CHAPTER 7

PHYSICAL ENVIRONMENT

7.0 PHYSICAL ENVIRONMENT

7.1 EXISTING ENVIRONMENT

The Selkirk G.S. is located in East Selkirk, Manitoba, on the outskirts of the City of Selkirk, in the Rural Municipality (R.M.) of St. Clements (Figure 3-1). The station is located at the northeast corner of the intersection of Provincial Road (PR) 204 and PR 212. The site and area zoning is administered under the R.M. of St. Clements Planning Scheme and generally reflects existing land use planning. The station is bordered by lands zoned primarily as residential to the north and rural to the east. The Red River borders the station to the west (and partially to the south) and Cooks Creek flows through the east corner of the property.

7.1.1 TERRESTRIAL BIOLOGY

The Selkirk G.S. site has been extensively disturbed by human presence and little original habitat remains. Much of the site was cleared for construction of the station, the coal storage area and the ash lagoon in the late 1950's and early 1960's. Additional disturbances in the region are present through human activity, introduction of alien species, use of herbicides and pesticides, and construction of roads. The following sections summarize information that has been previously submitted (SENES, 1992) and update this information, where applicable, with more current studies.

7.1.1.1 Wildlife and Wildlife Habitat

There is little natural habitat not affected by human presence in proximity to the Selkirk G.S. The significant nearby natural areas include the Red River Corridor, Birds Hill Provincial Park, and Oak Hammock Marsh Wildlife Management Area (shown on Figure 7-1).

The Selkirk G.S. site itself has been highly disturbed by on-going activities. The most significant remaining areas of wildlife habitat and communities are the Red River woods, Cooks Creek woods and the snye adjacent to the ash lagoon.

The Red River woods provide suitable habitat for aquatic birds. White pelican are known to use the river for feeding and resting. Where the understorey has not been affected (such as the northwest corner relative to the station), woodland habitat is available.

The Cooks Creek woods, although relatively small, are utilized by the wood duck, a regionally uncommon bird. Another regionally uncommon bird, the black-billed cuckoo, has been observed in the area, and possibly nests in the woods.

The snye adjacent to the ash lagoon is used by aquatic birds and is locally significant for breeding waterfowl. Duck species that have been observed using the area include mallard, black duck, wood duck, blue-winged teal and hooded merganser (a regionally uncommon species). The wet areas of the ash lagoon itself have been used as a resting and staging area by gulls and terns. The lagoon has also seasonally harboured Canada geese, snow geese, various species of duck, blackbirds, and pelicans. The decommissioning activities for the ash lagoon have been designed to allow this area to return to a natural state and are expected to provide increased habitat opportunity for resting and staging waterfowl.

Over 50 species of birds have been noted on the station grounds, primarily due to the diversity of habitat available. A listing of birds, amphibians, reptiles, and mammals likely to be found in this area is presented in Appendix M.

The federal Species at Risk Act (SARA) and Manitoba Endangered Species Act (MESA) are in place to preserve and protect wildlife species designated at risk. Constitutional authority for wildlife is shared between the federal and provincial governments. Since SARA is a federal act, it is limited to federal land, except for aquatic species and migratory birds that are protected wherever they are found. MESA protects provincially listed species on provincial and private land.

Species protected under SARA whose habitat range may overlap with the Selkirk G.S. include the least bittern (threatened), loggerhead shrike (endangered), sprague's pipit (threatened), yellow rail (special concern), northern leopard frog (special concern), monarch (special concern), and silver chub (special concern). The loggerhead shrike is also listed as endangered under MESA. The least bittern, loggerhead shrike, sprague's pipit and yellow rail are migratory birds and, as such, these species and their residences are protected wherever they are found. The northern leopard frog and monarch are currently only protected on federal land, none of which exists near the generating station.

7.1.1.2 Vegetation

The Selkirk G.S. is located in the boreal forest zone of Manitoba, although it is close to the boundary of the prairie zone to the west and the eastern deciduous forest to the east. There is some mixing of species from these zones present in the Selkirk area. A recent study (CFIR, University of Winnipeg, 2003) described the area around the Selkirk G.S. as part of the Aspen Parkland vegetation zone, within the Boreal Plains Ecozone, and the Interlake Plan ecoregion, as defined by Environment Canada. Selkirk is also found at the border of two forest regions within the Boreal Forest zone: the Manitoba Lowlands section and the Aspen-Oak section.

Typical boreal forest vegetation includes black spruce and tamarack on poorly drained sites, and white spruce, balsam fir, trembling aspen, balsam poplar and white birch on well-drained sites. However, most of these species have been affected by clearing for agricultural purposes, and only remnants are found in the Selkirk area presently. The dominant tree species within 16 km of the Selkirk G.S. are trembling aspen and bur oak, but American elm, green ash, and Manitoba maple are also present in some of the hardwood stands. White spruce does occur in some stands, mixed with trembling aspen, but pure stands are generally only found to the south of the station in and around Birds Hill Park (CFIR, 2003).

The Selkirk G.S. site itself has been highly disturbed by on-going activities. The most significant remaining vegetative communities are the Red River woods, Cooks Creek woods and the snye adjacent to the former ash lagoon.

The Red River woods (the banks of the Red River) are still well treed. The dominant canopy trees consist of ashes, basswood, and willows. The understorey vegetation has been affected by on-going recreational use of the river and by control measures to allow access to the river.

The Cooks Creek woods consist mainly of trembling aspen and ashes, and are well treed. The snye adjacent to the former ash lagoon provides a small wetland area.

7.1.2 SOILS AND GEOLOGY

The Selkirk area lies within the Manitoba Lowlands once occupied by glacial Lake Agassiz. The topography and geology of the area is relatively homogeneous, except for glaciofluvial sand and gravel deposits in the south towards Birds Hill Park. The underlying bedrock is dolomitic limestone and soils are generally Chernozemic (CFIR, 2003).

The Selkirk regional area is underlain by a sequence of lacustrine clay, glacial till and unconsolidated deposits. The surficial deposits rest on carbonate bedrock that is seated on shale and sandstone. These deposits are found on the Precambrian basement rock (Carbonate Aquifer Capacity as Related to the Town of Selkirk Water Supply, F.W. Render, 1986).

The glacial Lake Agassiz clay and fluvial deposits range from 0 to 12 metres thick. To east and west of Selkirk, and the Red River channel, large areas of glacial till and glaciofluvial deposits are present at surface (Render, 1986).

The glacial till below the Lake Agassiz deposits is up to 21 metres thick. The till is predominantly carbonate rock fragments in silty clay loam, named the Libau Drift. The till drift is generally two to three orders of magnitude more permeable than the clay deposits (Render, 1986).

The nature of the bedrock surface is hummocked and depressional, typical of karst terrain. The surficial deposits rest on Ordovician carbonate rock of the Red River formation. In the East Selkirk area, the bedrock is at 53 metres depth, which is the shallowest point in area. The carbonate rock overlies shale and sandstone rock from the Ordovician Winnipeg formation. This rock is estimated to be 40 metres thick, and composed of stiff dark grey-green shale with interbeds of fine-grained weakly cemented silica sandstone. It is also expected that a bed of silica sandstone occurs at the lower contact with the Precambrian rock (Render, 1986).

Test hole and well log information from the Selkirk G.S. indicate that the station is underlain by between 10 to 12 m of silty-clay overlying a dense till stratum that extends to bedrock surface at a depth of 18 to 24 m below surface.

7.1.3 HYDROLOGY AND HYDROGEOLOGY

As shown on Figures 3-1 and 5-1, the Selkirk G.S. is located on the east side of the Red River opposite the City of Selkirk. At its western edge, the site lies within 100 m of the Red River shoreline. The Selkirk G.S. pumphouse is situated on the river edge. Site topography is flat and low lying, with elevations ranging between 219 m and 225 m. Normal fluctuations in the Red River water levels range from a low water level of 216.0 m to a high water level of 218.5 m. During recent floods, water levels have exceeded 222.5 m for brief periods.

The major aquifer system under Selkirk is located in the carbonate rock. The water is stored and transmitted through fractures, bedding plane openings and solution cavities. In general, there are two aquifers referred to as the upper and lower aquifers, and they appear to produce water with a similar productivity (Render, 1986).

The carbonate rock aquifers are underlain by saline sandstone aquifers similar to those that occur in the Winnipeg formation under Winnipeg (Render, 1970). The saline water from these aquifers is considered a threat to the carbonate aquifer water quality.

Horizontal ground water flow at the site has been established to trend primarily in a north/northwest direction (towards the Red River). Piezometric data from nested piezometers across the overburden deposits is not available to evaluate vertical flow. It has been suggested that downward vertical leakage of water through the overburden occurs within the Selkirk carbonate aquifer drawdown cone (Render, 1986). The station is located within the drawdown cone and it seems reasonable to assume a downward hydraulic gradient exists.

7.1.3.1 Groundwater

The soils near the Selkirk G.S. are relatively impermeable (infiltration rates of less than 1.25 cm/hr) but these soils are isolated from the underlying bedrock by a thick layer of clay till (SENES 1992). The major aquifer in the area is the deeper dolomitic limestone, and is used as a municipal source for the City of Selkirk as well as the source of domestic water for local residences and for domestic and process purposes at the Selkirk G.S. (UMA Environmental, 1995).

Manitoba Hydro has monitored groundwater levels and water quality at ten observation wells established on the Selkirk G.S. site since 1993 (see Figure 7-2). The results of this monitoring are contained in the document “Results of the Selkirk Observation Well Monitoring Program 1993 to 2004” (Appendix L) and are summarized below.

Nine shallow observation wells (eight on the Selkirk G.S. site and one off-site and 1 reference well) were monitored for water elevation, standard water chemistry constituents and trace elements. Between 1993 and 1997, seven parameters were monitored. This was increased to 25 parameters, plus water elevation, from 1997 to the present. Samples were taken on monthly, quarterly, and annual basis depending on the parameter and time period, and analyzed at Manitoba Hydro’s accredited laboratory. The results from the observation wells monitoring were submitted to regulatory authorities. Concentrations of most parameters in the majority of samples were within the preferred range indicated by Manitoba and National Drinking Water Guidelines (Summary Guidelines for Canadian Drinking Water Quality, April 2002). In most of the instances where the concentrations in the on-site well samples exceeded the Guidelines, (e.g. total dissolved solids, sulphates, boron, iron, manganese, sodium, zinc and occasionally, selenium) the concentrations in the reference well were also consistently high indicating the results were indicative of prevailing local conditions. Elevated arsenic concentrations were recorded in two wells but have declined to less than drinking water Guideline values in recent years. Over the period of record of the monitoring program, no trends indicating significant changes in groundwater quality were observed.

7.2 ENVIRONMENTAL EFFECTS

7.2.1 TERRESTRIAL BIOLOGY

It is not expected that continued operation of the station will result in any new or increased adverse impacts on the local wildlife or vegetation. The construction and operation of the station, as well as surrounding agricultural land use and residential developments, has already affected the local vegetation

and wildlife habitat through habitat loss and disturbance. However, unless there are unforeseen changes in the operating procedures, it is expected that the current impacts will simply continue and not increase. Certain previously impacted areas are being rehabilitated as part of the decommissioning activities and will provide enhanced habitat opportunities.

In the fall of 2000, Manitoba Hydro requested that Manitoba Conservation "conduct an investigation into the operation of the Selkirk Generating Station (Selkirk G.S.) with special emphasis on the cause of (environmental) problems experienced by residents in the East Selkirk/Bird's Hill region".

These studies included: an Environmental Soil Assessment completed by AXYS Agronomics/University of Manitoba; Environmental Impact Assessment 1993 – 2000 completed by SENES Consultants Limited; Assessing Airborne Deposition of Particulates and Gases in the Selkirk Area Using Lichens Growing on Tree Trunks by ECOSTEM Ltd.; and an Assessment of Forest Decline in the Birds Hill Provincial Park area in Relation to the Manitoba Hydro Selkirk Power Generating Plant by the University of Winnipeg's Centre for Interdisciplinary Forest Research.

Taken together, the studies indicate that the operation of the Selkirk G.S. (on coal) has not had a significant adverse impact on the terrestrial environment in the Selkirk and surrounding area. Similarly, continuing with operation on natural gas is not expected to have an adverse impact in Selkirk or the surrounding area.

7.2.1.1 Wildlife and Wildlife Habitat

It is not expected that the continued operation of the Selkirk G.S. will result in any new adverse impacts on the local wildlife or wildlife habitat. The decommissioning and rehabilitation of the ash lagoon, to be completed in 2005, will result in improved habitat for waterfowl as the lagoon will be allowed to return to a more natural state, and the connection to the Red River snye will be re-established.

Gulls and terns have been observed to use the wet areas of the ash lagoon for resting and staging, and may also use it for drinking, although this has not previously been observed or documented. With the relocation of the deposited ash to the southeastern corner of the ash lagoon, where it will be capped with clay soil and vegetated, the remainder of the ash lagoon that does not have deposited ash, or had only trace amounts, will be left to develop a natural vegetative state. With the removal of the dykes and the reconnection to the snye, it is expected that good portion of the western ash lagoon will develop as a wetland. Accessible parts of the remainder of the lagoon will be seeded with a natural seed mix to encourage vegetative growth.

7.2.1.2 Vegetation

Three studies completed by AXYS, ECOSTEM and the University of Winnipeg examined the impact of the operation of the Selkirk G.S. on vegetation in the regional area surrounding the station. These studies indicate that the operation of the Selkirk G.S. (on coal) has not had a significant adverse impact on the vegetative environment in the Selkirk and surrounding area.

Similarly, continuing with operation on natural gas, which produces fewer emissions than burning coal, and has reduced chemical parameters that may stress vegetation, is not expected to have an adverse

impact on in Selkirk and the surrounding area. The switch to natural gas has virtually eliminated the SO_2 and PM emissions, and significantly reduced NO_X emissions

Since the air emissions from the Selkirk G.S. easily meet all Manitoba air quality objectives that are considered prescriptive for the long-term protection of rural areas (see Chapter 6), there will be no significant impact on the vegetation communities in the Selkirk and surrounding area.

The continued operation of the Selkirk G.S. will not require the removal of any additional vegetation beyond that which has already been disturbed to construct the station. The decommissioning and rehabilitation of the ash lagoon area will provide an enhanced natural vegetation area and additional growth will be encouraged by seeding some areas of the ash lagoon with a native plant mix.

7.2.2 SOILS AND GEOLOGY

The air emissions from the station meet all Manitoba and federal air quality objectives that are considered prescriptive for the long-term protection of rural areas. As the switch to natural gas achieved virtual elimination of particulate matter emissions from the stack, aerial deposition from the continued operation of the station on natural gas is not expected to result in any adverse impacts on the local or regional soils.

The completion of the decommissioning activities related to encapsulating the ash within the former ash lagoon and the residual coal within the former coal stockpile area eliminates the potential for fugitive emissions to contaminate surrounding local soils. These activities also prevent runoff from percolating through the residual coal and ash. These actions mitigate the potential for precipitation and runoff to dissolve trace amounts of pollutants in the ash and coal residuals that could then slowly percolate towards the groundwater system.

7.2.3 HYDROLOGY AND HYDROGEOLOGY

Section 7.2.3.1 discusses the potential environmental effects on the groundwater, both for supply and quality issues. The continued operation of the Selkirk G.S. is not expected to adversely affect the hydrology of hydrogeology of the area. The decommissioning of the ash lagoon and coal stockpile areas will eliminate a potential source of contaminants that could enter the groundwater system through vertical migration into the overburden soils. The withdrawal of water, both from surface water and groundwater sources, is governed by licence terms and conditions that protect both supplies from over-utilization.

7.2.3.1 Groundwater

Two deep wells are licensed and operated at the Selkirk G.S. to supply process water; a third well provides domestic water to the station. The volume of groundwater withdrawn is within licensed limits. Past operation at similar volumes has produced no effect on the local water table.

Nine shallow observation wells including one reference well have been monitored for 25 parameters and water elevation since 1997 to demonstrate that contaminants from previous station facilities and materials were not leaching into the subsurface waters. Concentrations of most parameters in the majority of samples were within the preferred range indicated in the Manitoba and National Drinking Water Guidelines (Summary Guidelines for Canadian Drinking Water Quality, April 2002). In most instances

where the Guidelines were exceeded, concentrations in the reference well were also high indicating the readings were the product of prevailing local conditions. The two major potential sources of groundwater contamination at the Selkirk G.S. – the coal pile and the ash lagoon will both be decommissioned and reclaimed by the end of 2005

Continued operation of the Selkirk G.S. is not expected to result in any effects to local water tables or to cause any change in local groundwater quality.

7.2.3.1.1 Groundwater Use

Water is drawn from two deep (approximately 55 m) wells located on the Selkirk G.S. site for general service and boiler make-up water use at the station. A Water Rights Act Licence issued in 1988 and amended in 1990 allows a maximum withdrawal of 0.026 m^3/s and an annual diversion of 494 cubic decametres from the deep wells for this use. The water balance diagram in Figure 3-5 of this report indicates that the maximum theoretical (design) daily withdrawal from the wells under maximum generation is 2262 m^3/day and the Licence limit is 2246 m^3/day; actual withdrawals are less than the maximum theoretical. The domestic well withdrawal at maximum operation is 11 m^3/day, an insignificant volume.

7.2.3.1.2 Groundwater Quality

Nine shallow observation wells (4 wells surrounding the ash lagoon, 4 wells around the coal piles, and 1 reference well) have been monitored throughout the 1993 to 2004 period (Appendix L). Concentrations of 25 water quality parameters have been recorded as required by the Selkirk G.S. Environment Act Licence 1645 and the letter of March, 1997 from the Director, Manitoba Environment, and as documented in the report “Selkirk Generation Station Observation Well Monitoring Results, 2005” included in Appendix L.

Concentrations of most parameters in the majority of samples were within the preferred range indicated by Manitoba and National Drinking Water Guidelines. In the instances where the Guidelines were exceeded, there was no significant threat to local groundwater quality. There are no known local users of shallow groundwater formation downstream of the Selkirk G.S. site. The following groundwater concentrations in excess of guidelines were noted:

- TDS, boron, manganese, and zinc concentrations in all samples exceeded Guidelines in all wells including the reference well.
- Sulphate concentrations in most samples were in excess of the Guidelines in the wells around the coal piles, one near the ash lagoon, and the reference well.
- Arsenic concentrations in two of the wells near the ash lagoon were historically elevated but have been below Guidelines in recent years.
- Iron concentrations in two of the wells near the ash lagoon and the reference well were historically elevated but have been declining to guideline values in recent years.
- Sodium concentrations in one well near the coal pile and one well near the ash lagoon and the reference well were slightly elevated above the guidelines.
- Selenium concentrations in three wells and the reference well were in excess of the Guidelines for one sample period. Since 2002, all results have been less than the Guidelines.
- Lead concentrations are uncertain; while most samples tested at less than the detection limit, the laboratory analysis method in use had a detection limit that was greater than the guideline.

Rehabilitation of the ash lagoon and removal of the coal pile in association with the Fuel Switching Project at the Selkirk G.S. has reclaimed the two main sources of potential groundwater contamination at the station. No significant changes in groundwater quality are expected to occur at these sites during future operations.

The site of the former coal pile has been approved by Manitoba Conservation as the location for a sludge drying bed for dewatering and storage of lime sludge waste from the water treatment plant. The relatively impervious soils at this site and the installation of an impermeable synthetic liner to contain the sludge bed will prevent any sludge components from leaching into the groundwater. Monitoring will be conducted to track groundwater conditions at the sludge drying bed.

7.2.3.1.3 Groundwater Levels

Piezometric elevations were measured monthly in the nine observation wells and in a deep well on site since 1993 as documented in Appendix L. The water levels in these wells fluctuated from time to time but no trends in water table levels were evident in either the observation wells or the deep well.

The volume of water proposed to be withdrawn from the deep wells at the Selkirk G.S. during future operations will not exceed the amount licenced under the Water Rights Act. No effect was detected in groundwater levels when this amount of water was withdrawn for past operations.

7.3 MITIGATION AND MONITORING

Conversion to natural gas resulted in the restoration of certain spaces on the property back to a more natural state, as decommissioning of coal and ash handling facilities proceed.

There are no new or incremental mitigation measures that have been identified as part of this environmental assessment that would require implementation to protect the physical environment either on-site or off-site from potential environmental effects resulting from the operation of the station. Many mitigation measures have already been completed based on recommendations in earlier environmental assessments.

7.3.1 WILDLIFE

Measures should be taken to ensure that the Red River woods, Cooks Creek woods and snye abutting the ash lagoon are not adversely affected during continuing operation or decommissioning of the plant. These measures could include:

- Minimizing activities in these areas; and
- Application of measures discussed under Section 7.3.2.

Decommissioning activities in the ash lagoon will involve removal of the dyke walls over a large part of the lagoon, allowing part of the lagoon to return to a natural wetland state. This will enhance the use of the lagoon area by waterfowl as a resting and staging area. This area will not be actively managed, but allowed to reach a natural equilibrium with the Red River snye.

7.3.2 VEGETATION

Measures should be taken to ensure that the Red River woods, Cooks Creek woods and oxbow abutting the ash lagoon (snye area) are not adversely affected during continuing operation or decommissioning of the plant. These measures could include:

- Ensure that these areas are not cleared;
- Ensure that drainage is not altered to or from these areas;
- Keep any construction or clearing activities at least 10 m from the nearest trees to reduce potential for damage from construction equipment; and
- Minimize the risk of fires where possible.

Decommissioning activities in the ash lagoon will involve removal of the dyke walls over a large part of the lagoon, allowing part of the lagoon to return to a natural wetland state. Additional areas of the lagoon will be seeded with native plant species to encourage vegetative growth.

Where possible, plant species used for landscaping or restoration should be native species and low maintenance. Pesticide, herbicide, and fertilizer use will be eliminated if possible.

7.3.3 GROUNDWATER

Mitigation programs to monitor and control groundwater use and effects include:

- Regular monitoring and reporting of groundwater withdrawal and utilization to demonstrate compliance with Licence limits.
- Regular monitoring and reporting of water levels in both shallow and deep wells.
- Regular monitoring and reporting of numerous water quality parameters in the on-site and reference shallow observation wells.

7.3.4 SOLID WASTE

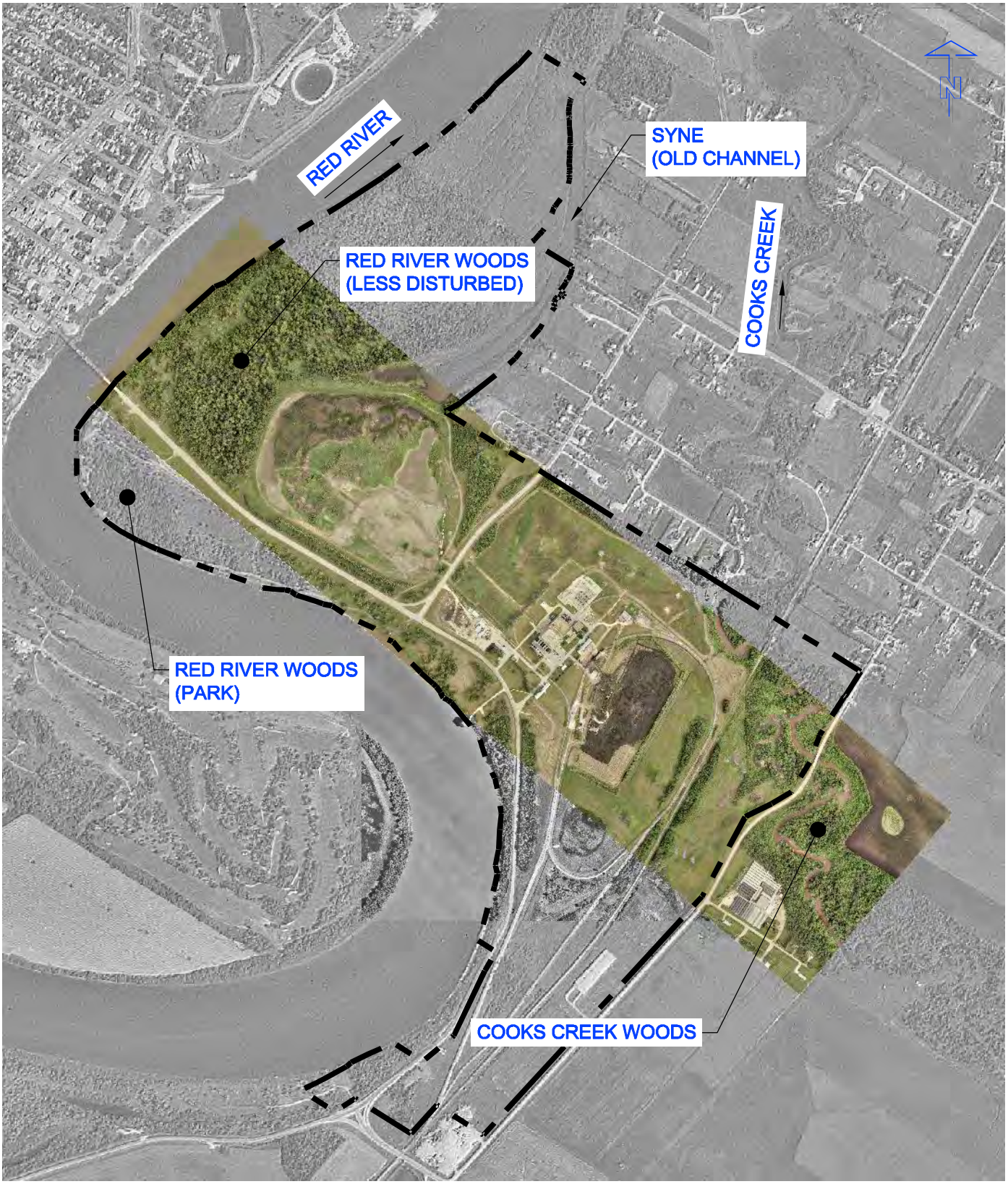
Current operational practices regarding proper disposal of solid waste should continue. There are no new or incremental mitigation measures that have been identified as part of this environmental assessment that would require implementation based on the continuing operation of the station.

7.4 RESIDUAL EFFECTS AND SIGNIFICANCE

Table 7-1 summarizes residual effects of operation of the Selkirk G.S., and describes each effect in terms of the magnitude, spatial extent of area affected, duration, frequency, and potential for a measurable effect to the physical environment.

Table 7-1 Residual Effects of the Operation of the Selkirk G.S. on the Physical Environment.

Source of Effect	Description of Effect	Mitigation Measures	Residual Effect
Storage of coal combustion by-products on-site (ash and coal residue)	Storage of ash and coal residue on-site has the potential to impact groundwater, surface water, soils, and vegetation through leachate movement and surface runoff.	Long-term mitigation measures have been developed and approved by Manitoba Conservation based on the Decommissioning Plan adopted by Manitoba Hydro. The mitigation measures include the storage of ash and coal residues in engineered secure cells and regular groundwater monitoring in these areas. Restoration of the ash lagoon will have a positive effect on the environment.	Effect is negligible to small, restricted to the plant site, and long term. The frequency is low. The expected effects to off-site receptors are negligible.
Long-term presence of station (continued operation).	On-going activity and human presence at the station site has the potential to impact vegetation, terrestrial biology, wildlife, and wildlife habitat.	The disturbance to the natural area occurred at the time of construction, on-going activities are not contributing significantly to new impacts in these areas. An extensive list of mitigation measures has already been implemented to manage impacts to the physical environment. Residual effects from the presence of the station will be addressed at the time of final station decommissioning.	Effect is negligible to small, restricted to the plant site, and long term. The frequency is low. The expected effects to off-site receptors are negligible.



Manitoba Hydro
Selkirk Generating Station
Licence Review

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ORTHOPHOTO DATES:
BASE MAP: 1994-1997
DETAIL PHOTO: 2004

Natural Habitat in the Vicinity of Selkirk Generating Station

Figure 7-1

UMA | AECOM

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Figure Not Included in Original Submission

Manitoba Hydro
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Monitoring Well Locations

UMA | AECOM

Figure 7-2

UMA FILE NAME: 0217-162-01_02-H-F072_RX.dwg Saved By: mhadfiel PLOT: 06-03-09 2:21:43 PM B SIZE 11" x 17" (279.4mm x 431.8mm)