Hamlet of Tuktoyaktuk

Background Report for Water Licence Renewal

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Project Number:

111351-03 (60118825)

Date:

November 2009

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November 27, 2009

Debbie Raddi
Senior Administrative Officer
Hamlet of Tuktoyaktuk
P.O. Box 120
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Dear Ms. Raddi:

Project No: **111351-03 (60118825)**

Regarding: **Background Report for Water Licence Renewal**

AECOM is please to submit the Background Report for Water Licence Renewal for the Hamlet of Tuktoyaktuk. Copies of this report have also been submitted to the NWT Water Board to assist the Board in its review of the Hamlet's application for water licence renewal.

If you have any questions, please contact me at 780-453-0910.

Sincerely,
AECOM Canada Ltd.

Ken Johnson, P.Eng.
Ken.Johnson@aecom.com

KRJ:cm
Encl.
cc: Executive Director, NWT Water Board

Distribution List

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7	1	NWT Water Board

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	**Ken Johnson**	**November 25, 2009**	**First issue**

AECOM Signatures

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The Association of Professional Engineers, Geologists and Geophysicists of Alberta.

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1. Introduction

In support of the Hamlet of Tuktoyaktuk's application for renewal of its water licence, AECOM has prepared a background report to provide an overview of the water and waste infrastructure within the community based upon the compilation of existing information. In addition, this report will serve as a communication tool for the community to address questions and concerns raised by the mayor, council, senior administration, residents, and other potential stakeholders of the community's water and waste infrastructure.

The scope of the report includes background information on water supply and distribution, sewage collection and treatment, and solid waste management. The report summarizes previous annual reports and INAC Inspection Reports to provide an overview of past issues and improvements to the systems. This report also describes recent improvements to the water and waste infrastructure.

The information review is presented through a combination of figures and text to provide a complete understanding of the community's infrastructure. The water and waste systems are illustrated in regional maps and aerial photos, and tables are used throughout the report to summarize information. This variety of presentation techniques should make the information clear and convenient for the various stakeholders in the application process.

2. Community Brief

The Hamlet of Tuktoyaktuk (or Tuktuujaartuq, "looks like a caribou") is located on Kugmallit Bay near the Mackenzie River Delta. Tuktoyaktuk is accessible by plane, or seasonally by ice-road.

Tuktoyaktuk is the most northern community on Canada's mainland. Prior to 1900, the area was home to many Inuit whalers, but this original population was badly hit by years of influenza epidemics brought by American whalers. Eventually Alaskan Dene people and inhabitants of Herschel Island settled in the area. A Hudson's Bay trading post was built in 1928, and in the 1950s Tuktoyaktuk became a supply base for the Cold War DEW Line. Today, many community residents work in transportation with the Northern Transportation Company Ltd., or practice traditional economic activities such as hunting and trapping.

Table 1 presents a brief profile of the community including size, terrain, climate and socio-economic characteristics.

Table 1: Profile of Tuktoyaktuk

Category	Description
Location:	69° 27' N and 133° 02' W
Population:	956 in 2007 (NWT Bureau of Statistics)
Residences:	270 (2006 NWT Bureau of Statistics)
Proximity:	137 km north of Inuvik, 1130 km northwest of Yellowknife
Weather:	Annual Daily Average = -10.2°C July Daily Average = 10.9°C and January Daily Average = -25.9°C (Canadian Climate Normals 1971-2000)
Precipitation:	7.02 cm of rainfall and 69.2 cm of snowfall annually
Vegetation:	Surrounding vegetation consists of moss, peat, grasses, lichens, and small bushes of willow and Labrador Tea. Small flowering plants are common in summer (GNWT, 1982).
Transportation:	Accessible by air year-round, or by ice road from Inuvik or Aklavik in winter
Economy:	Major industries include transportation, petroleum exploration, and traditional trapping and hunting
Services:	Public School, Health Centre, RCMP Station, etc.
Geology/Terrain:	Terrain around Tuk is flat, barren tundra dotted with shallow lakes and pingos. Permafrost is continuous, with an active layer generally less than 0.5 m. The peninsula under the community is coarse sand, silt, clay and gravel with interbedded ice lenses, formed from erosion material.

3. Infrastructure Descriptions

This section provides an overview of Tuktoyaktuk's water supply and waste disposal systems. See **Figure 1** for the locations of the water and waste management infrastructure described below.

3.1 Water Supply

The Hamlet's potable water supply system consists of the following elements:

- seasonal raw water supply from Kudlak Lake,
- raw water storage reservoir,
- water treatment facility and truckfill station, and
- trucked water delivery.

See **Figure 2** for the water supply site plan and **Figure 3** for water supply photographs.

3.1.1 Seasonal Raw Water Supply

Tuktoyaktuk's raw water comes from Kudlak Lake, a shallow lake located approximately 5.5 km east of the community centre and 4.5 km east of the raw water reservoir. Tuktoyaktuk's raw supply water is of good chemical quality for domestic use. The water is clear, moderately hard, well buffered, slightly alkaline, and has a moderate amount of dissolved solids.

In winter, the lake freezes deep enough that obtaining water from the lake is difficult and water quality is poor. The Hamlet uses a raw water storage reservoir to hold water for use during winter months.

The community obtains water from the lake via a high-density polyethylene pipeline. This intake line is partially submerged under Tuktoyaktuk Harbour and runs along the ground surface for the overland distance to the raw water reservoir. The intake line was replaced in October 2006 with a new 200 mm (8") diameter pipe after the old 100 mm diameter pipeline broke in the summer of 2006.

The water pumphouse at Kudlak Lake was relocated south of the previous location in April 2007.

3.1.2 Water Storage Reservoir

The water reservoir, built in 1984, is an earth structure with a capacity of approximately 90,300 m³. The reservoir characteristics are presented in **Table 2** below.

Figure 1. Facility Locations

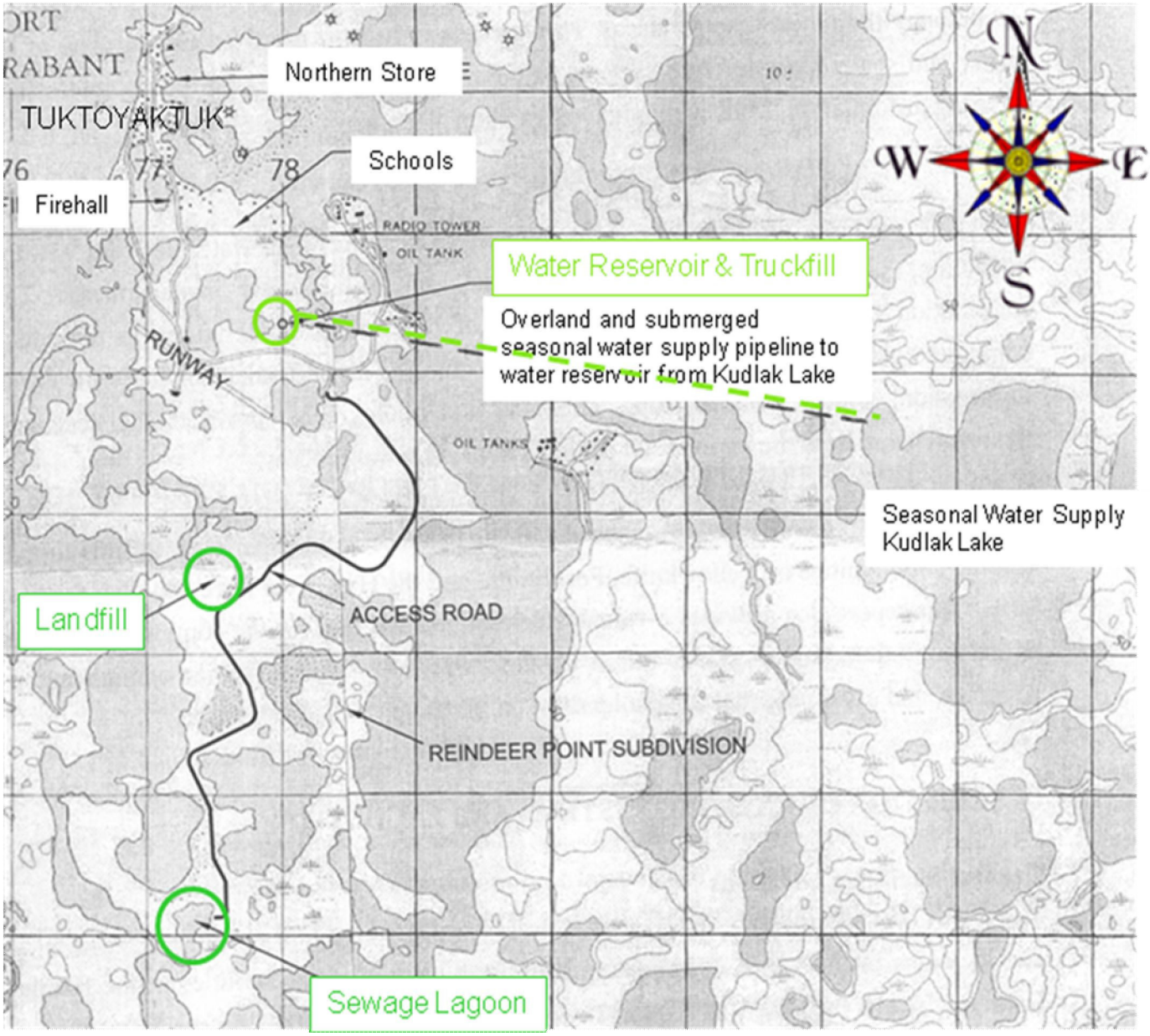


Figure 2. Water Supply Site Plan

Figure 3. Water Supply Photographs

Water reservoir

Truckfill Inlet Piping and Pumphouse (without new building)

Old Pipeline from Kudlak Lake

Water Treatment Plant and Truckfill building

Table 2: Tuktoyaktuk Water Reservoir Characteristics

Characteristic	Description
Maximum Reservoir Capacity	94,300 m³
Usable Volume Under Ice	53,100 m³
Maximum Water Depth	7.0 m
Design Ice Thickness	2.1 m
Dead Storage Depth	0.5 m
Freeboard	1.3 m
Full Reservoir Water Surface Dimension	102 m in diameter
Inside Slope	4:1
Liner	0.8 mm CPE with sand cover

The design capacity of the water reservoir is equivalent to consumption by 1,900 community residents and 250 camp residents.

The raw water storage reservoir is filled to capacity in the late summer of each year. This filling procedure usually takes about a week of continuous pumping of water from Kudlak Lake.

3.1.3 Water Treatment and Truckfill Station

Prior to 2009, water was treated by chlorinating with calcium hypochlorite (powdered form of chlorine) during truckfill.

A new water treatment plant and truckfill station was constructed in 2009 by Corix Water Systems. The new water treatment process includes 50 micron cartridge filters, a pressure filter, UV reactors applying a 40 mJ/cm^2 dose, and a chlorine contact chamber.

3.1.4 Distribution

Water is distributed throughout the community using water trucks operated by a private contractor. Two trucks operate seven days per week, filling individual building water tanks. Most of the existing houses have small tanks that are filled daily. Each truck has a capacity of 15, 890 L. Water deliveries are metered at the truck.

3.2 Sanitary Sewage Facility

Tuktoyaktuk's sewage is collected using trucked pumpout services. The sewage is treated at a sewage lagoon, shown in **Figures 4** and **5**, which is located approximately 3.9 km due south of the Airport Terminal Building.

3.2.1 Trucked Sewage Pumpout

Sewage is collected by a local contractor using 15,890 L vacuum trucks. Two trucks operate seven days per week. The sewage is transferred from holding tanks in each building to a retention lagoon approximately 5 km south of the community via an all-weather gravel road.

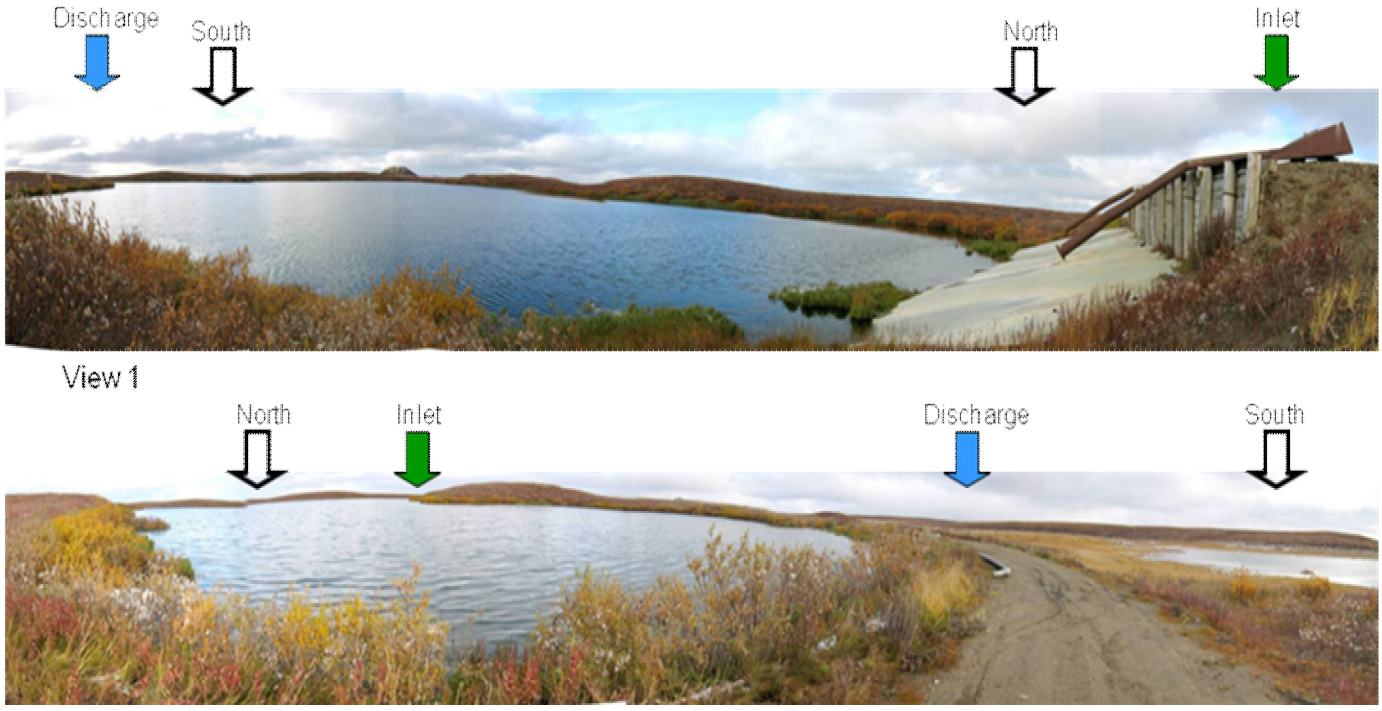
3.2.2 Lagoon Access Road and Sewage Truck Discharge Area

The access road to the sewage lagoon is an all-weather gravel road which exits the Reindeer Point subdivision access road. The access road leads to the truck discharge area at the north end of the lagoon. A seasonal access road extends to the south end of the lagoon.

Figure 4. Sewage Lagoon Site Plan

Base Image from GoogleEarthPro, © 2009 DigitalGlobe

Figure 5a. Sewage Lagoon Photographs



View 1

View 2

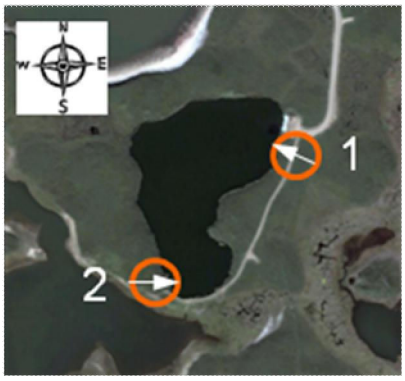
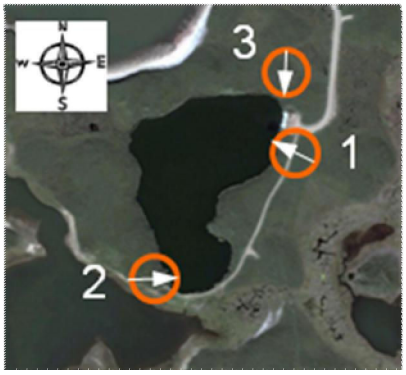


Figure 5b. Sewage Lagoon Photographs

View 3 – Discharge Structure in 2009



The truck discharge area consists of a gravel area with two gravel ramps leading to a steel chute and pipe system for the discharge from the vacuum trucks. The vacuum trucks discharge by elevating the tank at the front end of the truck, and opening a valve at the back of the truck.

The dispersion structures at the sewage lagoon consist of a timber retaining wall and a metal ramp from the base of the retaining wall into the lagoon. The metal ramp provides a means of effluent dispersion into the lagoon and provides erosion protection to the retaining wall.

3.2.3 Sewage Lagoon

The Hamlet's sewage lagoon is located approximately 5.8 km due south from the Hamlet Office, or 3.9 km south of the Airport Terminal Building, and 1.5 km southwest of the Reindeer Point subdivision.

The sewage retention lagoon provides 365-day retention to treat the sanitary sewage generated by the community. This is a secondary sewage treatment facility. The facility is a 5.9 hectare natural lake that has been modified with a perimeter berm at the south edge to provide the necessary retention capacity. The lagoon has sufficient capacity for a population of 1,900 community residents and 250 camp residents, assuming only domestic use.

3.2.4 Lagoon Effluent Discharge

The sewage lagoon is discharged in the early fall of each year to a saltwater inlet. Fall discharge ensures that the sewage receives the maximum possible natural aerobic treatment within the lagoon provided by sunlight, warm temperatures, and wind in the summer.

The seasonal discharge point is located on the constructed berm at the south edge of the lagoon, 3.0 km directly southeast from the open ocean of Kugmallit Bay and approximately 6.5 km from the ocean by way of the inlet channels. Discharge is accomplished by pumping effluent over the berm.

Over the recent water licence term, the Hamlet has collected samples from the sewage lagoon (SNP 0714-2) and the run-off lagoon at the landfill (SNP 0714-3) during summer and fall months. Data is available from Taiga labs for the number of samples shown in **Table 3**.

Table 3: Lagoon Effluent Sampling Summary

SNP Sampling Location	Number of Samples with Available Data			
	2005	2006	2007	2008
0714-2 (Sewage Lagoon)	6	2	4	1
0714-3 (Runoff Lagoon at Landfill)	1	3	1	0

The following tables show the average sample results for the sewage lagoon and solid waste lagoon, along with the operating parameter requirements of the Hamlet's Water Licence.

Table 4: Results of Sewage Lagoon Effluent Sampling

Parameter	Units	Licence Requirement	Average Sample Result
BOD_5	mg/L	120 (MAC)	25
TSS	mg/L	180 (MAC)	56
pH		6 to 9	8.68
Oil / Grease Sheen		none visible	none visible
Fecal Coliforms	CFU/100mL	no requirements	1351
Ammonia (NH3)	mg/L	no requirements	8.07

Table 5: Results of Solid Waste Run-off Lagoon Effluent Sampling

Parameter	Units	Licence Requirement	Average Sample Result
BOD_5	mg/L	120 (MAC)	5
TSS	mg/L	180 (MAC)	9
Polychlorinated Biphenyls (PCBs)	µg/L	25 (MAC)	0.075
pH			8.38
Fecal Coliforms	CFU/100mL		311
Ammonia (NH3)	mg/L		0.21
Cadmium	µg/L		0.1
Cobalt	µg/L		0.3
Chromium	µg/L		1
Copper	µg/L		12.2
Iron	µg/L		1190
Mercury	µg/L		0.02
Manganese	µg/L		58
Nickel	µg/L		2.6
Lead	µg/L		0.78
Zinc	µg/L		20

3.3 Solid Waste Facility

Tuktoyaktuk's solid waste is collected by truck and transported to the solid waste landfill, approximately 3 km south of the Hamlet. The landfill site consists of the following components:

- Perimeter fence and access roads to landfill areas
- Active municipal waste disposal area (east area)
- Bulky waste disposal area (south area)
- Remediated disposal areas
- On-site drainage retention system.

See **Figure 6** for the facility layout and **Figure 7** for site photographs.

3.3.1 Solid Waste Collection and Site Access

Solid waste collection is done by truck under contract to the Hamlet. Collection currently involves two trucks operating seven days per week.

The Solid Waste Disposal site is accessed from a gate along the all-weather road to Reindeer Point. This entrance provides access to the bulky waste area, the hazardous waste storage area, and a storage shed for the Hamlet's caterpillar tractor. The gate is normally closed to provide security for the caterpillar tractor.

The landfill site is surrounded by a 1200 m perimeter fence on the inland side of the site. The ocean-facing side of the landfill, to the west, is not fenced.

Figure 6. Landfill Site Plan

Base Image from GoogleEarthPro, © 2009 DigitalGlobe

Figure 7a. Landfill Photographs

View 1: Entrance to Municipal Solid Waste (MSW) Area

View 2: Active Municipal Solid Waste (MSW) Area

View 3: Perimeter berm

Figure 7b. Landfill Photographs

View 4: Active Municipal Solid Waste (MSW) Area in 2009

3.3.2 Solid Waste Disposal Facility

The Tuktoyaktuk Solid Waste Disposal site is a large fenced-in facility, approximately 3 km south of the Hamlet. It has been in operation since the early 1970s as a replacement to the dump formerly located at the end of the community airstrip. The facility covers an area of approximately 20 hectares, but not all of the area is currently in use.

The municipal waste area occupies an area approximately 70 m wide and 50 m long. The landfill is operated with limited compaction and limited cover.

The domestic waste area has a limited area for household hazardous waste storage, and no designated areas for waste separation. The municipal waste area is used by both the community and the local industries with no direct fee charged. There is no permanent supervision of the site, and no records of the quantities and types of waste are kept.

The Hamlet was operating a bulky metal waste area approximately 100 m wide by 100 m long. This area was remediated with complete cover in 2004. There is no designated metal waste area currently at the site.

Several old landfill areas were remediated in the north, southwest and east portions of the landfill site. These areas have been covered, with limited vegetative cover in the north and southwest areas and substantial vegetative cover in the east area.

3.3.3 Solid Waste Disposal Facility On-site Drainage Retention and Control Berm

Most of the surface area of the Solid Waste Disposal facility is covered by a lagoon containing surface runoff from the landfill. The surface runoff lagoon is retained by a 250 m long gravel and clay berm on the eastern edge of the landfill site.

The berm does not have any discharge control structure, so drainage continually accumulates. The perimeter berm also prevents the ingress of the ocean.

3.3.4 Water Pollution

The pollution factors associated with the landfill include surface water pollution, and subsurface water pollution. Surface water pollution is a concern which is managed with the on-site runoff collection within the landfill area.

3.3.5 Landfill Site Management

It has been suggested in the studies that the landfill site needs management improvements. The most significant of these improvements is that the municipal waste area requires management (signs and barricades) to limit the waste disposal area into a more manageable (smaller) area.

4. Water Licence Compliance Inspections and Annual Reports

This section summarizes the information from past INAC inspection reports and the Hamlet's annual reports. No other studies or reports have been completed since 2005 on the Hamlet's water and waste systems, as far as AECOM is aware.

4.1 Water Licence and Amendments

The Hamlet of Tuktoyaktuk currently holds Water Licence N7L3-0714 from the NWT Water Board, for municipal water use up to 100,000 m^3/year and municipal waste disposal. The Licence was first issued to the Hamlet in 1984 for water use up to 150,000 m^3/year and waste disposal.

Table 6 Summary of Water Licence Periods

Effective Date	Expiry Date	Licence #
June 28, 2005	June 27, 2009	N7L3-0714 (renewal)
April 30, 2002	April 29, 2005	N7L3-0714 (renewal)
March 1, 2000	April 29, 2002	N7L3-0714 (extension)
March 1, 2000	February 28, 2002	N7L3-0714
January 1, 1997	February 29, 2000	N7L3-0714 (extension)
September 11, 1997		N7L3-0714 (amendment)
January 1, 1997	December 31, 1999	N7L3-0714
March 1, 1994	February 28, 1997	N7L3-0714
March 1, 1984	February 28, 1994	N7L4-0714

4.2 Water Licence Annual Reports

The Hamlet did not submit annual reports during the years 2003 to 2008. The reports for these years have now been completed and will be submitted to the Water Board by AECOM in November 2009.

The Hamlet's average water use from 2003 to 2008 was 45,057 m^3 per year, or 129 litres per capita per day.

SNP sampling results, as summarized in the annual reports, indicate that the sewage lagoon and solid waste disposal run-off lagoon are operating within the water licence parameters with one exception. The pH of water in the sewage lagoon should be 6-9, but this parameter has been consistently above 9 throughout 2005-2008.

4.3 Water Licence Compliance Inspection Reports, 2005, 2007, 2008

Water Licence inspections were done in 2005, 2007 and 2008 by inspectors from Indian and Northern Affairs Canada (INAC).

4.3.1 Water Supply

Water supply facilities were generally acceptable in 2007 and 2008, although the inspector noted in 2007 that the water meter was not working and quantities were being recorded from a flow meter on the truckfill pipe at roof level instead.

However, in 2005 several “unacceptable” items were noted, including a non-functioning water meter and improper chemical storage. The other unacceptable items involved a fuel spill at Kudlak Lake which occurred in August 2004. The INAC inspection in July, 2005 noted that the intake facility and pumping station were “unacceptable” because the spill had still not been cleaned up and remediated.

The 2007 report indicated that the spill had been adequately cleaned up and remediated.

Table 7 presents a summary of comments from the 2005, 2007 and 2008 Inspection Reports on the Hamlet's Water Supply.

Table 7: Summary of INAC Inspections (Water Supply)

Inspection	Concerns	Notes/Comments
November 24, 2008 by Jan Davies	• Fuel tank and piping: Fuel tank has rust at connection points and hose flex connector on fuel tank is out of alignment.	• New Water Treatment Plant planned for fall 2009. • Intake facility not inspected. • Measures are being taken related to pumping and reservoir filling because of 2004 fuel spill.
August 2, 2007 by Jan Davies		• Intake facilities, conveyance lines, pumping stations at Kudlak Lake were not inspected. Conveyance lines and pump station at truckfill station were acceptable. • Water meter broken but flow meter on pipe at roof level is used instead. • There has been adequate clean up and remediation of Spill 04-572 to date. • Measures taken because of 2004 spill: propane motor with diesel backup used to run water intake pump; during water reservoir filling there is a 24-hour watch of the pump station at Kudlak Lake, and it is checked three times a day.
July 5, 2005 by Kevin R. Glowa	• Small fuel spill (Spill 04-572) clean up still in progress. • Bag of chemical above the doorwell should be stored in appropriate area. • Water meter not working. • Pumping facilities at Kudlak Lake and water treatment facility are unacceptable re: fuel storage and clean-up/remediation of Spill 04-572. In addition, the fuel storage tank and lines are badly corroded.	• Hamlet meeting regarding Kudlak Lake spill 04-572 occurred at 1:00 pm.

4.3.2 Waste Disposal

Table 8 presents a summary of comments from the 2005, 2007 and 2008 Inspection Reports on the Hamlet's Waste Disposal Facilities.

Table 8: Summary of INAC Inspections (Waste Facilities)

Inspection Date	Concerns	Notes
November 24, 2008 by Jan Davies	• Sewage discharge chute knocked off position by vacuum truck, needs to be put back in place with curbs or tire stop blocks. • Sewage spilled from vacuum truck on discharge chute turnaround pad, needs to be cleaned up. • Additional signage needed at landfill to increase public guidance and waste segregation. • More cover material is needed to ensure proper maintenance of the landfill. • Waste facilities O&M Plans need to be updated and components of the Plan are not being followed. • Sewage lagoon floating intake sinks to the bottom when full of water, so plywood is used under intake. Need to apply to NWT Water Board for modification to Licence.	• Only sewage lagoon was decanted this year, not solid waste lagoon. • Waste oil goes to E-Grubens Transport waste oil burner. • Batteries collected at Hamlet Four Bay Garage and put on pallet to send out with contractor. • Continue to control access to north side of landfill. • Ensure that groundwater monitoring wells around landfill are properly maintained.
August 2, 2007 by Jan Davies	• Some signage present at landfill, but additional signage needed to increase public guidance and waste segregation. • Visible erosion on south side of sewage lagoon – needs to be dealt with before greater damage occurs. • Oil staining present at sewage dump off and on dyke surrounding lagoon. There is potential for this to contaminate water in the area; soil needs to be disposed of and leaks from vehicles repaired. • Less than 0.5 m freeboard at solid waste lagoon. • Burn bin was present on north side of landfill, however, burning of non-segregated waste is unacceptable. • Draft O&M Plan for landfill was submitted October 2005; no indication whether revisions to O&M Plan have been completed and final document has been approved by NWTWB. • Sewage lagoon floating intake sinks to the bottom when full of water, so plywood is used under intake. Need to apply to NWT Water Board for modification to Licence.	• Only the sewage lagoon was decanted in 2006; both sewage and solid waste lagoons were decanted in 2005. • Used oil goes to E-Grubens Transport. • More signs were present on site at one time but some have been damaged. • Groundwater monitoring wells around landfill site should be properly maintained (covered and locked to prevent contamination of future samples).
July 5, 2005 by Kevin R. Glowa	• "Old" waste oil and hazardous waste area is becoming a permanent storage area, and these materials do not seem to have a designated area. Leaking oil, etc. is making its way into the landfill runoff lagoon. • No signs for waste segregation. Understanding is that these signs are being made and will be posted shortly. • O&M Plan was deemed incomplete by NWT Water Board – revised Plan is due October 1, 2005. • Bagged toilet waste (honey bag) disposal location is unclear.	• No leaks found at sewage and solid waste lagoon containment berms. • Last sewage lagoon decant occurred in October 2004. No decant since the last inspection period. 2004 Inspection indicated high pH levels (above MAC).

4.3.3 Surveillance Network Program

Table 9 presents a summary of comments from the 2005, 2007 and 2008 Inspection Reports regarding the Hamlet's Surveillance Network Program (SNP) and records and reporting requirements.

Table 9: Summary of INAC Inspections (SNP and Reporting)

Inspection Date	Records & Reporting	SNP
November 24, 2008 by Jan Davies	• 2003 – 2008 annual reports not submitted. • Need to identify landfill and provide additional signage for waste segregation.	• Hamlet collected sample prior to decant of sewage lagoon.
August 2, 2007 by Jan Davies	• 2001-2006 annual reports not submitted.	• Hamlet and DIAND have both collected samples. • Signs posted and correctly located. • More signage needed throughout facilities.
July 5, 2005 by Kevin R. Glowa	• 2003 and 2004 annual reports not received. • Lagoon and Landfill Condition Assessments received summer 2004.	• SNP samples collected by Hamlet in 2004. • DIAND 2004 samples showed no concerns except high pH at lagoon discharge; 2005 initial sample results indicated pH below 9. • SNP 0714-2 and 0714-3 signs posted in wrong locations, should be moved. • SNP 0714-1 needs re-painting.

5. Recent and Planned Improvements

Some modifications to the water licence infrastructure since the last water licence renewal (June 2005) include:

- The Hamlet modified the sewage decant structure sometime between 2005 and 2007 (see **Figure 5**)
- The water intake line was replaced in October 2006
- The water pumphouse at Kudlak Lake was relocated south of the original location in April 2007
- A new water treatment plant was constructed in 2009.

The water treatment plant at Tuktoyaktuk was recently upgraded by Corix Water Systems for the GNWT. The new WTP consists of two parallel process trains, each with a pressure filter and ultraviolet (UV) disinfection reactor. Sodium hypochlorite is added in the water storage tank for further disinfection. The new plant is designed to treat 530 L/minute and provide 1000 L/minute in truckfill flow or 1000 L/minute of untreated water for fire flow. For more information on the upgraded WTP, see Appendix A.

6. Conclusions and Recommendations

Over the most recent term of its Water Licence, the Hamlet of Tuktoyaktuk has had some non-compliance issues. The Hamlet did not submit water licence reports annually as required by the licence; however, reports for 2003 to 2008 have now been completed and submitted to the Water Board. The Hamlet's sewage effluent pH is often above the limit for unknown reasons, but other sewage water quality parameters are consistently within the limits of the licence.

The Hamlet has a new water treatment plant which is expected to be operational in late 2009. The new WTP will provide high-quality potable water for Tuktoyaktuk well into the future.

Tuktoyaktuk's water and waste facilities have served the community successfully, and should continue to do so in the future.

7. References

- NWT Bureau of Statistics, *Tuktoyaktuk Statistical Profile*. http://www.stats.gov.nt.ca/Profile/Profile%20PDF/Tuktoyaktuk.pdf accessed online January 2009.
- NWT Bureau of Statistics, *Tuktoyaktuk main profile page*. http://www.stats.gov.nt.ca/Infrastructure/Comm%20Sheets/Tuk.html accessed online January 2009.
- Legislative Assembly of the Northwest Territories, *Tuktoyaktuk Profile*. Accessed January 2009. http://www.assembly.gov.nt.ca/_live/pages/wpPages/maptuktoyaktuk.aspx
- Environment Canada, *Canadian Climate Normals 1971-2000: Tuktoyaktuk.* http://www.climate.weatheroffice.ec.gc.ca/climate_normals accessed online January 2009.
- Government of the Northwest Territories, Community Planning Division, *Community Water & Sanitation Services – 1982, Inuvik Region Northwest Territories.* December, 1982.
- Jan Davies, Indian and Northern Affairs Canada, *Water Licence Inspection Report (Tuktoyaktuk).* November 24, 2008.
- Jan Davies, Indian and Northern Affairs Canada, *Water Licence Inspection Report (Tuktoyaktuk).* August 2, 2007.
- Kevin R. Glowa, Indian and Northern Affairs Canada, *Municipal Water Licence Inspection Report (Tuktoyaktuk).* July 5, 2005.

Appendix A

Tuktoyaktuk Water Treatment Plant Upgrade - Brief

TUKTOYAKTUK WATER PLANT UPGRADE

RESERVOIR FILL SYSTEM

Raw water drawn from Kudlak Lake is stored in 100,500 m3 circular, single cell, above ground earthen reservoir. The reservoir has a total depth of 8.3 m, 1.2 m of which is for dead storage, 1.3 m for freeboard, 2.1 m for ice formation and 3.7 m for water storage. The active storage capacity of the reservoir is approximately 90,300 m3. The reservoir is fenced and lined with a 30 mm un-reinforced corrugated polyethylene liner. The reservoir is filled once per year, usually in September, via a 250 mm polyethylene reservoir fill line and a diesel pump.

OVERVIEW OF NEW SYSTEM

The new Water Treatment Plant is designed to treat raw water for the removal of impurities and to provide a high quality effluent for potable and domestic use. The treatment process is a completely automatic operation. The new plant consists of two parallel trains, each consisting of a pressure filter and ultraviolet (UV) disinfection reactor. The suspended solids are separated from the water as it flows through the pressure filter. The filtered water proceeds to the UV reactors where it is exposed to UV light. The UV light provides a 3 log inactivation of protozoa found in the water. As the treated water travels to the water storage tank, it is injected with sodium hypochlorite to further disinfect any other pathogens. Normally, plant operation is automatic but it can be switched to manual by the HOA switch located on the plant control panel. The design details of treatment system are given in the following table.

Overall	Nominal Design Flow:	530 L/min (140 US gpm)
	Fire Flow:	1000 L/min (264 US gpm)
	Truck Fill Flow:	1000 L/min (264 US gpm)
Pressure Filter:	Nominal Design Flow per Unit:	530 L/min (140 US gpm)
	Maximum Flow per Unit:	530 L/min (140 US gpm)
	No. of Filters:	2 (1 duty; 1 standby)
UV Reactor:	Nominal Design Flow per Unit:	530 L/min (140 US gpm)
	Maximum Flow per Unit:	1250 L/min (330 US gpm)
	No. of Units:	2 (1 duty; 1 standby)
	Log Removal for Cysts/Oocyst:	3
Chlorine Disinfection:	Virus Credit from Chlorine Disinfection:	4 log
	Minimum Design Chlorine CT:	12 mg min/L (between 0.5-30°C at pH 6-8)

Raw water is drawn from the Reservoir by the intake pump and pipeline, entering the Water Treatment Plant. The intake pumps provide water to the filter and UV treatment train and are controlled by the level of the water in the treated water storage tank. Only one supply pump is in operation at a given time. An air release/vacuum release valve, situated at the highest point between the intake pipes in the pump service building, emit air from the pipe and allow the raw water piping to drain down between pumping cycles.

Treated water is stored in a 29,123 L (7,693 US gallons) aluminum water storage tank. The water storage tank is divided into four chambers using baffles which acts as a clearwell to provide the required contact time for chlorine disinfection.

TREATED WATER SUPPLY SYSTEM – TRUCK FILL

The truckfill system is started by the operator activating the On/Off button located on the truckfill arm panel (TFP). The operator can also access the start and stop of the truck fill operation from the main control panel located inside the water treatment plant. When the operator pushes the ON button, the system signals the truck fill pump to start. The Truckfill pump will turn off once the truckfill control is deactivated by the operator pressing the OFF button.

The truck fill pump transfers the treated water from the treated water tank to the truck and is initiated by the truck operator. Before entering the water truck, the treated water is analyzed to determine if there is sufficient chlorine residual in the water. During the operation of the truckfill system, additional chlorine is injected if required to maintain the FAC residual of 0.4 mg/L. This is to ensure that after 20 minutes, there is enough chlorine residual in the water truck before water is delivered to the community.

TREATED WATER SUPPLY SYSTEM – FIRE FLOW

Fire flow rate, provided by the supply pump(s), is 1000 L/min (264 US gpm) and set by the Fire Marshall. A control switch is located on the truckfill arm will be activated and provide chlorinated raw water to the water truck, by-passing the filtration and UV treatment units. This system will only be implemented in the event of a fire and by the plant operator.

WASTEWATER SYSTEM

During the production of potable water, various types of wastewater will be generated by the plant. Wastewater generated by the process includes:

- Pressure filter backwash water;
- Pressure filter rinse water;
- General housekeeping and cleaning of lab equipment

The backwash water supply is provided from the water storage tank. Typically, a single backwash is required per day for each operating filter (1 duty, 1 standby) at a flow rate of 594 L/min (157 US gpm) for duration of about 8 minutes. Only one filter is backwashed at a time while the other filter is still producing water.

The filter backwash and rinse water flows directly to the wastewater tank. The net storage capacity of the wastewater tank is 9,550 L. Constant overflow should be avoided by having more frequent wastewater hauling and/or recycling of wastewater. The wastewater tank will be periodically emptied for off-site disposal. A level transmitter inside the

All other housekeeping wastewater - wastewater from the process floor drains and UV reactor drain - are collected by gravity and directly sent to the sump pump tank. A float switch, situated in the sump pit, will monitor the level in the sump tank and initiate the sump pump to start automatically, transferring the wastewater to the Wastewater Storage Tank.

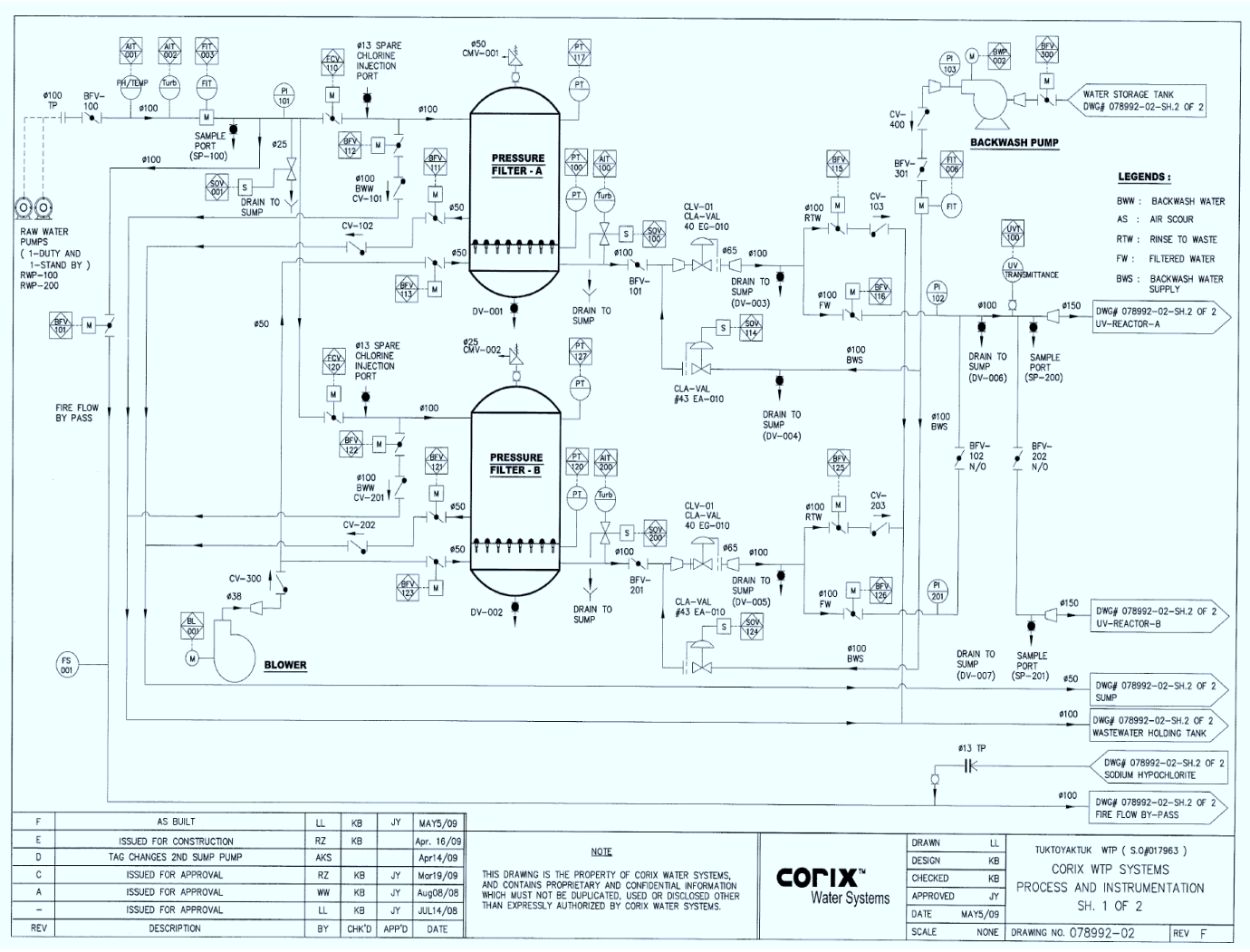
Wastewater Holding Tank will indicate when the tank is full and requires emptying. When the wastewater tank is full, it will automatically send an alarm to the Operator and will shut down the plant completely in order to avoid any further backwash water going into the tank. Only the plant will stop producing water (the truck fill operation and chlorine dosing will continue to operate) during times when the wastewater tank is full. The sump pump however, will not be stopped, as locking this pump out could result in the flooding of the entire plant. The sump pump will continue to pump water into the Wastewater Holding Tank and excess water will go out of the overflow line to the outside of the building.

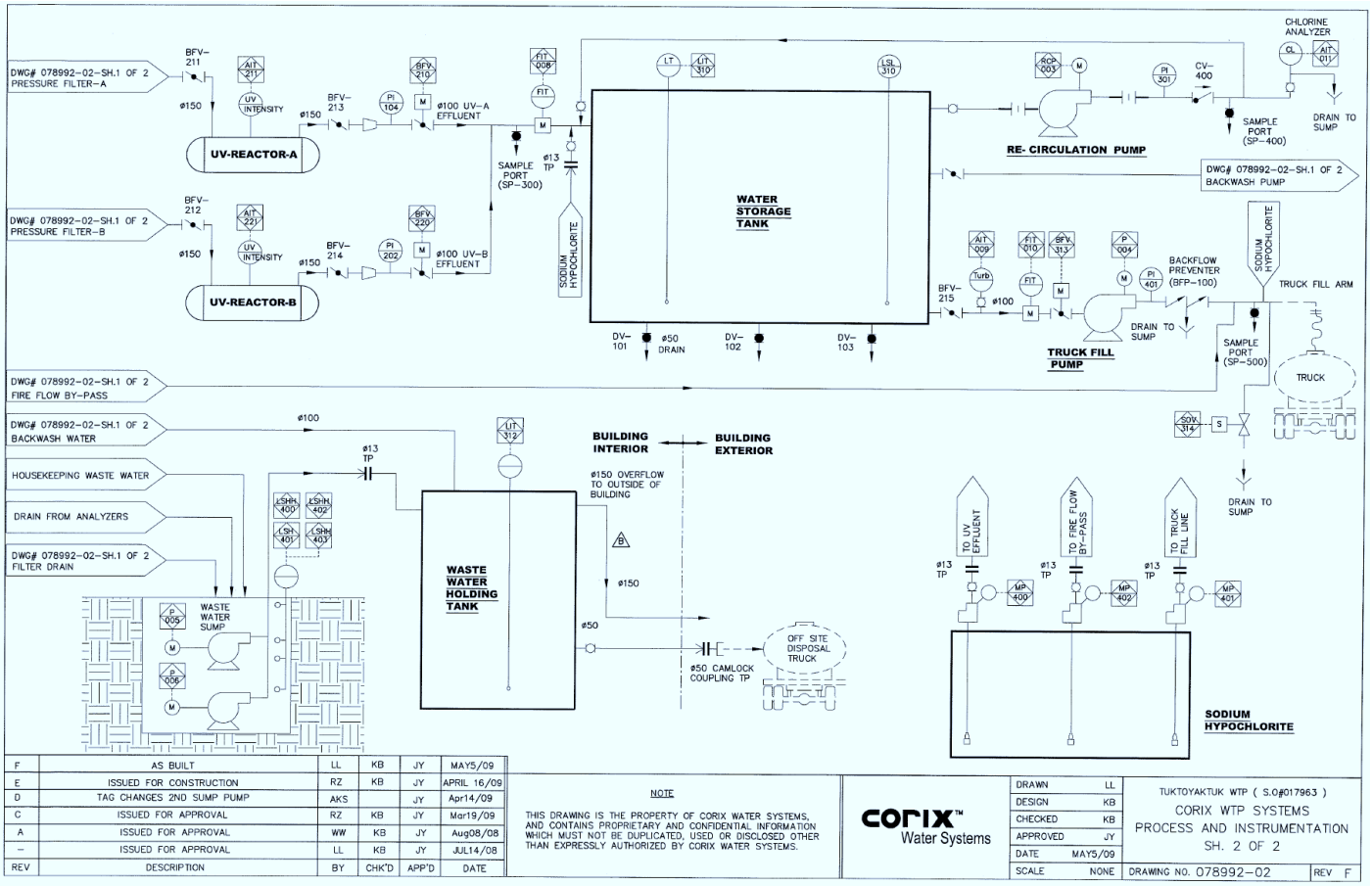
STANDBY DIESEL GENERATOR

A 50 kW diesel generator will be installed in water treatment plant to provide standby power. The diesel standby generator is design to provide power to all components in the water treatment plant.

Prime power is normally supplied by the power transmission line. During times when there is insufficient power supplied by the power utility service, such as if there is a disruption in the power lines, the automatic transfer switch 1 (ATS 1) will initiate the standby generator to start. ATS 1 will control the transfer of power from line power (Source 1) to generator power (Source 2). Once line power has returned, ATS 1 will switch back to Source 1, allow the generator to cool, and stop the generator.

PID OF NEW WATER TREATMENT PLANT





REV	DESCRIPTION	BY	CHK'D	APP'D	DATE
F	AS BUILT	LL	KB	JY	MAY5/09
E	ISSUED FOR CONSTRUCTION	RZ	KB	JY	APRIL 16/09
D	TAG CHANGES 2ND SUMP PUMP	AKS		JY	Apr14/09
C	ISSUED FOR APPROVAL	RZ	KB	JY	Mar19/09
A	ISSUED FOR APPROVAL	WW	KB	JY	Aug08/08
–	ISSUED FOR APPROVAL	LL	KB	JY	JUL14/08

NOTE

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CORIX™ Water Systems

DRAWN	LL
DESIGN	KB
CHECKED	KB
APPROVED	JY
DATE	MAY5/09
SCALE	NONE

TUKTOYAKTUK WTP (S.O#017963)
CORIX WTP SYSTEMS
PROCESS AND INSTRUMENTATION
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