Friesen Drillers Ltd.
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March 11, 2016

Mr. Robert Boswick, P. Eng.
Environmental Engineer
Manitoba Conservation and Water Stewardship
Environmental Approvals Branch
2nd floor 123 Main Street (Box 80)
Winnipeg MB R3C 1A5

Dear Mr. Boswick:

Subject **Town of Virden Wastewater Treatment Plant Decommissioning**
**Virden, Manitoba**

Friesen Drillers Ltd. has been retained by The Manitoba Water Services Board (MWSB) to undertake the sealing and decommissioning of a former deep sewage injection shaft at the former wastewater treatment plant.

**Project Background**

The mechanical wastewater treatment plant for the Town of Virden was built in the 1960's and was operated using a high rate activated sludge process. The plant originally consisted of a surge tank, bar screen, a deep shaft (aeration reactor), three flotation cells, secondary clarifiers and chlorine disinfection (Associated Engineering, et. al, 2014).

The aeration reactor consisted of deep 30 inch diameter steel shaft cased to a depth of approximately 500 feet from the ground. The shaft contained an open end 12 inch diameter shaft set to approximately 430 feet. Wastewater was injected into the deep shaft through the smaller diameter pipe and air was introduced in the system. The mixture was allowed to circulate into the large diameter shaft and back to surface. Air was used to create a highly aerated environment which promoted the degradation of waste material by supplying oxygen for microbial growth. Air was also used to circulate the wastewater mixture to surface. Air was supplied into the shaft through air lines installed in the 12 inch pipe and riser sections. Air from the 12 inch pipe was used to push the mixture down, while air from the riser section was used to push the mixture up. After treatment, flotation was used to separate solids from wastewater mixture. Liquids from this process were subjected to a series of flotation, sedimentation via clarifiers and chlorine disinfection. The resulting effluent was then disposed into an outfall pipe in a ditch close to the plant.

A cross section of the deep shaft is shown on the following page as Figure 1.

Over the years, the treatment system became obsolete was not able to meet the modern environmental standards. In 2012, the deep shaft became partially blocked and the system went offline. In the report submitted in 2013, it was speculated that the deep shaft had perforations on the casing as a result of corrosion induced by the corrosive wastewater in the shaft. Further, it was deemed that the deep sewage shaft was in such poor conditions that it could not be repaired with any available equipment. Hence, the need for a new wastewater treatment system and sealing of the sewage injection shaft became more evident.

**Project Background (cont'd)**

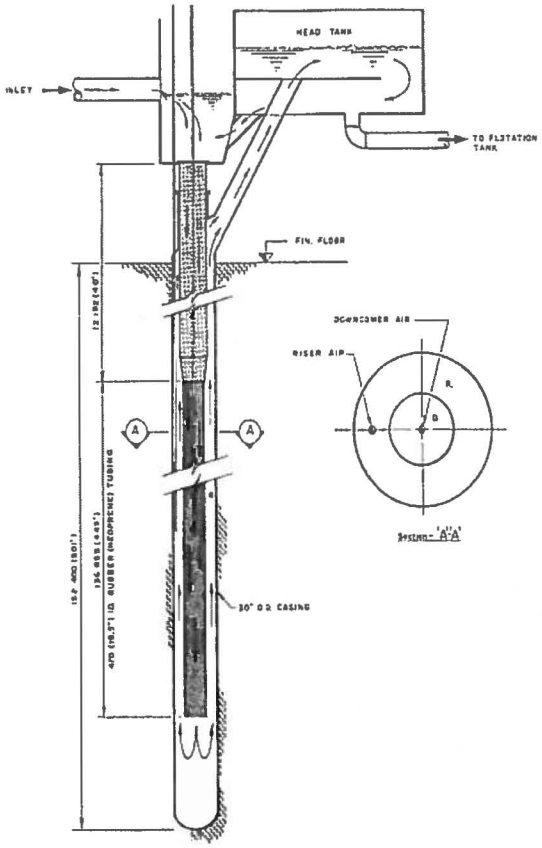


*Figure 1: Cross Section of the Deep Shaft (Source- Town of Virden Sewage Shaft Operating Manual)*

**Methodology**

In February 2016, Friesen Drillers was retained by MWSB to undertake the sealing of the sewage shaft. Friesen Drillers proposed to modify the current water well abandonment procedures to seal the sewage shaft.

The current conditions on the treatment plant are as follows:

- The treatment plant building housing the deep shaft was deemed to be in good condition and will not be demolished. Upgrades on the heating, cooling and ventilation system were also conducted.

- The deep shaft was cut at basement surface level (approximately 10 feet below grade), removing the inlet and the head tank in the process.

- There is no feasible way to safely and efficiently remove the steel casing due to the condition and size of the casing. Therefore, it was proposed that the casing be sealed in place using tremie placed cementitious grout.

- Downhole camera logging the inside of the shaft is not achievable due to sanitary and visibility reasons and the presence of broken air lines and corroded casing.

**Methodology (cont'd)**

The following methodology was developed for the sealing and abandoning the deep sewage shaft:

- Friesen Drillers have reviewed the appropriate regulations for both the Oil and Gas Act and the Ground Water and Water Well Act. The review indicated that the deep injection shaft is not completed into an aquifer and does not meet the criteria to be classified as water well. Therefore, Friesen Drillers proposes to seal the shaft in a manner similar to oil well abandonment.

- Since the treatment building is going to stay in place, access to the shaft will be done through a hatch opening in the roof.

- Two rigid grouting lines made of 2 inch diameter steel pipes will be installed from the surface down to the bottom of the shaft. One will be installed inside the 12 inch pipe and a back-up grouting line will be installed in between the 12 inch and the 30 inch casing. The grout lines will be sacrificial as they would not be removed after cementing. Once the grout lines are installed, the lines will be flushed with water to ensure that there is continuous hydraulic connection in the shaft. Some sewage material is expected to get displaced and flow out of the shaft in the process. Sewage will flow into the floor sump and will be suctioned by a suction truck and disposed according to provincial regulations.

- Concrete is widely accepted in constructing numerous types of subaqueous foundations, grouting the annulus in water wells and in sealing abandoned underground tunnels, shafts, boreholes and oil wells. The concrete grout preferred over bentonite grout because it offers more resistance to sulphate attacks, more impermeability and more self-consolidating properties. Concrete grout density (~2,400 kg/cu.m.) is also much higher than bentonite slurry (~1,100 kg/cu.m.) making it ideal for displacing sewage and any accumulated water at the bottom of the shaft. Bentonite is also not likely to hydrate in highly saline environment.

- Using a concrete grout pump, the shaft will be grouted continuously from bottom to top of the shaft using sulphate resistant concrete grout. This method of grouting is considered tremie placing where concrete grout flows from the bottom of the casing and builds up, effectively sealing any holes in the casing as it goes to the top of the shaft at surface level. As the concrete rises from the bottom to the surface of the shaft, it will displace any remaining sewage material in the shaft. The displaced sewage will flow out of the shaft into the floor sump where it will be removed and collected by suction trucks. Sewage will be disposed according to provincial regulations. Sandbags will also be placed around the floor sump to act as secondary sewage flow inhibitors and containment.

- Once the well sealing is completed, a short abandonment report and supporting documentation will be submitted.

- Friesen Drillers suggests conducting a meeting including Manitoba Conservation and Water Stewardship and the Petroleum Branch of Manitoba Mineral Resources to address any concerns.

Should you require anything further or have additional questions, please call us at (204)326-2485.

Sincerely

**Friesen Drillers Limited**

Paulynn Estrella – Legal, E.I.T.
Hydrogeological E.I.T.

PROVINCE OF MANITOBA J. J. BELL Member 22621 March 11/16 REGISTERED PROFESSIONAL ENGINEER

Reviewed by

**Friesen Drillers Limited**

J.J. (Jeff) Bell, B.Sc.(G.E.), P.Eng.
Hydrogeological Engineer

APEGM Certificate of Authorization Friesen Drillers Limited No. 4016 Date: March 11/2016.

**References**

Associated Engineering and EGE Engineering Ltd. (2014). *Town of Virden- ENVIRONMENT ACT PROPOSAL - For a New Wastewater Treatment Facility in Virden.*

Town of Virden Sewage Shaft Operating Manual (~1969).