ONTARIO POWER GENERATION

Plan

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Pickering Nuclear Site Overarching Preliminary Decommissioning Plan

Pickering Nuclear Site Overarching Preliminary Decommissioning Plan

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Revision Summary

Revision Number	Date	Comments
R00	February 21, 2025	Initial Issue

Acronyms

AHJ	–	Authorities Having Jurisdiction
AIFB	–	Auxiliary Irradiated Fuel Bay
APM	–	Adaptive Phased Management
CANDU	–	Canada Deuterium Uranium
CN	–	Canadian National
CNSC	–	Canadian Nuclear Safety Commission
CSA	–	Canadian Standards Association
DDP	–	Detailed Decommissioning Plan
DSC	–	Dry Storage Container
DSM	–	Dry Storage Module
ECCC	–	Environment and Climate Change Canada
ECO	–	End of Commercial Operations
EOL	–	End of Life
HPECI		High Pressure Emergency Coolant Injection
HS&E	–	Health Safety & Environment
IEP	–	Indigenous Engagement Plan
IFB	–	Irradiated Fuel Bay
IGLD		International Great Lakes Datum
ILW	–	Intermediate Level Waste
MCR	–	Main Control Room
MECP	–	Ministry of Environment, Conservation and Parks
NGS	–	Nuclear Generating Station
NPP	–	Nuclear Power Plant
NRCan	–	Natural Resources Canada
NSS-PWMF	–	Pickering Waste Management Facility
OPG	–	Ontario Power Generation
PDP	–	Preliminary Decommissioning Plan
PNGS	–	Pickering Nuclear Generating Station
PNGS-A	–	Pickering Nuclear Generating Station A
PNGS-B	–	Pickering Nuclear Generating Station B
RAP	–	Reconciliation Action Plan
RCS	–	Retube Component Storage
REGDOC	–	Regulatory Document
SAP	–	Stabilization Activity Plan
SB	–	Storage Building
SSCs	–	Structures, Systems and Components
SWS	–	Storage with Surveillance
TRCA	–	Toronto Regional Conservation Authority
TSSA	–	Technical Standards and Safety Authority
UFDS	–	Used Fuel Dry Storage
UPP		Upgrading Plant at Pickering

Abstract

This overarching Preliminary Decommissioning Plan for the Pickering Nuclear Site addresses common aspects and interdependences between decommissioning the Pickering Nuclear Generating Stations A and B and Nuclear Sustainability Services - Pickering Waste Management Facility located on the Pickering Nuclear Site. The overall objective is to restore the site for other Ontario Power Generation uses.

1.0 INTRODUCTION

Pickering Nuclear Generating Stations A and B (PNGS-A and PNGS-B respectively or PNGS collectively) are owned and operated by Ontario Power Generation (OPG). Each of PNGS-A and PNGS-B is a four-unit Canada Deuterium Uranium (CANDU) Nuclear Generating Station (NGS). The Pickering Waste Management Facility (NSS-PWMF) is composed of 2 sites: The NSS-PWMF Phase I site is located within the PNGS protected area and the NSS-PWMF Phase II site is located approximately 500 m north-east of the site in the East Complex, within a distinct "protected area". The PNGS and NSS-PWMF are all located on the Pickering Nuclear Site, in the Municipality of Pickering, Ontario and are approximately 32 km east of Toronto.

PNGS-A reached the end of its commercial operations in 2024 and is in the preparation for decommissioning phase [1]. PNGS-B is planned for refurbishment, pending regulatory approval, to enable extended operations and remains in the planning for decommissioning phase. The life cycle plan of the NSS-PWMF is separate from PNGS and remains in the planning for decommissioning phase.

The decommissioning planning framework for the Pickering site is supported by multiple regulatory documents:

- The Detailed Decommissioning Plan (DDP) [1] specifically addresses the decommissioning scope for PNGS-A (Units 1-4),
- The Preliminary Decommissioning Plan (PDP) for PNGS-B [2] covers Units 5-8,
- The NSS-PWMF has its own PDP [3], and
- This Pickering Site Overarching Document defines the interfaces between the PNGS-A DDP [1], PNGS-B PDP [2], and NSS-PWMF PDP [3], reflecting the current documentation hierarchy, as illustrated in Figure 1-1.

This Overarching PDP is prepared to satisfy the requirements in the Canadian Nuclear Safety Commission (CNSC) Regulatory Document (REGDOC)-2.11.2 [4] and the Canadian Standards Association (CSA) Standard N294 [5] to have a site PDP for licensed sites with more than one facility, for which the licensee (i.e., OPG) is responsible. It provides a high-level schedule of the decommissioning of the facilities on the Pickering Nuclear Site. This Overarching PDP also describes the interfaces between the PNGS-A DDP, PNGS-B PDP and the NSS-PWMF PDP, as shown in Figure 1-1. In addition, this site overarching PDP addresses the following aspects for decommissioning of the facilities on the Pickering Nuclear Site:

- Common elements such as surrounding environment;
- Interfaces and interdependencies;
- Brief summaries of Health Safety & Environment (HS&E) and other programs with reference to facility specific plans for detailed information; and
- Legislation, Standards and Regulatory Guidance applicable to decommissioning.

Within 5 years of submission, the site PDP will be reviewed and updated as required, per CNSC REGDOC-2.11.2 [4].

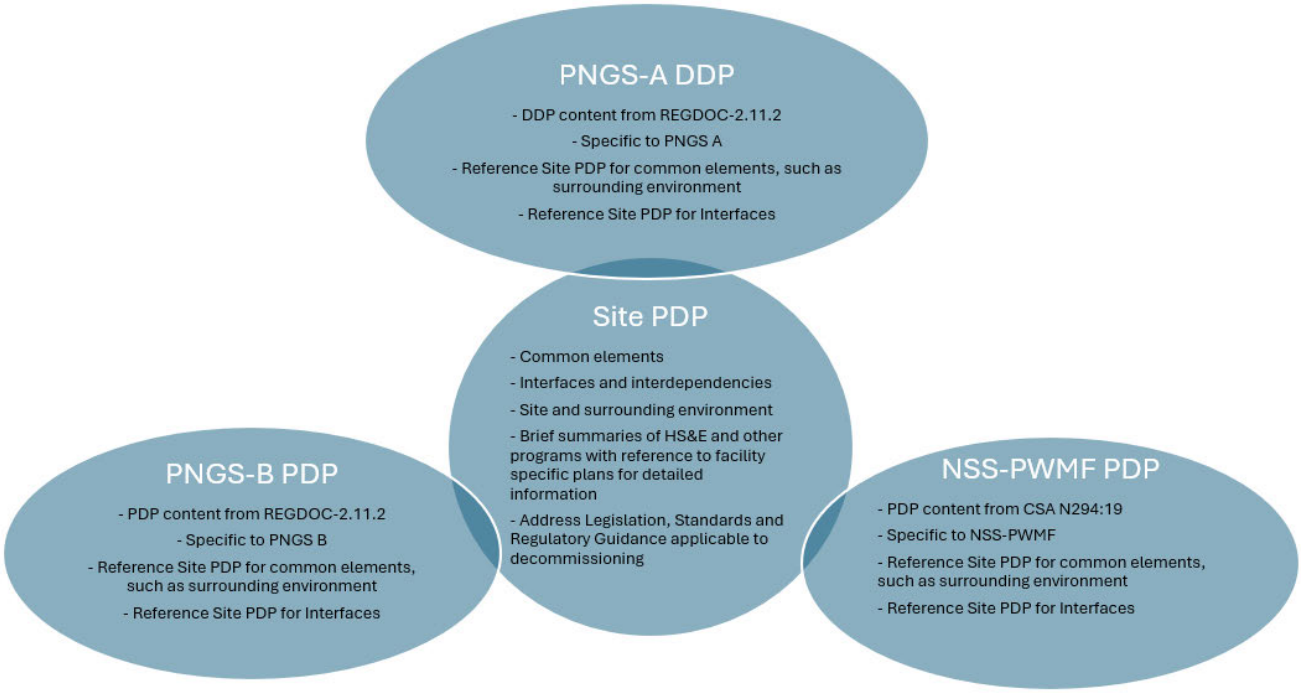

Figure 1-1: Interfaces between the Site PDP (this document), PNGS-A DDP [1], PNGS-B PDP [2] and NSS-PWMF PDP [3]

1.1 Land Acknowledgement

The lands and waters on which the PNGS is situated are the traditional territory of the Michi Saagiig and Chippewa Nations of the Williams Treaties First Nations. The Johnson-Butler Purchase (also known as the Gunshot Treaty 1877-88) covers the PNGS lands.

Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation (known as the Michi Saagiig), Chippewas of Georgina Island First Nation, Beausoleil Island First Nation and Rama First Nation are all signatories to the Williams Treaties (1923) and to the Williams Treaties First Nations Settlement Agreement of 2018.

1.2 Applicable Legislation, Standards and Regulatory Guidance

All decommissioning activities will be performed in accordance with the most relevant licence, legislation, regulations, codes and standards.

The following subsections provide a list of federal and provincial regulatory agencies (Authorities Having Jurisdiction (AHJ)) involved in the decommissioning project.

1.2.1 Federal

- CNSC
- Environment and Climate Change Canada (ECCC)
- Natural Resources Canada (NRCan)
- Health Canada
- Transport Canada
- Fisheries and Oceans Canada
- Canada Industrial Relations Board
- Canadian Endangered Species Conservation Council

1.2.2 Provincial (Ontario)

- Ministry of Natural Resources and Forestry
- Ministry of Environment, Conservation and Parks (MECP)
- Ministry of Labour, Immigration, Training and Skills Development
- Ministry of Transportation
- Ministry of Finance
- Fire Marshall
- Electrical Safety Authority
- The office of the Fire Marshal
- Ministry of Indigenous Affairs
- Emergency Management Ontario

- Ministry of Energy
- Technical Standards and Safety Authority (TSSA)
- Toronto Regional Conservation Authority (TRCA)
- Central Lake Ontario Conservation Authority

1.3 Regulatory Compliance with Applicable Standards

The PNGS-A DDP [1], PNGS-B PDP [2] and NSS-PWMF PDP [3][1] include compliance matrices and the specific requirements of CNSC REGOC-2.11.2 [4] and CSA N294:19[2] [5], and identify the respective sections of the DDPs and PDPs that cover these requirements.

Appendix A of this document provides a mapping of requirements from CNSC REGDOC-2.11.2 [4], Sections 6.1.1 and 7.1.1 for the content of a PDP and DDP, respectively, and where these requirements have been addressed in the following: the Pickering Nuclear Site Overarching PDP (i.e., this document), the PNGS-A DDP [1], PNGS-B PDP [2] and NSS-PWMF PDP [3]. See Figure 1-1 for the interfaces between these documents.

[1] CNSC REGDOC-2.11.2 [4] was published in January 2021 and supersedes G-219. The NSS-PWMF PDP was produced at the time REGDOC-2.11.2 was issued. OPG has communicated the timing for a gap analysis and implementation plan to REGDOC-2.11.2 in [31]. The next update of the NSS-PWMF PDP, for the 2028-2032 financial guarantee submission to the CNSC expected in 2027, will include a compliance matrix with REGDOC-2.11.2 [4].

[2] A preliminary review of the draft CSA N294:25 issued for Public Review was performed. This PDP generally complies with the revised/new requirements in this standard.

2.0 DESCRIPTION OF THE PICKERING NUCLEAR SITE AND SURROUNDING ENVIRONMENT

2.1 Location of the Pickering Nuclear Site

The Pickering Nuclear Site is located on the north shore of Lake Ontario at Moore Point in the City of Pickering Regional Municipality of Durham, Province of Ontario. The site is 32 km east-north-east of downtown Toronto and 21 km south-west of the City of Oshawa at a latitude of 43°49' N and longitude of 79°04' W. The location of the Pickering Nuclear Site is shown in Figure 2-1.

The Pickering Nuclear Site occupies a land area of 240 ha (600 acres) in lots 17 to 22 inclusive in the Broken Front Concession. The total frontage of the site along the shoreline of Lake Ontario is approximately 2,260 m (7,400 ft.). The transmission egress right-of-way which leads north from the site boundary is 155 m (500 ft.) in width and occupies part of lots 19 and 20 in the Broken Front Concession. Two licensed nuclear facilities are currently operating on the site. There is a one-site licence for both power reactor stations (PNGS-A and PNGS-B) and the second licensed facility is the NSS-PWMF. The location of NSS-PWMF within the Pickering Nuclear Site is shown in Figure 2-2.

The site is well serviced by road and rail. Two major roadways, Highway 401 and Highway 2, as well as the main Canadian National (CN) rail line run in an east-west direction, at a closest distance of 2.8 km to the site [6]. Access from the site to the highways is provided by Brock Road, a four-lane north-south artery. A spur line from the CN to the site was built in the initial stages of site development; it is no longer in place but could be re-instated if necessary. A dock was constructed on the west side of PNGS-A to facilitate unloading of the major reactor components. The two major watercourses closest to the site are Duffin Creek, 2.2 km to the east and the Rouge River, 4 km to the west [7].

2.2 Description of the Facilities on the Pickering Nuclear Site

The two generating stations (PNGS-A, consisting of Units 1-4 and PNGS-B, consisting of Units 5-8) and the NSS-PWMF are located on the property described in Section 2.1. PNGS-A and PNGS-B are located in an area protected by the operating island security fence called the protected area.

Figure 2-3 and Figure 2-4 show the site plan and the PNGS stations, respectively. Buildings inside the licensed area (as highlighted on this figure) are included in the decommissioning plans for the two stations and the NSS-PWMF.

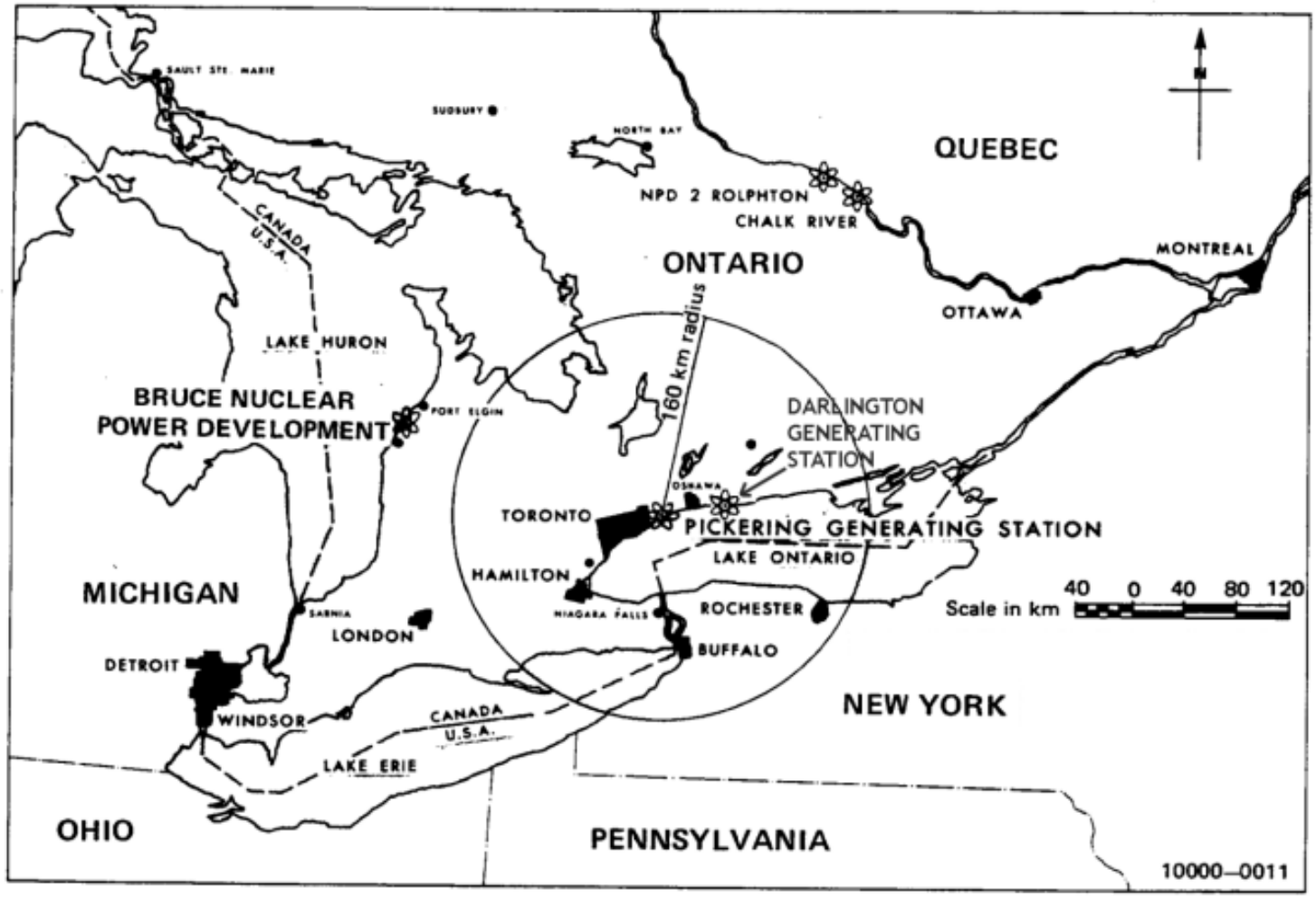

Figure 2-1: Map Showing Location of the Pickering Nuclear Site

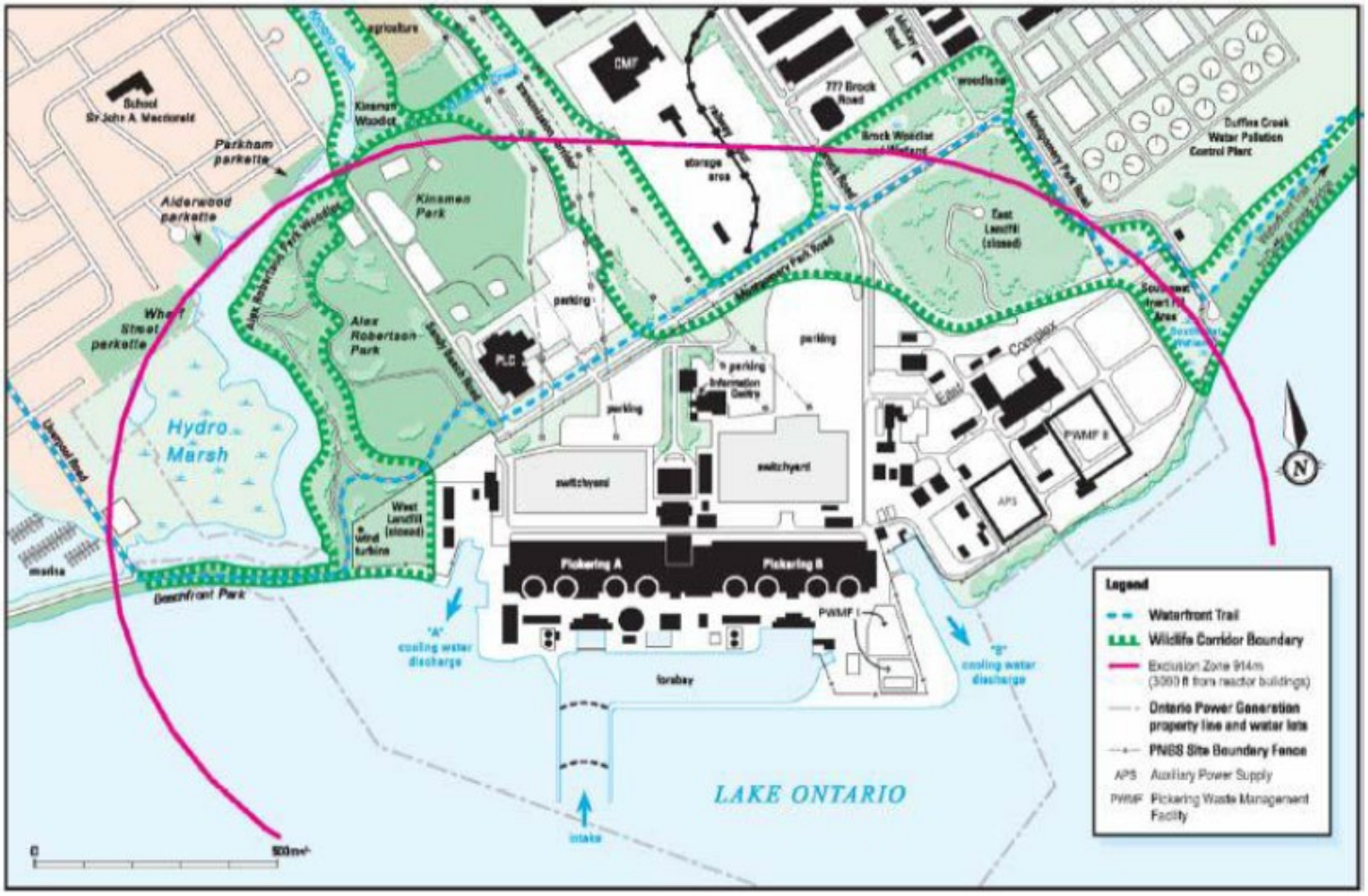

Figure 2-2: Location of NSS-PWMF within the Pickering Nuclear Site

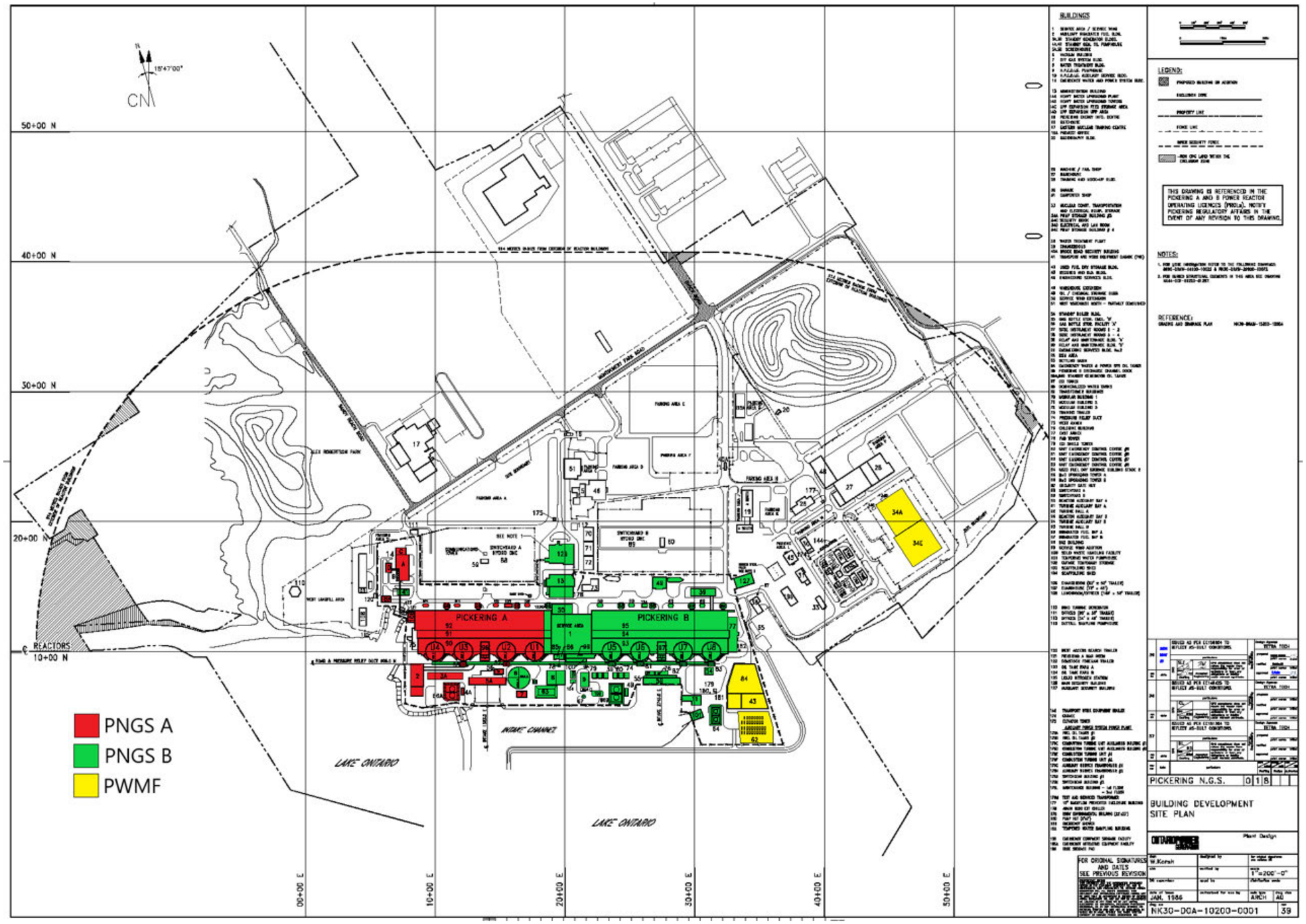

Figure 2-3: Site Layout

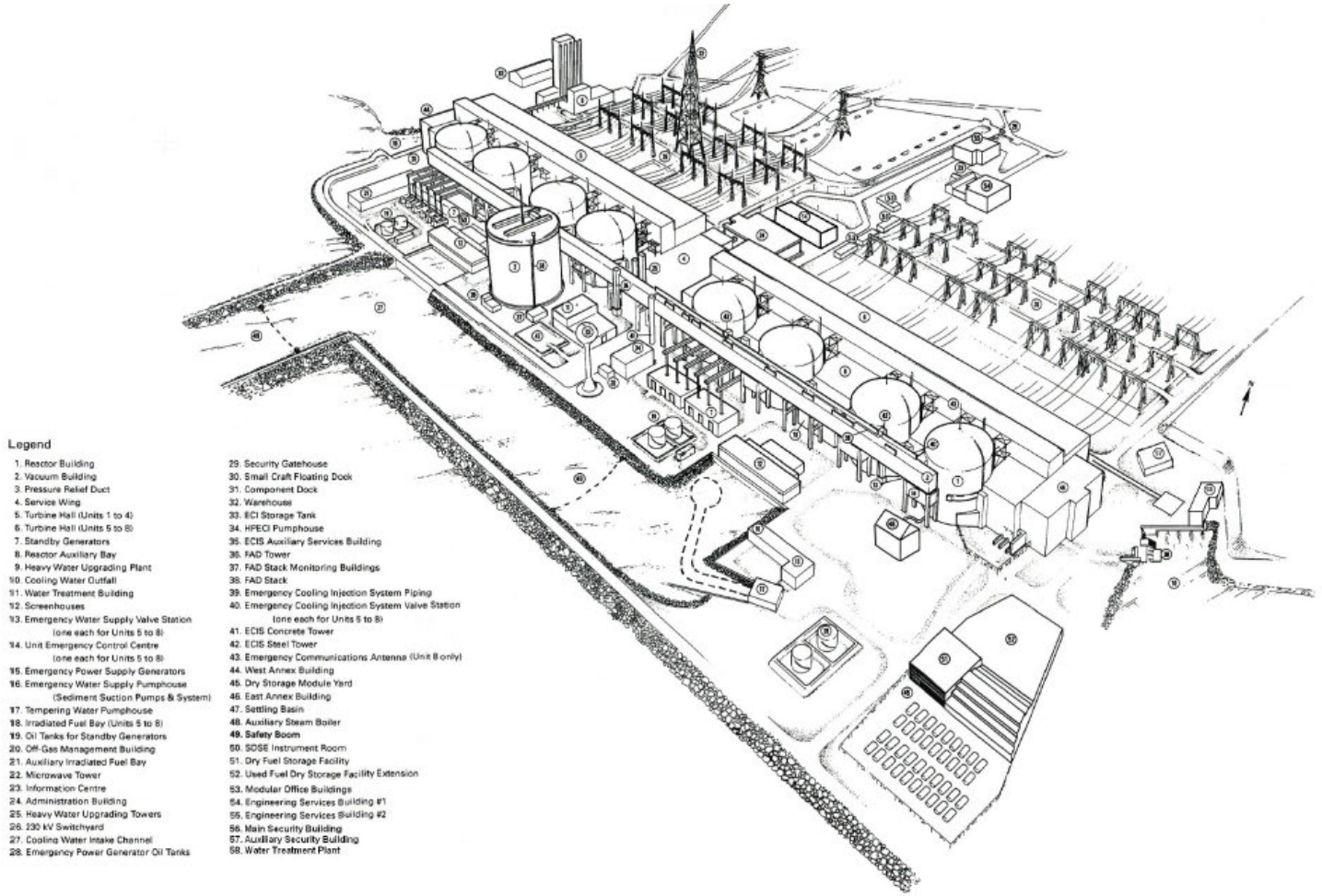

Figure 2-4: Pickering Nuclear Generating Stations

2.2.1 Description of the PNGS-A and PNGS-B

2.2.1.1 Overview

The generating stations are described in detail in their respective Safety Reports [7], [8] and [9]. Each station consists of:

- Four (4) Reactor Buildings;
- Reactor Auxiliary Bay for each station;
- Main Control Rooms (MCRs);
- Irradiated Fuel Bays (IFBs);
- Powerhouse (including the Turbine Hall and Turbine Auxiliary Bay) for each station;
- Annex Building (connected to the Reactor Auxiliary Bay and the Powerhouse);
- Screen house; and
- Standby Generators and their Oil Tanks.

There are additional structures on site that support the station, including:

- Administration Building;
- Service Wing and Service Wing Extension (between PNGS-A and PNGS-B and connected to both);
- Heavy Water Upgrading Plant at Pickering (UPP);
- High Pressure Emergency Coolant Injection (HPECI) Pumphouse and HPECI Water Storage Tank, PNGS-B;
- Pressure Relief Duct that runs the full length of PNGS-A and PNGS-B;
- Vacuum Building with its associated pressure relief duct;
- Auxiliary Irradiated Fuel Bay (AIFB), located southwest of Unit 4, PNGS-A;
- Water Treatment Building, PNGS-A (old), PNGS-B complex (new);
- Tempering Water Pumphouse, PNGS-B;
- Emergency Water Pumphouse and Power Supply Building, PNGS-B; and
- East Security Complex.

Two switchyards, one for each station, are located outside the protected area. A variety of workshops, office buildings and warehouses and Auxiliary Power System are also located outside the protected area. NSS-PWMF Phase I (including the Processing Building, Storage Buildings (SBs) 1 and 2 and a storage area for Dry Storage Modules (DSMs)) is located at the southeast corner of PNGS-B, just off the lake shoreline. NSS-PWMF Phase II consists of SBs 3 and 4, which are currently both in service. Additional SBs 5 and 6 are also currently planned for construction. PWMF Phase II is located on the PNGS site in the East complex, but within its own protected area approximately 500 m north-east of Phase I.

2.2.1.2 Reactor Building

The Reactor Building houses the reactor and associated equipment. It is also part of the containment system, which prevents the escape of radioactivity, and provides radiation shielding between active areas and staff outside the building. It is a cylindrical, reinforced-concrete structure, 42 m (140 ft.) in diameter and 36 m (117 ft.) high with elliptical domed roof. The pressure relief panel separates the Reactor Building from the Pressure Relief Duct.

The interior of the Reactor Building is subdivided by a massive concrete structure of walls and floors, which are independent of the external wall and dome. This structure provides shielded areas that can be safely entered while the reactor is operating and other areas, which may be occupied while the reactor is shut down depending on the nature of the equipment contained in the areas. A system of steel platforms, walkways, ladders and stairs provide access to equipment that cannot be reached directly from the concrete floors. Access to the Reactor Building is by means of airlocks so that the containment integrity is intact at all times. These airlocks are provided in pairs on three elevations.

The Calandria Vault forms an independent box-like structure of concrete and contains the calandria. The two stations have different Calandria vault configurations. The PNGS-A vaults are concrete chambers that house both the calandria and the dump tank (see Figure 2-5) while the PNGS-B vaults are concrete, steel-lined, water-filled tanks that house the calandria (see Figure 2-6). There are also differences in the calandria design. The PNGS-A calandria has 390 fuel channels while the PNGS-B calandria has only 380 fuel channels. Differences in the shielding design resulted in the PNGS-A calandria having a greater mass than that of PNGS-B. The PNGS-A design includes a dump tank directly below the calandria for the heavy water moderator, but the PNGS-B design does not include this tank (see Figure 2-7 and Figure 2-8). Furthermore, the PNGS-A design also includes a helium storage tank on each unit; this is not included on PNGS-B (see Figure 2-7 and Figure 2-8).

Cross walls are located directly north and south of the Calandria Vault. These walls run east to west across the full width of the Reactor Building and extend from the grade floor at elevation 254 ft. to the Boiler Room floor at elevation 317 ft. 6 in. Above the Boiler Room floor there is a structural steel framework that supports a crane, the Steam Generators (also called ‘boilers’) and the Heat Transport Pumps.

The Steam Generators and Heat Transport Pumps are also part of the Heat Transport System, which is designed to circulate pressurized heavy water through the fuel channels. The configuration of Steam Generators is shown in Figure 2-9. There are 12 boilers and 16

Heat Transport Pumps (four on standby), per unit, at PNGS. The heat transport system also includes the headers and the feeder pipes that run to and from each fuel channel.

The crane is centred on and runs along the north to south centreline of the Reactor Building. A hatch in the northern part of the Boiler Room floor allows the crane to work the full height of the building on the south side.

2.2.1.3 Reactor Auxiliary Bay

To keep the size of the Reactor Building and the need for entry of personnel to a minimum, reactor auxiliary systems that do not require the containment and shielding provided by the Reactor Building are located in a Reactor Auxiliary Bay that runs the full length of each station. The Auxiliary Bay is a conventional four-storey steel frame building that is fitted around the northern half of the four Reactor Buildings. The Reactor Auxiliary Bays for the two stations are connected between the two stations. The MCR and the IFB for each station are located in the centre of the Reactor Auxiliary Building (between Units 2 and 3 for PNGS-A and between Units 6 and 7 for PNGS-B).

2.2.1.4 Other Nuclear Systems & Structures

The Service Wing and Service Wing Extension are located at the centre of the station. They are connected to the east end of PNGS-A and the west end of PNGS-B. The Service Wing and its extension house laboratories, stores, locker and change room facilities, maintenance shops, fuelling machine dismantling facilities, waste management areas and office space.

The AIFB is located southwest of Unit 4 at the west end of PNGS-A. It is connected to the PNGS-A IFB in the Reactor Auxiliary Bay by the IFB Hallway.

The Heavy Water UPP is located north-west of PNGS-A. It is connected to PNGS-A by the overhead UPP duct. The HPECI Pumphouse and HPECI Tower are located south of the Service Wing.

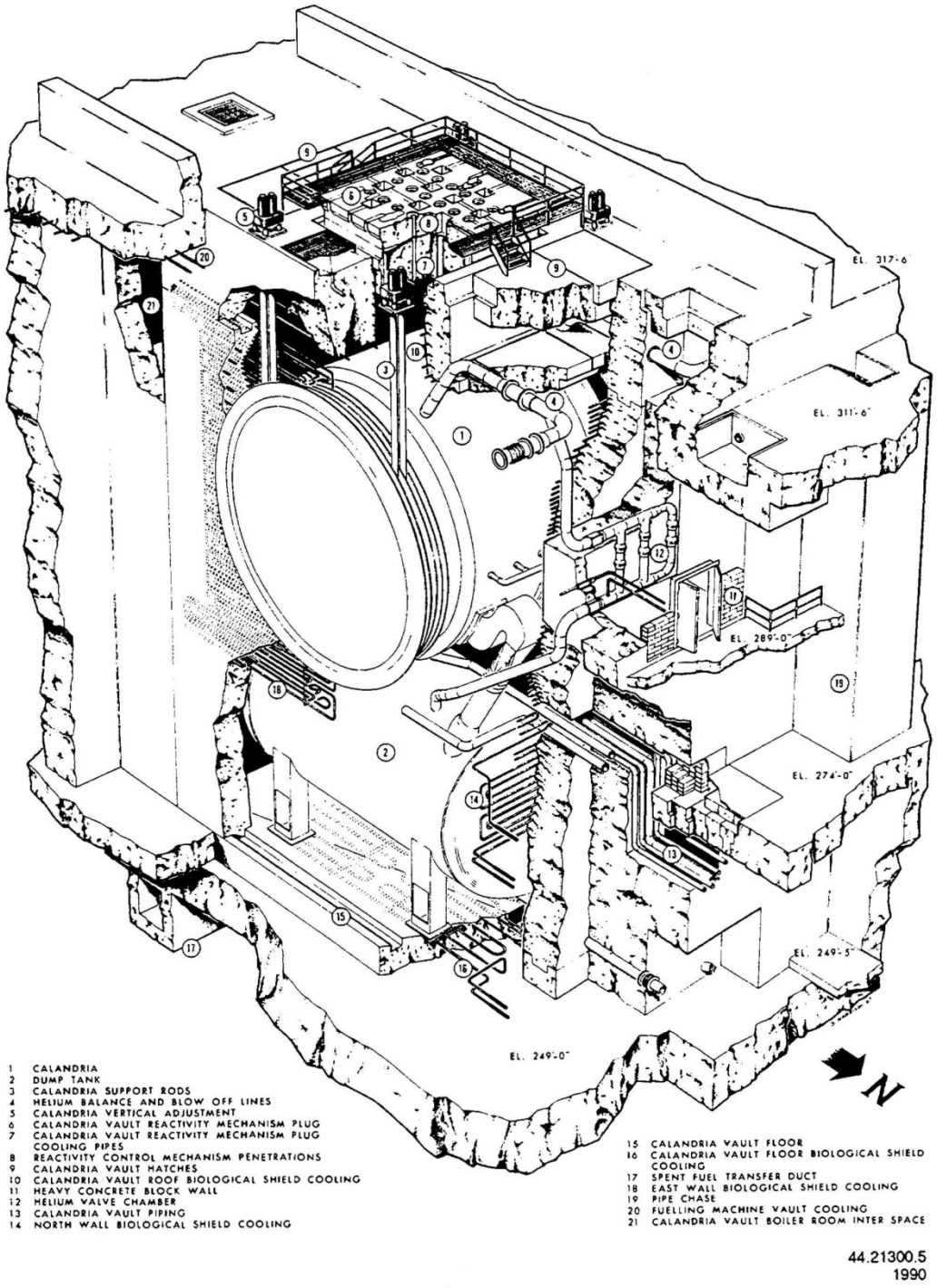

Figure 2-5: PNGS-A Calandria Vault

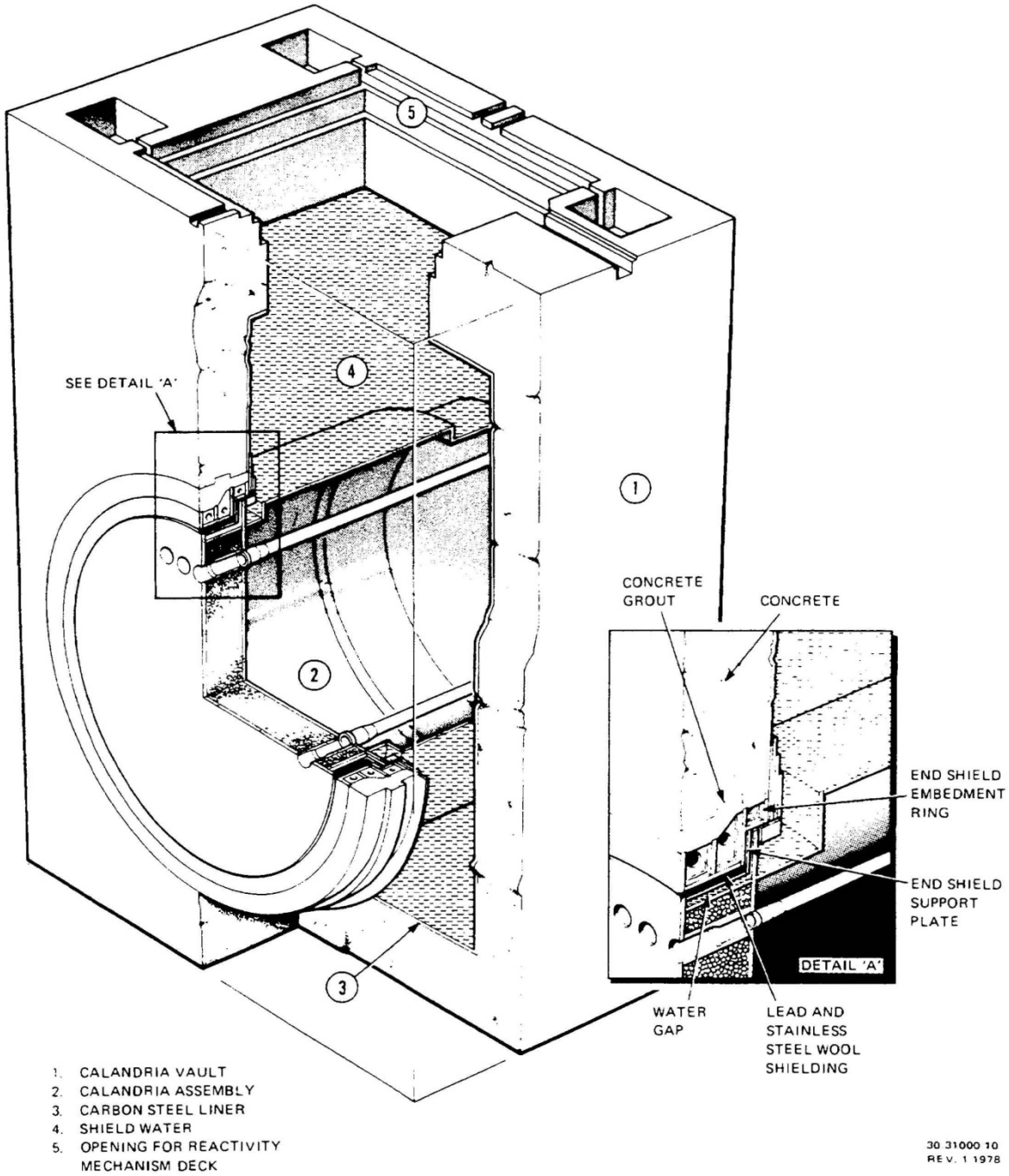

Figure 2-6: PNGS-B Calandria Vault

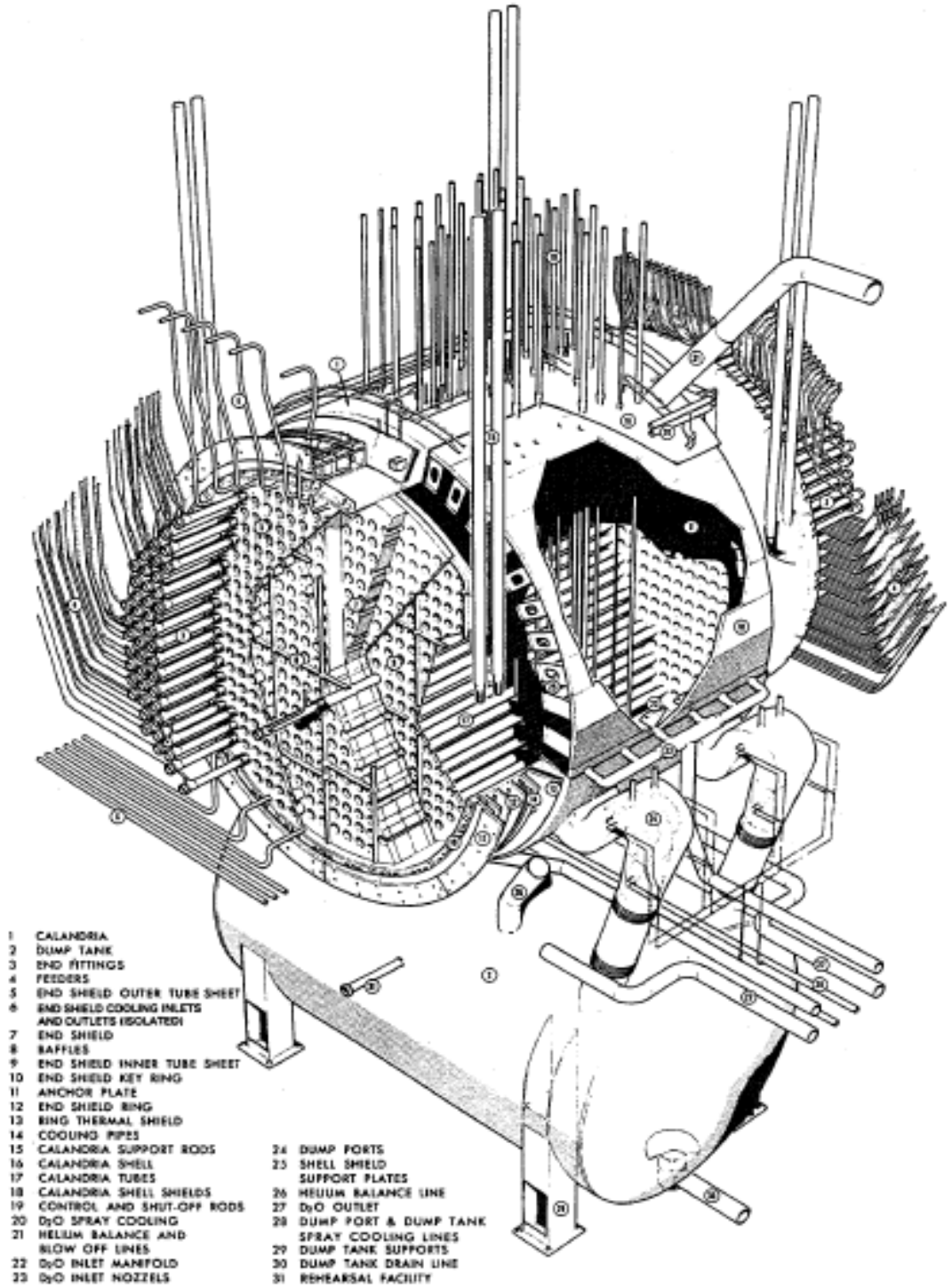

Figure 2-7: PNGS-A Reactor Assembly

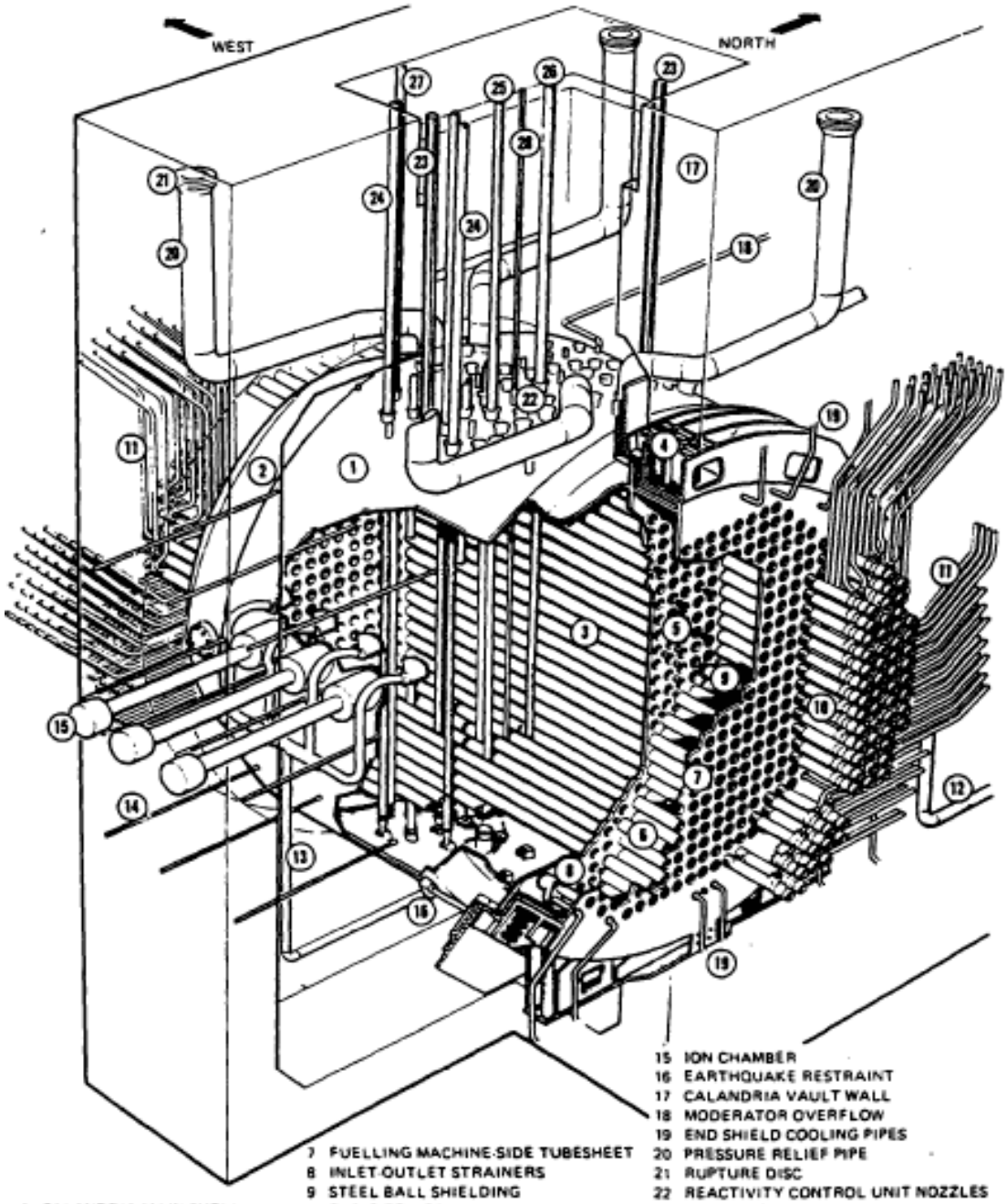

Figure 2-8: PNGS-B Reactor Assembly

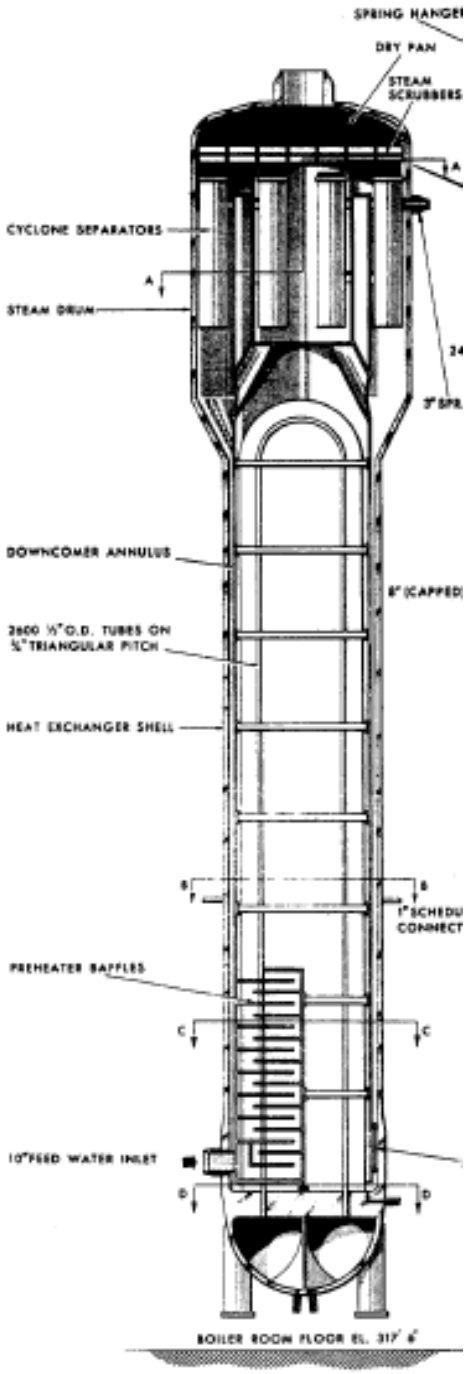

Figure 2-9: Steam Generator

2.2.1.5 Containment

Together, the Reactor Buildings, the Pressure Relief Duct, the Vacuum Ducts and the Vacuum Building form the containment boundary of the stations.

The Pressure Relief Duct is an elevated, rectangular, reinforced concrete structure set on concrete supports. It is a common system that runs the full length of PNGS-A and PNGS-B and is being considered as part of the separation modifications. Twelve cylindrical steel Vacuum Ducts 1.6 m (6 ft.) in diameter link the Pressure Relief Duct to the Vacuum Building.

The Vacuum Building (Figure 2-10) is a reinforced-concrete structure with an internal space frame. The frame supports the roof and the emergency water storage tank. The basement houses the Vacuum Building equipment including the vacuum pumps, electrical and instrumentation equipment and the water recirculation and recovery system. Two hatches are provided in the floor slab and sized for personnel access and equipment passage. Two hatches are located in the roof slab for access to the water tank. A ramp is provided to the basement for personnel and vehicle access. Services to the basement are routed through a tunnel connected to the Reactor Auxiliary Bay.

2.2.1.6 Powerhouse

The Powerhouse is a conventional steel structure, supported on concrete spread footings. It consists of a Turbine Hall and a Turbine Auxiliary Bay. The turbine generators are arranged in a line down the Turbine Hall that runs the length of each station. A loading bay is centrally located on the main axis of each Turbine Hall. The Turbine Auxiliary Bay houses the condenser circulating water and process water pumps, switch gear, deaerators and other auxiliary equipment.

2.2.1.7 Other Non-Nuclear Systems & Structures

The Administration Building is located north of the Service Wing and Service Wing Extension. It is connected to an upper floor of the Service Wing by a pedestrian bridge.

The Administration Building is a conventional cross-braced steel frame building. It has concrete foundation walls, and the steel columns have isolated concrete footings on piles. The building has two upper floors and a lower ground floor [9].

Two buildings, the Main Security Building and the Auxiliary Security Building, have been constructed north of the Administration Building and north of the East Annex Building, respectively providing security requirements for the station [9].

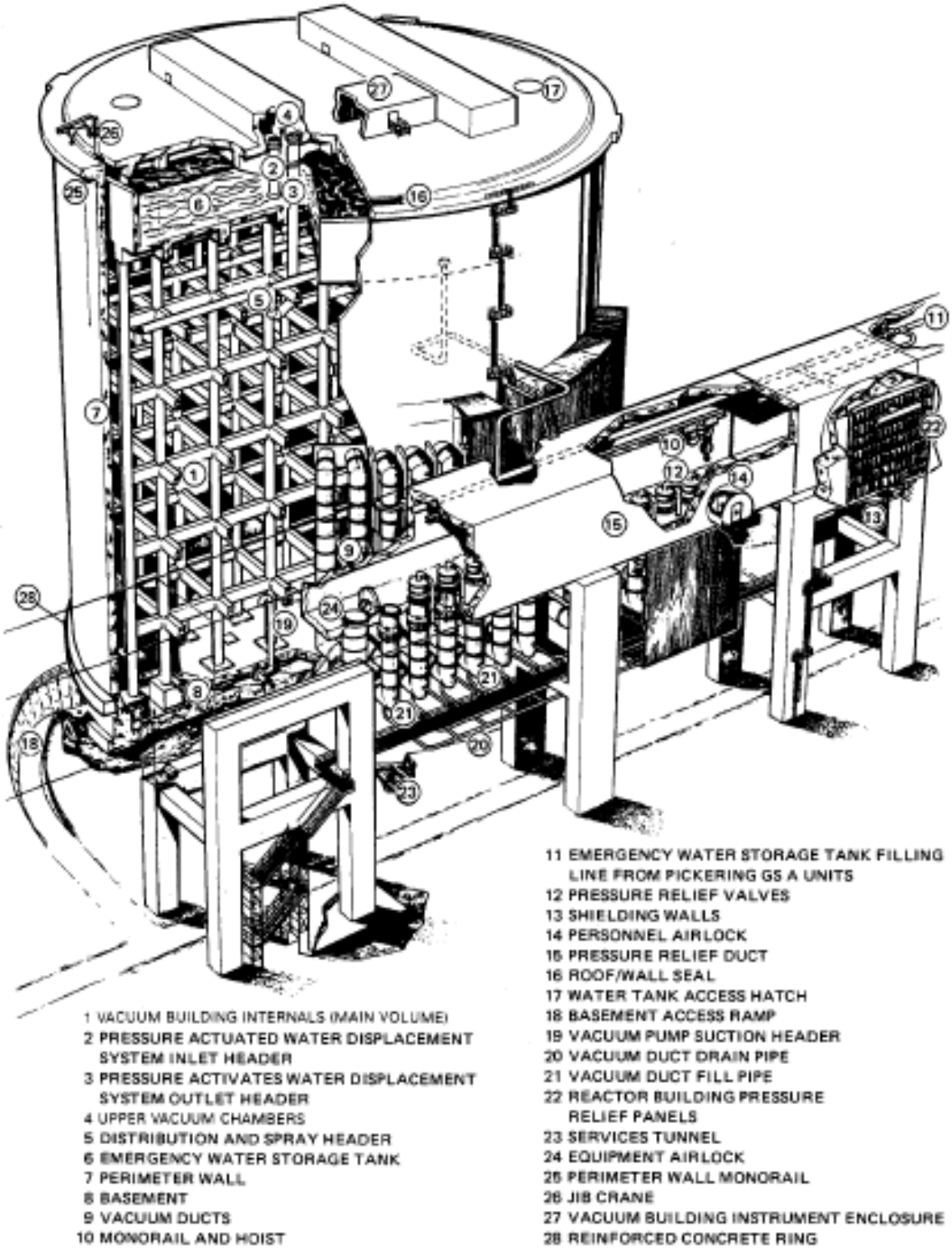

Figure 2-10: Vacuum Building and Relief Duct

The East Security Complex is located east of PNGS-B and north-east of NSS-PWMF.

The Screenhouses, Pumphouses and a number of other small buildings, including the Standby Generator Buildings and Above Ground Storage Tanks, are all located south of the stations within the operating island protected area.

There are two Annex Buildings that are now used for offices, tool and equipment laydown areas, and for control maintenance shops. The West Annex is beside the west end of the PNGS-A Reactor Auxiliary and Turbine Auxiliary bays and is part of the PNGS-A decommissioning scope. The East Annex is beside the east end of the PNGS-B Reactor Auxiliary and Turbine Auxiliary bays. Both Annex Buildings are connected to the Powerhouse and are accessible from the Reactor Auxiliary Bays via truck and personnel doors [9].

The Oil and Chemical Storage and Dispensing Building is a new building consisting of about 900 m^2 of single-story warehouse of high-hazard industrial occupancy. Although it is located north of the PNGS-B Powerhouse, it serves both stations [9].

2.2.2 Pickering Waste Management Facility

The NSS-PWMF is shown in Figure 2-2 and Figure 2-11. As mentioned in Section 2.1, the NSS-PWMF is licensed independently of the PNGS. The purpose of the NSS-PWMF is:

- To provide safe interim storage of the used fuel from PNGS reactors in Dry Storage Containers (DSCs) until all the used fuel is transported to a used fuel disposal facility (i.e., Adaptive Phased Management (APM)).

- To provide safe storage of the retube reactor components for PNGS-A in DSMs until they are transported to a disposal facility for Intermediate Level Waste (ILW).

The NSS-PWMF is composed of two sites:

- NSS-PWMF Phase I is located within the PNGS protected area, south-east of Unit 8 and adjacent to the east side of the PNGS security fence (see Figure 2-3). The NSS-PWMF Phase I site consists of the following sub-facilities: Used Fuel Dry Storage (UFDS) for interim storage of Pickering used fuel in DSCs; and Retube Component Storage (RCS) for interim storage of PNGS-A irradiated reactor components in DSMs.

- NSS-PWMF Phase II is located approximately 500 m north-east of the NSS-PWMF Phase I site in the East Complex, within a distinct “protected area”. The NSS-PWMF Phase II site contains a security kiosk, DSC SBs 3 and 4 and the site for additional DSC SBs.

Used fuel from the PNGS-A AIFB and PNGS-B IFB is loaded into DSCs and then transferred to dry storage at the NSS-PWMF. Used fuel from PNGS-A IFB is transferred to AIFB before being loaded in DSCs. The fuel removal strategy is a key component of the decommissioning strategy. The NSS-PWMF is described in more detail in its Safety Report [6] and PDP [3].

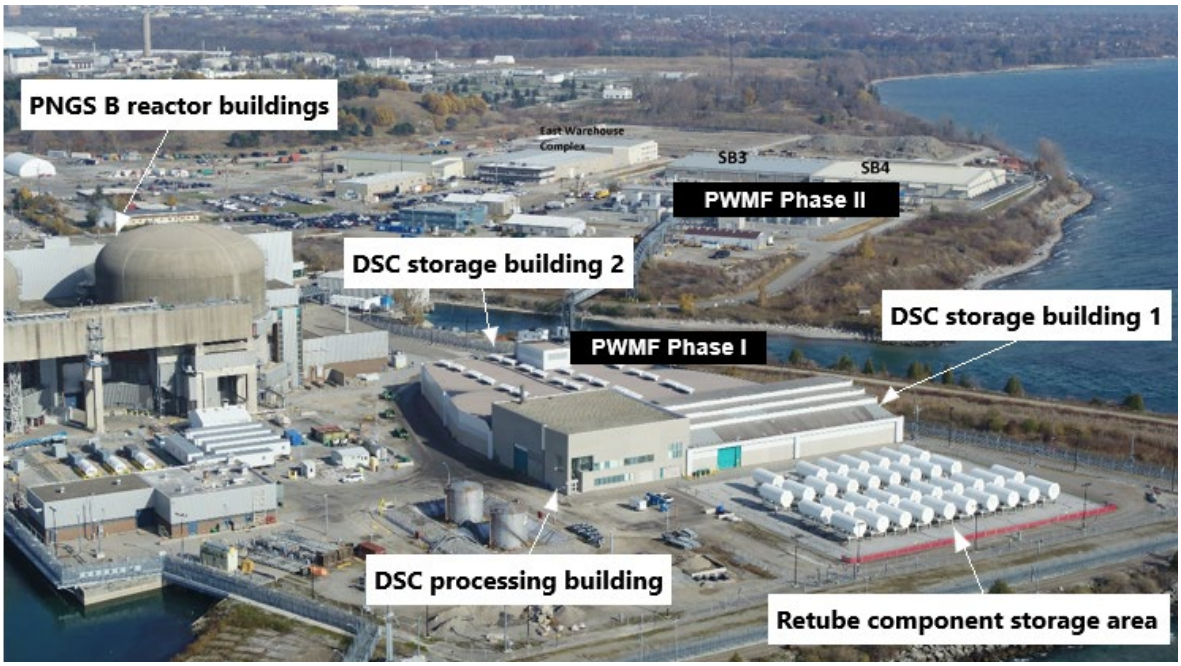

Figure 2-11: NSS-PWMF Layout and Surrounding Buildings

2.3 Description of the Surrounding Environment

2.3.1 Natural Environment

The environment in the immediate vicinity of the Pickering Nuclear Site is heavily urbanized and the surrounding areas are dominated by light manufacturing enterprises, repair shops, warehouses and laboratories. The southern portion of the Pickering Nuclear Site is dedicated to power generation while most of the northern portion is vegetated. The vegetated lands are occupied by public parkland, athletic fields and a transmission corridor [10].

One swamp thicket area and five marsh areas were identified within and in the vicinity of the Pickering Nuclear Site [10]. The eastern end of the site is dominated by an artificial hill covering the East Landfill. A second waste landfill is located on the western end of the site. These landfills were closed in 1997 and 1999 and have become a habitat for wildlife.

The area within and surrounding the Pickering Nuclear Site is host to a variety of natural vegetation. The dominant vegetation cover is related to agricultural use, including cash crops and pasture land. Other natural vegetation features are associated with valley lowlands associated with rivers and creeks, and the Lake Ontario shoreline environment. Dominant tree species in the natural forest areas in the vicinity of the Pickering Nuclear Site include: beech, sugar maple, basswood, red maple, white oak and bur oak. Four terrestrial community types were identified in the vicinity of the Pickering Nuclear Site, including deciduous, coniferous, and mixed forest areas, and an open beach/bar [10].

A number of small wetlands (wet meadows and shallow marshes) can be found throughout the site, with a larger wetland occupying the north-west corner of the Pickering Nuclear Site boundary. More details about the vegetation are provided in Section 4.1.3.

Most undeveloped areas on the site are covered by grasses or scrub bush. Numerous species of gulls, ducks, geese and swans have been observed during waterfowl surveys around Pickering Nuclear Site. Woodland habitat within the Pickering Nuclear Site is used for nesting foraging and roosting by resident and migratory bird species. Small mammals will also use these sites for shelter, foraging and reproduction [10]. More details about the wildlife are provided in Section 4.1.4.

2.3.2 Geophysical Environment

2.3.2.1 Soils

The surface deposits beneath the Pickering Nuclear Site are comprised of two layers of dense, clayey glacial till overlying bedrock. The Upper Till is nearly continuous across the site except where it was removed during construction. It consists of impervious clay tills with inter-glacial strata of very dense layered silts, sands and gravel containing water and some accumulations of flammable gas (probably methane) under very low pressure. The Lower Till consists of firm to stiff clayey silt till with random lenses and layers of soft, wet clay and sand.

2.3.2.2 Bedrock

The Pickering Nuclear Site is underlain by Ordovician age sedimentary rocks composed of nearly flat-lying shales and limestones that dip gently (1%) southward, characteristic of the north shore of Lake Ontario. The bedrock surface is encountered at depths of approximately 10 m to 20 m below the surface with localized areas of low bedrock topography. The surface of the bedrock sequence slopes southward from elevations of 68 m above sea level at the north of the site to elevations of approximately 47 m above sea level approximately 1.5 km offshore in Lake Ontario. The projected local dip of the bedrock is southeastward at a generally uniform grade of 1%. The bedrock surface directly beneath the Pickering Nuclear Site, in the vicinity of the units is relatively level, varying between elevations of approximately 58 m to 62 m, with a gentle southward dip of approximately 0.1% to 0.2% [10].

There is no evidence in the borings and excavations carried out to date of any structural weakness in the rock at the site. No mining activity or withdrawal of fluids under the site has occurred that may affect the foundations of the plant structures. There is no evidence of surface faulting at the site. No evidence of fault offset or discontinuity was found in the investigation borings. There are no zones in the load bearing soil or bedrock that are considered to be unstable [7], [8].

2.3.2.3 Groundwater

Regional groundwater flow patterns are largely determined by topography. With high topography to the north at the Oak Ridges Moraine and low topography at Lake Ontario, the regional groundwater flow direction is towards Lake Ontario. Groundwater flow is also directed to the local surface water drainage basins, which also flow to the south and discharge to Lake Ontario.

Groundwater flow in the area local to PNGS generally follows the regional trend, with groundwater generally flowing to the south, with discharge to Lake Ontario. Shallow groundwater flow is directed from the high elevation at the East Landfill radially outward to the south, southwest, and west. The westerly flow component is directed to the Hydro Marsh. The remainder of the shallow groundwater will flow to the south or southwest and discharge into Lake Ontario.

Groundwater flow patterns on the Pickering Nuclear Site are influenced by the significant network of buried structures and utilities present beneath the surface. These include building foundations/slabs, foundation drains, water intake and discharge ducts, soldier pile walls and utility pipelines. Depending on the depth and characteristics of these structures, they impact local groundwater flow patterns by introducing either preferential pathways for groundwater flow (in the case of permeable fill materials), or groundwater barriers (in the case of impermeable structures or fill). Higher rates of groundwater flow are also associated with backfill beneath the building structures, such as the Reactor buildings, Auxiliary Reactor Buildings, and the backfill of the condenser cooling water intake and discharge ducts.

The most significant or influential subsurface features on site are the foundation drainage systems which collects groundwater seepage from below the powerhouse. These foundation drains represent the lowest hydraulic points in the groundwater flow system and as a result act as a sink for groundwater flow, inducing groundwater flow toward these systems under hydraulic gradients, which would otherwise follow the local flow pattern southerly toward the lake.

The intermediate groundwater flow system is similar to the shallow system. Local influences affecting intermediate groundwater flow include the Turbine Auxiliary Bay drains and Vacuum Building Ramp Sump which create artificial hydraulic sinks similar to those observed in the shallow groundwater system, limiting groundwater flow towards the lake south of the Reactor buildings [10].

The latest groundwater monitoring program results [11] indicate that the groundwater near Units 1 and 8 had increased tritium concentrations. It is expected that the tritiated groundwater near Unit 1 will migrate, collect in actively pumped sumps and eventually be managed through monitored pathways. Concentrations of tritium in downgradient locations are not inferred to impact groundwater end-use. The tritium concentrations in groundwater near Unit 8 remain below risk-based evaluation and monitoring will continue at these locations. The remaining groundwater data collected indicate that the tritium concentrations are consistent with results for previous years. Tritium concentrations within the site boundary wells and shoreline wells are stable and are within historical ranges with some slightly increased concentrations. Overall, the tritium concentrations in all boundary and shoreline wells at the site perimeter remain substantively below groundwater evaluation criteria, demonstrating no potential for off-site impacts from tritium in groundwater at the Pickering Nuclear Site. Off-site effects of tritium in groundwater to Lake Ontario are not observed [11].

The groundwater monitoring program will continue to track, monitor, and report on the groundwater quality on site.

2.3.2.4 Seismicity

The western Lake Ontario region lies within the tectonically stable interior of the North American continent, which is characterized by low rates of seismicity. Two seismic events with a magnitude of greater than 4 have been recorded within 100 km of the station from 1900-1991; one centered southeast of St. Catharines in 1954 had a magnitude of 4.1 and the other centered near Hamilton in 1958 had a magnitude of 4.3.

From 1992-2017, 655 events were detected, out of which 9 events had a magnitude greater (M, called 'Richter' magnitude) than 4.0 M and 120 events had a magnitude greater than 2.6 M. Within an approximated 100 km radius of the PNGS, 72 events were recorded and of these, the highest event magnitude was 3.8 [8]. From August 2017 to February 2021 inclusive, there has been an additional 12 seismic events (two of which are man-made seismic events) reported in Ontario of a magnitude greater to or equal to 3.0. The magnitude of these earthquakes range between 3.0 and 4.1, and two of these earthquakes were within a 100-km radius of Pickering Nuclear Site [12].

2.3.3 Aquatic Environment

The total frontage along the shoreline of Lake Ontario is approximately 2,260 m [7]. The shoreline immediately adjacent to the site has been altered by the construction of the common Cooling Water Intake Channel and two Cooling Water Outfall Channels, one on each side of the Pickering Nuclear Site. No natural shoreline remains; all structures are man-made.

2.3.3.1 Drainage

No major watercourses traverse the Pickering Nuclear Site, but a number of major cold-water streams enter Lake Ontario within 50 km of the site. The two major ones closest to the site are Duffin's Creek (2.2 km to the east) and the Rouge River (4 km to the west) [7], [8], [9]. The Hydro Marsh, Frenchman's Bay Marsh and Duffins Creek Marsh are provincially significant wetlands [6]. Drainage in the PNGS site is a mix of ephemeral swales, ditches, culverts and storm sewers. Surface drainage from the PNGS site is enabled by 19 separate storm water drainage basins, or catchments. The NSS-PWMF Phase I site is part of a smaller drainage basin. The NSS-PWMF Phase I site shares this area with the PNGS-B standby generators. Surface drainage from the NSS-PWMF Phase II site in the East Complex area drains to Lake Ontario. Further details on the drainage are found in the PNGS [7], [8], [9] and NSS-PWMF Safety Reports [6].

2.3.3.2 Fish

More than 100 fish species are known to inhabit Lake Ontario, of which 60 species have been observed in impingement, gillnetting and electrofishing studies at the PNGS site. These 60 species are considered to broadly represent the fish community in the vicinity of the Pickering Nuclear Site. The American Eel was identified as a provincial species at risk in the Environmental Risk Assessment and is periodically impinged in the surface water supplied Condenser Cooling Water system [10]. As there are no watercourses that are suitable as fish habitat within the site, aquatic habitat and biota are located within Lake Ontario. Habitat use of Lake Ontario nearshore area varies with species and life stage. Depending on the species,

the nearshore waters are used for spawning, rearing, feeding, migration and over-wintering [7], [8]. Lake Ontario supports a commercial fish industry in the Canadian waters of Lake Ontario east of Brighton (including the Bay of Quinte, East and West Lakes) and the St. Lawrence River (Fig. 3.2.1). The waters contained within the Ministry of Natural Resources quota zone 1-8, in which the Pickering Nuclear Site is found, currently have no commercial licences.

2.3.3.3 Lake Water Levels

Based on measurements of the monthly average water levels of Lake Ontario (i.e., the average levels of the whole lake) from 1918 to 2011, the annual maximum monthly average water levels range from a low of 73.74 m relative to the International Great Lakes Datum (IGLD) (1934) to a high of 75.76 m relative to the IGLD (1952). Lake Ontario water levels have been regulated since the completion of the St. Lawrence Power Project in 1958. The mean Lake Ontario water level from 2004 to 2019 has been 74.63 m (December) – 75.79 m (June) above mean sea level [6].

With near-shore water depths of 2 to 2.5 m, the maximum wave run-ups will be approximately 2 m on a riprap shore. As the crest of the protection walls at PNGS exceeds 77.5 m IGLD for much of their length, the probability of flooding due to wave run-up and overtopping is considered low. Periodic wetting during extreme events due to wave spray and splash will occur; however, it is considered unlikely that waves breaking directly over top of the foreshore works will occur. It is also reasonable to assume that the surface drainage system will have adequate capacity to deal with any spray that may occur [6].

2.3.4 Current Use of the Adjacent Land

As mentioned in Section 2.1, PNGS is located in the Regional Municipality of Durham, which is one of the largest municipalities in Canada and is also among the fastest growing. The Pickering Nuclear Site is close to residential, industrial, agricultural, agricultural, recreational, municipal service and transportation lands [7].

Agriculture has historically been an important component of the local and regional economies, environment and social fabric, and represents the most significant land use throughout most of the northern portions of the City of Pickering and Durham Region. Notwithstanding this agricultural heritage, both the City and the Region have developed an industrial platform with major industries in energy, automotive manufacturing, plastics/packaging, pharmaceuticals, aerospace/defense, chemicals/ rubber and environmental technologies [6].

Existing residential as well as other land uses in the vicinity of the site are illustrated in Figure 2-12. This figure is taken from the Regional Municipality of Durham official plan and is used to demonstrate existing land use designations [13]. The area bounded by Highway 401 on the north, Duffin Creek on the east, the Pickering Nuclear Site on the south and Sandy Beach Road on the west has been designated for industrial development. The southern boundary of the Pickering Nuclear Site property extends as a water lot into Lake Ontario. The lake is used locally for sport fishing, as well as recreational swimming and boating. The lands and ravines associated with Frenchman's Bay, immediately west of the Pickering Nuclear Site boundary fence, also provide the greatest concentration of recreational amenities in the City of Pickering. In addition, recreational and natural areas are located immediately to the east and north-west

of the site, while the residential areas of Bay Ridges and Fairport are located further to the north-west (north of the Alex Robertson Community Park and Frenchman's Bay) [7], [8].

Lake Ontario provides water supply to the adjacent municipalities, the nearest water supply plant being in Ajax, 4 km to the east. The Duffin Creek Water Pollution Control Plant is located on lands immediately east of the Pickering property. The remaining portions of the Brock Industrial neighbourhood contain a variety of employment uses and vacant land [6].

Beyond this limit, land uses include recreational, institutional, industrial, commercial and park facilities. In general, land use adjacent to the Pickering Nuclear Site is consistent with industrial and residential development throughout the city.

The Pickering Nuclear Site has been developed since its inception in the early 1960s. The Pickering property is designated as a utility in the Region of Durham Official Plan. The property is zoned Industrial Zone M2. The entire property is fenced and access to the site is restricted and controlled by OPG. Within the PNGS boundaries, existing land uses consist of buildings, structures, switchyards (belonging to Hydro One Inc.) and transportation access required to operate and support the stations' functions. A small site located between the closed Brock Road right-of-way and the PNGS-B thermal discharge bay is zoned as Public Service Zone M3 [6].

The Waterfront Trail, an active recreational path paralleling Lake Ontario across the City of Pickering, with connections to municipalities to the east and west, runs adjacent to the Pickering Nuclear site boundary fence along Montgomery Park Road, on lands leased to the municipality by OPG [6].

The Bay Ridges, West Shore and Rosebank neighbourhoods west of PNGS contain predominately residential and compatible ancillary uses (e.g., schools), with some employment and commercial uses generally along Bayly Street and Liverpool Road [6].

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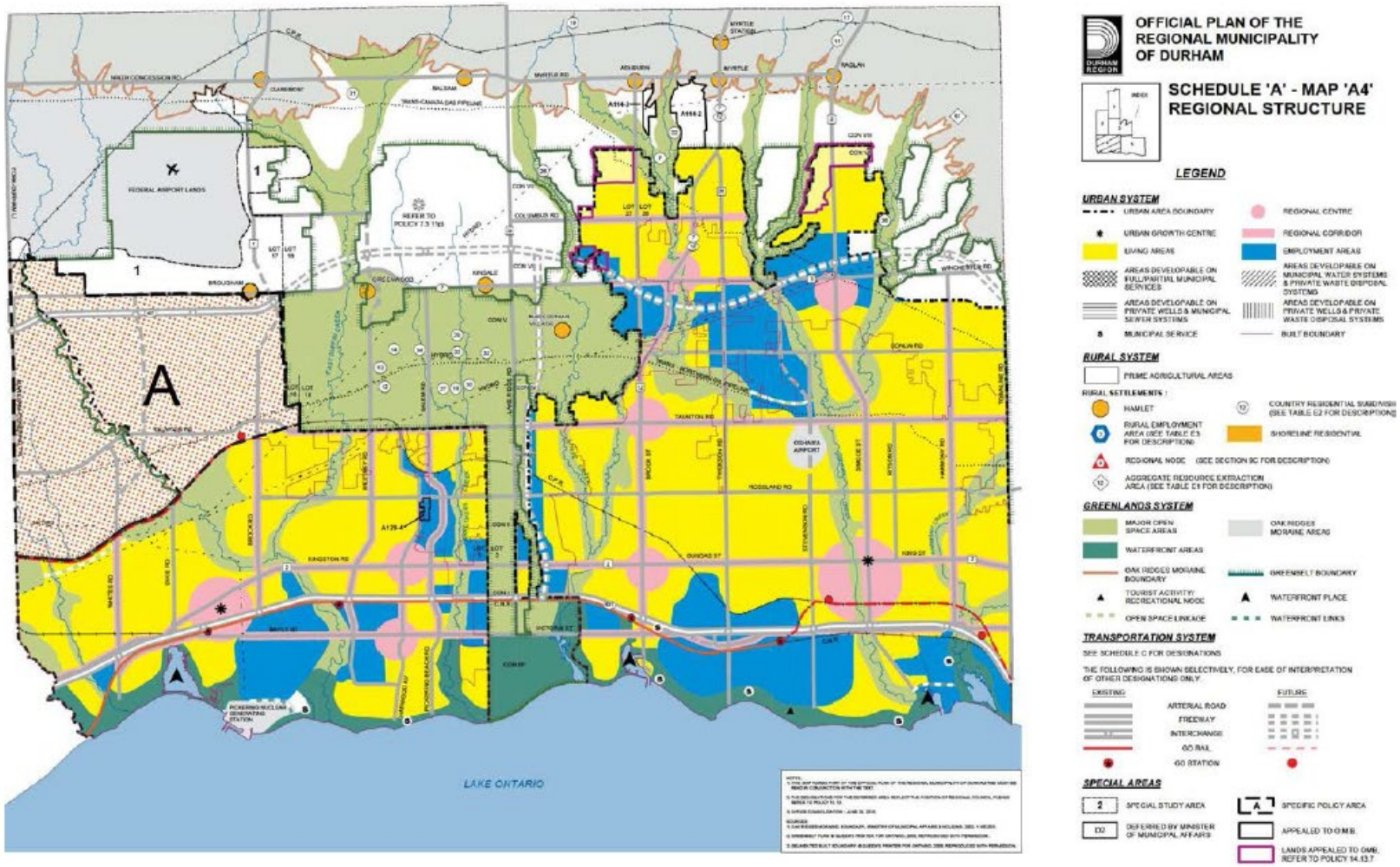

Figure 2-12: Land Use in the Vicinity of the Pickering Nuclear Site

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2.3.5 Local Communities

The local and regional areas have experienced strong population and economic growth over the last decade. Detailed population data of the city and the nearby municipalities in 2021 are shown in Table 2-1. Forecasts indicate that the populations and housing stock of Durham Region and the City of Pickering will continue to grow by an average of approximately 2.5 percent per year over the next 20 years [6].

Table 2-1: Population of Nearby Municipalities [6]

Municipality	Population (2021)
City of Pickering	99,186
Town of Ajax	126,666
Town of Whitby	138,501
Town of Clarington	101,427
Township of Scugog	21,707
Township of Uxbridge	21,556
Brock Township	12,567
Total Regional Municipality of Durham	696,992

The economy in the region of the Pickering Nuclear Site is founded on a diverse manufacturing base. As such, there is a large and mobile labour force, which supports a wide range of industrial, commercial, technological and institutional businesses. The economic base, in turn, is supported by good infrastructure, skilled labour and a solid range of available community amenities and housing. PNGS is a major employer within the region [6].

2.3.6 Indigenous Nations and Communities

The lands and waters on which the Pickering Nuclear site is situated are the traditional territory of the Michi Saagiig and Chippewa Nations of the Williams Treaties First Nations. The PNGS is also covered by the Gunshot Treaty (1877-88).

Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation, known as the Michi Saagiig, and Chippewas of Georgina Island First Nation, Beausoleil Island First Nation and Rama First Nation are all signatories to the Williams Treaties (1923) and to the Williams Treaties First Nations Settlement Agreement of 2018.

2.3.7 Community Relationships

The Nuclear Public Information and Disclosure Standard, N-STD-AS-0013 [14], identifies Indigenous Nations and communities and peoples as one of the target audiences, among others, for regular and targeted communication through the Public Information protocol.

2.3.7.1 Indigenous Relations

OPG is committed to taking concrete and measurable actions corporately to advance reconciliation with Indigenous peoples and to regularly report on the company's activities and progress in achieving established goals. In the fall of 2021, OPG launched its Reconciliation Action Plan (RAP). The RAP is a public document that serves as a roadmap to reconciliation and the inaugural 2021 edition included a number of specific actions and commitments with clear deliverables and timelines spanning between 2022 and 2031.

The Indigenous Relations Policy, OPG-POL-0027 [15], describes OPG's commitment to work with Indigenous Nations and communities and peoples, proximate to OPG's present and future operations, and to develop positive and mutually beneficial relationships that will create social and economic benefits through partnership and collaboration. This policy governs OPG's engagement with Indigenous peoples with respect to End of Commercial Operations (ECO) and beyond planning for PNGS.

With respect to PNGS, OPG values the relationship it holds with the Williams Treaties First Nations and remains committed to meaningful engagement with these Rights Holders. OPG also engages with other Indigenous Nations and communities who express an interest in OPG's current operations and proposed initiatives at PNGS.

To guide engagement, OPG developed an Indigenous Engagement Plan (IEP) that identifies engagement scope and activities for ongoing and proposed initiative at PNGS. The purpose of the IEP is to:

- Foster relationships with the Williams Treaties First Nations as Rights Holders and other identified Indigenous Nations and communities who have expressed an interest in PNGS;
- Communicate effectively by keeping proximate Indigenous Nations and communities informed of nuclear station operations, emerging projects, and station environmental performance;
- Seek the input and perspectives of Indigenous Nations and community representatives about OPG's ongoing nuclear operations and projects;
- Address and resolve identified concerns as applicable and to the extent possible; and
- Advance reconciliation with Indigenous Nations and communities as described in OPG's RAP which sets out goals under five pillars: Leadership, Relationships, People, Economic Empowerment, and Environmental Stewardship.

The IEP is intended to be a living document that can be updated over time to respond to engagement priorities and needs. Engagement on the PDP for PNGS is covered by the IEP. Currently, the IEP identifies and guides engagement with the following Indigenous Nations and communities:

Williams Treaties First Nations Rights Holders

- Alderville First Nation;
- Beausoleil First Nation;
- Curve Lake First Nation;
- Georgina Island First Nation;
- Hiawatha First Nation;
- Mississaugas of Scugog Island First Nation; and
- Rama First Nation.

Indigenous Nations and communities who have expressed interest in PNGS

- Huron-Wendat Nation;
- Mohawks of the Bay of Quinte;
- Métis Nation of Ontario – Region 8;
- Saugeen Ojibway Nation (Saugeen First Nation and Chippewas of Nawash Unceded First Nation); and
- Six Nations of the Grand River

OPG continuously hears that nuclear waste operations are an important issue to Indigenous Nations and communities. OPG continues to host site visits, meetings and attend communities to share information, answer questions, and raise awareness of the work being done to manage the waste at its various facilities. To respond to the interests of the Michi Saagiig Nations, OPG and the Michi Saagiig Nations established a Waste Table in August 2024 to have a coordinated and comprehensive engagement approach to waste across PNGS and Darlington NGS.

3.0 INTERDEPENDENCIES BETWEEN THE FACILITIES ON THE PICKERING NUCLEAR SITE

As mentioned in Section 1.0, the Pickering Nuclear Site consists of PNGS-A, PNGS-B and NSS-PWMF, each of which may be decommissioned at different times. The decommissioning of each facilities is described in detail in the individual plans [1], [2], and [3].

The following subsections describe the interfaces and interdependencies of the facilities on the Pickering Nuclear Site.

3.1 Separation of PNGS-A and PNGS-B

Should there be a decision to refurbish PNGS-B, there is a need to define the boundary between PNGS-A (Units 1 to 4) and PNGS-B (Units 5 to 8). Common systems and infrastructure will no longer be shared as each facility will be in a different lifecycle phase of a Nuclear Power Plant (NPP):

- PNGS-A will enter the decommissioning phase of the lifecycle after stabilization, and be kept in Storage with Surveillance (SWS) until decommissioned; and

- PNGS-B is planned to be refurbished (pending regulatory approval) and continue to be in the operational phase of the lifecycle.

The separation of PNGS-A and PNGS-B is denoted by the concept of an AB Gate which is illustrated in Figure 3-1 and has been defined for planning purposes, denoting the separation between the PNGS-B operating and the PNGS-A decommissioning stations. The planned engineering and physical modifications are addressed in the Stabilization Activity Plan (SAP) and therefore are excluded from the scope of this PDP.

3.2 AB Gate Criteria

The AB Gate is planned to separate PNGS-A Decommissioning from PNGS-B planned Refurbishment/Extended Operations. This gate was defined based on the following criteria:

- Systems on the PNGS-A side are to support SWS activities, while the systems on PNGS-B are to support planned extended operations of PNGS-B. By the time the separation of common system is complete, no PNGS-B systems required to support operations will be on PNGS-A.

- Terminal points to be established if required for energy sources crossing the AB gate barrier.

- The AB Gate may change location over time dependent on the overall site strategy.

- At the appropriate point in decommissioning, the AB Gate may become a physical barrier to separate the operating island from the active decommissioning island, enabling the following (depending on execution strategy):

    1) Implementation of different organizational and operational controlling authorities on each side of the AB Gate.

    2) Controlling/limiting movement of personnel and materials between PNGS-A and PNGS-B.

    3) Implementation of different security requirements on each side of the AB Gate.

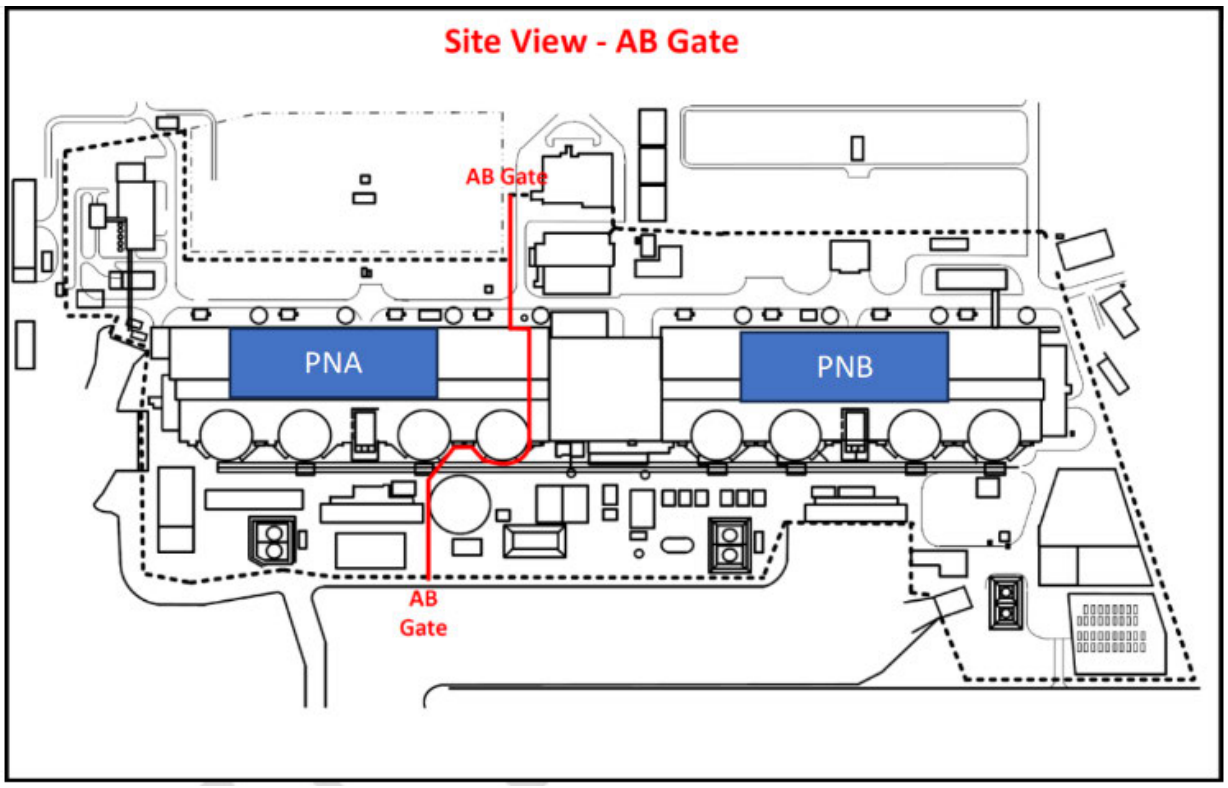

Figure 3-1: Separation of PNGS-A and PNGS-B

3.3 Interfacing Systems and Services between PNGS-A and NSS-PWMF

The NSS-PWMF remains in operation after the shutdown of the PNGS-A units and is expected to continue receiving, processing, and storing DSCs during Stabilization and SWS, until all the fuel has been removed from the IFBs.

As none of the systems used by SB #3 are sourced from PNGS-A, there will be no impact on NSS-PWMF operation. In addition, since SB #4 connects internally to systems of SB #3 and does not require additional supplies, it will not be impacted.

As discussed in Section 3.4 below, the services for NSS-PWMF are supplied by PNGS-B and are not expected to be impacted during PNGS-A Stabilization and SWS.

3.4 Interfacing Systems and Services between PNGS-B and NSS-PWMF

There are currently multiple interfacing systems and services between PNGS-B and NSS-PWMF to ensure safe operations of these facilities. The interfacing systems that are sources from PNGS-B to NSS-PWMF include:

- Electrical power:
- Fire protection water;
- Instrument air;
- Domestic (service) water;
- Active drainage; and
- Sewage drains system.

There are other systems at the NSS-PWMF such as Heating, Ventilation and Air Conditioning and service air, which are standalone systems.

The current interfacing services between PNGS-B and NSS-PWMF include the following:

- Environmental Monitoring;
- Radiation Protection;
- Security; and
- Emergency Response.

The interfacing systems and services between these PNGS-B and NSS-PWMF will be isolated prior to NSS-PWMF decommissioning.

3.5 Pickering Nuclear Site Overview Schedule

Figure 3-2 shows the overall decommissioning timeline of the stations and the NSS-PWMF.

The End of Life (EOL) timeline for NSS-PWMF have been extended to take into account the planned extended operations of PNGS-B. These dates are preliminary and will be updated as part of the next update of the NSS-PWMF PDP, for the 2028-2032 financial guarantee submission to the CNSC expected in 2027. Decommissioning of the NSS-PWMF may begin once the used fuel, retube waste and any hazardous materials have been removed and the facility has been removed from service.

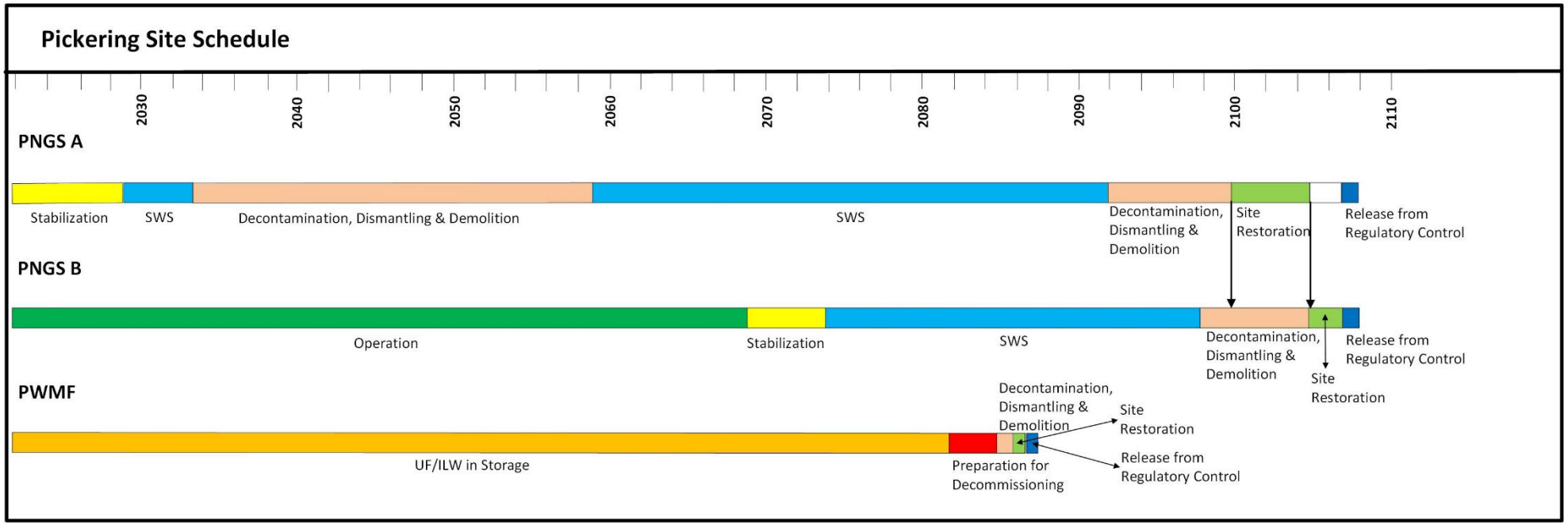

Figure 3-2: Pickering Decommissioning Interference

Note 1: Units 2 & 3 are already in a SWS Phase.

Note 2: NSS-PWMF EOL timeline is preliminary and will be updated as part of the next update of the NSS-PWMF PDP, for the 2028-2032 financial guarantee submission to the CNSC expected in 2027.

Note 3: For PNGS-A, risk reduction activities may occur during SWS phase. The empty PNGS-A Reactor Buildings will be safe stored prior to be dismantled with PNGS-B. Further details of the PNGS-A timeline are provided in [1].

4.0 POTENTIAL ENVIRONMENTAL EFFECTS

To support the decommissioning project, OPG's environmental programs will be maintained, and updated as needed, to ensure continual protection of human health and the environment. The following sections highlight some of the effects on the natural environment that might occur over the course of the decommissioning work. An environmental review that will encompass the full scope of activities for decommissioning each facility on the Pickering Nuclear Site will be performed and captured in the DDPs for each facility.

4.1 Natural Environment

4.1.1 Air Quality

The decontamination and dismantling of nuclear systems could release airborne radioactivity. The impact of these releases will be minimized through the use of temporary containment structures and local filtered ventilation. All buildings and structures will be decontaminated before demolition. However, even residual activity after decontamination can produce radioactive dust, which can therefore affect decommissioning workers, members of the public and the environment. This can be reduced by careful selection of appropriate decommissioning and demolition techniques. Dust can further be minimized by using fine mist sprays. Activities on site can also be scheduled to consider the potential impact of air pollution on the vicinity of the facilities being decommissioned [16].

The heavy construction equipment and the vehicles used for transport of waste and other materials will release particulates (dust) and exhaust gases into the atmosphere. These vehicles may also result in traffic and noise pollution. The nature and extent of these releases will depend on the type of equipment in use at the time of the decommissioning. Dusts, fumes and other emissions from cutting or blasting operations, particularly during the dismantling operations, may have some impact on air quality.

Traffic resulting from the movement of heavy vehicles to and from the Pickering Nuclear Site during decommissioning may have an impact on the surrounding community but the additional impact on the environment should not be significant. Shipment of radioactive waste and used fuel from the site is governed by the Radioactive Materials Transportation program [17] and will be subject to strict application of the following transportation regulations [18], [19], and [20].

As described in Section 4.2.2, there may be noise pollution resulting from use of heavy equipment, but this should be limited to a small number of distinct events during the Dismantling & Demolition work.

4.1.2 Surface Waters, Groundwater and Soil Quality

Some increase in turbidity of the water along the lakeshore may result from filling and sealing the stations' water inlets and outlets as well as from runoff during the Dismantling & Demolition and Site Restoration work.

The wetlands on the Pickering Nuclear Site are well removed from both PNGS-A and PNGS-B. Runoff from the decommissioning work can be controlled by standard construction techniques.

Two conventional waste landfill sites (the East Landfill and the West Landfill) are located outside the operating island security fence of the stations. These landfills were closed in 1997 and 1999. Landfill monitoring was conducted after closure to ensure that these sites do not adversely affect the groundwater on or off the site.

Investigations, which began in the late nineties, have identified localized contamination of the groundwater on the Pickering Nuclear Site by tritium and fuel oil. There is no indication that any of the contamination has migrated beyond the immediate vicinity of the stations. OPG has a comprehensive tritium Groundwater Monitoring Program that monitors the quality of groundwater in and around the Pickering Nuclear site and can detect changed conditions that affect groundwater quality. Monitoring has shown that there are no new sources of tritium contamination and the concentration in the already affected groundwater is decreasing due, in part, to removal by the foundation till drains.

At the time of decommissioning, there are two foreseeable sources of sub-surface radioactivity at PNGS, due to [21]:

- Known tritium-contaminated groundwater.

  After the PNGS-A units are shut down, significant decreases in overall groundwater tritium concentrations can be expected to occur over the course of the SWS period due to dispersion and radioactive decay over time. OPG operates a Groundwater Protection and Monitoring Program which demonstrate that facilities do not pose an unreasonable risk to the environment or to the health and safety of humans and non-human biota from groundwater [22].

- Potentially contaminated soil that has become contaminated with activation and fission products.

  The longer half-life radionuclides that are typically found during decommissioning are Co-60, Cs-137 and Sr-90. This contamination is likely to be found in soil relatively close (within a few meters) to the underside of the structure or components from which the leakage occurred.

  Remediation would likely entail excavation of the affected soil, with off-site disposal of the soil as radioactive waste. A preliminary estimate has been made, which indicates that there is an estimated volume of 6,730 m^3 of contaminated

soil that would require excavation and disposal at the Pickering A station. This quantity represents the volume of soil packaged for disposal.

Annual reports on the monitoring and remedial work are being submitted to the CNSC [23]. Prior to decommissioning OPG will develop a risk-based approach which will ensure that soil and groundwater remediation measures are implemented during decommissioning to meet regulatory requirements and ensure that doses to the public and non-human biota are minimized [24].

The potential impact of a spill of tritium in Lake Ontario from the PNGS has also been evaluated. Mitigating actions/reduction plans will be put in place in cooperation with Central Lake Ontario Conservation Authority in the event of a tritium spill to avoid taking raw water containing elevated tritium levels into the municipal drinking water treatment plants [25].

The tiered assessment [26] concluded that all emissions containing contaminants of potential concern would be discharged at acceptable levels and that most of the current conditions were considered bounding. The overall emissions from the site and the effects on the environment during these future phases are expected to be reduced overall; therefore, the need for monitoring and mitigations and emission controls will be commensurately reduced.

Decommissioning is also a potential source of soil and groundwater contamination, through spills of heavy water, oils and chemicals. The impact of possible releases will be minimized through the reduction of inventories immediately following the end of operations or during Preparation for Safe Storage and through the use of good practices as well as appropriate mitigating actions. More details regarding mitigating actions, such as runoff control measures, will be provided in the DDPs for each facility.

4.1.3 Vegetation

As mentioned in Section 2.3.3.1, the Hydro Marsh and the Frenchman's Bay Marsh are located west of the Pickering Nuclear Site. Both Hydro Marsh and Frenchman's Bay Marsh provide habitat for migrating waterfowl and are both designated provincially significant wetlands.

Two butternut trees (designated as a nationally endangered species and protected under Ontario's Endangered Species Act) are present along the north edge of the Mixed Forest lot north of Kinsmen Park. There are also three other plant species at risk have been recorded at the Pickering Nuclear Site, but which have not been observed since 2000 [10].

The latest annual species at risk monitoring reports such as that documented in [27] will be reviewed for reference and guidance to ensure compliance prior to decommissioning. However, it is not anticipated that the work performed during Preparation for Safe Storage period would have any impact on the vegetation in the immediate vicinity of the site beyond that caused by normal station operations.

The reduced level of activity on the site during the SWS period might permit increased growth of the vegetation on the site. However, it is anticipated that the growth of vegetation inside the security fence would be controlled to prevent the areas from becoming naturalized habitat prior to dismantling.

The Dismantling & Demolition and Site Restoration work may temporarily affect whatever vegetation is growing in the immediate vicinity of the work sites. The dust produced by the work may also impact some of the vegetation near the site.

4.1.4 Wildlife

The warm water of the condenser cooling water outlets and the booms across the forebay have created feeding grounds and resting places for a variety of other waterbirds including ducks, geese and gulls. These areas remain ice-free throughout the winter and offer shelter from Lake Ontario during inclement weather [10]. Shutting down the stations will change the habitat of these birds. There are also some avian species that have been identified on the Pickering Nuclear Site that have the potential to be listed under the Endangered Species Act [28] in the future. The taller buildings and their auxiliary structures provide opportunity for raptors, such as Peregrine Falcon, and other species to scan for food sources and provides roosting opportunities for other species such as doves and sparrows. The Pickering Nuclear Site is also visited by birds during the spring and fall migration and a number of species have also been identified as breeding on-site, particularly in association with the Hydro Marsh and adjacent Frenchman's Bay Marsh. Few reptile or amphibian species have been recorded on the Pickering Nuclear Site. The Black-crowned Night Heron, which is classified as a vulnerable species in the province, is commonly observed roosting on cables across the PNGS Units 5-8 discharge channel. One reptile species and six bird species with a provincial ranking of threatened or special concern have been recently or historically recorded at the Pickering Nuclear Site [10]. If decommissioning activities impact the habitats of these species, such as removing buildings or removing grassed areas for lay-down areas, the Endangered Species Act states certain requirements are to be met and which may include providing mitigation and off-sets plans to protect these species.

In addition, the warm water conditions likely create a productive environment for fish that serves as a food source for waterfowl species. Removing the warm water source will change the water environment which may impact fish and waterfowl species.

Some parts of the site that are not routinely used (such as the East Landfill and West Landfill and the marsh areas at the east and west ends of the site) have naturalized and thus become a habitat for wildlife. A variety of species of mammals, birds, reptiles and amphibians have been observed in these areas.

The latest annual species at risk monitoring reports such as that documented in [27] will be reviewed for reference and guidance to ensure compliance prior to decommissioning. However, it is not anticipated that the work performed during Preparation for Safe Storage period would have any impact on local animal populations beyond that caused by the operating facilities.

The local animal populations may increase during the SWS period since there will be less activity on the site. Any clearing and grubbing of vegetation on the site during the SWS period will be planned so as not to impact the annual breeding bird season.

The increased level of activity during the Dismantling & Demolition and Site Restoration period, along with the noise and dust has the potential to affect species inhabiting the Pickering Nuclear Site. Increased vehicular traffic during active phases of the decommissioning due to trucks carrying heavy equipment or decommissioning waste as well as use of private vehicles may have a potential to impact wildlife.

4.1.5 Aquatic Life

As mentioned in Section 2.3.3.2, the American Eel was identified as a provincial species at risk in the Environmental Risk Assessment [10]. The Environmental Risk Assessment [10] concluded that this species was likely not at risk from any contaminants of potential concern arising from PNGS operations. By shutting down the stations the thermal plume and, local aquatic environment interaction will transform. This may also have an impact on fisheries in the area.

A number of fish, amphibians and other forms of aquatic life have been observed in the coastal wetland to the east and west of the site. It is not anticipated that the work performed during Preparation for Safe Storage period would have any substantial negative impact on local aquatic populations. The local aquatic populations may increase or decrease during the SWS period since there will be relatively little activity on the site. The predictive effects assessment for Pickering Nuclear Safe Storage further concluded that the American Eel is not at risk during the Stabilization and SWS phases [26], [29].

Changes in runoff from the site during Dismantling & Demolition and Site Restoration period may impact some species found on the site and this will require discussion and consultation with the Department of Fisheries and Oceans. These impacts can be mitigated by controlling run-off from the work areas. Some increase in turbidity of the water along the lakeshore may result from filling and sealing the stations' water inlets and outlets as well as from runoff during the Dismantling & Demolition and Site Restoration work.

If part of the decommissioning plans requires in-filling of the intake channels and forebay, then avoidance, mitigation and off-set measures may be required under the Fisheries Act [30].

4.2 Land Use and Noise

4.2.1 Land Use

The site itself is anticipated to be utilized for other OPG uses, although it is recognized that this is subject to change. See Section 2.3.4.

Decommissioning itself is anticipated to have minimal impact on the use of the surrounding lands.

4.2.2 Noise

Several station systems are known to be noise sources. These include the station stacks, the standby generators and the paging system. Shutdown of the station will reduce and eventually eliminate these noise sources.

Heavy construction equipment and blasting may be used during the dismantling and demolition work towards the end of the decommissioning project. This work may produce localized elevated noise levels during the Dismantling & Demolition work. Site workers and wildlife may be temporarily impacted by the increased noise. The potential impacts of demolition noise will be assessed prior to Dismantling & Demolition and appropriate mitigation strategies will be put in place, such as not using certain demolition methods.

4.3 Human and Socio-Economic Environment

CSA N294 suggests that definition of the proposed end-state(s) may require consideration of socioeconomic consequences of decommissioning [5].

Aspects to be considered include:

- Direct economic impacts – employment (local/non-local), skill groups required, labour supply, etc.;
- Indirect economic impacts – employee expenditure, suppliers, labour markets, etc.;
- Demographics – changes in population size and characteristics (long and short term);
- Housing; and
- Other local services – police, health, social, education, etc.

4.4 Temporal Considerations and Risks of Potential Environmental Effects

Shutting down the PNGS and NSS-PWMF and the four phases associated with decommissioning, (i.e., Planning, Preparation, Execution and Completion Phases) will each have discrete activities that will result in effects on local communities. As a part of the planning activities, the local communities will be engaged throughout the process. This has already begun for PNGS-A and will continue until the end of decommissioning.

For planning purposes, it is assumed that these effects have commenced in 2022 for PNGS-A and will extend until decommissioning is complete for the site. The scheduled phases of decommissioning are almost continuous and overlapping for PNGS-A from

shutdown to end of decommissioning. The actual activities associated with these planned phases will be intermittent; however, it is important to understand the overall flow of activities, as these will be the major source of potential socio-economic impacts. The PNGS-A Program Overview DDP [1] elaborates the potential environmental effects associated with the decommissioning activities planned for PNGS-A from 2025 through 2033. It also provides mitigation measures that will be employed throughout the decommissioning process.

The PNGS-B PDP [2] and NSS-PWMF PDP [3] provide further details on the temporal considerations during the preparation and execution of decommissioning as well as measures to mitigate significant adverse effects to the environment and human populations.

6.0 REFERENCES

[1] OPG, "PNGS A Detailed Decommissioning Plan - Program overview," NA44-PLAN-00960-00004.

[2] OPG, "Pickering Nuclear Generating Station B Preliminary Decommissioning Plan," NK30-PLAN-00960-0001 R000, 2024.

[3] OPG, "Pickering Waste Management Facility Preliminary Decommissioning Plan," 92896-PLAN-00960-00001 R004, June 16, 2022.

[4] CNSC, *Waste Management, Decommissioning, REGDOC-2.11.2,* January 2021.

[5] CSA, "Decommissioning of facilities containing nuclear substances," N294:19, November 2019.

[6] OPG, "Nuclear Sustainability Services – Pickering Waste Management Facility – Safety Report," 92896-SR-01320-10002 R007, October 19, 2023.

[7] OPG, "Pickering NGS A Safety Report," NA44-SR-01320-00001 R017, July 8, 2022.

[8] OPG, "Pickering NGS B Safety Report – Part 1," NK30-SR-01320-00001-R006, October 7, 2022.

[9] OPG, "Pickering NGS B Safety Report – Part 2," NK30-SR-01320-00002-R006, October 7, 2022.

[10] OPG, "Environmental Risk Assessment Report for Pickering Nuclear," P-REP-07701-00007 R001, March 31, 2023.

[11] OPG, "2023 Pickering Nuclear Groundwater Monitoring Program Results," P-REP-10120-10052 R000, April 2, 2024.

[12] Government of Canada Website, "Earthquakes Canada," accessed March 24, 2021. [Online]. Available: https://earthquakescanada.nrcan.gc.ca/index-en.php.

[13] Durham Region, accessed October 2024. [Online]. Available: https://www.durham.ca/en/doing-business/resources/Documents/PlanningandDevelopment/Official-Plan/Schedule-A.pdf.

[14] OPG, "Nuclear Public Information and Disclosure," N-STD-AS-0013.

[15] OPG, "Indigenous Relations Policy," OPG-POL-0027 R006, November 2021.

[16] International Atomic Energy Agency, "Decommissioning at a Multifacilty Site: An Integrated Approach," No. NW-T-2.13, 2022.

[17] OPG, "Radioactive Materials Transportation," W-PROG-WM-0002.

[18] Minister of Justice, "Transportation of Dangerous Goods Regulations," SOR/2001-286, Current to August 2024.

[19] Ontario Ministry of Transportation, " Ontario Highway Traffic Act (R.S.O. 1990, CHAPTER H.8) and Regulations," accessed: October 2024. [Online]. Available: https://www.ontario.ca/laws/statute/90h08.

[20] Minister of Justice, "Packaging and Transport of Nuclear Substance Regulations, 2015," SOR/2015-145, Current to August 2024.

[21] OPG, "Pickering Contaminated Groundwater and Soil Remediation Recommendation," TLG Letter 005-1701-1403, February 2015.

[22] OPG, "IMPLEMENTATION Groundwater Protection Program," P-REP-07294-00002, 7 September 2023.

[23] OPG, "2020 Results of Environmental Monitoring Programs," N-REP-03443-10026 R000, April 2021.

[24] OPG, "Environmental Risk Assessment Report for Pickering Nuclear," P-REP-07701-00007 R001, March 31, 2023.

[25] CTC Source Protection Region, "Approved Source Protection Plan: CTC Source Protection Region," June 2015.

[26] OPG, "Predictive Effects Assessment for Pickering Nuclear Safe Storage - 2022 Addendum Report," P-REP-07701-00006 R001, March 31, 2023.

[27] OPG, "2020 Pickering Nuclear Biodiversity Program Technical Memo," P-REP-07811-133411 R000, December 21, 2023.

[28] Government of Ontario, "Endangered Species Act, S.O. 2007," Chapter 6', 2007.

[29] OPG, "Predictive Effects Assessment for Pickering Nuclear Safe Storage," P-REP-07701-00002 R000, April 2017.

[30] Minister of Justice, "Fisheries Act, R.S.C., c. F-14," 1985.

[31] OPG, Letter from OPG to CNSC, "Implementation of Waste Management, Decommissioning and Financial Guarantee Regulatory Documents at the Pickering, Darlington and Western Waste Management Facilities and Radioactive Facilities and Radioactive Operations Sites 1," W-CORR-00531-01771, October 15, 2021.

Appendix A: Mapping of PDPs

Content of PDP - CNSC REGDOC 2.11.2 (Section 6.1.1) [4]	Content of DDP - CNSC REGDOC 2.11.2 (Section 7.1.1) [4]	Pickering Nuclear Site PDP	PNGS-A DDPs	PNGS-B PDP	NSS-PWMF PDP
A description of the location of the facility, including e.g., a map of the facility and its specifications	-	Cover the Pickering Nuclear Site, including PNGS-A, PNGS-B and NSS-PWMF	-	-	-
-	A description of, and diagram showing, the areas, components and structures to be decommissioned, grouped, where appropriate, into logical decommissioning planning envelopes	-	Introduction to Planning Envelopes in Volume 0, with detailed descriptions of each Structures, Systems and Components (SSCs) in the respective DDP Volumes	N/A	N/A
The purpose and description of the facility, including e.g., primary SSCs	-	-	N/A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
The anticipated post-operational conditions, including e.g., a summary of the shutdown process, including planned removal of stored inventories of hazardous or radioactive materials	The operational history, including incidents or accidents that could affect decommissioning	-	Summary of the Operational History of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
The decommissioning strategy, including e.g., the final end-state objective	A decommissioning strategy for each planning envelope that highlights any significant changes from the strategy identified in the PDP	-	Include PNGS-A Decommissioning strategy	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
The decommissioning strategy, including any institutional controls	A description of the requirements for any institutional controls	-	Address specifics of PNGS-A	Address the specifics of PNGS-B	N/A for NSS-PWMF
The plan of the decommissioning work, including e.g., a work breakdown structure	A description of the decommissioning work packages, including e.g., a step-wise technical approach	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
-	The project management structure		Address the specifics of PNGS-A	N/A	N/A
-	The storage with surveillance stage, as applicable, and requirements of the functional building services, etc.	-	Address the specifics of PNGS-A	N/A	N/A
-	The final radiological, physical and chemical end-state objectives, and interim end-state objectives, as applicable	-	Address the specifics of PNGS-A	N/A	N/A
-	A list of federal and provincial regulatory agencies involved in the project	Addressed in the Site PDP	-	N/A	N/A
-	Applicable programs (e.g., management system, emergency response, site security, radiation protection, environmental protection, fire, and personnel training) (Note: this	-	Address the specifics of PNGS-A	N/A	N/A

Content of PDP - CNSC REGDOC 2.11.2 (Section 6.1.1) [4]	Content of DDP - CNSC REGDOC 2.11.2 (Section 7.1.1) [4]	Pickering Nuclear Site PDP	PNGS-A DDPs	PNGS-B PDP	NSS-PWMF PDP
	includes programs applicable during storage with surveillance and decommissioning)				
-	A human factors program that includes e.g., human factors analysis	-	Address the specifics of PNGS-A	N/A	N/A
-	Criticality safety assessment, as required, and planned actions involving fissile material	-	Address the specifics of PNGS-A	N/A	N/A
A conceptual schedule showing the approximate year of facility shutdown and the approximate sequencing and duration of the decommissioning work packages and, where relevant, storage periods	A schedule of the execution of decommissioning activities showing e.g., the start date of the proposed execution of decommissioning activities	Conceptual schedule showing the decommissioning interference of facilities on the Pickering Nuclear Site	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
The hazardous monitoring and survey commitments, including e.g., a program for conducting periodic contamination surveys and the recording of contamination events during facility operation	Comprehensive and systematic survey results of radiological and other potentially hazardous conditions, including identification and description of the remaining significant gaps or uncertainties in the measurement or prediction of such conditions	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
-	A characterization of potential environmental effects and the measures to be employed to mitigate and monitor these effects	-	Address the specifics of PNGS-A	N/A	N/A
-	The final survey program with interpretation criteria	-	Address the specifics of PNGS-A	N/A	N/A
-	Conventional occupational health and safety issues and associated training and protection programs	-	Address the specifics of PNGS-A	N/A	N/A
A waste management strategy specifying e.g., the conservative quantities and characteristics of radioactive and chemically hazardous wastes expected to arise from the decommissioning (tied to specific work packages, if possible)	A waste management plan A description of the decommissioning work packages, including the quantities, characteristics and disposition methods of waste	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
A commitment to prepare a DDP for CNSC acceptance prior to decommissioning	-	-	N/A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
A commitment to periodically review and update the PDP, in accordance with section 6.1	-	-	N/A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF

Content of PDP - CNSC REGDOC 2.11.2 (Section 6.1.1) [4]	Content of DDP - CNSC REGDOC 2.11.2 (Section 7.1.1) [4]	Pickering Nuclear Site PDP	PNGS-A DDPs	PNGS-B PDP	NSS-PWMF PDP
The physical state of the facility at the end of operations (permanent shutdown state) and the start of decommissioning (stable state for decommissioning)	-	-	N/A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
The records required for decommissioning, including a description of the facility's operational records that will be maintained to periodically update the PDP and prepare the DDP(s)	The operating and decommissioning records that will be retained, and the method of retention	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
A public consultation plan, including a public information program and avenues for public participation as per the requirements and guidance of REGDOC-3.2.1, Public Information and Disclosure	A summary report of any public and Indigenous consultations undertaken in preparing the plan, including issues raised and how they were considered and dispositioned	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
An Indigenous engagement plan as per the requirements and guidance of REGDOC-3.2.2, Indigenous Engagement		-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
The conservative cost estimate of decommissioning and a financial guarantee, as described in REGDOC-3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	A conservative cost estimate (based on the work packages), as described in REGDOC-3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities [6], for labour, materials, equipment, waste management, environmental assessment, monitoring and administration (e.g., training, safety, licensing, project management, government and public liaison)	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
A description of how the required funds will be provided	Financial guarantee arrangements	-	Address the specifics of PNGS-A	Address the specifics of PNGS-B	Address the specifics of NSS-PWMF
-	A table of contents for the final end-state report, outlining the topics to be covered	-	Address the specifics of PNGS-A	N/A	N/A
-	Operational experience and lessons learned from the decommissioning of similar nuclear facilities	-	Address the specifics of PNGS-A	N/A	N/A