and McCartney (2002).

The known and reported archaeological sites on St. Paul Island are shown in plate 3-4.

Polovina is the closest archaeological site to the project area (see plate 3-5). The Polovina site is more than 3 miles from site of the wind power plant expansion project.

Of these sites, only the Vesolia Mista site has not been found, perhaps because of shifting sand dunes on that part of the island. The remaining sites all show generally similar characteristics: vegetation is usually quite lush compared to areas away from the sites themselves; most former houses and buildings are very

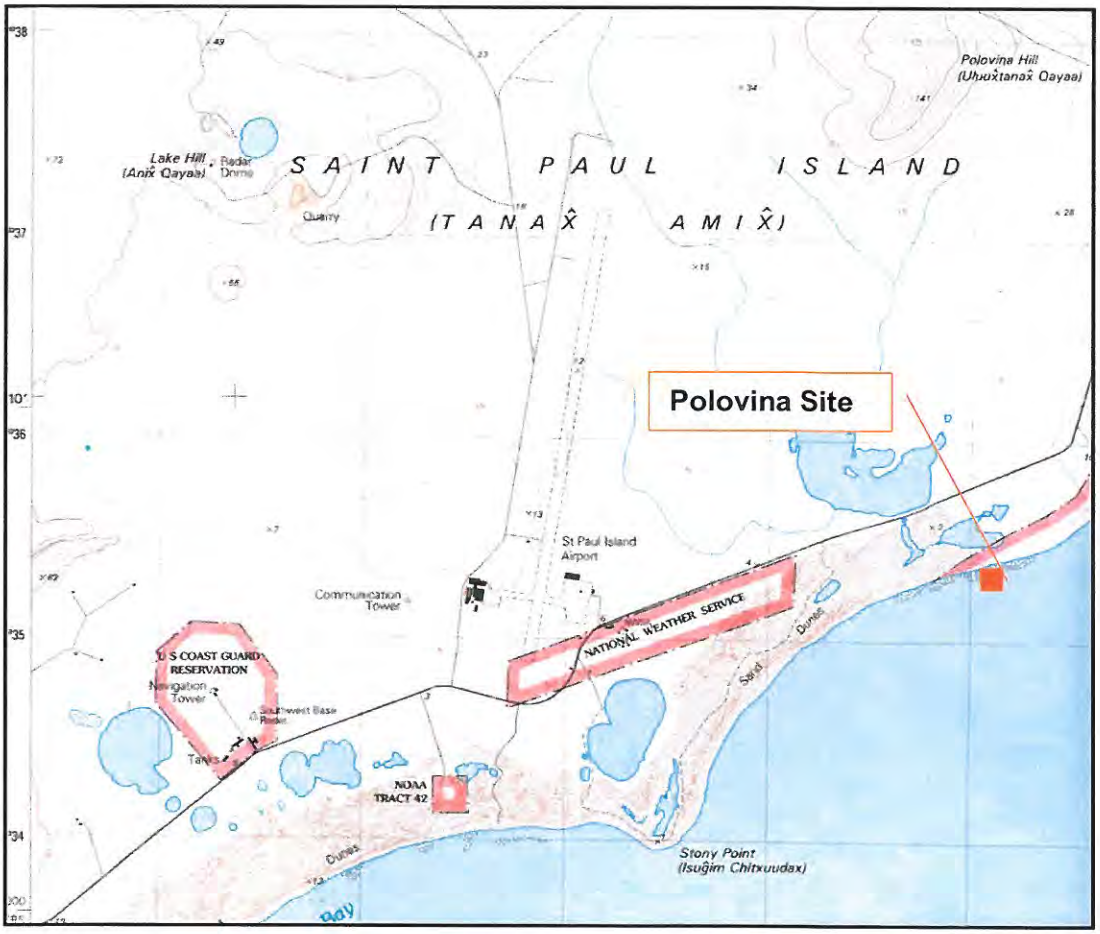


Plate 3-5. *The former settlement at Polovina (marked) is the closest archaeological site to the project area. Also shown is the location of U.S. Coast Guard facility, the airport, Weather Service buildings, and Lake Hill. Note that the existing wind turbine is incorrectly labeled on this USGS map as "Communication Tower."*

apparent from their raised sod-block lower walls; most structures have floors noticeably below the present ground surface; long whale bones occasionally protrude from the ground in and near the structures' remains. Importantly, these sites are very easy to see today; thus, it may be concluded that any appreciable disturbance or alteration of the fragile tundra vegetation takes more than centuries to heal completely.

Of all of the archaeological sites identified, Zapadni is the largest, with over 30 structural features clearly visible on the ground surface today. It was this site, located several miles from the wind expansion project location, which served as the focal point for large-scale excavations in 2000 and 2001 (Veltre and McCartney 2000, 2001). Those excavations produced a large collection of artifacts, including traditional, precontact-style Aleut stone and bone tools as well as glass, metal, and other items of obvious Russian origin.

To date, no demonstrably precontact age (i.e., pre-Russian or pre-1787) archaeological remains have been located on St. Paul Island, and it is considered unlikely that any are, in fact, present on the island. The most likely reason for this absence is that the Pribilof Islands—unlike all other islands in Alaska—lie well out of view of all other land areas of Alaska or the Russian Far East. This visual isolation, therefore, appears to have served as an effective means for preventing any purposeful (as opposed to accidental, such as shipwrecked) human use of the islands until the historical period.

It is important to note that all of the oldest settlement and camp locations found on St. Paul are in close proximity to the fur seal resources of the island. The only cultural features elsewhere on the island appear to be for special purposes and date to the twentieth and present centuries.

These include defunct reindeer corrals near the north end of the runway and in Lake Hill, recent and current radio antennas and other navigational aids (such as at the U.S. Coast Guard Loran Station, at Lake Hill, and at Southwest Point), and facilities such as the Weather Service buildings southeast of the airport and the airport buildings themselves. Therefore, most areas of the island away from the immediate coast show no signs of cultural remains of any age.

ON-SITE SURVEY RESULTS

Several areas within and around the project area have been sites of recent development and other activity. Except these areas, the ground surface throughout the project area and the land elsewhere in the general region are vegetated with typical tundra plants and show no indications

of any cultural activities. No surface artifacts, ground disturbances, or other archaeological indicators of human activity were observed in the area.

Environmental Effects

Based on historical documentation, the results of previous archaeological work on the island, and the present on-site examination, there is no reason to expect that significant cultural materials exist in the project area or in the immediate surrounding region. The project area is not one that would have had any particular appeal to the early Russians or Aleuts on the island. Except for the island's road system, the only recent use of this part of the island appears to be directly related to airport activities.

Neither alternative under consideration would result in impacts to the archeological value of the project area.

Biological Resources

WETLANDS

Existing Environment

In October 1996, the U.S. Army Corps of Engineers evaluated the function and value of the wetlands within the airport vicinity, which includes the proposed project site (see appendix 2). Wetlands were investigated and classified according to the methodology described in *Methodology for Wetland Delineation and Site Characterization for FAA Stations*, Alaska (1996). Based on the evaluation, two areas located south of the airport and the project site were identified as wetlands having low value. However, no wetlands were identified in the project area.

Environmental Effects

The proposed project is well outside the identified wetlands area. Therefore, neither the proposed action nor the No Build alternative would impact the wetlands.

FLOODPLAINS

Existing Environment

The wind power plant is approximately 3,000 feet from the south shore of the island, and 44 feet above sea level. Based on the 1994 ADOT&PF St. Paul Airport Improvement Project it appears that there is not a flood hazard in the area of the airport. Historical information did indicate that there had been some coastal flooding caused by storm surges in the area south of the village, but such events did not affect the airport.

Environmental Effects

There are no floodplains in the vicinity of the project site and it does not appear that the project site is located within a flood hazard area; therefore, neither the Proposed Action nor the

No Action Alternative would affect floodplains.

COASTAL ZONE MANAGEMENT

Existing Environment

The island of St. Paul lies completely within the St. Paul Coastal Management District.

Environmental Effects

Consultation with the Alaska Department of Natural Resources Office of Project Management and Permitting has determined that the project does not require completion of a Coastal Zone Questionnaire.

The No Action Alternative would not impact the coastal zone

FISH AND MARINE AND TERRESTIAL MAMMALS

Existing Environment

FISH

Anadromous and resident fish are present in the Bering Sea located approximately 5,000 feet from the project site. Local populations of fish species include Pollock, Pacific cod, fin sole, Pacific Ocean perch, turbot, sablefish, halibut, small flounders, herring, squid, blue king crab, Tanner crab, Korean hair crab, and red king crab. The Bering Sea waters also provide migratory passage for all five of the Pacific salmon species. There are no fish streams within the proposed project area.

MARINE MAMMALS

Northern fur seal, the number of which are in decline, migrate to the Pribilof Islands for breeding and pupping. Seal breeding and sunning beaches are located on the southern tip and along the north and northwest shores of the island approximately three miles from the project site.

Plate 3-6. *Northern fur seal lounging at Reef Point rookery, more than 4 miles from the project site (picture taken August 2003).*

TERRESTRIAL MAMMALS

A herd of reindeer, Arctic fox and the Pribilof shrew are found on the island. The reindeer herd roams freely on the island, as do Arctic fox. Reindeer forage for food in the valleys and higher elevations of the island. Arctic fox typically stay close to the cliff areas for their food source. Pribilof shrews burrow in soft soil.

Environmental Effects

The St. Paul Island Wind Power expansion project will not impact fish, marine mammals, or terrestrial mammals.

Plate 3-7. *Part of the island's reindeer herd (picture taken June 2003).*

BIRDS

Alaska field biologist and ornithologist Declan Troy performed an onsite survey of the project and surrounding area during a field trip to St. Paul Island in August 2003.

Existing Environment

Spectacled Eider has occurred in the Pribilof Islands during winter; however, Saint Paul is well south of the southern limit (61°N) of the normal winter range (Petersen et al. 2000). Steller's Eider occurs more regularly in small numbers, primarily during the winter. Most or all of these are likely of the Russian breeding population. It is unknown if any Alaska breeding Steller's Eiders (i.e., members of the listed population) are present. Most of the world's Steller's Eiders migrate through the Bering Sea but generally stay close to the Alaska Peninsula, Bristol Bay, and along the eastern coast (Larned 2003). Neither of these species would be expected in the project area as no water bodies are present at the project site and both species are largely restricted to marine waters during the periods when they might occur around St. Paul Island.

St. Paul Island is renowned for its seabird populations. Most bird colonies are restricted to the coastal fringe, in particular where cliffs provide nesting sites for seabirds. Inland sites on St. Paul Island have a depauperate avifauna.

The most common terrestrial birds breeding on Saint Paul are Rock Sandpiper (*Calidris ptilocnemis*), Lapland Longspur (*Calcarius lapponicus*), Snow Bunting (*Plectrophenax nivalis*), and Gray-crowned Rosy Finch (*Leucosticte tephrocotis*). The local populations of Rock Sandpiper (*Calidris p. ptilocnemis*) and Grey-crowned Rosy Finch (*Leucosticte tephrocotis umbrina*) are of interest due to their rather restricted distributions. This subspecies of Rosy Finch (breeds only on Bering Sea islands of the Pribilof and St. Matthews groups and in the Aleutians.

Plate 3-8. *Rosy finch.*

The breeding range of Rock Sandpiper is restricted to the Pribilof and St. Matthew groups and St. Lawrence Island. Rosy Finches on Saint Paul breed primarily near cliffs and human habitation (Hanna 1922) so are unlikely to nest on the project site (but do occur around the facilities at the airport). The highest densities of breeding Rock Sandpipers occur in the drier upland portions of the island (Hanna 1921) but it does occur in Lowland Forb Tundra such as around the project site), at least early in the summer before the vegetation becomes too rank (Lee Tibbitts USGS, personal communication).

The most likely breeding species around the project site are expected to be Lapland Longspur and perhaps Rock Sandpiper. Additional species such Snow Bunting (*Plectrophenax nivalis*) and Gray-crowned Rosy Finch (*Leucosticte tephrocotis*) would be expected where the tundra has been disturbed, such as along access roads and near existing facilities especially post-breeding.

No aggregations of birds are known to occur nor are expected at the project site. The nearest concentrations are found on freshwater ponds approximately 1 km SE of the proposed turbine sites. Gulls primarily Black-legged Kittiwakes (*Rissa tridactyla*) and Glaucous-winged Gulls (*Larus glaucesens*) loaf in these ponds. Most movement of these birds appears to be directly between the coast and the ponds and is not thought to occur trough the project areas. A landfill that was located approximately 1 km from the project site is being relocated to another location on the island. Incineration minimizes the availability of food at the project site; consequently, it is not an attractant to gulls.

Environmental Effects

Only low numbers of waterfowl have been reported among fatalities at wind farms (Erickson et al. 2002). This may reflect the location of turbines in habitat little used by waterfowl; however, Dirksen et al. 2000 found that diving ducks (mostly *Aythya* spp.) appear to detect and avoid wind turbines, even at night, showing avoidance responses 100-200 from the turbines. Some mortality of Common Eiders (*Somateria mollissima*) occurred at a coastal wind farm in England (c.f. Lowther 2000). Given the low number of Spectacled and Steller's eiders around Saint Paul Island and the absence of suitable habitat near the proposed turbines, impacts of the project on these species is expected to be negligible.

Wind turbines are perceived as posing risks to birds. Indeed, poorly sited wind farms have resulted in substantial bird mortality. In particular, several hundred raptors are killed each year at a wind farm in

Altamont Pass, California (Hunt 2002). Substantial raptor mortality has also been recorded at a wind farm in Spain near Gibraltar (c.f. Lowther 2000). These installations have proved the exception in terms of the prevalence of raptors amongst fatalities. At most sites, raptor mortality at wind turbines is relatively infrequent. Monitoring at many installations indicates that wind turbines result in the deaths of 1-3 birds/turbine/year (e.g., Erickson et al. 2003, Johnson et al. 2002, 2003; Thelander and Rugge 2001, Young et al. 2003). Combining studies yields an overall average of 2.19 birds/turbine/year including 0.033 raptors/turbine/year fatalities (Erickson et al. 2001). Excluding California these averages are reduced to 1.83 birds including 0.006 raptors/turbine/year.

Although examples of mortality events involving of most groups of birds are known, passerines comprise over 80% of reported fatalities (Erickson et al. 2001) and approximately half of these involve nocturnal migrants. Risks of bird strikes increase in areas with large numbers of raptors or large numbers of nocturnal migrants. Raptors occur infrequently in the Pribilof Islands. Passerines are probably the most numerous birds at the project site but large numbers of nocturnal migrants are not expected. Situations conducive to bird strikes include:

- **Movement corridors**
  Birds often concentrate along linear features such as coasts, rivers, and ridges especially during the day (Richardson 2000). The proposed site is removed from all such features.

- **Tower height**
  Towers (all types, not limited to wind turbines) less than 400-500 feet cause minimal mortality (Kerlinger 2000) and towers less than 300' rarely implicated in bird kills (Kerlinger 2002). The wind turbines proposed for Saint Paul are less than 200' tall.

- **Artificial perches**
  Some wind turbine designs attract birds by providing perches in formerly featureless terrain. For example, lattice towers provide numerous potential perches and are discouraged to minimize attraction of birds (Curry and Kerlinger 2000). The turbine style to be used on Saint Paul has a solid tubular tower offering minimal perching opportunities.

- **Rotor speed**
  Available evidence suggests that mortality is greatest at turbines with faster rotors; therefore, models with slower rotors (< 35 rpm) are recommended to minimize potential bird strikes. The wind turbines to be used at Saint Paul have an operating range of 760-1008 RPM.

- **Lighting**
  Bird mortality at towers (not just wind turbines) appears to be exacerbated by lights, which, especially under adverse weather conditions. may attract and confuse migrants. General guidelines are, subject to requirements by FAA and other regulation, to minimize lights and if lights are necessary use the minimum number, minimum intensity, and only white strobes at the minimum frequency.

- **Guy lines**
  Guy lines supporting towers (not just wind turbines) may be more important than the towers they support as agents of bird strikes (Kerlinger 2002). The wind turbines proposed for Saint Paul have no guys.

Overall, most mortality at wind turbines is usually unrelated to the turbine itself but rather factors associated with generic tower kills, i.e., the poor weather in concert with lighting, guy wires, and tower height. The proposed towers minimize most of these factors, being low, without guys, without perches, and with minimum lighting. The high rotational speed of the turbine is the least bird friendly aspect of the model turbine being proposed. However, given the relatively benign location, away from the coast and known or potential bird concentration areas the risk to birds at the proposed wind turbines is expected to be low and less than the average reported for existing installations.

In addition to direct mortality some changes in bird use of the project area may be expect due to disturbance from increased human activity, turbine noise, and perhaps movement of the turbines. Leddy et al. (1999) found reduced densities of nesting birds in uplands near (within approximately 180 m) wind turbines in Minnesota.

The project also will entail construction of gravel pads to support the wind turbines and roads connecting these pads to existing facilities. In total gravel placement cover less than 1 hectare of tundra. Effects of this loss of habitat should be minimal and likely to affect nesting Lapland Longspur and perhaps Rock Sandpiper. Disruption of tundra and introduction of road edges will likely increase use of the area by Gray-crowed Rosy Finches, Snow Buntings, and Lapland Longspurs (foraging and post-breeding).

At present, electricity at St. Paul is obtained from diesel-powered generators. Greater reliance on wind generated power would be expected to reduce use of diesel. Shipping and transferring fuel poses risks to birds. In excess of 1700 birds (mostly King Eiders) were estimated to have died as an oil spill following a ship collision near St. Paul Island in 1966 (Flint et al. 1999). Although the proposed

action in isolation will result only in a modest reduction in future fuel shipments (the greatest reduction occurred with the installation of the first turbine), the potential benefits to birds may outweigh the small risk due to collisions with the turbines.

THREATENED AND ENDANGERED SPECIES

According to the list of endangered, threatened, and candidate species in Alaska found on the U.S. Fish and Wildlife Service (USFWS) web page, there are no threatened or endangered species within the project area (see appendix). Furthermore, consultation with USFWS during the scoping process confirms that there are no endangered species within the project area.

Miscellaneous

SOLID AND HAZARDOUS WASTE

Existing Environment

The following information is based on past research done for the St. Paul Airport Improvement Plan in 1994 and the St. Paul Airport Paving Project in 2003.

A fueling facility on the east side of the runway, next to the existing parking apron, is used by transient aircraft. It consists of one 22,500-gallon aboveground fuel tank with a fueling pump. There is another aboveground storage tank, used for heating, located behind the ARFF building. Two aboveground aviation fuel tanks were known to be located south of the existing parking apron. These tanks have been removed and no known contamination or spills exist at the location.

On the west side of the runway, adjacent to the POSS facility, are thirteen aboveground fuel tanks. These were previously used by EXXON U.S.A. for storage of aviation fuel. TDX owns the POSS Camp facility and stores fuel and waste fuel in the tanks. ADEC indicated that the POSS Camp facility has contaminants in the adjacent gravel pad surrounding the buildings. Spills from aircraft and vehicle maintenance, numerous 55-gallon drums, and other assorted equipment has produced surface contaminants. TDX and National Oceanic and Atmospheric Administration (NOAA) are in the process of cleaning up the contaminants.

A landfill facility approximately 2,500 feet southwest of the wind power plant contains hazardous materials in the form of buried leaking drums. The Alaska Department of Environmental Conservation (ADEC) has required that NOAA cleanup the drums in the landfill, as well as near the airport.

The current wind power plant consists of a wind turbine, a diesel control

shelter, a diesel generator shelter, and a thermal bay with an insulated 6,000-gallon hydronic tank. There also is a 3,000 aboveground diesel storage tank. No solid or hazardous waste is generated by the wind power plant.

Environmental Effects

Based on the information obtained from ADEC during the airport projects, it does not appear that hazardous materials would be encountered during construction. Nor is generation of solid or hazardous waste anticipated during expansion of the wind power plant

Should hazardous waste or suspected hazardous substances be encountered during construction, all work in the vicinity of the contamination would be stopped immediately and the ADEC would be contacted.

The No Action Alternative would preclude any potential involvement with hazardous materials due to the lack of construction.

Chapter 4: Required Permits

The following list identifies permits or clearances that may be required before construction of the Proposed Alternative. It is important to note that this permit list may change as the result of agency comments received during the scoping process.

- Application for a city of St. Paul Planning and Zoning Permit
- Federal Aviation Form 7460-1 Notice of Proposed Construction or Alteration
- Department of Natural Resources, Office of Project Management and Permitting - Coastal Zone Project Questionnaire

Chapter 5: Distribution

USACE, Regulatory Branch
ADNR, History and Archaeology
EPA
NMFS
ADEC, Division of Water
ADNR, OPMP-ACMP
ADNR, OHMP
City of St. Paul, ACMP
USFWS
ADNR
The Aleut Corporation
City of Saint Paul
Tribal Government of St. Paul

Chapter 6: List of Preparers and Contributors

Preparers

DOWL ENGINEERS

- Kristen Hansen, Project Manager, 7 years of experience
- LaQuita Chmielowski, E.I.T., Project Engineer, 3 years of experience

TDX CORPORATION

- Doug Veltre, Ph.D., Professor of Anthropology at the University of Alaska Anchorage, Consultant
- Declan Troy, Field Biologist and Ornithologist, Consultant
- Helen R. Letts, Project Manager, Technical Writer/Editor

Contributors

TDX POWER

- Nick Goodman, CEO
- John Lyons, Operations Manager

Chapter 7: References

Alaska Department of Transportation and Public Facilities, 1994. Environmental Assessment St. Paul Airport Improvements Project No. 50678, Report prepared for Federal Aviation Administration by Alaska Department of Transportation and Public Facilities.

DOWL Engineers, 2003. St. Paul Airport Pavement Design Project Draft Scoping Summary Report. Report prepared for State of Alaska Department of Transportation and Public Facilities, Anchorage, Alaska, by DOWL Engineers, Anchorage, Alaska.

U.S. Fish and Wildlife Service, March 2001. Endangered, Threatened, and Candidate Species in Alaska. http://ecos.fws.gov/tess_public/TESSWebpageUsaLists?state=AK

Department of Community and Economic Development, Alaska Community Information Summary. http://www.dced.state.ak.us/cbd/commdb/CF_CIS.cfm

Veltre, Douglas W., and Allen P. McCartney

1994 An Archaeological Survey of the Early Russian and Aleut Settlements of St. Paul Island, Pribilof Islands, Alaska. St. Paul, Alaska: Report submitted to the TDX Corporation, Anchorage, Alaska.

2000 The St. Paul History and Archaeology Project: Overview of 2000 Field Operations. St. Paul, Alaska: Report submitted to the TDX Corporation, Anchorage, Alaska.

2001 The St. Paul History and Archaeology Project: Overview of 2001 Field Operations. St. Paul, Alaska: Report submitted to the TDX Corporation, Anchorage, Alaska.

2002 Russian Exploitation of Aleuts and Fur Seals: The Archaeology of Eighteenth- and Early-Nineteenth Century Settlements in the Pribilof Islands, Alaska. Historical Archaeology 36(3):8-17.

2003 St. Paul Oral History Project: 2001 Interview Transcripts. Anchorage, Alaska: Department of Anthropology, University of Alaska, Anchorage.

Curry, R.C. and P. Kerlinger. 2000. Avian Mitigation Plan: Kenetech Model Wind Turbines, Altamont Pass WRA, California. Pp 18-28 In: PNAWPPM-III. Proceedings of National Avian - Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ont. 202 p.

Dirksen, S., A.L. Spaans, and J. vander Winden 2000. Studies on Nocturnal Flight Paths and Altitudes of Waterbirds in Relation to Wind. Turbines: A Review of Current Research in The Netherlands Pp 97-109 In: PNAWPPM-III. Proceedings of National Avian - Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ont. 202 p.

Erickson, W.P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K.J. Sernka and R.E. Good. 2001. Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, Washington, D.C.

Erickson, W., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K Bay, and K. Sernka. 2002. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Prepared by WEST, Inc., Cheyenne, WY for Bonneville Power Administration, Portland Oregon.

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. Stateline Wind Project Wildlife Monitoring Annual Report, Results for the Period July 2001—December 2002. 2003. Technical report submitted to FPL Energy, the Oregon Office of Energy, and the Stateline Technical Advisory Committee.

Flint, P.L., A.C. Fowler, and R.F. Rockwell. 1999. Modeling bird mortality associated with the M/V/ Citrus oil spill off St. Paul Island, Alaska. Ecological Modeling 117: 261-267.

Hanna, G.D. 1921. The Pribilof Sandpiper. Condor 23: 50-57.

Hanna, G.D. 1922 The Aleutian Rosy Finch. Condor 24: 88-91.

Hunt, G. 2002. Golden Eagles in a perilous landscape: Predicting the effects of mitigation for wind turbine blade-strike mortality. California Energy Commission Consultant Report P500-02-043F.

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Sheperd, and S.A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30: 879-887.

Johnson, G.D., Erickson, W.P., White, J., and McKinney, R. 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. Prepared by WEST, Inc., Cheyenne, WY for Northwestern Wind Power, Goldendale, WA.

Kerlinger, P. 2000. Avian mortality at communications towers: a review of recent literature, research, and methodology. Prepared for: United States Fish and Wildlife Service. Office of Migratory Bird Management. Prepared by Curry & Kerlinger, Cape May Point, NJ.

Kerlinger, P. 2002. An Assessment of the Impacts of Green Mountain Power Corporation's Wind Power Facility on Breeding and Migrating Birds in Searsburg, Vermont July 1996–July 1998. National Renewable Energy Laboratory, NREL/SR-500-28591.

Larned, W.W. 2003. Steller's Eider spring migration surveys, 2003. U.S. Fish and Wildlife Service, Migratory Bird Management Office, Waterfowl Branch - Anchorage, Alaska.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. Wilson Bull. 111: 100-104.

Lowther, S. 2000. The European Perspective: Some Lessons from Case Studies. Pp 115-124 In: PNAWPPM-III. Proceedings of National Avian - Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the

Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ont. 202 p.

Petersen, M.R., J.B. Grand, and C.P. Dau. 2000. Spectacled Eider (*Somateria fischeri*). *In*: The Birds of North America, No. 547 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Richardson, W.J. 2000. Bird Migration and Wind Turbines: Migration Timing, Flight Behavior, and Collision Risk. Pp. 132-140 In: PNAWPPM-III. Proceedings of National Avian - Wind Power Planning Meeting III, San Diego, California, May 1998. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by LGL Ltd., King City, Ont. 202 p

Young, D.P., Jr., W.P. Erickson, R.E. Good, M.D. Strickland, and G.D. Johnson. 2003. Avian and bat mortality associated with the initial phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming. Prepared by: Western EcoSystems Technology, Inc. Cheyenne, Wyoming for Pacificorp, Inc., Portland, Oregon, SeaWest Windpower Inc., San Diego, California, and Bureau of Land Management, Rawlins, Wyoming.

Appendix 1: Airport Improvement Project

Part of an airport improvement project, a geotechnical investigation was conducted in August 1994 by the Alaska Department of Transportation and Public Facilities.