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2. DESCRIPTION OF WATER AND WASTEWATER SYSTEMS

2.1 GENERAL

The purpose of this Section is to describe the Existing Facilities including the existing Evan-Thomas potable water treatment plant and wastewater treatment plant, the potable water distribution system and wastewater collection network, and the remote infrastructure including the Nakiska Base water treatment plant, and the Barrier Lake Lagoons and Sludge Drying Beds.

2.2 EXISTING FACILITIES REFERENCE AND RECORD DOCUMENTS

The Contractor acknowledges that it has been provided access to reference documents including unverified as-built records of the Existing Facilities.

The description of the Existing Facilities and systems in this Section 2 are provided for information only. The provision of this description and information by the Province shall not relieve the Contractor from its exclusive responsibility for ensuring that the Project, the O&M and the Existing Facilities O&M comply with the Project Requirements, nor shall estop the Province from asserting any non-compliance with the Project Requirements.

2.3 EXISTING INFRASTRUCTURE LOCATION AND LEGAL DESCRIPTION

2.3.1 Water Treatment

There are three existing potable water treatment facilities within the Evan-Thomas Provincial Recreation Area:

(a) The Evan-Thomas potable water treatment plant (Section 35 Township 22 Range 9 West of the 5th Meridian);

(b) Nakiska Base potable water treatment plant (Section 11 Township 23 Range 9 West of the 5th Meridian); and

(c) The Nakiska Mid-Mountain potable water treatment plant.

Only facility (a) is included in the scope of this DBFO Agreement. The existing Evan-Thomas potable water treatment plant is the site of the new PWTP. The Nakiska Mid-Mountain and Nakiska Base potable water treatment plants will remain under the ownership and control of Resorts of the Canadian Rockies Inc.

In 1981 - 1982 the Evan-Thomas potable water treatment plant was constructed to serve the water needs of the Kananaskis recreational area. Initially, only the Mount Kidd R.V. Park, Kananaskis Golf Course, and Kananaskis Village were serviced by this plant. In 2002 the service area was expanded to incorporate two adjacent properties located to the east of Highway 40 being the Kananaskis Emergency Services Centre and Boundary Ranch.

The Nakiska Base potable water treatment plant was constructed to provide potable water to the Nakiska Ski Hill base area which was developed for the 1988 Calgary Winter Olympics.

The Nakiska Mid-Mountain potable water treatment plant was also constructed as part of the Olympic facilities development. This stand-alone facility provides potable water to the Nakiska Mid-Mountain day lodge. As noted above this facility is NOT part of the scope of this DBFO Agreement.

2.3.2 Wastewater Treatment

There are three existing wastewater treatment facilities in Evan-Thomas Provincial Recreation Area:

(a) Evan-Thomas wastewater treatment plant (Section 35 Township 22 Range 9 West of the 5th Meridian);

(b) Equalization tank and lift station at the Nakiska Base snowmaking facility (currently operated in flow-through mode); and

(c) Barrier Lake Lagoons and Sludge Drying Beds (N½ of Section 10 Township 24 Range 8 West of the 5th Meridian).

Only facilities (a) and (c) above are included in the scope of this DBFO Agreement. The existing Evan-Thomas wastewater treatment plant is the site of the new WWTP. The Nakiska Base equalization tank and lift station will remain under the ownership and control of Resorts of the Canadian Rockies Inc.

In 1981 - 1982, the Evan-Thomas wastewater treatment facilities were constructed to serve the sanitation needs of the Evan-Thomas Provincial Recreational Area. Originally the Mount Kidd R.V. Park, Kananaskis Golf Course, and Kananaskis Village were serviced by the Evan-Thomas wastewater treatment plant. Treated wastewater from the treatment plant is discharged through an outfall to the Kananaskis River. In 1988, the Olympic village and, more recently the adjacent properties of the Kananaskis Emergency Services Centre and Boundary Ranch were tied into the system. By 1991-1992 the combined facilities serviced by the Evan-Thomas wastewater treatment plant exceeded the original design capacity, and upgrades were performed to provide secondary biological treatment for the incoming wastewater flows to meet the treated wastewater permit standards of the day. The upgraded treatment plant comprised raw sewage pumping, preliminary treatment, secondary treatment, and disinfection.

2.4 EXISTING EVAN-THOMAS POTABLE WATER TREATMENT PLANT DESCRIPTION

The raw water source for the Evan-Thomas potable water treatment plant consists of two 18 m deep groundwater wells that are suspected to be GWUDI. These wells are located at the north end of the Kananaskis Golf Course and adjacent to the existing Evan-Thomas potable water treatment plant.

Each well head has a submersible 37 kW (50 HP) well pump and sodium hypochlorite injection

system. One well head acts as duty while the other acts as standby for the water supply. The sodium hypochlorite dosing system at each well head consists of a 300 L sodium hypochlorite solution tank and chemical dosing pump. Sodium hypochlorite is dosed to maintain a free chlorine residual of 0.5 - 0.8 mg/L leaving the well.

Treated well water is pumped from the wells via a single pipeline to the Evan-Thomas potable water distribution system. The system can provide a maximum production capacity of approximately 3,000 m3/d.

2.5 NAKISKA BASE POTABLE WATER TREATMENT PLANT DESCRIPTION

The Nakiska Base water treatment plant provides potable water to the Nakiska Ski Hill base area including food services, ski patrol and administration.

Raw water for the water treatment plant is supplied by three ground water wells that are located adjacent to the Kananaskis River east of Nakiska Base. These three ground water wells are suspected to be GWUDI. The wells also supply raw water for snowmaking. Both the water treatment plant and the snowmaking facility are housed in Snowmaking Building.

The water treatment plant was upgraded in 2003 and consists of four parallel trains of 5 µm and 1 µm cartridge filters followed by two parallel trains of Wedeco UV disinfection units, sodium hypochlorite injection, and a 16 m^3 baffled clearwell to achieve the required chlorine CT. The liquid hypochlorite injection system consists of a polyethylene tank and chemical dosing pump. Continuous on-line monitoring of free chlorine residual entering the distribution system is provided.

The design production rate for this facility is 0.4 Megalitres/d based on the current pumping capacity.

The raw water wells supply the snowmaking system in parallel with the potable water treatment plant. When snowmaking is in progress the raw water is supplied from one of the two larger wells. When snowmaking is not in progress, there is a third well with a smaller pump dedicated to feed the water treatment process. In all configurations, all of the water is drawn into a common header and a pressure reducing valve is used to reduce the pressure entering the potable water treatment system.

The two existing distribution pumps at the Snowmaking Building operate as duty and standby to provide the present maximum day flow. Treated water is pumped from the above ground tank via a single pipeline to the Nakiska Base potable water distribution system.

2.6 EXISTING POTABLE WATER DISTRIBUTION SYSTEM

There are three existing potable water distribution systems within the Evan-Thomas Provincial Recreation Area:

(a) Evan-Thomas potable water distribution system;

(b) Nakiska Base potable water distribution system; and

(c) Nakiska Mid-Mountain potable water distribution system.

Only facilities (a) and (b) above are included in the scope of this DBFO Agreement. The existing Evan-Thomas potable water distribution system and the existing Nakiska Base potable water distribution system will form part of the new Potable Water Distribution System. The Nakiska Mid-Mountain potable water distribution system will remain under the ownership and control of Resorts of the Canadian Rockies Inc.

The existing Evan-Thomas potable water distribution system consists of a network of pressurized distribution mains, valves, a reservoir, and fire hydrants. The reservoir is a non-baffled 1.1 Megalitre storage reservoir situated above and to the west of Kananaskis Village. Potable water from the reservoir flows via gravity into the distribution mains. The reservoir is buried beneath a grassy knoll with only a control panel and vents visible. To the Department's knowledge, this reservoir has never been cleaned.

The existing Evan-Thomas potable water distribution systems services potable water for domestic consumption and for fire protection to the following areas within, and adjacent to the Evan-Thomas Provincial Recreational Area:

(a) Mount Kidd R.V. Park;
(b) Kananaskis Golf Course;
(c) Kananaskis Village;
(d) Kananaskis Village Staff Housing;
(e) Kananaskis Emergency Services Centre; and
(f) Boundary Ranch.

The existing Nakiska Base potable water distribution system consists of a network of pressurized distribution mains, valves, a reservoir and fire hydrants. The reservoir is a non-baffled 0.45 Megalitre reservoir which is located at an elevation above Nakiska Base. Potable water from the reservoir flows via gravity into the distribution mains. The concrete reservoir, constructed in 1979 is non-baffled and earthen covered. Although the physical condition has not been assessed, no operational concerns about the reservoir have been recorded. The reservoir was last cleaned in early 2000.

The existing Nakiska Base potable water distribution system services potable water for domestic consumption and for fire protection to the Nakiska Base facilities and Snowmaking Building.

2.7 EXISTING EVAN-THOMAS WASTEWATER TREATMENT PLANT DESCRIPTION

Wastewater enters the Evan-Thomas wastewater treatment plant via a raw sewage pumping station wet well and is pumped to preliminary treatment by three variable speed controlled submersible pumps. Wastewater then flows by gravity through the treatment process units and on to the treated wastewater discharge outfall.

The wastewater from the raw sewage wet well is pumped to a splitter box. In the splitter box, an emergency overflow diverts sewage that cannot be handled hydraulically by the downstream processes to the emergency overflow lagoon.

Downstream of the splitter box is a comminutor which reduces the size of solids in the wastewater flow. A manually raked bar screen is installed to remove large objects from the wastewater if the comminutor needs to be bypassed.

A primary clarifier comprising three channels is used to separate settle-able and floating solids from the wastewater, reducing the influent suspended solids and organic material. A traveling bridge mechanism conveys the settled primary sludge into hoppers at the downstream end of the primary clarifier channels. The sludge collected in the hoppers is withdrawn by sludge pumps and transferred to the aerobic digesters. A mixer (not currently used) is mounted within the primary scum tank; scum pit levels are checked manually and pumped down when necessary. Scum drawn from the scum tank is hauled away by tanker.

Primary clarifier effluent is piped into three Rotating Biological Contactors ("**RBCs**"). The RBCs rotation and aeration is powered by two centrifugal blowers housed in the basement of the wastewater treatment plant.

Solids from the RBC units are separated in the secondary clarifiers. Secondary sludge is then pumped either to the primary clarifiers for co-settlement or directly to the aerobic digesters. Clarified treated wastewater overflows the secondary clarifier perimeter weirs to the UV disinfection units.

The UV disinfection units are located in a channel between the RBC units. Under normal operating conditions, the UV treated wastewater continues along a pipeline by gravity to the outfall into the Kananaskis River. However, if a high water level is detected at the end of the UV channels then treated wastewater is diverted to the treated wastewater lift station and pumped into the river.

Two vertically mounted solids handling pumps transfer sludge from the primary and secondary clarifiers to the aerobic digesters.

The aerobic digesters consist of two concrete tanks with aeration piping and diffusers installed on the tank floor.

From the aerobic digesters, digested sludge is hauled by tanker trucks to the sludge drying beds at Barrier Lake. At Barrier Lake, sludge is spread in thin layers on the sand in the drying beds and allowed to dewater naturally. Dewatered sludge is scraped off the drying beds and stockpiled on the Barrier Lake Lagoon and Sludge Drying Beds lands prior to ultimate disposal to a landfill.

2.7.1 Wastewater Pumping

The total pump station capacity of the current pumping system with one pump designated as a standby is approximately 2,200 m^3/d. Pump operation is based on level set points within the wet well, and flow control is maintained by variable speed drives for each pump. Periodically, the pump station must be cleaned of screenings material and grit. An influent flow meter records the flow rate into the wastewater treatment facility and is monitored by the plant PLC.

2.7.2 Comminutor and Bar Screen

The existing comminutor has a rated capacity of 5,500 m^3/d. A manually raked inclined bar screen is provided as a bypass.

2.7.3 Primary Clarifier

The primary clarifier comprises three separate channels that are each approximately 1.1 m wide x 12.2 m long and have a side water depth of 3.3 m. With all three channels in operation, the clarifier has a design overflow rate of 40 m^3/m^2/d at average flows, and 80 m^3/m^2/d at peak hour flows.

The channels have individual isolation to facilitate maintenance. Currently, there is ongoing maintenance required on the travelling bridge scraper due to the channel structure being slightly out of alignment, causing wear on the sludge collector rakes, collector guide tracks and collector wheels.

2.7.4 Rotating Biological Contactors

Three RBCs provide secondary biological treatment at the Evan-Thomas wastewater treatment plant with space provided for another RBC to be installed in the future. Each RBC is 4.395 m long x 3.025 m wide x 2.000 m deep. Each RBC shaft has two stages of treatment attached: the first consisting of standard density media (4,427 m^2), and the second stage consisting of high density media (6,243 m^2). The shafts rotate at approximately 1.2 rotations per minute exposing the biofilm alternately to air and sewage. Replacement parts for the existing RBC units are becoming very difficult to find, and this may cause operational problems in the near future.

Air to the RBC units is supplied by two centrifugal blowers in a duty/standby configuration mounted in the basement of the wastewater treatment plant. The air blowers are 37 kW (50 HP) 4-stage centrifugal blowers rated at 60 sm^3/min; the blower air powers the rotation of the RBCs. One blower is sufficient to run all three existing RBC units, with the capacity to run four RBCs. Originally, one blower was installed for the operation of all three RBC units, and the backup capacity was provided by the aerobic digester blowers. A second dedicated RBC standby blower of 37 kW (50 HP) was added in 2001.

2.7.5 Secondary Clarifiers

Each secondary clarifier is 6.1 m in diameter with a side water depth of 3.2 m. With both units in operation, the secondary clarifiers design overflow rates are 20 $m^3/m^2/d$ for average day flow and 40 $m^3/m^2/d$ for peak hour flow. Settled sludge is normally pumped to the primary clarifiers for co-settling but can also be pumped directly to the aerobic digesters.

2.7.6 UV Disinfection

Two Fisher and Porter units provide UV disinfection. The UV disinfection system is designed for a peak hour capacity of 125 m^3/hour, and consists of two banks of UV lamp tubes mounted in two parallel disinfection channels. Each UV unit consists of six racks of four UV tubes controlled separately from the UV control panel located in the basement of the plant.

Operations data shows that the UV disinfection system has consistently treated the flows to the existing treated wastewater standard. However, the equipment is no longer manufactured and replacement parts are increasingly difficult to procure.

2.7.7 Treated Wastewater Lift Station and Pumps

The treated wastewater lift station dimensions are 4.2 m x 3.0 m x 3.4 m with a total volume of 43.0 m^3. Each of the three treated wastewater pumps is rated for 1,600 m^3/d at a total dynamic head of 7.1 m. One of the three pumps acts as a standby to ensure adequate reliability; the nominal total capacity of the system is 3,200 m^3/d. Under normal operating conditions, treated wastewater flows by gravity from the UV system to the Kananaskis River outfall. Under high river level conditions treated wastewater pumps are used to assist the discharge of treated wastewater into the river.

2.7.8 Treated Wastewater Discharge

A 200 mm mild steel pipe conveys the treated wastewater from the existing Evan-Thomas wastewater treatment plant to the Kananaskis River. A new outfall was constructed in 1991, including a 400 mm diameter perforated diffuser pipe installed in the middle of the river and extending approximately 10 meters downstream. Repair work to the downstream end of the outfall was completed in December 2011.

2.7.9 Emergency Overflow Lagoon

In the splitter box at the inlet to the preliminary treatment facilities an emergency overflow diverts raw sewage that cannot be handled hydraulically by the downstream processes through a manhole and into an emergency overflow lagoon. The contents of the lagoon are then pumped back into the headworks of the plant using a portable pump positioned in the manhole. The emergency lagoon was originally 40 m long x 32 m wide with an overflow invert at 1.5 m above the base of the lagoon (providing an approximate volume of 1,920 m^3). The lagoon has recently been refurbished as part of which the drain line from the manhole to the emergency overflow

lagoon has been relocated to the bottom of the tank; this causes the drain to plug with ice in the winter if any water is left in the lagoon. As a result, the emergency overflow lagoon is now unusable during the winter periods.

2.7.10 Solids Pumping

Each of the two solids handling pumps is rated at a capacity of 870 m^3/d at 3.2 m total dynamic head. At the current influent loads, sludge is typically pumped from each of the three primary clarifiers every hour for a 30 second interval. A magnetic flow meter is used to record the total sludge volume pumped to the aerobic digester, which at present day flows typically ranges between 15-20 m^3/d.

2.7.11 Aerobic Digesters

The two concrete aerobic digester cells (7.5 m x 7.5 m x 6.9 m) are operated at a side water depth of 3.1 to 3.9 m providing a capacity of approximately 220 m^3 for each cell, 440 m^3 total. The digesters are currently emptied approximately three times a year (spring, summer and fall). Digested sludge is taken out of the digesters and hauled by tanker to the sludge drying beds located at the Barrier Lake Lagoon and Sludge Drying Beds.

2.7.12 Digester Blowers

Air is supplied to the digesters by two 11 kW (15 HP) positive displacement blowers; piping and coarse bubble diffusers are used for mixing and aeration. There is a tee off of the common air header that can be used to supply air on an emergency basis to the RBC units. Each of the 11 kW (15 HP) blowers has a capacity of 67 sm^3/min to 73 sm^3/min, with one blower providing sufficient air to maintain aerobic conditions and keep the solids in suspension in the digester.

2.8 BARRIER LAKE LAGOONS AND SLUDGE DRYING BEDS

The Barrier Lake lagoon and sludge dewatering facility is located approximately 20 km northeast of the Evan-Thomas wastewater treatment plant. The facility provides sludge dewatering for aerobically digested sludge from the Evan-Thomas wastewater treatment plant and the William Watson Lodge wastewater treatment plant, and also serves the University of Calgary Field Station. The facility includes the following treatment units:

(a) Two facultative storage lagoons;
(b) Truck haul dump station and three septage cells (not currently used); and
(c) Four sludge drying beds.

2.8.1 Facultative Storage Lagoons

There are two facultative storage lagoons that provide treatment of wastewater from the University of Calgary Field Station delivered through a 200 mm gravity sewer and the under drainage from the sludge drying beds located in between the lagoons. The east lagoon has an

approximate storage capacity of 10,725 m^3 and the west lagoon has an approximate storage capacity of 7,360 m^3, providing a total combined storage volume of approximately 18,000 m^3. Treated wastewater from the facultative storage lagoons flows by gravity through a 200 mm outfall to the Kananaskis River.

2.8.2 Truck Haul Dump Station and Septage Cells - Discontinued

A truck haul dump station and three septage cells that were formerly used to treat septage from vault toilets and holding tanks in the Evan-Thomas Provincial Recreation Area have been discontinued and are no longer used for any treatment purposes. Septage is no longer received at the Barrier Lake Lagoons and Sludge Drying Beds.

2.8.3 Sludge Drying Beds

There are four sludge drying beds with a combined area of 700 m^2 which are currently utilized by the William Watson Lodge and the Evan-Thomas wastewater treatment plant for dewatering of aerobically digested sludge. Dewatered sludge removed from the drying beds is temporarily stockpiled on a part of the Lands at the sludge drying bed site prior to ultimate disposal to landfill.

2.9 WASTEWATER COLLECTION NETWORK

The Evan-Thomas Provincial Recreation Area wastewater collection network consists of gravity sanitary sewer mains, manholes, and lift stations feeding force mains, all of which convey sewage to the Evan-Thomas wastewater treatment plant. The mains feeding the wastewater treatment plant incorporate several sections of steel main, including; a section under a small creek at the north end of the golf course; a section under the Evan-Thomas Creek; the mains around the Evan-Thomas wastewater treatment plant itself; and a section under the Kananaskis River. Cathodic protection was added to these steel mains in 2006. The sanitary sewer mains ultimately convey the sewage to the Evan-Thomas wastewater treatment plant which services the following facilities within Kananaskis:

2.9.1 Mount Kidd R.V. Park

Sanitary service for the Mount Kidd R.V. Park consists of a 200 mm PVC collection main, which discharges at two lift stations, one at the northeast end of the R.V. Park, and one near the mobile homes. Wastewater is then conveyed via the 1,000 mm concrete main to a manhole on the main line, from where it connects to Evan-Thomas wastewater treatment plant via the 200 mm PVC main. This pipe infrastructure was installed in the early 1980s and is reported to be in good operating condition. The lift stations were both upgraded during the summer of 2007.

2.9.2 Kananaskis Golf Course

A 200 mm PVC gravity sanitary main services the golf course maintenance yard and staff housing areas in addition to the golf course club house. The pro-shop has an insulated 100 mm service that gravity feeds to a lift station for pump out via a 50 mm main to the sanitary main line. The starter shack has its own lift station that feeds into the pro-shop station.

2.9.3 Kananaskis Village

A 200 mm PVC sanitary collection header runs through the Kananaskis Village, and the collected flows are conveyed via gravity from there, under the Kananaskis River, to the Evan-Thomas wastewater treatment plant.

2.9.4 Kananaskis Emergency Services Centre

Kananaskis Emergency Services Centre sanitary waste is pumped by a lift station to a 200 mm gravity sewer which drains to the Evan-Thomas wastewater treatment plant. The sewer service to these facilities was installed in the mid-2000's.

2.9.5 Boundary Ranch

The Boundary Ranch sanitary waste is pumped by a lift station to a 200 mm PVC gravity sewer which drains to the Evan-Thomas wastewater treatment plant. The service to the Boundary Ranch was installed in 2002.

There is a radio link from Kananaskis Emergency Services Centre lift station to Boundary Ranch lift station to prevent both lift stations from operating simultaneously (against each other).

2.9.6 Nakiska Base and Nakiska Mid-Mountain Facilities

The linear infrastructure to the Nakiska Base facilities was constructed in 1984 - 1985 with services to the lodge at Nakiska Mid-Mountain constructed in 1988.

A 200 mm PVC gravity main runs throughout the base facilities and a length of sewer services the lodge at mid-mountain, returning sewage to the snowmaking equipment compound; from there the flow passes through EQ Tank and then continues to the Evan-Thomas wastewater treatment plant.

The EQ Tank was constructed in 1984; it has a gross volume of 250 m^3 and is complete with discharge pumps, a flowmeter, blowers, and other associated equipment and controls for the purposes of equalization and sewage pumping. The EQ Tank was originally designed to provide pre-treatment, storage, and pumping of the wastewater from the Nakiska ski facilities.

However, the EQ Tank is no longer used for the purpose of equalization or sewage pumping. Accordingly, sewage from the Nakiska ski facilities flows straight through the EQ Tank and out

via gravity through a 100 mm sanitary line into the main sewer system which discharges into the raw sewage pumping station at the Evan-Thomas wastewater treatment plant.

For emergency purposes, the outlet valve from the EQ Tank can be closed or throttled if needed by the operations staff, or the discharge pumps operated if gravity flow via the 100 mm sanitary line is not attainable, but this has not been practiced for many years.