Hickman, John

From: Hickman(NMSS), John
Sent: Thursday, June 23, 2016 8:20 AM
To: Tom Rielly
Cc: Watson, Bruce
Subject: RE: LTP Preliminary Meeting at NRC Headquarters
Attachments: Env Analysis of Intake Discharge Structure Oct 2013 R.pdf

Tom,

I think the attached is the document you are asking for. This document is being reviewed and considered as part of our Environmental Assessment for the License Termination Plan.

John

From: Tom Rielly [mailto:tr649@sbcglobal.net]
Sent: Thursday, June 16, 2016 10:50 AM
To: Hickman(NMSS), John <John.HickmanNMSS@nrc.gov>
Subject: [External_Sender] LTP Preliminary Meeting at NRC Headquarters

Subject : Zion Decommissioning & Site Rehabilitation Facility Operating License Nos. DPR-39 ans DPR-48 NRC Docket Nos 50-295 and 50-304

Hi John,
There was a noticed (1ST) LTP preliminary meeting at the NRC with Zion Solutions LLC and the NRC and interested parties from the public in attendance (we do not recall the NRC category of the meeting), we were not in physical attendance but a question to the NRC was posed following the narrative discussion and presentation to the NRC (in part) of the proposed and envisioned Zion crib house work, various back filling of basements, demolition work and piping ect related subject matter of the meeting.

The question posed by Vista 360 to the NRC involved the crib house piping? We have come to understand via various confirming remarks of the licensee, Zion Solutions LLC, that the piping is not part of the Zion Decommissioning & Site Rehabilitation Project.

At the present date as we gather, this leaving the intake pipe is a given in the concluding quarters of the Decommissioning, we would like to identify and get a copy of the supporting independent consulting study that the licensee,Zion Solutions LLC, indicated would be in place regarding this matter and its disposition.

Could you review the LTP Meeting identified and the follow on Zion Solutions LLC submission. We would like to review it.

Thank you

Thomas P. Rielly
Executive Principal
Vista 360
649 Innsbruck
Libertyville IL 60048
847/680-0670

Summary of Environmental Analysis of the Intake/Discharge Structure at the Zion Nuclear Station Zion, Illinois

Prepared for:

Zion*Solutions* LLC
101 Shiloh Blvd
Zion, IL 60099

AMEC Project No. 3205121254

Kimberly A. Pesenko
Project Manager

William Elzinga
Sr. Principal Scientist

October 2013

Executive Summary

Introduction

The Zion Nuclear Station (ZNS or Site) is located in Northeast Illinois on the western shore of Lake Michigan, approximately 40 miles north of Chicago, Illinois. Commonwealth Edison (ComEd) announced the permanent shutdown of the ZNS on January 15, 1998. Zion*Solutions*, LLC (Zion*Solutions*) is administering and overseeing the permanent decommissioning and demolition phase. Zion*Solutions* commissioned an environmental analysis of the removal and remain in place options for the lakefront intake/discharge structure. This report identifies the option with the lowest environmental impact and includes a summary of the evaluations.

Alternative 1 – No Action

- No removal of structures

Alternative 2 – Full Facility Removal

- Removal of all piping from exterior of Circulating Water Intake Structure (CWIS) forebay extending to supporting structures

Basis for Selection

Alternative 1 – No Action

Under this alternative, the existing intake/discharge structures would not be removed or modified.

Under the No Action Alternative, there would be no physical or environmental impacts to the subject property or the lake environs. This alternative is the least environmentally disruptive, requires the least regulatory interaction/approvals and meets the intent of the project purpose, as outlined in Section 1. Therefore, this alternative is recommended.

Alternative 2 – Full Facility Removal

This alternative entails full removal of all intake/discharge facilities extending from the intake forebay to their termini within the lake. As such, it represents the alternative that has the greatest potential for disruption to environmental resources. Key resource issues associated with this alternative include potential effects to shoreline environs (terrestrial ecosystems, beach erosion), sediments, water quality, and aquatic ecosystems. While this alternative does meet the objectives of the project purpose, it results in the greater environmental impact. Therefore, this alternative is not recommended for further consideration.

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List of Abbreviations and Acronyms

ACS	American Community Survey
ADID	Advance Identification
APE	Area of Potential Effect
BMPs	Best Management Practices
CAA	Clean Air Act
CCDD	Clean Construction or Demolition Debris
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
ComEd	Commonwealth Edison
cu yds	cubic yards
CWIS	circulating water intake structure
CZMA	Federal Coastal Zone Management Act
EcoCAT	Ecological Compliance Assessment Tool
EMT	emergency medical treatment
EO	Executive Order
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
GLERL	Great Lakes Environmental Research Laboratory
IDNR	Illinois Department of Natural Resources
ICMP	Illinois Coastal Management Program
IGLD	International Great Lakes Datum
IHPA	Illinois Historic Preservation Agency
Illinois EPA	Illinois Environmental Protection Agency
INHS	Illinois Natural History Survey
L	LARGE (with regard to magnitude of environmental effect)
LCPWD	Lake County Public Water District
M	MODERATE (with regard to magnitude of environmental effect)
MGD	million gallons per day
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NI	No Impact (with regard to magnitude of environmental effect)
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSSD	North Shore Sanitary District
NUREG	US Nuclear Regulatory Commission Regulation, refers to publications of technical or administrative information
OWR	Office of Water Resources
S	SMALL (with regard to magnitude of environmental effect)
SAV	submerged aquatic vegetation
STANT	Station Aids to Navigation Team
STP	Sewage Treatment Plant
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Atomic Energy Commission
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNRC	U.S. Nuclear Regulatory Commission
USWHC	U.S. Wildlife Habitat Council
ZNS	Zion Nuclear Station

1.0 Project Purpose and Description of Need

1.1 Introduction

The Zion Nuclear Station (ZNS or Site) is located in Northeast Illinois on the western shore of Lake Michigan. The Site is approximately 40 miles north of Chicago, Illinois, and 42 miles south of Milwaukee, Wisconsin. The Site is in the extreme eastern portion of the City of Zion, Lake County, Illinois, on the west shore of Lake Michigan (Figure 1-1). The Site is located at longitude 87 degrees 48.1 minutes W and latitude 42 degrees 26.8 minutes N. The Site occupies portions of Sections 22, 23, 26 and 27 in Township 46 North, Range 23 East.

Commonwealth Edison (ComEd) announced the permanent shutdown of the ZNS on January 15, 1998. Zion*Solutions* is performing the permanent decommissioning and demolition phase. As part of this process, Zion*Solutions* is evaluating potential alternatives related to the disposition of the intake and discharge components of the circulating water system. The circulating water system of the plant provided the heat sink required for removal of heat in the power plant's thermal cycle. Water was withdrawn from Lake Michigan via three intake pipes which connected to the forebay of the crib house, becoming the suction source for the circulating water pumps. After passing through the plant condensers, the discharge was routed back to the lake through the discharge lines (Units 1 and Unit 2).

This report provides a summary of the analysis of the two final alternatives considered with regard to the disposition of the offshore intake and discharge structures in Lake Michigan at the ZNS. The study area for this analysis can therefore be described as an area extending from the outside headwall of the circulating water intake structure (CWIS) forebay, extending east into the lake and encompassing both the intake and discharge structures for both Units 1 and 2 (Figure 1-2). This analysis is performed in a manner consistent with the interdisciplinary analysis as required by the National Environmental Policy Act of 1969 (NEPA) and the guidance of the Council on Environmental Quality implementing NEPA (40 CFR Parts 1500-1508). As such this report provides an overview of the project purpose and need, the alternatives under consideration, and assessed the potential interdisciplinary effects of project alternatives on each of 18 separate environmental factors. Accordingly this analysis is considered to be consistent with and useful for supporting NEPA compliance performed in support of decommissioning activities as per NUREG-0586, Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1.

This project assesses the regulatory framework and interfaces needed for project implementation and entails a preliminary assessment of impacts associated with two project alternatives.

1.2 Project Purpose

The purpose of the proposed intake/discharge facility evaluation is to determine the alternative with the lowest environmental impact and identify the regulatory framework.

1.3 Description of Need

The need for the consideration of disposition alternatives is driven by the decision to decommission and dismantle the ZNS. The US Nuclear Regulatory Commission (NRC) guidance document NUREG-1757 provides guidance for decommissioning leading to termination of an NRC license. Licensees decommissioning their facilities are required to demonstrate to the NRC that their proposed methods will ensure that the decommissioning can be conducted safely and that the facility, at the completion of decommissioning activities, will comply with NRC's requirements for license termination. The National Environmental Policy Act of 1969 (NEPA) further mandates the interdisciplinary evaluation of multiple alternatives as part of the Federal decision making process.

This document provides an interdisciplinary alternatives analysis and is, therefore, consistent with the intent of NEPA. Consideration of alternatives for intake/discharge facility disposition and the evaluation of alternatives with respect to a full range of environmental factors (human and natural environments) provide important input to this decision-making process.

2.0 Description of Project Alternatives

A basic principle of NEPA is that reasonable alternatives be evaluated as part of the decision-making process. Considering alternatives helps to avoid unnecessary impacts and allows analysis of reasonable options to achieve the stated purpose. To warrant detailed evaluation, an alternative must be reasonable, and to be considered reasonable, an alternative must be ready for decision making (any necessary preceding events having taken place), capable of implementation, and satisfactory with respect to meeting the purpose of and need for the action.

2.1 Description of the Existing Structures

The water intake system of the ZNS consists of three buried pipes extending approximately 2,600 lineal feet offshore from the crib house to the intake structure (Figure 2-1). The pipes were designed to have a crown located a minimum of approximately 2 feet below the lake bed at the time of design. No information is available regarding the lake bed level relative to the pipe for the current condition. There is the potential that the lake bed elevation has changed and is likely lower than it was at the time of the design work in the late 1960s given observed trends in coastal erosion along the Illinois shoreline (IDNR, 2011a). The intake pipes have nominal diameters of 13 feet. The pipes are buried under the lakebed. The intake structure has an overall plan (horizontal) diameter of 104 feet. There is a velocity cap ("canopy") at the top of the structure and the top elevation is 568.5 feet (International Great Lakes Datum [IGLD], 1955) (US Atomic Energy Commission, 1972) (Figure 2-2). This elevation is equivalent to 569.2 feet on the current IGLD of 1985 datum (due to a required add of 0.7 feet [US Army Corps of Engineers, 2008]). Therefore, based on the design drawings, the lake bed in the vicinity of the intake structure at time of design was approximately 556 feet (IGLD of 1955), or approximately 557 feet (IGLD of 1985).

There is a separate circulating water discharge system for each of the two units at the ZNS (see Figure 1-2). The discharge systems are identical and are located 154 feet on either side of the centerline of the circulating water intake pipe system. Each discharge has a 14-foot diameter pipe extending from the crib house a distance of approximately 760 feet to a diffuser structure, which is approximately 125 feet long, 30 feet wide, and 25 feet high (see Figure 2-1). The design elevation of the top of the diffuser is 570.5 feet IGLD of 1955 (approximately 571.3 feet IGLD of 1985) (see Figure 2-2). The diffuser structure has vanes and ports that deflect the discharge outward and upward at angles of 45 degrees. The lake bed elevation in the vicinity of the diffuser boxes at the time of design in the late 1960s was approximately 566 feet IGLD of 1955; the lake bed at the diffusers was indicated to be more steeply sloping than at the intake structure that is located more than 1800 feet further from the shoreline. The top of the discharge structures was approximately 4 to 5 feet above the lake bed at the time of design.

In 1990, a failure of the Unit 2 discharge pipe occurred (Sargent & Lundy, 1990). ComEd concluded that air trapped at a high point in the pipe at a location approximately 150 feet from the shoreline caused the pipe to be displaced vertically upward. The pipe was repaired, including re-establishing the original vertical alignment. According to repair design drawings, armor rock was placed over the repaired section with a top elevation matching adjacent lake bed elevation (Figure 2-3). In available documents regarding the pipe failure, there was no identification of any cause of the failure being anything other than air collecting in the pipeline during operation and creating the upward force to cause pipe movement; no environmental conditions such as erosion/sediment transport, ice, waves, etc. were identified as contributing to the failure.

2.2 Description of Alternatives

This section provides a description of the alternatives evaluated as part of this environmental assessment. The term "impact area" is used to define the portion of the Site potentially affected by each alternative. Two final alternatives were retained for full analysis and included:

- No Action
- Full Facility Removal

2.2.1 Alternative 1 – No Action

The Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500 to 1508) require consideration of a No Action Alternative. The No Action Alternative serves as a baseline against which the impacts of the proposed action and other alternatives can be evaluated. Accordingly, the No Action Alternative is evaluated in this document and is referred to as Alternative 1. As indicated, this alternative does not entail any actions to remove or modify the existing intake/discharge structures. All structures remain in place after minor preparations for abandonment are implemented.

2.2.2 Alternative 2 – Full Facility Removal

The full facility removal alternative involves complete removal of the pipes exiting the CWIS forebay and continuing under the Lake Michigan lakebed, terminating at the discharge and intake structures. Demolition on the crib house and forebay would be performed. These items would be isolated from the intake and discharge pipes and structures located under the surface of Lake Michigan at the interface between the structure and the pipe. The crib house and forebay would be demolished. This evaluation includes recommendations for the disposal or abandonment of the components outside the isolation from the structure. The lakebed at the discharge and intake structures is under approximately 12 feet and 22 feet of water, respectively. The intake and discharge structures would be removed in their entirety.

All pipes would be sealed at the forebay. Beyond the exterior walls of the forebay, sand will be excavated to access and remove the portion of the pipes under the beach and the shallow areas along the shoreline. Once the water depth reaches approximately 4 feet, barges will be used to carry machinery needed to continue excavation and removal activities of the pipes up to the discharge and intake structures. It is estimated that approximately 44,400 cubic yards (cu yds) of sand will be required to backfill the voids left by the removed piping to the original elevations from the beach to the intake and discharge structures.

Each discharge structure is estimated to contain approximately 2,150 cu yds of concrete and steel. The structures will be broken into small pieces with water saws and barge-mounted heavy machinery. The broken pieces will be loaded onto barges to carry back to an off-site location for disposal or recycle. The void left by removal of each discharge structure will require approximately 2,000 cu yds of sand to fill to match the surrounding lakebed elevation.

The intake structure contains approximately 6,150 cu yds of concrete and steel. This structure will be demolished in a similar manner to the discharge structures, with water saws and barge-mounted heavy machinery. The broken pieces will again be taken off the property for disposal or recycling. Approximately 4,200 cu yds of sand/fill will be required to fill the void left by the removal of the intake structure to match the surrounding lakebed elevation.

The estimated area of impact for the duration of removal activities is an approximate 50 foot radius around the pipes and structures, from the exterior of the forebay to the intake and discharge structures. Based on this radius, the impact area during demolition/restoration activities is estimated at 630,000 square feet or 14.5 acres and includes a portion of the shoreline.

3.0 Environmental Impact Analysis

3.1 Procedures

The ZNS is undergoing decommissioning and is in the process of preparing a license termination plan subject to approval by the NRC. Because the decision to terminate the license to operate is a Federal action, the NRC decision making is subject to the requirements of NEPA, the CEQ regulations implementing NEPA (40 CFR 1500-1508), and NRC Regulations. Licensees decommissioning their facilities are required to demonstrate to the NRC that their proposed methods will ensure that the decommissioning can be conducted safely and that the facility, at the completion of decommissioning activities, will comply with NRC's requirements for license termination.

While this report is not a NEPA document, the analysis summarized in this report is intended to be consistent with the requirements of NEPA and the CEQ regulations that mandate an interdisciplinary analysis of multiple project alternatives, including the No Action Alternative. Results of this study are therefore intended to support the NEPA analysis performed in conjunction with license termination.

This documentation is also intended to support the application for permits that may be required to implement the selected alternative. An interdisciplinary analysis is typically required to support permits and approvals by other Federal agencies (U.S. Army Corps of Engineers [USACE], USCG) and to provide a basis for full disclosure of the issues and alternatives to stakeholders and the general public.

The following subsections provide a characterization of environmental baselines and an assessment of potential impacts for each of the resource areas under consideration. Impact analyses in the following sections are summarized in tabular and narrative form for each resource issue. General criteria for the impact summaries provided in each table include the following:

Level of Significance	Criterion
NO IMPACT (NI)	Total Impact avoidance
SMALL (S)	Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource
MODERATE (M)	Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource
LARGE (L)	Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

The context for analysis and assessment of level of significance is considered to be the broader region surrounding the ZNS site. Therefore, while some impacts of project alternatives may be evident on a localized basis, the capacity for noticeable alteration and destabilization of the resource is evaluated within the broader context. The category of "NI" was used to reflect complete avoidance or non-applicability of a given resource issue to the project under consideration. Definitions of other criteria followed the guidance given in USNRC Impact Rankings 10 CFR 51, Subpart A, Appendix B, Table B1.

3.2 Prior Environmental Studies

Prior environmental studies that are specific to the ZNS which were reviewed during the preparation of this assessment included the following:

- Final Environmental Statement Related to Operation of Zion Nuclear Power Station Units 1 and 2 (U.S. Atomic Energy Commission, 1972);
- Zion Station Historical Site Assessment (ComEd, 1999); and
- Site Assessment and Wildlife Management Opportunities for Exelon Corporation's Zion Generating Station (Wildlife Habitat Council, 2005).

3.3 Specific Areas Evaluated

The following sections contain discussions of each environmental area evaluated, the existing conditions at the Site and impact area, potential impacts associated with the proposed plans for the property, and associated strategies to mitigate impacts, as may be warranted. The findings are based on a review of prior studies and analyses, publically available information regarding the affected environment, interviews with Site personnel, and a site visit conducted on November 27, 2012.

This assessment examines the potential impacts of the alternatives under consideration at the ZNS on geology and soils, water resources, ecological resources, coastal zones,

socioeconomic conditions, land use and real property, aesthetics and noise, environmental justice, air quality, cultural and historic resources, and solid and hazardous waste.

3.3.1 Geology and Soils

This section evaluates the potential for impacts to sediments, soils and bedrock, and changes in geological conditions due to removal operations.

Existing Conditions

The upper Illinois River Basin lies within the Central Lowland Province and includes the Great Lakes and the Till Plains sections. Landforms in these physiographic sections are the result of glaciations and typically have less than 300 feet of relief. The Great Lakes section is further subdivided into the Chicago Lake Plain and Wheaton Morainal subsections, and the Till Plains section is further subdivided into the Kankakee Plain and Bloomington Ridged Plain subsections. The most recent glaciation event was the Wisconsin period. The last glacial ice began receding from the Illinois coastal area about 14,000 years ago.

From the Illinois-Wisconsin state line and extending south to North Chicago, the land bordering the shore is a low-lying plain not exceeding 10 to 15 feet above the mean lake level. The plain is up to one-mile wide at Zion. The Zion beach-ridge plain formed during the past 4,000 years as wave action transported and deposited sand and sandy gravel from the north. Elongate sand ridges and intermediate wetland-dominated swales give the plain a washboard topography. The ridges and swales are a record of the successive shoreline positions that occurred as sand accretion progressively built the plain southward and added to its lakeward width (Chrzastowski and Frankie, 2000). The western margin of the plain is bordered by a 10- to 30-foot bluff that was formed by wave erosion prior to the sediment accretion that built the beach-ridge plain.

Along the coast beyond the lake plain lie the Zion City and Highland Park Moraines. These end moraines formed about 14,000 years ago just prior to glacial ice permanently receding into the Lake Michigan basin. These are thus the youngest end moraines in Illinois. The dominant material in the Illinois coastal zone is a compact, gray, silty and clayey till. The till may contain discontinuous layers of sand and gravelly sand. This till, which is ubiquitous across the coastal zone, was deposited by glacial ice during the most recent (Wisconsin) glacial episode. The till is exposed along the coastal bluffs, as well as the material first encountered beneath most of the soils in the area. It also occurs beneath the beach sand and it occurs on the nearshore lake bottom either beneath the nearshore sand or exposed where sand cover is absent.

Analysis of the till exposed in the bluffs indicate that a typical sediment size distribution is 48 percent clay, 42 percent silt, and 10 percent sand (Lineback, 1974). When bluff erosion occurs, only the sand-size material ultimately remains along the beaches and nearshore. The

dominant clay and silt are transported offshore for eventual deposition in deep water (Colman and Foster 1994). The till directly overlies the underlying regional bedrock which is Silurian-age dolomite (Willman, 1971; Willman and Lineback, 1970). The uppermost rock unit recognized is the Racine Formation, containing many small cavities and fossiliferous dolomites characterized by reef structures that stand out from surrounding massive layered dolomites. Underlying the Racine Formation is a series of dolomitic units locally known as the Waukesha Formation, Brandon Bridge Formation, and the Kankakee Formation. This rock resulted from marine deposition when all of northeastern Illinois and much of the neighboring Great Lakes region was the floor of a tropical sea from about 440 to 410 million years ago. The thickness of the till sequence above the bedrock is variable depending on the surficial landscape or lake-bottom topography compared to the subsurface bedrock topography.

Locally, the till sequence thins and is even absent where mound-like protrusions of the bedrock rise to at or near land surface. These bedrock knobs are the remains of reefs that formed in the tropical sea. The resistance of the reef rock allowed these features to persist despite glacial scouring. Several of these bedrock exposures in the offshore area of the Illinois coast are prominent features rising tens of feet above the surrounding lake bottom and historically were known as prime offshore fishing areas (Collinson, Norby and Hansel, 1979; Fucciolo 1993).

Much of the Michigan lakefloor is a dynamic environment of shore currents, induced by storm waves, which transport fine sand and silt, resulting in a patchy, continually changing distribution of lacustrine (lake) sediments overlying a glacially-derived till-gravel pavement. North of Waukegan, silty sand completely covers the surface of Wadsworth Till, which is a glacial deposit composed mostly of silty clay. The lakebed of the outer nearshore zone shows apparent significant sediment movement only during major storms which typically occur with a frequency of years to decades. Grain size and morphologic data have shown consistency over time indicating a non-depositional environment. Evidence for significant erosion or deposition in the area over time is lacking. This is consistent with more southern Lake Michigan. However, the Illinois Beach lakebed, which is characterized by a substantial sheet of loose sand over much of its area may be more dynamic in terms of sediment movement (more sediment transported in and out) than the southern lake floor (Polloni, et al.). Sediment thickness from borings drilled below the lake in this area ranged from approximately 40 to 80 feet. Sediments in the lake in industrial areas are known to be impacted by metals and, in some areas, by polynuclear aromatic hydrocarbons and polychlorinated biphenyls (Miller and Hornbuckle. 2010; Zion*Solutions* Site Personnel). Areas around Illinois Beach State Park have had asbestos materials wash ashore from other industries (Occupational Health and Safety, 2009; Zion*Solutions* Site Personnel).

Potential Environmental Impacts and Proposed Mitigation Measures – Geology and Soils

Attribute	1 – No Action	2 – Full Removal
Rock Excavation	☐	☐
Cut/Fill Operations	☐	☒
Grading	☐	☐
Adverse	☐	☒
Beneficial	☐	☐
Soil Erosion	☐	☒
Soil Compaction	☐	☐
Soil Horizon Removal and Mixing	☐	☐
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Under the No Action Alternative, there would be no impacts on the geology or sediments of the area.

No impacts to the overburden or bedrock geology at the Site are expected to occur as a result of any of the planned alternatives as the alternatives will not extend deep enough to have an impact.

The full removal (Alternative 2) would require excavation of sediments to up to 20 feet in depth. Since the rate of sediment movement in the immediate area is unknown, depletion of sand cover across the nearshore lake bottom, and erosion of the glacial till lakebed could be a sustained management concern. Although contamination of sediments has not been confirmed in the immediate area, a literature review indicates that contaminants in Lake Michigan sediments from other industries are widespread (Adriaens et al., 2002; Illinois EPA et al, 1986; and Zion*Solutions* Site Personnel). Fragile ecosystems may be threatened by the redistribution of sediments and the associated transport of contaminants. Mitigation of these effects could be obtained by sediment sampling to determine contaminant levels in the immediate area, minimizing the amount of excavation performed, and careful and immediate replacement of disturbed sediments.

3.3.2 Water Resources

This section evaluates potential project effects on those portions of the natural environment related to surface water and groundwater. Surface water generally refers to streams, rivers, ponds, reservoirs and lakes. Groundwater refers to water located beneath the ground surface that is beyond the soil-root zone.

Existing Conditions

There is no available recent detailed bathymetric mapping of the lake bed in the vicinity of the intake and discharge systems. Design drawings prepared for maintenance work on the discharge structures around 1968 indicates scour bathymetry near the discharge structures as would be expected. Scour holes along the port sides of the discharge box extended down to approximately the bottom the boxes at elevation 550 feet (IGLD of 1955) and sloped upward to the lake bed at a distance of approximately 100 to 150 feet from the boxes. Sediments within the scoured area are indicated on the drawings to be mud, sand and gravel. It is anticipated that these scour holes resulting from discharge have refilled with sediments since operations ceased (including filling of the discharge structure itself) and that any residual local scour feature(s) are small and transient, resulting from long-shore currents and wave action.

Lake Michigan Water Levels

Historic water level observations for Lake Michigan are available since 1860. The water levels vary due to climatic variations over time scales ranging from hours to decades. The range in average water levels in Lake Michigan since 1860 has been slightly greater than 6 feet, from a low of around 576 feet (IGLD of 1985) to a high of over 582 feet (IGLD of 1985). The long-term average water level from 1918 through 2012 was 578.8 feet (IGLD of 1985) (Great Lakes Environmental Research Laboratory [GLERL] 2013). Recognizing that some anthropogenic influences may exist that may have, or may in the future, influence lake levels, lake level statistics are useful. Water level statistics based on average monthly water level data from 1918 through 2012 are summarized in Table 3-1. There is a small seasonal component to water levels, with winter levels averaging more than 0.3 foot lower than May through October levels. Water level variations on shorter time scales occur as a result of wind speed and direction and atmospheric pressures. Comparison of limited recent National Oceanic and Atmospheric Administration (NOAA, 2013) 6-minute average water levels to the average monthly water level indicates that brief water level variations rarely vary from monthly average levels by more than one foot, and typically not more than plus or minus 0.3 foot.

Various researchers have attempted to predict Lake Michigan water levels in response to climate change predictions. Generally the predictions have been for slightly lower water levels, although more recent predictions are for less of a decrease in level or even no significant changes. Hayhoe et al. (2010) predicted lake levels lower by approximately 1 to 1.5 feet by the end of the century, with most of that decrease occurring after 2040. Lofgren et al. (2011),

however, contended that the earlier methods used simplifying assumptions about evaporation and predicted little change in lake levels, with the upper range of the prediction including a slight increase in levels.

Table 3-1. Lake Michigan Monthly Average Water Level Statistics (1918 through 2012)

Percentile	No. of Months	Elevation (ft IGLD of 1985)	
		Annual	May - Oct
100%	1140	582.38	582.38
90%	1026	580.57	580.87
75%	855	579.82	580.15
50%	570	578.83	579.15
25%	285	577.75	578.01
10%	114	577.16	577.52
2%	23	576.56	576.93
0%	0	576.08	576.47
mean		578.84	579.14

Source: GLERL, 2013

Lake Michigan Circulation and Shoreline Erosion

The Lake Michigan shoreline at the Site is a dynamic system. Water levels, water currents, and waves change constantly in response to seasonal and climatic conditions on time scales of hours to decades. The shoreline and lake bed in the area are both erodible boundaries that, while changing more slowly, do change in response to the lake dynamics as well as human activities.

As a result of investigations completed during recent years, extensive description of the Lake Michigan shoreline within Illinois is available. The Illinois Coastal Management Program (ICMP) (Illinois Department of Natural Resources (IDNR), 2011a) provides a comprehensive summary of conditions relevant to this assessment.

Prior to human influences, the Lake Michigan shoreline within Illinois was mostly a naturally eroding shoreline with the exception of limited segments, including a segment near the Dead River located approximately 2.5 miles south of the Site and a segment at the North Point Marina approximately 3 miles north of the Site where there is net accretion of sediments. The shoreline naturally erodes due to changing water levels, wave action, longshore currents, ice formation, and the erodible character of the land boundary. During the high water levels that existed in Lake Michigan during the period from the late 1960s through late 1980s, extensive shoreline erosion occurred, prompting extensive stabilization of the shoreline to protect public and private property. The stabilization work significantly reduced the shoreline/bluff erosion. However, the reduced influx of sediments has resulted in some depletion of sediments overlying the cohesive,

clay till that underlies the region. This in turn appears to have accelerated erosion of the clay till lake bed within the near-shore zone.

Longshore currents vary seasonally at the Site. The prevailing, net sediment transport appears to be southerly (i.e., a counter-clockwise circulation in the southern end of Lake Michigan). Seasonally, however, the net current and transport may be northerly.

Most of the Illinois shoreline has received some type of shoreline stabilization. The beach at Illinois Beach State Park has been identified as the longest segment of shoreline without man-made stabilization structures (IDNR, 2011a).

As described in the ICMP (IDNR, 2011a), when waves do occur they have an average wave height of 1.5 to 2 feet and an average maximum wave height of 8 feet. The largest waves along the shore rarely exceed 10 to 12 feet. Large waves are most common in late fall, winter, and early spring.

Ice has been found to play a significant role in shoreline erosion and lake bed erosion in southern Lake Michigan (Barnes et al, 1990). The nearshore ice complex, a system of ice ridges that typically forms and decays a few times each year along the shoreline was identified as extending from the shoreline into the lake a distance of approximately 328 feet. The ice ridges act as transporters (rafts) for sediment transport and as sea walls, frequently grounded on offshore bars, which protect the land side water from waves but cause wave scour on the lake side. Sediment was found to be carried offshore up to approximately 5 miles by ice.

While the shoreline is dynamic, it appears that the existing structures do not have a significant impact on hydraulic processes such as longshore currents, sediment transport, shoreline erosion, lake bed erosion, or bluff erosion. Also, while detailed local bathymetric information in the immediate vicinity of each of the structures is not available, it is assumed that the local scour areas that existed during plant operation have filled with sediment and that, if any significant local scour exists today around any of these structures, it is small and transient. If that is in fact true and if past and future shoreline management efforts maintain the current beach profile, leaving the structures in place would continue to have no significant effect on longshore currents, sediment transport, shoreline erosion, bluff erosion resulting from wave under-cutting of the bluff, or other nearshore/shoreline processes.

Potential effects of the No Action alternative are considered to be SMALL and in part, dependent upon beach nourishment programs that locally offset the effects of lakebed erosion. As noted in the ICMP has a goal of stabilization of the shoreline along the Illinois Beach State Park for protection of the natural dune systems through practices such as management of sediment (e.g., beach nourishment), with minimum reliance on hard structures. Such beach nourishment management activities, if successful, provide a means of continual replenishment

of sediments eroded in the nearshore area by lake currents and wave action. It is noted, however, that if nearshore sediment management efforts by others to control all gradual erosion of the beach profile in this area are unsuccessful then the intake and discharge structures left in place under the No Action alternative may be expected to become increasingly more exposed above the lake bed over time. A larger degree of exposure, or obstruction to longshore currents, will have an incremental increase in extent of local bathymetric and littoral transport effects.

The tops of the existing intake structure and discharge structures are approximately 6.8 feet and 4.8 feet, respectively, below the lowest historic monthly average lake level of 576.08 feet IGLD of 1985. Since 1918, the average monthly lake level has been above 577.19 feet IGLD of 1985 (1.1 feet higher than the record low) 90 percent of the time. Wave heights in the area are typically less than 2 feet. Under conditions of a 2-foot wave height, the water depth in the wave trough over the discharge structure would be reduced to approximately 3.8 feet.

Potential Environmental Impacts and Proposed Mitigation Measures – Water Resources

Attribute	1 – No Action	2 – Full Removal
Potential for demolition debris	☐	☒
Potential for Water Quality Effects (turbidity)	☐	☒
Potential for Lake Bed bathymetry impacts	☒	☐
Potential for shoreline process impacts (littoral transport)	☐	☒
Long Term	☒	☐
Short Term	☐	☒
Overall Rating	**Small**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Under Alternative 1 (No Action) the intake/discharge structures are left in place. Over time, the structures are expected to be degraded by waves and ice, leading to structural failures of the features projecting above the lake bed. Much of the broken structure would be expected to fall to the lake bed in proximity to its existing location. However, some broken pieces of the structures would, depending on numerous factors (including debris piece size and weight, etc.) be transported varying distances by the waves, currents, and ice. The degradation and structural failure of the piping has the potential to be mitigated by the abandonment preparations (see Section 2.2.1).

Alternative 2 (Full Removal) positively eliminates any potential impact of the structures over the long term, including potential for gradual increase in exposure and obstruction due to shoreline recession and/or lake bed erosion. The installation of the structures, including pipes, intake and discharge diffusers, required excavation below the clay till lake bed surface and that natural surface cannot practically be re-established. The removal process would result in increased local turbidity as bottom disturbance occurs and as select sediments (sand and gravel) are introduced to fill holes resulting from removal to avoid temporary impacts to littoral sediment transport. Since it is anticipated that the intake and discharge diffusers, and possibly a portion of the pipes, have filled with sediments, the amount of sediment fill is uncertain and would need to be determined by inspection of the structures with regard to sedimentation.

3.3.3 Water Quality

This section evaluates potential project effects on those portions of the natural environment related to surface water and groundwater. Surface water generally refers to streams, rivers, ponds, reservoirs and lakes. Groundwater refers to water located beneath the ground surface that is beyond the soil-root zone, and is a major source of potable water (Christopherson, 2003).

Existing Conditions

The ZNS is located on the shores of Lake Michigan. The lake is 307 miles long from north to south and has an average width of 70 miles. In the general vicinity of the Site, the 30-foot depth contour of the lake is 1.2 miles, and the 60-foot depth contour is 2.0 miles from the shore. Water from Lake Michigan is extensively used for municipal and domestic water supplies. All liquid waste discharged into the lake must be below radiological levels permitted under USNRC 10 CFR 20. There are multiple potable water intakes located in Lake Michigan in the vicinity of the ZNS. The nearest intake is located about 1 mile north of the Site and 3,000 feet out in the lake.

Surface streams near the Site include Kellogg Creek (1.25 mile north), Dead River (3 miles south), and Bull Creek (0.2 mile south). Kellogg Creek is a perennial stream that drains to the North Unit of Illinois Beach State Park through a bluff/ravine system that is moderately to severely eroded (see Figure 1-2). The creek has reduced natural function as it has been channelized since early industrial development. Bull Creek is also a perennial stream that drains

to the South Unit of Illinois Beach State Park. Similar to Kellogg Creek, the bluff/ravine system for Bull Creek is severely eroded along most of the length. Bull Creek becomes Dead River once it begins to cross the sand plain. The Dead River is an unaltered natural tributary to Lake Michigan that flows through an extensive high quality coastal wetland complex, which is a rare habitat type in the Illinois Lake Michigan watershed.

The groundwater table in the area is close to the ground surface, and has a flat gradient to the east and south.

Potential Environmental Impacts and Proposed Mitigation Measures – Water Quality

Attribute	1 – No Action	2 – Full Removal
Potential for Erosion and/or Sedimentation (NPDES)	☐	☒
Potential for Contamination of Water Regime (from Hazardous/Toxic Wastes)	☐	☐
Alteration/Quality Change of Surface Water Drainage	☐	☐
Alteration/Quality Change of Groundwater Discharge	☐	☐
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative		
☒= Applicable to the alternative		

Alternative 2 would result in some short-term water quality alterations during demolition activities. Sediment disturbance both on-shore and along the submerged portion would be short term and localized to the vicinity of the project. Dewatering activities within the cofferdam (Alternative 2) may cause temporary changes in waterflow around the cofferdam during construction; however conditions are expected to return to pre-activity conditions after activities are complete. Removal of piping and/or demolished materials in Alternative 2 would impact water quality as construction activities would result in sediment disturbance and increased turbidity in surrounding waters. Water having elevated turbidity levels is expected to drift beyond the impact area to distances that are dependent on conditions and currents evident at the time of construction.

Removal activities in the water could impact water quality through exhaust and other boat discharges entering the water. These impacts can be reduced through implementation of appropriate Best Management Practices (BMPs) and proper equipment maintenance. Recreational boating, sport fishing, and container shipping are common in Lake Michigan and are a major source of effluents in the water. Any changes in water quality as a result of facility removal activities is not anticipated to impair protected water uses or impact overall water quality in the region.

Due to the distance between the facility and the nearest potable water supply intake, no impacts to the public water supply are expected. Water current patterns nearshore in Lake Michigan are complex, however the general pattern is that water flows from northwest to southeast (Bhowmik, et al., 1991). The pattern is related to onshore and offshore currents due to wave action, as well as the longshore current along the shoreline. As a result, the net littoral transport is southward along the Illinois coast. Average velocity near shore is below 3 cm/s (0.06 knots), therefore sediments may remain suspended for longer periods of time depending on their size (Bhowmik, et al., 1991). Any sediments disturbed by removal activities would likely flow away from the impact area, and settle out before reaching other intake locations.

Beach nourishment practices north of the facility have been used since the late 1980s as part of shore erosion mitigation. The IDNR has been stockpiling sand at two designated feeder beaches, one located at the north end of the Illinois Beach State Park North Unit and the other along the shore at the north end of the park's South Unit. The sand was historically sourced from a variety of locations, including the nearby marina, yacht club, and inland sand pits. It is likely that the sand used for replenishment contains particles that contribute to an on-going source of suspended sediments and turbidity in the region. Once removal activities are completed any changes to water quality are expected to attenuate to pre-construction conditions. None of the alternatives includes the potential for contamination of the water regime by hazardous or toxic waste.

The proposed removal options are not anticipated to have negative impacts on groundwater resources. During removal activities at the onshore portion, appropriate BMPs would be implemented as required by applicable Federal, state and local rules and regulations, in order to minimize potential water quality impacts from construction activities.

Alternative 1 will not result in any impacts to water quality. Impacts to water quality from Alternative 2 is considered to be small and temporary.

3.3.4 Aquatic Ecology

This section considers potential effects to aquatic ecosystems that may occur at the impact area or surrounding area.

Existing Conditions

Potentially affected aquatic habitat at the ZNS includes the area from the intake house at the shoreline to the intake structure/cap that extends out into Lake Michigan approximately 2,600 feet from shore. There are also two discharge structures that each extends 760 feet out from the shoreline. The piping associated with the two discharge structures and the intake structure are buried under the lake bottom. According to plan drawings, water depth near the intake structure is approximately 22 feet and water depth near the discharge structures is approximately 12 feet. Habitats associated with this area were previously disturbed from the initial facility construction and consist of relatively shallow water with silt and sand substrates. A review of aerial photography suggests that limited submersed aquatic vegetation (SAV) beds may exist in the vicinity of the discharge structures in nearshore and offshore areas (see Figure 2-3). The SAV appears to be present near the outer edge of the rip-rap that was placed around the discharge structures to prevent erosion. Information is not sufficiently available to fully characterize the extent and composition of the SAV in the immediate vicinity of the intake/discharge structures.

Macroinvertebrate communities near the ZNS are expected to be of low diversity. The benthic macroinvertebrate community in waters less than 165 feet deep in southern Lake Michigan have historically been dominated by the amphipod *Diporeia*, oligochaetes of the family *Tubificidae*, and fingernail clams (*Sphaeriidae*) (Nalepa et al. 2000). In Lake Michigan, density declines of the critical food web components *Diporeia* and zooplankton in the last two decades are indications that this ecosystem is considerably stressed. In Lake Michigan, a vast majority of the native freshwater mussel population has been severely degraded by the establishment of the invasive zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena bugensis*) (US Environmental Protection Agency (USEPA) and Environment Canada, 2009).

Fish species potentially occurring in the vicinity of the ZNS may include coho salmon (*Oncorhynchus kisutch*), chinook salmon (*Oncorhynchus tshawytscha*), lake trout (*Salvelinus namaycush*), brown trout (*Salmo trutta*), yellow perch (*Perca flavescens*), catfishes (*Ictalurus sp.*), rainbow smelt (*Osmerus mordax*), bluegill (*Lepomis macrochirus*), rock bass (*Ambloplites rupestris*), common carp (*Cyprinus carpio*), alewife (*Alosa pseudoharengus*), bloater (*Coregonus hoyi*), ninespine stickleback (*Pungitius pungitius*), round goby (*Neogobius melanostomus*), and sea lamprey (*Petromyzon marinus*) (Smith, 2002, Madenjjian et al., and Lake Michigan Angler, 2013). During the 20th century, non-native invasive species such as the sea lamprey, round goby, and zebra mussel have significantly disrupted the ecosystem balance of native fauna in Lake Michigan.

Executive Order (EO) 13112, Exotic Organisms, prohibits executive agencies from introducing plants or animals which do not naturally occur, presently or historically, in ecosystems in the United States. Exotic species can threaten native species and ecosystems due to aggressive growth, reproduction or survival rate, and diseases or parasites they may transmit to native

species. Project alternatives for the ZNS will not introduce any exotic plants or animals. It is expected that appropriate BMPs consisting of equipment cleaning and maintenance procedures prior to and following use should prevent any introduction of exotic plants or animals.

Potential Environmental Impacts and Proposed Mitigation Measures – Aquatic Ecology

Attribute	1 – No Action	2 – Full Removal
Mobile Aquatic Species	☐	☒
Non-Mobile Aquatic Species	☐	☒
Lake Bottom Disturbance	☐	☒
Submersed Aquatic Vegetation	☐	☒
Shoreline Disturbance	☐	☒
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative		
☒= Applicable to the alternative		

Under Alternative1, the No Action Alternative, there would be no impacts to aquatic ecology.

Removal activities associated with Alternative 2 would be implemented using appropriate BMPs as required by applicable Federal, state, and local regulations to minimize potential adverse impacts from construction activities. A coffer dam, or similar structure, may be used to minimize disturbance and sediment dispersal should Alternative 2 be implemented. Sediment disturbance along the shoreline and in water will be temporary and localized in the vicinity of the project and will only occur where the piping and structures are present.

Proposed Alternative 2 would result in the complete removal of intake and discharge piping and structures. Removal of intake and discharge piping/structures will disturb shoreline and lake-bottom habitat and the associated sediments. Aquatic ecological effects associated with pipe removal and lake-bottom disturbance may include increases in suspended sediments, loss of immobile aquatic benthic organisms, and disturbance of SAV. Fish and other mobile organisms will likely avoid these areas during removal activities, and impacts would be mostly limited to temporary displacement. A small loss of immobile benthic organisms could occur during the removal of piping and/or intake and discharge structures. Once removal activities have ceased, however, benthic organisms would be expected to re-colonize the disturbed areas. Alternative 2 may result in adverse impacts to SAV since it includes the removal of all intake/discharge piping

and disturbance of the lake bed. Impacts, however, would be localized and temporary as the SAV will re-establish once removal activities have ceased. Field surveys may be required during Phase II activities to map existing SAV beds to more quantitatively assess the potential for impact. Relative to the expanse of undisturbed shoreline and shallow water habitat in the vicinity of the proposed project, aquatic ecosystem impacts associated with Alternative 2 are considered to be small and temporary.

3.3.5 Terrestrial Ecology

This section considers potential effects to flora and fauna, and exotic/invasive species that may occur at the impact area or surrounding area.

Existing Conditions – Vegetation

The ZNS is in the Chiwaukee Prairie Level IV ecoregion, which is within the Eastern Corn Belt Plains Level III ecoregion (Woods, et al, 2006). Where it borders Lake Michigan, the Chiwaukee Prairie ecoregion is characterized by beaches, sand dunes, swales, low sandy beach ridges, and bluffs. The landscape of Illinois Beach State Park, which is located to the north and to the south of the ZNS, is comprised of alternating sand ridges and marshy swales. This undulating topography contains many distinctive and complex habitats, including beach, foredune, sand prairie, sand savanna, marsh, fen, panne, sedge meadow, and pond (IDNR, 2011b). The ecologically diverse habitats found within Illinois Beach State Park support a wide variety of flora, ranging from dry, upland species to obligate wetland plants (Illinois Natural History Survey [INHS], 2013a).

The terrestrial portion of the study area consists of a section of sparsely vegetated beach shoreline immediately adjacent to the ZNS. Frequent disturbances from storms and periods of high water have prevented the establishment of vegetative communities on the open beach (U.S. Wildlife Habitat Council [USWHC], 2005). The foredunes and sand dunes, which support a diverse vegetated community and are found behind the open beach areas within Illinois Beach State Park, are not present in the project study area due to disturbance related to the original construction of the ZNS.

Existing Conditions – Wildlife

The wide range of natural community types found in Illinois Beach State Park provides habitat for over 300 animal species (IDNR, 2011b). Common species that have been observed in the vicinity of the ZNS and in Illinois Beach State Park include eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*Sciurus niger*), American red squirrel (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamius striatus*), white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), wild turkey (*Meleagris gallopavo*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), and American goldfinch (*Carduelis tristis*) (USWHC, 2005). The diverse habitats in Illinois Beach State Park also provide an important area for bird migratory routes (INHSa, 2013).

Since the study area is a sparsely vegetated, open beach and the foredune and sand dune habitat is not present, common species found within the study area consist mainly of shorebirds. Common bird species known to utilize open beach habitat and near shore areas include killdeer (*Charadrius vociferous*), ring-billed gull (*Larus delawarensis*), herring gull (*Larus sargentatus*), common goldeneye (*Bucephala clangula*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), ruddy turnstone (*Arenaria interpres*), willet (*Tringa semipalmata*), American avocet (*Recurvirostra americana*), semi-palmated plover (*Charadrius semipalmatus*), black-bellied plover (*Pluvialiss quatarola*), spotted sandpiper (*Actitis macularia*), great blue heron (*Ardea herodias*), and common grackle (*Quiscalus quiscula*) (USWHC, 2005; Illinois Raptor Center, 2011; Schilling and Williamson, 2011).

Existing Conditions – Exotic/Invasive Species

Exotic/invasive species are known to occur in only few locations on or near the ZNS. These exotic/invasive species include common reed (*Phragmites australis)* and purple loosestrife (*Lythrum salicaria)*, both of which are found in the swale and wetland habitats that are located behind the sand dunes (USWHC, 2005). The terrestrial portion of the study area is shoreline beach habitat. No known exotic or invasive species occur within the study area.

Potential Environmental Impacts and Proposed Mitigation Measures – Terrestrial Ecology

Attribute	1 – No Action	2 – Full Removal
Plant Species	☐	☒
Wildlife Species	☐	☒
Exotic/Invasive Species	☐	☐
Construction Noise Impacts	☐	☒
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Potential Plant Community Impacts

The only terrestrial habitat found within the study area consists of sparsely vegetated and non-vegetated sandy beach. A rip-rap sea wall separates the study area shoreline from the developed land of the ZNS. The sand dunes, wetland areas, and prairies that support much of the diverse vegetation in the vicinity are not found in the project study area. As Alternative 1 does not involve any construction or removal activities, impacts to terrestrial ecosystems are

not anticipated. Alternative 2 would temporarily disturb the sparsely vegetated shoreline resulting from the construction of a temporary coffer dam, if required, along the shore and nearshore areas and during removal if intake/discharge pipes. Since the habitat within the study area supports few plant species and no Federal or state-listed plant species, and, following structure removal, the beach would be restored to existing contours, the impacts to vegetation would be small and temporary.

Potential Wildlife Impacts

The dune, wetland, and prairie habitats that support much of the wildlife found in Illinois Beach State Park and surrounding areas are not located within the study area. The sparsely vegetated sandy beach may provide foraging and nesting habitat for shorebirds and seasonal migratory birds. Alternative 1 would not impact any wildlife species as there would be no construction or removal activities. Alternative 2 would impact shorebirds and seasonal migratory birds due to the construction of a temporary coffer dam (if required), the removal of piping, and construction noise. If removal activities are conducted during the non-nesting season, impacts to nesting shorebirds would be minimized. The beach would be re-graded following removal activities, and shorebirds utilizing the study area beach for foraging would likely return following completion of construction activities; thus, the impacts to wildlife would be small and temporary.

Potential Exotic/Invasive Species Impacts

EO 13112, Invasive Species, prohibits the introduction of invasive species and requires that the economic, ecological, and human health impacts related to invasive species be minimized. No known exotic or invasive species occur within the terrestrial portion of the study area. Since Alternative 1 does not involve any construction or removal activities, impacts associated with the inadvertent introduction of exotic or invasive species would be eliminated. Alternative 2 would involve full removal of piping resulting in ground disturbance, which may increase the risk of introducing opportunistic exotic or invasive species. To minimize introduction of exotic or invasive species, appropriate BMPs would be followed, including daily decontamination of trucks, track hoes, boats, and other construction equipment before and after use in the study area; consequently, impacts resulting from Alternative 2 would be small.

3.3.6 Sensitive Species

This section considers potential effects on Federal and/or state protected species of flora and fauna that may occur at the impact area or surrounding area.

Existing Conditions

Identification of sensitive species potentially affected by the project is based on an internet records search of the United States Fish and Wildlife Service (USFWS), NOAA, and IDNR for Lake County. Federally listed species that are known or believed to occur in Lake County include the piping plover (*Charadrius melodus*), pitcher's thistle (*Cirsium pitcheri*), Eastern

prairie fringed orchid (*Plantanthera leucophaea*), Karner blue butterfly (*Lycaeides melissa samuelis*), and Eastern massasauga (*Sistrurus catenatus*) (candidate species) (USFWS, 2012). As of September 2011, there are 137 state-listed threatened or endangered species located in Lake County, consisting largely of flora and avian species, but also includes some fish and herpetofauna (IDNR, 2011c). The list of potential species to occur in the project area was further refined with the IDNR's Ecological Compliance Assessment Tool (EcoCAT), which provides state-protected resources that may be in the vicinity of the project. Ten state-listed threatened or endangered species are identified as potentially occurring in the region (IDNR, 2012). Species identified by the EcoCAT report and the Federally listed species for the county are shown in Table 3-2. Because most of the project area occurs in Lake Michigan, and the onshore portion of the project consists of a sandy beach (Alternative 2 only), most of the species from these lists have been dismissed due to a lack of appropriate habitat in the project area. Those species further considered are identified in Table 3-2 and include marram grass (*Ammophila breviligulata*), sea rocket (*Cakile edentula*), piping plover (*Charadrius melodus*), pitcher's thistle, and Blanding's turtle (*Emydoidea blandingii*). Although Blanding's turtle is semi-aquatic, there are no state or Federally protected flora or fauna species identified on the Site or impact area that are truly aquatic.

Table 3-2 includes some plant species that are associated with beach dune habitat, including the dune willow and trailing juniper. Beach dunes are found along the northern Illinois section of the Lake Michigan shoreline, including Lake County and the adjacent Illinois Beach State Park. However, the shoreline area at the ZNS facility consists of a stretch of sandy beach with no dune formations. Therefore, these species are not discussed further in this assessment.

Marram Grass (*Ammophila breviligulata*). Marram grass is listed as endangered in Illinois but is not Federally listed. It is a perennial rhizomatous grass that can grow up to 3.28 feet tall. It is a coastal species that prefers open dunes along the beaches of Lake Michigan. The rhizomes are fast growing and can respond to the constantly shifting sands to allow it to serve as a critical sand binder. Marram grass habitat has been threatened by urban growth and accelerated shoreline erosion, which has limited the species in Illinois to Lake and Cook counties. While suitable habitat exists at the Site, there have been no reports of this species occurring at the ZNS Site.

Sea Rocket (*Cakile edentula*). Sea rocket is listed as threatened in the state of Illinois but is not Federally listed. This species is a summer annual that can reach almost 2 feet tall and branches frequently. The leaves are medium green, glabrous, and slightly succulent with a thick texture. Flowers consist of lavender to white petals that spread widely when in bloom. This species prefers full sun, moist to dry-mesic conditions, and very sandy soil. The sea rocket is a pioneer species of sandy beaches and colonizes areas that only a few plant species can tolerate. The sand is stabilized by the root system, while decayed remnants of foliage add

organic matter and nutrients to the soil. There have been no reports of sea rocket occurring at the ZNS.

Piping Plover (*Charadrius melodus*). The Great Lakes population of the piping plover is a Federally endangered species and is also listed as endangered for the state of Illinois. The piping plover is a small pallid shorebird (length about 7.25 inches) with a black collar, yellow/orange legs, and a short, stubby tail (Peterson, 2008). Piping plovers breed in three locations in North America – along the Atlantic Coast from North Carolina to Southern Canada, along the shores of the Great Lakes, and along rivers and wetlands of the northern Great Plains. Along the Great Lakes, piping plovers prefer wide, sandy, open beaches along the shore. Nesting territories may include river, lagoon, or other wetland habitats that generally have sparse vegetation and scattered cobble-stones (Hyde, 1999). In the winter, piping plovers migrate to the Gulf Coast between Florida and Texas and on into Mexico and the Caribbean, as well as migrating to the Atlantic Coast between southern North Carolina and Florida. Decline of the species has resulted from hunting, habitat loss, recreational pressure, predation, and environmental contaminants. In the 1970s and mid-1980s, high water levels in the Great Lakes reduced available breeding habitat in that region (Hyde, 1999).

The USFWS has designated critical habitat for the piping plover across approximately 6.21 miles of shoreline from Illinois Beach State Park to Waukegan Beach in Lake County, Illinois (50 CFR 17). Nesting for the piping plover in the Great Lakes region begins in early to late-May and extends until the birds migrate to their wintering grounds between late July and early September. Nesting birds are highly sensitive to disturbance, including loud noise, which may lead to abandonment of nests. While the piping plover has not been documented at the ZNS, the shoreline section of the project area has many of the primary constituent elements for nesting habitats. In 2009, the first piping plover nest in 30 years was found in Illinois along the shoreline south of the ZNS on Johns Manville property (USFWS, 2009). Nesting of piping plover has not been reported at the ZNS property.

Pitcher's Thistle (*Cirsium pitcheri*). This native thistle grows on the beaches and grassland dunes along the shorelines of Lakes Michigan, Superior, and Huron. It is listed as threatened at both the Federal and state levels. Its non-flowering form is a rosette or cluster of silvery leaves and its flowering form typically has one stem with many branches. The entire flowering plant may grow 3 feet tall. It takes 5 to 8 years before it blooms, and the flowers are cream or pink. The species has been threatened by direct habitat loss due to shoreline development, road maintenance and construction, and physical harm from shoreline recreation activities, such as hikers and off road vehicles. Pitcher's thistle was previously extirpated from Illinois but has been reintroduced in Lake County south of the ZNS. Pitcher's thistle is not known to occur on the ZNS.

Blanding's Turtle (*Emydoidea blandingii*). Blanding's turtles are long-lived, semi-aquatic turtles that spend a lot of time in water but are also known to travel long distances over land. In Illinois, they live on wet prairie or wetlands, near water. According to the INHS (2013b), they prefer quiet waters in marshes, prairie wetlands, wet sedge meadows, and shallow, vegetated portions of lakes. They eat, breed, and hibernate in water, preferring muddy-bottomed lakes or ponds. According to the Illinois State Museum (2013), the decline of this species may be related to the destruction of appropriate prairie habitat in Illinois. Although three Blanding's turtles have been observed on the Site in the past two years, they are likely utilizing remnant prairie or marsh habitat instead of the Lake Michigan shoreline. While pockets of suitable habitat may exist on the Site, suitable habitat does not exist on the open beach and open water of Lake Michigan.

Peregrine Falcon (*Falco peregrinus*). The peregrine falcon is a raptor that has a widespread range and has one of the longest migrations of any North American bird. Tundra-nesting falcons winter in South America, and may move 25,000 km (15,500 mi) in a year. Historically, peregrines bred along large (Mississippi River) rivers and lakes (Lake Michigan) where they constructed nests in cliffs. However, recent reintroduction programs have successfully established breeding pairs on buildings and other man-made structures. Associated habitat types include rocky crags, ledges, bluffs, forested regions, open country, grasslands or scrub land. Habitat types used by migrating peregrines are essentially waterways including the shorelines of Lake Michigan and the wetlands, marshes, open fields and woodland types found along edges of these areas (INHS, 2013c). Anecdotal observations made by ZNS staff have recorded the presence of peregrine falcon in the vicinity of the project area. However, nesting habitat on the fully decommissioned ZNS Site is considered to be lacking.

Threats to this species are related to use of chemical pesticides, chlorinated hydrocarbons and specifically DDT and DDE that are responsible for eggshell. Even though DDT has been banned in the U.S., its use in Mexico, Central and South American countries presents a serious hazard to peregrines throughout the western hemisphere. Indiscriminate shooting was reported to be the greatest factor contributing to adult mortality. Egg collecting, natural predators, disease, falconers, and human disturbance at the nest site and during the nesting period are also contributing factors to annual loss of eggs and young (INHS, 2013c).

Table 3-2. Special Status Species Identified in Project Vicinity

Scientific Name	Common Name	Federal Status	State Status	Preferred Habitat	Habitat on Site?
Aflexia rubranura	Redveined prairie leafhopper		T	Dry to wet-mesic prairie. In Illinois it is associated with moderately disturbed to relatively undisturbed prairies.	No

Table 3-2. Special Status Species Identified in Project Vicinity

Scientific Name	Common Name	Federal Status	State Status	Preferred Habitat	Habitat on Site?
Ammophila breviligulata	Marram grass		E	Close to the shore of Lake Michigan, usually near the beach itself, in the belt of actively moving sand, where it performs an extremely important ecological role in stabilization.	Yes
Cakile edentula	Sea rocket		T	Often found in the forefront of beach vegetation, in the areas most subject to disturbance by waves. It can sometimes be found at some distance from the water's edge, even on perched dunes.	Yes
Castilleja sessiliflora	Downy yellow painted cup		E	Usually found on hill prairies and very dry areas with poor soil. Where soil and moisture are better, plants are taller and more open.	No
Charadrius melodus	Piping plover	E	E	Found on wide sandy lakeshore beaches with scattered cobbles and sparse vegetation. Also found on Lake Michigan islands in areas with same characteristics. Nesting area may include interdunal wetland or small stream.	Yes
Cirsium pitcheri	Pitcher's thistle	T	T	Grows on the open sand dunes and low open beach ridges of the Great Lakes' shores. It is most often found in near-shore plant communities but it can grow in all non-forested areas of a dune system.	Yes
Eleocharis pauciflora	Few-flowered spikerush		E	Wet meadows, bogs, hot springs, and other moist places.	No
Emydoidea blandingii	Blanding's turtle		E	Wetland complexes and adjacent sandy uplands. Calm, shallow waters, including wetlands associated with rivers and streams, with rich, aquatic vegetation are especially preferred.	Yes
Falco peregrinus	Peregrine falcon		T	Often breed in open landscapes with cliffs for nest sites including along rivers and coastlines. In migration and winter they can be found in open habitats, with a greater likelihood along barrier islands, mudflats, coastlines, lake edges, and mountain chains.	Yes
Ixobrychus exilis	Least bittern		T	Freshwater or brackish marshes with tall emergent vegetation. Nesting also occurs within the tall stands of vegetation.	No
Juniperus horizontalis	Trailing juniper		E	Sunny, dry, sandy dunes in cool climates, particularly in areas with an alkaline substrate.	No

Table 3-2. Special Status Species Identified in Project Vicinity

Scientific Name	Common Name	Federal Status	State Status	Preferred Habitat	Habitat on Site?
Lycaeides melissa samuelis	Karner blue butterfly	E	E	Open barrens, oak savannas, and prairies that contain wild lupine, which is the food source for the caterpillar stage. Can also be found in frequently disturbed areas such as rights-of-way, old fields, and road margins.	No
Plantanthera leucophaea	Eastern prairie fringed orchid	T	E	A wide variety of habitats, from mesic prairie to wetlands such as sedge meadows, marsh edges, even bogs. It requires full sun for optimum growth and flowering and a grassy habitat with little or no woody encroachment.	No
Salix syrticola	Dune willow		E	Foredunes along Lake Michigan with sandy and alluvial soils.	No
Sistrurus catenatus	Eastern massasauga	C	E	Wet areas including wet prairies, marshes and low areas along rivers and lakes. They also use adjacent uplands during part of the year and hibernate in crayfish burrows but they may also be found under logs and tree roots or in small mammal burrows.	No

E – Endangered; T- Threatened; C – Candidate

Potential Environmental Impacts and Proposed Mitigation Measures – Sensitive Species

Attribute	1 – No Action	2 – Full Removal
State-listed T or E	☐	☒
Federally Listed T or E	☐	☒
Construction Noise Impacts	☐	☒
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

As of 2005, there has been no documentation of state and/or Federally listed species occurring in the immediate impact area at the ZNS (USWHC, 2005). The Illinois Beach State Park, which borders the facility to both the north and south, is home to a large diversity of plants and animals, including many Federal and state-listed sensitive species. The park also provides breeding habitat for birds of state conservation concern. The foredunes to the south of Zion support a reintroduced population of pitcher's thistle (IDNR, 2011b). Additionally, these same habitats provide potential nesting habitat for the piping plover. Marram grass and sea rocket could occur at the ZNS; however there have been no recorded observations to date.

The immediate impact area of the Site was initially disturbed during construction of the ZNS and no longer resembles the dune formations prevalent in surrounding areas. This alteration results in a less desirable habitat for many of the listed species that rely on dune formations for habitat. Given the short-term nature of the work associated with removal of the facility, and that the project area is isolated from the state park by a rip-rap seawall, no direct impacts to these species are anticipated. Additionally, upon completion of construction activities, the shoreline is expected to be regraded and returned to pre-construction conditions, therefore reducing any long-term impacts to listed species that may incidentally use the area. Consultation with IDNR and USFWS may be performed to ensure that construction activities avoid the piping plover breeding period and any other sensitive time periods for listed species in the vicinity, thereby avoiding potential impacts.

Alternative 1 would not impact sensitive species as there would be no change to the current conditions and no associated construction activity. Alternative 2 results in the highest potential impact to the shoreline. Impacts, however, are expected to be short term as the impact area is expected to be restored following construction. However, noise associated with Alternative 2 has the potential to disturb piping plover nesting behaviors, potentially leading to nest abandonment. However, such impacts are highly dependent upon distance from the impact

area and timing of construction activities. If construction activities are performed outside the nesting period for the piping plover, impacts for Alternative 2 are temporary and negligible.

3.3.7 Floodplains and Wetlands

EO 11988 and the floodplain management criteria contained in 44 CFR Part 60, Criteria for Land Management and Use, requires that long-term and short-term adverse impacts associated with occupancy and modification of floodplains be avoided to the extent possible. A floodplain can generally be defined as the flat, low-lying area flanking a stream channel that is subjected to periodic flooding (Christopherson, 2003). Floodplains have been delineated in most areas of the country by the Federal Emergency Management Agency (FEMA) and identified on Flood Insurance Rate Maps, as occurring in either a 100-year and/or 500-year floodplain.

Jurisdictional waters of the United States, including streams and wetlands, are defined by 33 CFR Part 328.3 and are protected by Section 404 of the Clean Water Act (33 USC 1344), which is administered and enforced by the USACE. The 1987 USACE Wetlands Delineation Manual defines wetlands as "*areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.*" This definition supports the three criteria that must be met for a determination of jurisdictional wetlands according to the USACE: (1) wetland hydrology (subject to inundation or saturation near the surface for a period during the growing season), (2) hydrophytic vegetation (vegetation cover dominated by plants adapted to wet conditions), and (3) hydric soils (soils with characteristics that developed due to saturated conditions). All three criteria must be present for an area to be classified as a jurisdictional wetland.

Existing Conditions

The 100-year floodplains have been mapped in Illinois Beach State Park, near the ZNS (Figure 3-1). According to the FEMA Map Service Center website, the floodplains are located to the northwest and southwest of the study area and the ZNS. As shown on Figure 3-1 the project Impact area is not located within the 100-year floodplains. The entire shoreline within the study area is mapped as wetland by the Lake County Wetlands Inventory as depicted in Figure 3-1. Aerial photographs of the study area show that the shore consists of sparsely vegetated, sandy beach, with a rip-rap wall separating the beach from the ZNS. Obvious indicators of hydrophytic vegetation and wetland hydrology (saturated soils or surface water) are not visible on recent aerial photographs. Natural Resources Conservation Service Web Soil Survey maps classify the soil of the shoreline in the study area entirely as beach sand, which is considered not hydric.

According to the INHS (2013a), Illinois Beach State Park, which is located to the north and south of the study area, contains several diverse wetland habitats, including marsh, fen, panne,

sedge meadow, and pond. These habitats occur in swales lying between sand ridges and dunes that have formed behind the beach and foredunes adjacent to Lake Michigan. The USEPA in conjunction with Lake County, Illinois, completed an Advance Identification (ADID) study to identify wetlands of high functional value and quality throughout Lake County (Dreher, et al., 1992). ADID wetlands are mapped in areas to the north, west and south of the ZNS, but none are located within the study area (see Figure 3-1).

A review of aerial photography suggests that limited submersed aquatic vegetation beds (SAV) may exist in the vicinity of the discharge structures in near shore and off shore areas (see Figure 2-3). The SAV appears to be present near the outer edge of the rip-rap that was placed around the discharge structures to prevent erosion. Water depth may be too great for SAV growth near the intake structure.

Potential Environmental Impacts and Proposed Mitigation Measures – Floodplains and Wetlands

Attribute	1 – No Action	2 – Full Removal
100-Year Floodplain	☐	☐
State/County Wetlands	☐	☒
ADID Wetlands	☐	☐
Other Waters of the U.S. (Lake Michigan)	☐	☒
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Since the project Impact area is not located within a 100-year floodplain, no impacts to floodplains would occur as a result of Alternatives 1 or 2.

As Alternative 1 does not involve any construction or removal activities, there would be no impacts to wetlands. Alternative 2 would temporarily disturb areas mapped as Lake County Wetlands Inventory wetlands resulting from the construction of a temporary coffer dam, if required, along the shore and near shore areas, and during removal of intake/discharge pipes. This disturbance would be confined to the shore and near shore areas where discharge and intake pipes are located and, following structure removal, would be restored to existing contours. Thus, impacts resulting from Alternative 2 would be small and temporary.

Removal activities at the intake and discharge structures will likely occur within the limits of the rip-rap that was placed around these structures to prevent erosion. Since the SAV is growing

just beyond the limits of the rip-rap, disturbance to SAV will be small. Alternative 2 will potentially impact SAV since it includes the removal of all intake/discharge piping and disturbance of the lake bed. However, these impacts will be localized and temporary as the SAV will re-establish once removal activities have ceased. Field surveys may be required during Phase II activities to map existing SAV beds and assess the potential for impact.

Because Lake Michigan is a traditionally navigable water and, therefore, a jurisdictional water of the United States as determined by the USACE, Alternative 2 may require Clean Water Act Section 401/404 permitting for any demolition and/or removal activities that result in "fill" placement within Lake Michigan. Because of the size of the area potentially subject to fill activities, an Individual Section 404 permit is expected to be required for Alternative 2.

3.3.8 Coastal Zones

This section considers potential effects on coastal zones that may occur at the Site or surrounding area.

Existing Conditions

A coastal zone is defined in 16 U.S.C. § 1453 of the Coastal Zone Management Act (CZMA) as *"the coastal waters and adjacent shorelands, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches."* The CZMA provides for management of the nation's coastal resources, including the Great Lakes, and balances economic development with environmental conservation. The CZMA is administered by the NOAA's Office of Ocean and Coastal Resource Management.

The coastal zone boundary in Illinois includes approximately 1,500 square miles of lake and lake bottom of Lake Michigan. The lakeward coastal boundary is the Illinois state line in Lake Michigan and the landward limit is based on the landscape, more specifically the Lake Michigan watershed. Due to the degree of urbanization across the entire Illinois coastal area, the coastal zone boundary is designated along the center line of selected streets, roads, and highways that approximate the watershed limits. In northern Lake County, Green Bay Road, approximately four miles west of the ZNS, defines the coastal zone boundary (IDNR, 2011b). It has a north-south orientation, and generally follows the crest of a glacial moraine (the Highland Park Moraine) that is the high ground forming the boundary of the Lake Michigan watershed. In addition to Lake Michigan, this coastal zone also includes all streams that drain this area and discharge to Lake Michigan.

The coastal zone surrounding the ZNS includes a diversity of land use, habitat types, and resources. Municipalities located within the coastal zone near the ZNS include Winthrop Harbor, Zion, Beach Park, and Waukegan. Streams within the coastal zone include Dead Dog Creek, Kellogg Creek, and Bull Creek. Illinois Beach State Park includes the North Unit and South Unit,

located on either side of the ZNS. Issues of concern that have been identified within this coastal zone region include shore erosion, invasive species, and hydrology changes (IDNR, 2011b).

Potential Environmental Impacts and Proposed Mitigation Measures – Coastal Zones

Attribute	1 – No Action	2 – Full Removal
Shore Erosion	☐	☒
Invasive Species	☐	☐
Adverse	☐	☒
Beneficial	☐	☐
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Shore erosion within the coastal zone region currently occurs along the northern section of the Illinois Beach State Park North Unit. While erosion is part of the natural dynamics of the coastal system, it is currently being accentuated by the lack of a sediment supply from the north. It is estimated that a minimum of 80,000 cubic yards per year of sediment are needed to maintain a balanced annual sediment budget along the state park shore (Foyle, Chrazastowski, and Trask, 1998). Sediment from the park's North Unit contributes to the sediment supply at the South Unit, resulting in diminishing rates of shore erosion progressing southward with a null zone in the center (IDNR, 2011b. The project area is located within this null zone; therefore any actions which would change the current erosion patterns would impact the coastal zone region.

As Alternative 1 does not include any removal activities, there would be no impacts to shore erosion. Alternative 2 could potentially cause short-term adverse impacts to shore erosion as a result of coffer dam construction along the shore, if required. Implementation and adherence to BMPs will reduce the potential for erosion above the normal levels. Due to the short-term nature of the project and subsequent removal of structures upon completion, any changes in erosion are anticipated to be temporary and localized.

Invasive species in the coastal zone are a threat to state and Federal-threatened and endangered species found in the Illinois Beach State Park. There are currently multiple invasive species being managed within and adjacent to the park. Facility removal activities do not include the addition of any new vegetation which could threaten protected species. The area of shoreline to be impacted by the project is regularly disturbed; therefore removal activities are not anticipated to create conditions that would favor any new weedy or invasive species. Potential impacts from invasive species are discussed more in Section 3.3.5-Terrestrial Ecology.

Concerns regarding hydrology are related to impacts to streams within the coastal zone that discharge into Lake Michigan. As discussed in Section 3.3.3- Water Quality, the nearest stream to the project Site is Bull Creek located 0.2 miles to the south. Direct discharge into any stream or alteration of hydrology is not anticipated.

As described above, no impacts to the coastal zone are expected with Alternatives 1 and 2. However, Alternative 2 has the potential to have minor effects to shore erosion due to coffer dam placement, if required, and shoreline construction activities. Impacts from Alternative 2 therefore, are small but temporary.

3.3.9 Population

Population assessment refers to the temporary or permanent increases in local resident and transient populations due to construction or operation staff, which may result in changes in property values, increased traffic, and increased demands on potable water and wastewater treatment facilities, educational facilities, and medical facilities and physicians.

Existing Conditions

The ZNS is located within Census Tract 8602; this census tract is located wholly within the City of Zion and is one of several census tracts that make up the City of Zion. For analysis of Census Bureau Tracts, the American Community Survey (ACS) 5-year estimates provide the most reliable data. The most recent data set for the 5-year estimates is 2007-2011. For the City of Zion and Lake County, the most recent complete one-year data set available from the Census Bureau is 2010, which provides the most current numbers for these populations.

The total population of Census Tract 8602 was 3,508 per the ACS 2007-2011 report (United States Census Bureau (USCB), 2011a). The total number of housing units available for Census Tract 8602 was 1,363 to serve 1,143 households, resulting in 220 vacant units (USCB, 2011b). The 2010 Census Bureau total population for the City of Zion was 24,413 and for Lake County was 703,462 (USCB, 2010a). The City of Zion had 9,270 total housing units available to serve 8,041 households and Lake County had 259,358 total housing units available to serve 239,947 households (USCB, 2011b). The median value of owner occupied homes was $162,200 in Census Tract 8602, $169,800 for the City of Zion and $280,900 in Lake County (USCB, 2011b).

The City of Zion provides services through their Public Works Department. The City of Zion purchases their water from the Lake County Public Water District (LCPWD) and uses approximately 2 million gallons per day (MGD) (City of Zion, 2013). The Lake County Public Water District water treatment facilities are capable of supplying its existing customers a maximum flow of 6.5 MGD (LCPWD, 2013). The North Shore Sanitary District (NSSD) is a municipal body which owns and operates more than 100 miles of intercepting sewer lines and pumping stations which collect and convey wastewater from local sewer systems to Sewage

Treatment Plants (STPs) in Gurnee, Waukegan, and Highland Park, Illinois (NSSD, 2013). The City of Zion is serviced by the Waukegan STP. As of 2008, the Waukegan STP has a capacity of 22 MGD compared to usage of 18 MGD (USEPA, 2008).

The City of Zion Elementary School District 6 currently has six elementary schools and one middle school. However, due to decreased enrollment, the District is looking at closing one of the elementary schools (Zion, 2013). As of 2005, there were six community hospitals with a combined capacity of 872 beds and a total of about 2,450 physicians in Lake County (USCB, 2007).

Potential Impacts and Proposed Mitigation Measures – Population

Attribute	1 – No Action	2 – Full Removal
Population Increase	☐	☒
Property Value	☐	☐
Traffic	☐	☐
Water Supplies	☐	☐
Wastewater Treatment Facilities	☐	☐
Education Facilities	☐	☐
Medical Facilities	☐	☐
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Under the No Action Alternative, there would be no impacts on resident populations in the Zion area.

An estimated labor force of 20 would be required to complete the proposed intake/discharge structure disposition. The laborers will be skilled and predominantly from out-of-state, comprised mostly of divers and laborers skilled in underwater demolition activities/barge operations. Out-of-state laborers will stay in local hotels on a temporary basis and will nominally increase the transient population of the project area. No changes in residential population are expected, therefore there will be no impact to property values, traffic volume, or public facilities (including public works, education, medical).

3.3.10 Community Services

Community services refer to services provided by surrounding communities such as police, fire and emergency medical treatment (EMT) services.

Existing Conditions

Police, firefighting, and EMT services are available to the Site from the City of Zion. The Zion Police Department has 60 total law enforcement employees including 47 officers and 13 civilians (Federal Bureau of Investigation (FBI), 2011). The Zion Police Department is a member of the Lake County Major Crimes unit and the Northern Illinois Police Alarm System. Firefighting and EMT services are available from the City of Zion Fire and Rescue Department (City of Zion, 2012). The Fire and Rescue Department consists of 26 personnel, of whom 24 shift personnel are divided into three shifts. The Site is also serviced by the Lake County Sheriff's office, which includes a Marine Unit. The purpose of the Marine Unit is to enforce state laws and local and county ordinances in cooperation with the IDNR, McHenry County Sheriff's Department, the USCG and the Fox Waterway Agency (for the Fox River waterway) (Lake County Sheriff, 2010). The Marine Unit is staffed with two command officers, 50 part-time Sheriff's Deputies and part-time communication dispatchers and maintenance technicians.

USCG Sector Lake Michigan is responsible for all Coast Guard missions on Lake Michigan and surrounding navigable waterways, including Search and Rescue, Law Enforcement, Aids to Navigation, Marine Safety, and Homeland Security. Headquartered in Milwaukee, Wisconsin, the Sector is the operational and administrative commander of 22 subordinate field units, including 19 multi-mission Stations, 1 Marine Safety Unit, 1 Marine Safety Detachment and 1 Sector Field Office. Coast Guard Station Aids to Navigation Team (STANT) Kenosha is a multi mission shore facility with its primary missions is Search and Rescue and Aids to Navigation, under the control of USCG Sector Lake Michigan. Fulfillment of these missions includes professionally servicing all aids and correcting all aids to navigation discrepancies. STANT Kenosha enforces Federal laws in accordance with Coast Guard Regulations and directives (USCG, 2013). The current aids to navigation at the Site include Zion Intake Buoys A-C and Zion Intake West Light. These are permitted as private aids to navigation under the jurisdiction of USCG STANT Kenosha (USCG, 2010).

Potential Impacts and Proposed Mitigation Measures – Community Services

Attribute	1 – No Action	2 – Full Removal
City of Zion Public Services	☐	☐
USCG Services	☐	☐
Long Term	☐	☐
Short Term	☐	☐
Overall Rating	**No Impact**	**No Impact**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

The intake/discharge structure disposition is expected to be carried out by a small labor pool of approximately 20 persons in a combination of local and out-of-state laborers. Therefore, local fire, police and medical services would not be affected since no additional demands for services would occur from potential relocations to the area. During the period of the intake/discharge structure disposition, crews will be operating in Lake Michigan. Although there is not a specific requirement from the USCG for additional patrols, it is anticipated that the USCG will actively patrol the area during the disposition operations.

Under the No Action Alternative, the USCG STANT Kenosha would maintain authority on a long-term basis over the aids to navigation associated with the intake structure. Under the removal alternatives, USCG STANT Kenosha would be involved on a short-term basis to process the documentation associated with removing the aids to navigation. However, once the aids are removed, USCG STANT Kenosha would no longer have these aids under their jurisdiction.

3.3.11 Land Use and Real Property

Land use represents the current and planned use of the property in a jurisdiction by the governing authorities. Real property issues consider the potential impacts associated with the reduction of land on the tax rolls or change in land value.

Existing Conditions

The ZNS property is located in the extreme eastern portion of the City of Zion in Lake County, Illinois on the west shore of Lake Michigan (ComEd, 1999). Although the Site encompasses approximately 250 acres, it is relatively isolated as the property is bordered to the north and south by Illinois Beach State Park, a small industrial area followed by railroad tracks to the west and Lake Michigan to the east. The center of the community of Zion is approximately 1.6 miles from the plant location on the Site. There are no schools or hospitals within one mile and there are no residences within 2,000 feet of station structures (ComEd, 1999). The nearest church, Memorial United Methodist Church, is located 1.1 miles west of the Site at 2935 Sheridan Road.

East Elementary School is the closest school facility, at 2913 Elim Avenue, 1 mile west of the Site. The closest daycare is Martha's Daycare North, at 2682 Sheridan Road, in Zion, located 1.1 miles west of the Site.

Lake Michigan is used for commercial barge and ship traffic, which do not ordinarily operate within five miles of the Site. The circulating water intake and discharge pipes in Lake Michigan have been in place since approximately 1970 and are designated with aids to navigation.

Potential Impacts and Proposed Mitigation Measures – Land Use and Real Property

Attribute	1 – No Action	2 – Full Removal
Encroachment on Existing Land Use	☐	☐
Change in Land Use Pattern	☐	☐
Land Value	☐	☐
Tax Rolls	☐	☐
Long Term	☐	☐
Short Term	☐	☐
Overall Rating	**No Impact**	**No Impact**
☐= Not applicable to the alternative		
☒= Applicable to the alternative		

The removal alternatives would occur within the existing Site bounds. Additionally, no alteration of land use is expected with any of the project alternatives under consideration. Public access to the lake area in the vicinity of the removal of the aids to navigation is discussed separately in Section 3.3.13 Recreation.

Under both the No Action and Removal Alternatives, no property acquisition or transfers will be required. Therefore, there will be no impact on land values or tax rolls within the City of Zion. No mitigation measures are required since no adverse impacts are expected to land use or real property with either the No Action or Removal Alternatives.

3.3.12 Aesthetics and Noise

Aesthetics refers to the visual resources, including natural and man-made features that give a particular landscape its aesthetic properties. High sensitivity areas relate to rare or unique natural settings. Medium sensitivity areas relate to more developed areas with motor vehicles and modern civilization. Low sensitivity areas relate to areas with minimal landscape features and few changes in appearance. Noise refers to the generation of noise by construction or normal operations on the property.

Existing Conditions

The setting at the facility consists of a small strip of shoreline and nearshore open water areas of Lake Michigan. The topography of the shoreline area and its immediate environs is relatively flat with elevations varying from the lake shoreline to approximately 20 feet above the lake level. The only surface waters identified within the boundaries of the planned project area are those in Lake Michigan. Wetlands and marsh habitats are located near the project area in the adjacent Illinois Beach State Park. The region around the project Site would be qualified as a medium sensitivity area. While there is relatively no elevation change, the neighboring state park offers a diversity of natural settings, including beach dunes, which are rare in Illinois.

At the facility, noise had previously been generated from the twin main generators from the original design that have been converted into synchronous condensers, which are no longer operating. There are no other noise generating facilities near the ZNS. The Site is bordered to the north and south by the Illinois Beach State Park, which is largely used for recreational and conservation purposes. There are no residences within 2000 feet of the station structures and no schools or hospitals within one mile. The center of the nearest community, Zion, Illinois is located 1.6 miles to the west of the plant.

Potential Environmental Impacts and Proposed Mitigation Measures – Aesthetics and Noise

Attribute	1 – No Action	2 – Full Removal
Vegetation Removal	☐	☐
Viewscape Alteration	☐	☒
Land Use Change	☐	☐
Removal of Navigation Buoys	☐	☒
Alteration/Change of Noise Levels	☐	☒
Adverse	☒	☐
Beneficial	☐	☒
Long Term	☒	☒
Short Term	☐	☒
Overall Rating	**Small**	**Small**
☐= Not applicable to the alternative		
☒= Applicable to the alternative		

Short-term impacts to aesthetics vary slightly with each alternative action. Alternative 1 (No Action) would not result in any changes to the current aesthetic conditions as the navigation buoys would remain in place. However, the visibility of the existing aids to navigation would represent a long term unnatural feature of the lake viewshed. Alternative 2 (full removal) would

require bulkhead construction near the shoreline area to support facility removal. In addition, removal activities associated with Alternative 2 is expected to entail a short term disruption of the viewshed associated with the equipment and vessels in the lake that could be visible from shore or water. However the project area is not open to public access and is blocked from the viewshed to the west by the ZNS, therefore no significant alterations of viewscapes are expected during the removal phase.

The proposed facility removal activities associated with Alternative 2 will have a minor beneficial long-term (permanent) impact to the viewshed by virtue of the removal of buoys associated with navigation aids. Upon completion of work under Alternative 2, it is expected that the shoreline will be graded and returned to pre-construction conditions. The majority of the project area for Alternative 2 is in Lake Michigan where the pipes are located at the bottom of the lake; therefore post-removal viewshed conditions will not be affected.

Noise generation will result from construction activities, including those associated with removal of piping near the CWIS forebay. For on-shore activities, noise levels are expected to be a result of common construction equipment. Due to the distance of the Site from sensitive receptors, there will be limited temporary impacts on noise levels. Some increased noise may be experienced by people visiting the neighboring Illinois Beach State Park; however noise impacts will be temporary and will attenuate with distance from the Site.

Removal of piping and other demolition activities within Lake Michigan in Alternative 2 will result in underwater noise. Sources of noise include boat operation, coffer dam installation and removal, dredging, and structure demolition. Noise generation due to facility removal can impact fish species in the vicinity. It is anticipated that the fish will exhibit avoidance behavior in response to increased noise levels, therefore minimizing physical harm. Consultation with IDNR and USFWS can ensure construction activities avoid any sensitive time periods for area species.

Under Alternative 1, the intake/discharge structures and navigation buoy currently located at the end of the intake line would remain in place. Therefore, there would be no change to the aesthetics or impacts on noise levels of the area. During removal activities, there would be small temporary impacts to aesthetics associated with Alternative 2. These alternative options also include the removal of the navigation buoy, which would be a long-term beneficial impact to aesthetics. Noise impacts would only be small and temporary for Alternative 2.

3.3.13 Recreation

Recreation refers to public and private facilities and lands that provide opportunities for recreational activities, such as parks, trails, golf courses and marinas.

Existing Conditions

The following provides a summary of the existing recreational facilities located within a one-mile radius of the ZNS.

There following parks, which offer a variety of activities, are located within one mile of the center of the Site:

- Illinois Beach State Park, Zion, Illinois, adjacent to the south
- Hosah Park, Zion, Illinois, adjacent to the north
- Edina Park, Zion, Illinois, approximately 0.8 miles west
- North Dunes Nature Preserve, Zion, Illinois, approximately 1 mile north
- Camel Park, Zion, Illinois, 0.9 miles southwest

Recreational use of areas adjacent to the ZNS include swimming, skiing, and surfing in the lake near the shore (Illinois State Beaches) and walking, hiking, camping, and picnicking.

Although slightly further than one mile from the Site, there are two golf courses located 1.6 miles west of the Site, the Shiloh Park Golf Course at 2400 Dowie Memorial Drive, which also includes a public swimming pool and the Shiloh Golf Course at 2300 Bethesda Boulevard, both in Zion, Illinois.

Lake Michigan is used by recreational boaters in the project area. The nearest marina/public boat launch is North Point Marina, at 701 North Point Drive, Winthrop Harbor, Illinois. This marina is located approximately 2.5 miles north of the Site. Lake Michigan Angler, a tackle shop at 1038 Sheridan Road, in Winthrop Harbor, Illinois, is located 2.3 miles northwest of the Site. There are also several fishing charter services in Winthrop Harbor, Illinois that are located approximately three miles north of the Site, including Diamond Ghost Charters and Jackpot Fishing Charters.

Recreational boaters in Lake Michigan must avoid the area of the aids to navigation associated with the Site. As per USCG recommendations, "a safe boater will always have the appropriate nautical chart(s) onboard their vessel. The exact meaning of an aid to navigation may not be clear to the boater unless the appropriate chart is consulted. Boaters who pass too close to a buoy risk collision with a buoy, the buoy's mooring, or with the obstruction which the aid marks. Boaters must not rely solely on any single aid to navigation for determining their position, particularly buoys. Environmental conditions, seabed slope, composition, and collisions or other accidents may cause buoys to shift from their charted positions, sink or capsize. Boaters should not come close to beacons due to the danger of collision with rip-rap (stones/broken rocks), structure foundation, or with the obstruction/danger that the aid marks. Always maintain a safe distance from all aids to navigation." (USCG, 2003)

Potential Impacts and Proposed Mitigation Measures – Recreation

Attribute	1 – No Action	2 – Full Removal
Parks	☐	☐
Golf Courses	☐	☐
Marina/Boat Launch	☐	☐
Recreational Boaters and Fishing Charters	☒	☐
Long Term	☒	☐
Short Term	☐	☒
Overall Rating	**Small**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Under the No Action Alternative, recreational boaters and fishing charters would continue to be required to observe and avoid the aids to navigation and would be restricted from the immediate area. However, in consideration of the minor area of the lake to that is restrictive to boat access relative to the large area of the lake, impacts to recreation are considered to be small and adverse, but long term. No other impacts would occur under this alternative.

During the period of the intake/discharge structure deconstruction, crews will be operating in Lake Michigan. Barges will be anchored in the locations where work is occurring. For purposes of this assessment, a 50 foot radius around each structure is anticipated as the area of direct impact. Under the Full Removal Alternative 2, barges would move along the 2,600 foot length of the intake piping. Boaters would be restricted from traveling near the area of the barges during the approximate six months expected during removal.

3.3.14 Economic Effects

Economic activity refers to the effect that the proposed action would have on the economic conditions in the surrounding area. Factors contributing to economic activity that could potentially be affected by the proposed action are the size of civilian labor force, employment and unemployment levels, median household income, labor force distribution by occupation, economic characteristics, and poverty levels of families and individuals.

Existing Conditions

During the period of 2007-2011, the City of Zion had an estimated civilian labor force of 11,773, with approximately 14.8 percent of this labor force unemployed compared to Lake County which had an estimated civilian labor force of 367,716, with approximately 8.6 percent of this labor force unemployed. In the City of Zion, the civilian labor force occupations consist of approximately 27 percent management and professional, 31 percent sales and office, 18 percent service, 17 percent production and transportation, and 7 percent natural resources,

construction and maintenance. In Lake County, the civilian labor force occupations consist of approximately 42 percent management and professional, 26 percent sales and office, 14 percent service, 11 percent production and transportation, and 7 percent natural resources, construction and maintenance. The top three industries that employ the civilian labor force in the City of Zion are educational, health care and social services (23 percent), retail trade (17 percent) and manufacturing (15 percent). The top three industries that employ the civilian labor force in Lake County are educational, health care and social services (18 percent), manufacturing (16 percent), and professional, scientific, management, administrative and waste management services (13 percent) (USCB, 2011a).

According to 2007-2011 data for Census Tract 8602, the median household income (in 2011 dollars) was $66,953 with 14.5 percent of the population living below the poverty level. By comparison median household income was $51,650, with 17.5 percent of individuals living below the poverty line for the City of Zion, and $79,666 and 8.2 percent for Lake County (USCB, 2011a).

Potential Environmental Impacts and Proposed Mitigation Measures – Economic Effects

Attribute	1 – No Action	2 – Full Removal
Civilian Labor Workforce	☐	☐
Employment/ Unemployment Levels	☐	☐
Labor Force Distribution	☐	☐
Median Household Incomes	☐	☐
Poverty Levels	☐	☐
Beneficial	☐	☒
Long Term	☐	☒
Short Term	☐	☐
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative		
☒= Applicable to the alternative		

Since Alternative 2 requires specialized skills and equipment that would predominantly be derived from out-of-state, there is no anticipated short or long term impact to the local workforce, no changes to the industrial, civilian, or occupational labor forces. The costs for these activities are solely paid by a private entity and do not impact median household incomes or poverty levels. The positive short-term economic impacts will be an increase in hotel occupancy and restaurant patronage for the duration of the removal alternatives.

Under the No Action Alternative, there would be no impacts on economic activity in the City of Zion area.

3.3.15 Environmental Justice

EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) requires that Federal projects consider whether the project would have an adverse effect on minority or low-income populations. According to the CEQ guidelines (1997), minority populations that comprise more than 50 percent of the affected population or represent a significantly higher percentage (typically 20 percent or higher) of a population in a reference geographical area, such as a county or state, they require special consideration when assessing impacts.

This section includes a brief discussion of minority and/or low-income populations that are in the vicinity of the Site (relevant census tract, City of Zion, and Lake County), potential for disproportionate impacts to these populations, and the potential for controversy regarding the proposed project. The proposed actions do not involve expansion of the Site or any offsite construction activities.

Existing Conditions

According to the ACS 2007-2011 data for Census Tract 8602, the median household income (in 2011 dollars) was $66,953 with 14.5 percent of the population living below the poverty level. By comparison median household income was $51,650, with 17.5 percent of individuals living below the poverty line for the City of Zion, and $79,666 and 8.2 percent for Lake County (USCB, 2011a). Based on these comparisons, populations in the Site area have higher income and lower poverty levels than the City of Zion as a whole. Therefore, potential impact to low-income populations in the Site area is not of special concern.

According to the ACS 2007-2011 data for Census Tract 8602, the project area was comprised of 71.0 percent white, 7.7 percent black or African American, 17.5 percent Hispanic or Latino, 2.0 percent Asian, and 1.8 percent other races (USCB, 2011c). According to Census Bureau data from 2010, the population in the City of Zion, Illinois was comprised of 48.9 percent white, 31.0 percent black or African American, 27.7 percent Hispanic or Latino, 2.3 percent Asian and 0.1 percent other races. The 2010 Lake County population was comprised of 75.1 percent white, 7.0 percent black or African American, 19.9 percent Hispanic or Latino, 6.3 percent Asian, and 0.5 percent other races. These total amounts are greater than 100 percent because individuals may report more than one race (USCB, 2010a). The City of Zion has a higher percentage of minorities, including a significantly higher percentage of black or African Americans, than the Lake County population as a whole. The black or African American percentage of population in Zion is four times that of Lake County. However, the Site is located in Census Tract 8602, which has a much lower percentage of minorities than the City of Zion

and similar or lower minority populations than Lake County. Therefore, potential impact to a minority population in the Site area is not of special concern.

Potential Environmental Impacts and Proposed Mitigation Measures – Environmental Justice

Attribute	1 – No Action	2 – Full Removal
Impacts of Low Income	☐	☐
Impacts to Minorities	☐	☐
Disproportionate	☐	☐
Adverse	☐	☐
Beneficial	☐	☐
Long Term	☐	☐
Short Term	☐	☐
Cumulative	☐	☐
Overall Rating	**No Impact**	**No Impact**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

While low-income and minority populations are present in the vicinity of the ZNS, the percentages of low-income and minorities within the ZNS census tract are lower than those in the City of Zion. No impact to the greater population, including these special groups, is expected because all disposition activities would be on the ZNS property or within a localized area of Lake Michigan. Under the No Action Alternative, there would be no impacts on minority and low-income populations.

3.3.16 Air Quality

Air quality refers to the concentration of air contaminants in a specific location. Air quality is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions. The Clean Air Act (CAA), as amended, requires the USEPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The CAA established two types of national air quality standards. Primary standards set limits to protect public health, including the health of "sensitive" populations, such as asthmatics, children and the elderly; and secondary standards set limits to protect public welfare, including protection against decreased visibility, and damage to animals, crops, vegetation or buildings. The criteria air pollutants monitored under the CAA include; carbon monoxide, sulfur dioxide, nitrogen oxides, ozone, lead, and particulate matter. Locations that meet the NAAQS are designated "attainment" areas and locations that fail to meet NAAQS are designated as "non-attainment"

areas. "Maintenance areas" are those geographic areas that have had a history of nonattainment, but are now consistently meeting the NAAQS. Maintenance areas have been re-designated by the EPA from "nonattainment" to "attainment with a maintenance plan."

Existing Conditions

According to the EPA's Green Book (USEPA, 2012) and the Illinois Environmental Protection Agency (Illinois EPA), the ZNS is located in an area that is in attainment for all criteria pollutants, with the exception of ozone and particulate matter. Lake County is classified as Marginal with regard to the 8-hr ozone 2008 ozone standard. The Illinois portion of the Chicago-Gary-Lake County, IL-IN area is noted to be non-attainment with regard to the 1997 standard for particulate matter less than 2.5 microns in aerodynamic diameter (PM2.5).

Potential Environmental Impacts and Proposed Mitigation Measures – Air Quality

Attribute	1 – No Action	2 – Full Removal
Non-Attainment Area	☐	☐
Particulate Matter Emissions	☐	☐
Diesel/Gas-Fired Emissions	☐	☒
Exceedance of NAAQS	☐	☐
Long Term	☐	☐
Short Term	☐	☒
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Under the No Action Alternative, there would be no impacts on the air quality of the area. Under Alternative 2, emissions from internal combustion engines, if required at the ZNS for removal activities, could temporarily increase levels of some pollutants in the immediate proximity of the operating equipment. State air permits and/or Federally-mandated operating procedures may be required for certain types of equipment. Appropriate construction BMPs will be observed and equipment would be properly maintained in order to reduce emissions. Overall impacts to air quality under Alternative 2 are expected to be short-term and minor.

3.3.17 Cultural and Historic Resources

Under NEPA, compliance is required with Section 106 of the National Historic Preservation Act (NHPA), as amended, which addresses the protection of archeological, historic and cultural resources.

Existing Conditions

A review of Federal and State records for cultural, historic, and archeological resources at the project area included an internet search of records from the National Register of Historic Places (NRHP) and the Illinois Historic Preservation Agency (IHPA). The purpose of the search was to identify and map cultural and historic sites within the Area of Potential Effect (APE) and in surrounding areas, and to assess the potential project effects on these sites and archeological resources. The APE for direct effects to archaeological, cultural, and historical resources is assumed to include the immediate project area (50-feet beyond the limits of the existing structures) as stated in Section 2.0, whereas the surrounding vicinity is considered to be an area within 100 feet of the existing intake/discharge structures.

The NRHP and IHPA search entailed a review of all prehistoric and historic units of the National Park System, National Historic Landmarks, previously-recorded prehistoric and historic archaeological sites, and any other national or state historically significant sites located within a one-mile radius of the APE. The U.S. Geological Survey (USGS) records review involved a search for any Indian Reservations with an area equal to or greater than 640 acres within a one-mile radius of the APE.

The results of the records review showed no mapped historic, cultural, or archaeological resources within the APE or vicinity (IHPA, 2013 and National Atlas of the United States, 2006). The nearest site, located 1.2 miles to the west is the Shiloh House and is listed on the NRHP for architecture (NRHP, 2013) (Table 3-3). Two additional properties were located within 1.5 miles of the facility. These included the Zion Chapter House (NRHP) and Camp Logan National Guard Rifle Range Historic District (NRHP) (Table 3-3).

Table 3-3. Historic Properties within Two Miles of Project Location

Site Name	Location	Listing Status	Listing Criteria
Camp Logan National Guard Rifle Range Historic District	Illinois Beach State Park, 1.5 miles north of Site	NRHP	Event; military
Shiloh House	1300 Shiloh Blvd, Zion. 1.2 miles west of Site	NRHP	Architecture/engineering; person; religion; building
Zion Chapter House	2715 Emmaus Ave., Zion. 1.4 miles west of Site	NRHP	Architecture/engineering; building; social history

Potential Environmental Impacts and Proposed Mitigation Measures – Cultural and Historic Resources

Attribute	1 – No Action	2 – Full Removal
NRHP Listed Property	☐	☐
NRHP Eligible Property	☐	☐
Cultural Resources	☐	☐
Adverse	☐	☐
Beneficial	☐	☐
Action Requires Historic Preservation Office Coordination	☐	☐
Long Term	☐	☐
Short Term	☐	☐
Overall Rating	**No Impact**	**No Impact**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

There are no historic or cultural resources located within the APE or vicinity. Given the nature of the project and previous disturbance of the shoreline and lake bottom to construct the facility, the potential for encountering previously unrecorded archaeological sites is considered to be low. In the unlikely event that undocumented archaeological resources are encountered during ground-disturbing activities within the impact area, consultation shall be conducted with the IHPA.

In consideration of the absence of recorded historic properties within the immediate project area, and its previously disturbed nature, it is expected that there would be no impacts to

cultural or historic resources under any of the proposed alternatives, including Alternative 1, the No Action Alternative.

3.3.18 Solid and Hazardous Waste

The solid and hazardous waste category refers to changes in the proper management of solid waste and hazardous waste in compliance with local, state and Federal regulations.

Existing Conditions

The water intake system of the ZNS consists of three buried pipes extending approximately 2,600 lineal feet offshore from the crib house to the intake structure. As described in Section 2.0 and illustrated in Figure 2-1, the as-built construction of the intake/discharge systems consists of steel, concrete and corrugated pipe.

Potential Environmental Impacts and Proposed Mitigation Measures – Solid and Hazardous Waste

Attribute	1 – No Action	2 – Full Removal
Steel Removal/ Demolition	☐	☒
Bulk Operational Waste	☐	☒
Earth and/or Rock Debris	☐	☒
Adverse	☐	☐
Beneficial	☐	☐
Construction Site Stockpiling	☐	☐
Concrete Debris	☐	☒
Hazardous Waste	☐	☐
Long Term	☐	☐
Short Term	☐	☒
Cumulative	☐	☐
Overall Rating	**No Impact**	**Small**
☐= Not applicable to the alternative ☒= Applicable to the alternative		

Under Alternative 1 (No Action), there would be no new generation of solid or hazardous wastes at the Site.

Under Alternative 2 (Full Removal), the concrete in the intake and discharge systems would be removed from the lake and disposed as construction or demolition debris and the steel pipes,

fittings, and rebar would be salvaged and recycled. All material extending from the CWIS forebay to the terminus of the intake/discharge structures will be demolished and removed. The construction or demolition debris would need to meet Illinois EPA requirements prior to disposal in a permitted facility or, if certified under Illinois regulations as Clean Construction or Demolition Debris (CCDD), additional disposal options are available. The volume of material to be disposed and salvaged would include the concrete used to construct the intake structure, which is 104 feet in diameter; the concrete used to construct the two discharge diffuser structures, which are approximately 125 feet long, 30 feet wide, and 25 feet high; approximately 7,800 feet of 13 foot diameter steel pipe in the intake system; and approximately 1,520 feet of 14 foot diameter steel pipe in the two discharge systems. None of the material to be removed is known or suspected to be classified as hazardous material. Complete removal of the discharge piping will entail completion of a radiological survey to determine whether or not there are portions of the line that are contaminated with detectable levels of licensed radioactive materials. If such materials are detected, construction debris under this alternative would require disposal as radioactive waste. However, for the purposes of cost estimating as is summarized in Chapter 2, it is assumed that radioactive materials are not detected and that special handling of this construction debris is not required.

3.3.19 Regulatory Compliance

The analysis and recommendations in this assessment support the conclusion that the alternative selected for disposition of the intake/discharge structures at the ZNS requires no additional permits and will be in compliance with all applicable regulations (Table 3-4).

Alternative 1 is considered to be the alternative that involved the least amount of regulatory interaction and complexity. Under this alternative all structures remain in place and existing Class I navigation aids are subject to long term maintenance in accordance with USCG permit requirements. While other alternatives would eliminate this long term commitment, demolition would require additional consultation with USCG and permitting by USACE, IDNR OWR. Consultation with USFWS would also be required with Alternative 2. The effort to obtain required permits is considered to be a larger level of effort for Alternative 2 because of the magnitude of temporary impacts to the aquatic environment. While it is expected that most construction debris will be removed from the lake under Alternative 2, the "incidental fallback" of demolition debris on the lakebed during construction will continue to drive the permitting requirement with USACE, IDNR OWR. Upland disposal location assumed to be previously permitted or permitted by others.

Table 3-4. Regulatory Compliance

Regulation	Subject	Project Compliance Issues
EO 11988	Floodplain Management	Portions of the immediate surrounding area are located within the 100-year floodplain; however, the activities associated with structure removal are temporary actions that will not alter floodplain elevations.
EO 11990	Protection of Wetlands	Portions of the immediate surrounding area are located within areas that may be designated as wetlands under the jurisdiction of US Army Corps of Engineers. However, the activities associated with structure removal are temporary actions that will not result in fill placement within designated wetlands.
EO 11987	Exotic Organisms	Exotic/invasive species consist of zebra mussels that are likely attached to intake/discharge structures. Removal of structures will not result in an increase in abundance or distribution of invasive species.
EO 12898	Environmental Justice	No disproportionate impact on minority and/or disadvantaged populations is expected as a result of this proposed project.
33 USC 1323, Section 313; 40 CFR 122	Clean Water	NPDES permit(s) will be obtained as necessary for grading/construction activities during the removal action (Alternative 2).
33 CFR Chapter 1	Aids to Navigation	Compliance with requirements associated with discontinuance and removal of Class I and II aids (Alternative 2)
33 CFR 325	Work in Navigable Waters	Any work in Lake Michigan requires a permit from the US Army Corps of Engineers. (Alternative 2)
50 CFR 17	Endangered Species	No Federal or state listed species or their critical habitat are directly impacted as a result of project activities. Use of the impact area by Federally listed species is considered to be occasional/incidental. Informal consultation to be conducted with USFWS. (Alternative 2)
43 CFR	Wild and Scenic Rivers	The Site is not in an area that has Federal designation as Wild and Scenic Rivers.
40 CFR 201-211	Noise Control	Compliance with Federal noise standards is expected during development activities at the proposed expansion area.
40 CFR 141-149	Safe Drinking Water	Groundwater is not impacted as a result of the proposed development.
15 CFR 921-930	Coastal Zone Management	Lake County is a regulated coastal county. However, the proposed action does not alter coastal zone conditions or development patterns
40 CFR 323	Discharge of Dredge or Fill Material	A fill permit is expected to be required for actions entailing placement of materials in a Water of the US. (Alternative 2)

Table 3-4. Regulatory Compliance

Regulation	Subject	Project Compliance Issues
40 CFR 117	Reportable Quantities of Hazardous Substances	Reportable quantities of hazardous substances are not known to occur within the project area, nor expected to be generated by the proposed project.
40 CFR 761	PCB Issues	PCBs are not reported from the project area.
36 CFR 800	Historic Preservation	No historic properties occur within the area or immediate surrounding area.
IDNR/OWR's Part 3704 Regulation of Public Waters	Development Activities in State of Illinois public waters	Permit required for work in Illinois' public rivers, lakes and streams. (Alternative 2)

4.0 Summary and Recommendation

Based on our analysis, Alternative 1, No Action is recommended as the Preferred Alternative. The context for analysis and assessment of level of significance is considered to be the broader region surrounding the ZNS site. Therefore, while some impacts to environmental attributes for each alternative are considered to be SMALL and evident on a localized basis, there is little capacity for noticeable alteration and destabilization if the resource is evaluated within the broader context.

Alternative 1, No Action, has the least impact with regard to all evaluated attributes. There were only SMALL and localized impacts with regard to water resources, aesthetics and noise, recreation, and regulatory compliance; Alternative 1 had NO IMPACT on all other attributes. The SMALL impact to water resources is with regard to degradation of structures over time by waves and ice, although much of the broken structure is expected to fall to the lakebed near the existing locations. The SMALL impact to aesthetics is due to continuation of existing aids to navigation which represents a long term unnatural feature of the lake viewshed. The SMALL impacts to recreation are long term and include a small area of the lake that is restrictive to boat access. The SMALL regulatory impact for this alternative includes maintenance of the USCG permit for the existing aids to navigation.

Alternative 2, Full Removal, has the greatest impact with regard to all evaluated attributes. This alternative includes removal of all piping and intake/discharge structures, both above and below the lakebed. It includes the use heavy machinery for removal activities both under the beach and lakebed and therefore has SMALL and short term impacts on all affected environments during removal activities, including Geology and Soils, Water Resources, Water Quality, Aquatic Ecology, Terrestrial Ecology, Sensitive Species, Floodplains and Wetlands, Coastal Zones, Air Quality and Solid and Hazardous Waste. Due to the addition of a small skilled labor workforce, there will be a SMALL and short term impact to Population and a SMALL, short term positive impact with regard to Economic Effects. There is also a SMALL impact to Recreation while removal activities are being conducted. A MODERATE impact is noted with regard to Regulatory Compliance as approvals and permits from several regulatory agencies including USCG, USACE, IDNR, and OWR. There may also be interest from potential local stakeholders with regard to the full removal alternative. There was NO IMPACT on Community Services, Land Use and Real Property, Environmental Justice, and Cultural and Historic issues. There were SMALL impacts with regard to all other attributes, except regulatory compliance which had a MODERATE impact.

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Zion*Solutions* Site Personnel interviewed: Dave Carter, Bob Decker, Steve Horvath, Bruce Mann, Angela Marinkovic, Darlene Murphy

6.0 List of Preparers

Bill Elzinga (B.S. Biology, M.S. Biology) served as the AMEC technical lead primary reviewer for all sections of the document. Mr. Elzinga is a Senior Principal Scientist and has more than 28 years of experience in performing environmental impact analysis for a full range of both public and private sector clients.

Kimberly Pesenko (B.S. Civil Engineering) served as the AMEC project manager and principal author for the air quality section of the document. Ms. Pesenko is a Senior Professional with more than 21 years of experience in environmental compliance and air quality projects.

Steve Stumne (B.S. Biology, M.S. Environmental Science) provided oversight and document review of sections related to floodplains and wetlands, sensitive species, terrestrial ecology, and aquatic ecology. Mr. Stumne has over 22 years of professional experience providing environmental planning, permitting, natural resource investigations, NEPA analysis and documentation, wetland and stream delineation, mitigation, ecosystem restoration, floristic quality assessments, and endangered species investigations. Mr. Stumne has worked on Federal lands, utility corridors, coal-fired power plants, and nuclear power plants throughout the Midwest and Great Lakes Region.

Matt Basler (B.S. Wildlife and Fisheries, M.S. Fisheries Science/Management). Mr. Basler is a Biologist who has over 12 years experience with expertise in fisheries science, intake/discharge permitting, and ecological sampling and monitoring for the utility industry. For the Zion*Solutions* Environmental Assessment he authored sections related to aquatic ecology.

Mary E. Jank (B.A. Geology, M.S. Geology) served as principal author of the section related to geology. Ms. Jank has over 25 years of experience in geologic investigation, hydrogeologic assessments, and regulatory closures, in numerous types of subsurface environments, including karst and discontinuous tills.

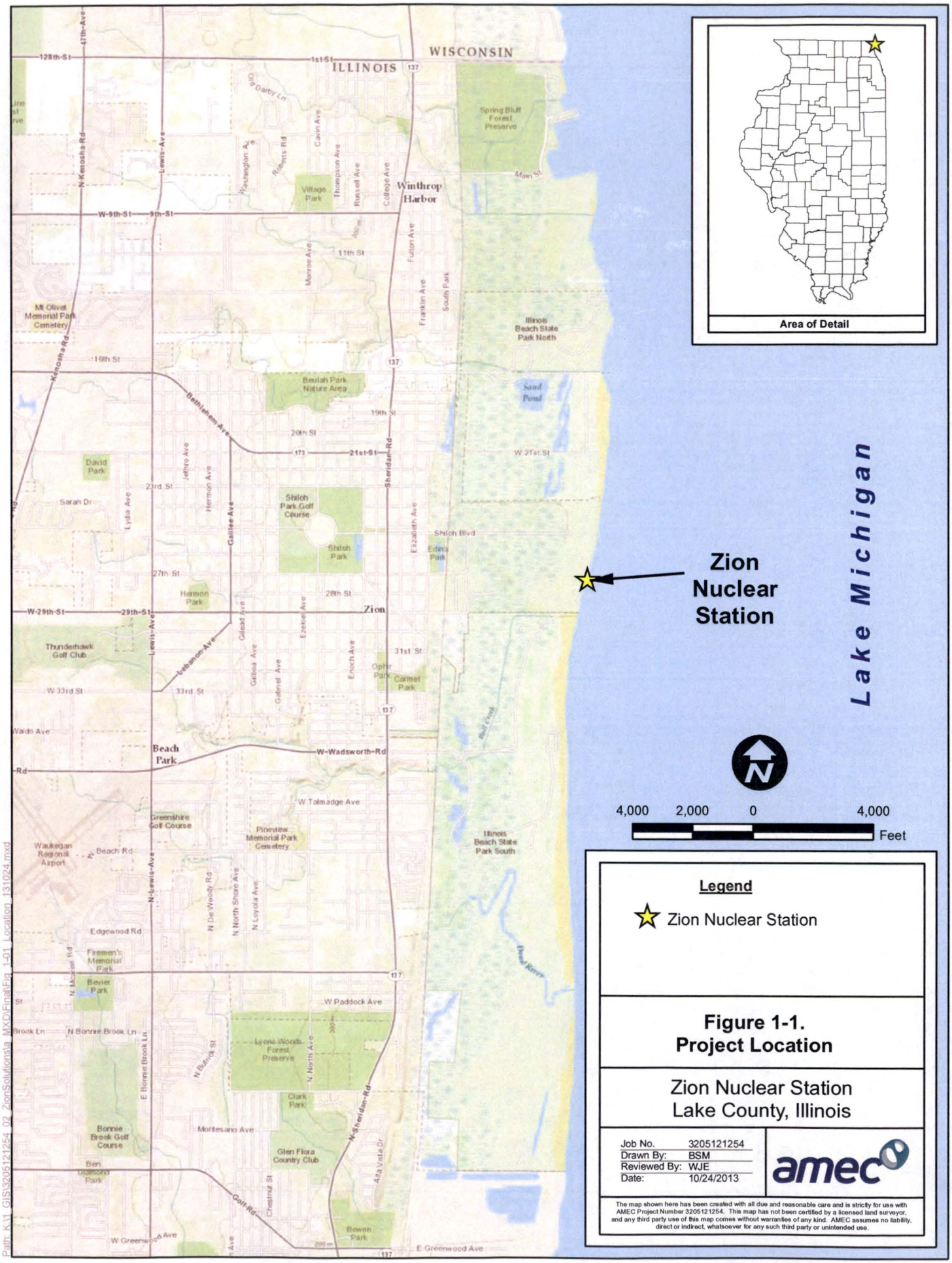
Caleb Leonard (B.S. Environmental Biology, M.S. Biology - Ecology, Evolution and Systematics) served as author for sections related to floodplains and wetlands, and terrestrial ecology. Mr. Leonard has 8 years of experience in wetland investigations, natural resource assessments, and environmental impact analysis.

Stephanie Miller (B.S. Marine Biology, M.S. Biology) was author for sections related to water quality, sensitive species, coastal zones, aesthetics and noise, and cultural and historic resources.

Wayne Ingram, PE (B.S. Civil Engineering) was author for sections related to lake water levels, lake currents, sediment transport, and shoreline erosion. Mr. Ingram has 34 years of experience in hydrology and hydraulics.

Chris Tedder (B.S. Geology) served as author for the section related to solid and hazardous waste. Mr. Tedder has over 25 years experience investigating, managing, and disposing of hazardous and solid waste.

Kristin Meek, PE (B.S. Civil and Environmental Engineering) served as principal author for sections related to Demographics/Community, Land Use, Recreation, Economics, and Environmental Justice.



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Dewey Ave
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Approximate Study Area
Zion Nuclear Station
Lake County, Illinois
Figure 1-2.
Study Area
Job No. 3205121254
Drawn By: BSM
Reviewed By: SPS
Date: 10/24/2013
amec
The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number 3205121254. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. AMEC assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.
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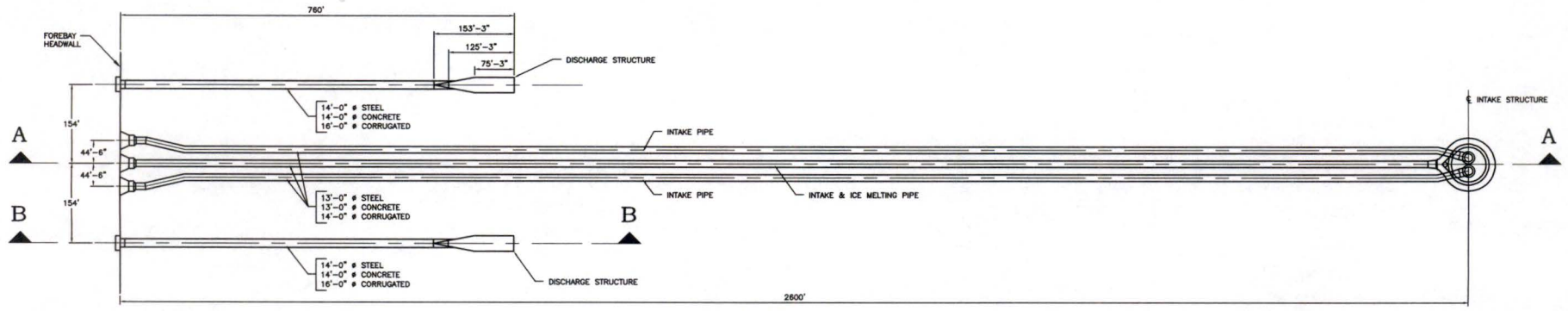
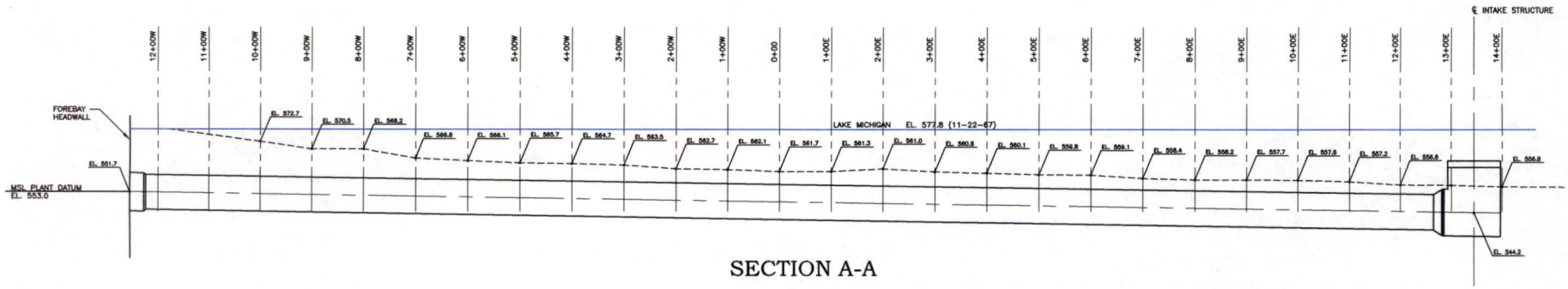
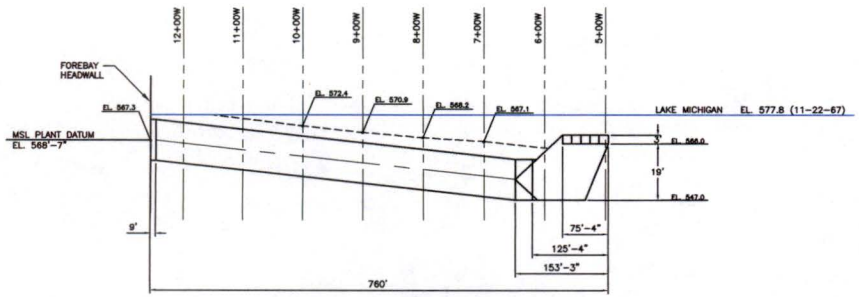


PLAN



SECTION A-A



SECTION B-B

amec

Existing Intake and Discharge Structures
Plan & Section
Zion Nuclear Station
Zion, IL

FIGURE
2-1

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
GAP	3205121254	WM	02/11/13	.

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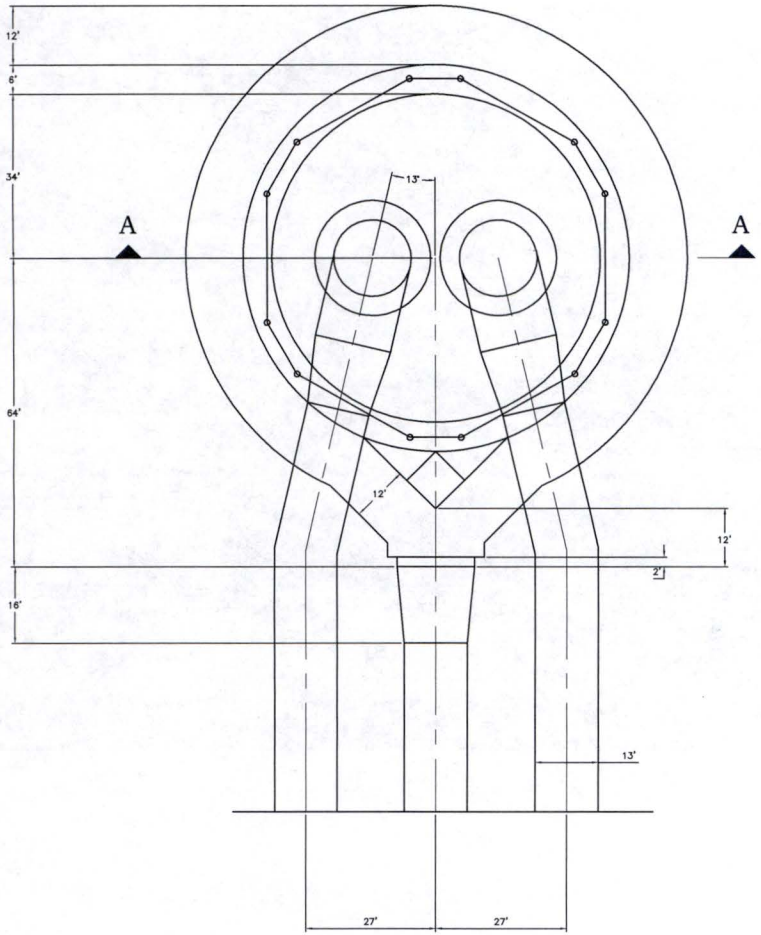
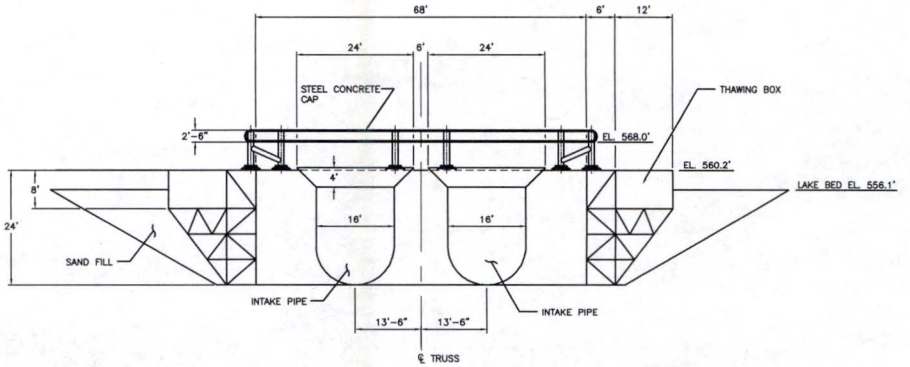


UPPER PLAN INTAKE STRUCTURE



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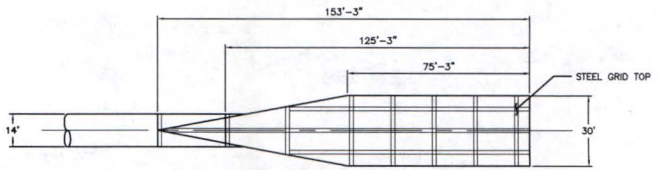
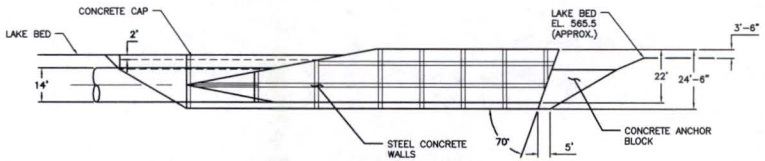


DISCHARGE STRUCTURE PLAN



DISCHARGE STRUCTURE ELEVATION

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Existing Intake and Discharge Structures
Details
Zion Nuclear Station
Zion, IL

FIGURE 2-2

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE
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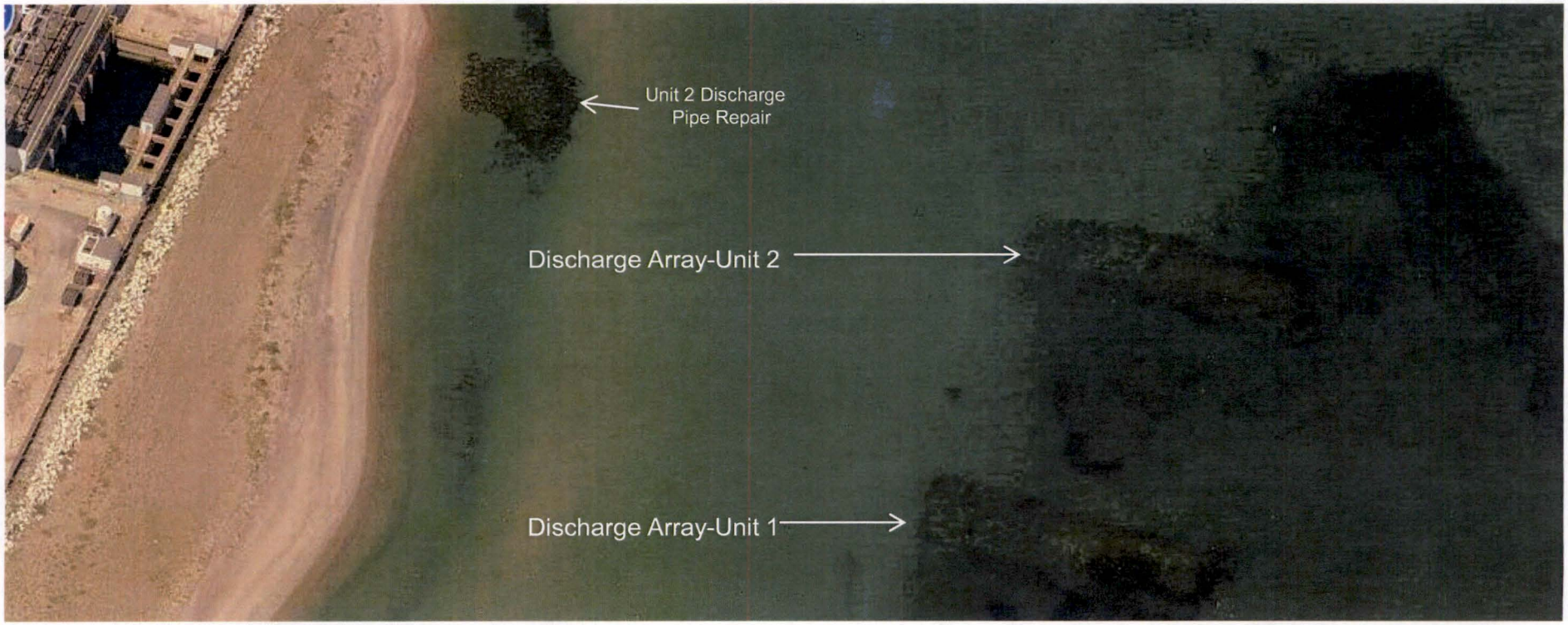

Approximate
Scale

150 feet

Drawn by:	WJE
Checked by:	KAP
Date:	2-8-13
Project No.:	3205121254

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Figure 2-3. Aerial View of Discharge Structures at ZNS

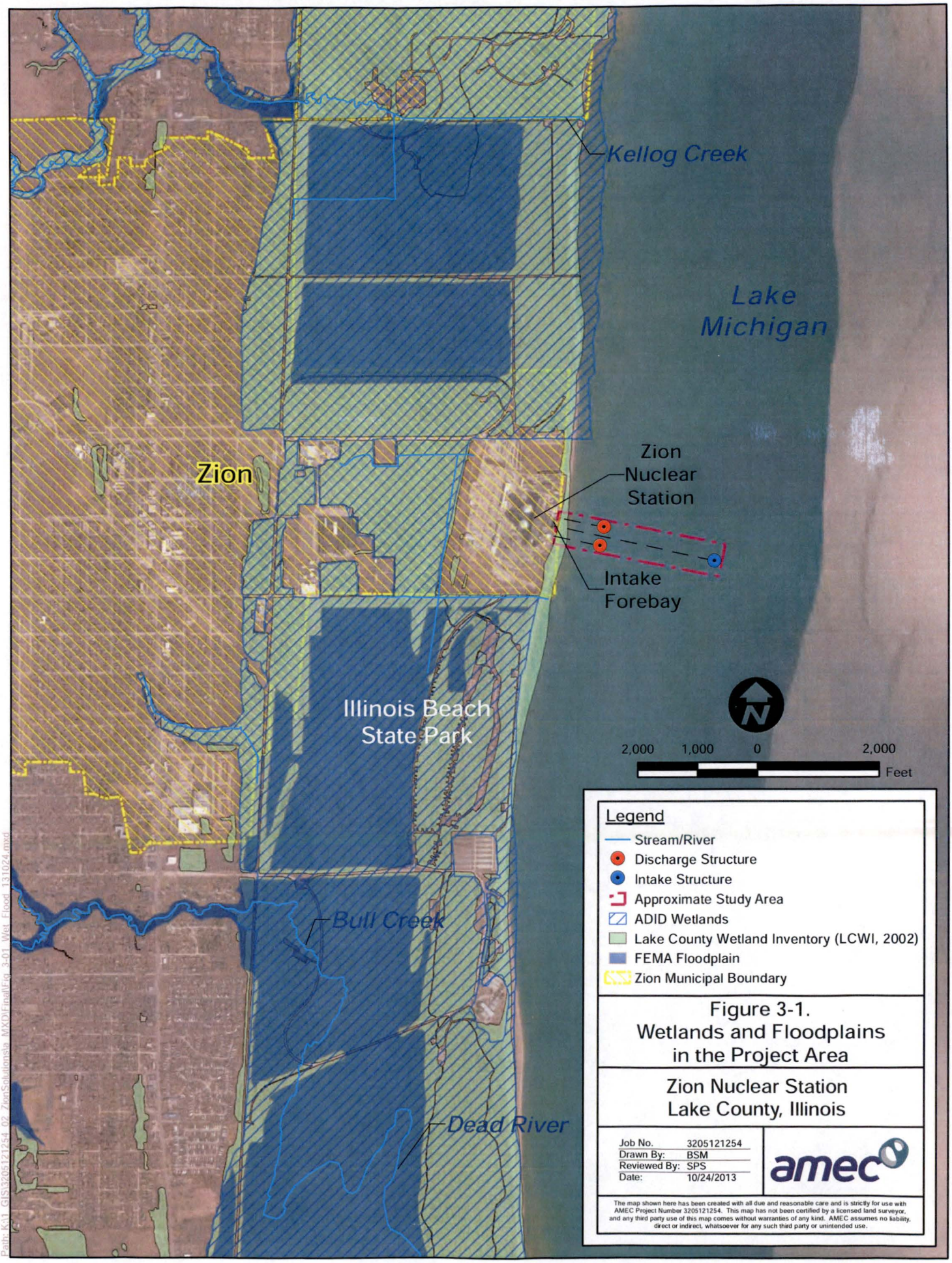

Figure 3-1.
Wetlands and Floodplains
in the Project Area

Zion Nuclear Station
Lake County, Illinois

Job No.	3205121254
Drawn By:	BSM
Reviewed By:	SPS
Date:	10/24/2013

amec

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